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Luz *y* Saber

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CONTENTS

- 5 **Comparative Analysis of the Implications of the ASEAN Convention against Trafficking in Persons (ACTIP) on the Cases of Trafficking in Persons through Digital Technology in the Philippines and Cambodia**
Gilda L. Quiñones
- 11 **Evaluating the Sustainability Initiatives at Letran Manila: A Unit-Based Approach**
Kobe Bryan L. Loterinia, Christian Reyes, Rolliezon Tagaytay
- 17 **Comparative Performance of Low-Power Audio-Band Modulations for IoT Energy Monitoring in EMI-Constrained Environments**
Christian Arnel R. Alcantara, Alshein Faith Aboy, Gino Rey Avila
- 22 **Fostering understanding: Exploring and exchanging climate change perspectives among middle schoolers from diverse socioeconomic backgrounds**
May Anne E. Mudlong, Cathlea N. Tongco, Rosmalen L. Rosell
- 30 **Assessing the Effectiveness of Google Workspace as a Learning Management System**
Ruth B. Manding, Marlit E. Encarnacion, Angelique R. Milarpis

COMPARATIVE ANALYSIS OF THE IMPLICATIONS OF THE ASEAN CONVENTION AGAINST TRAFFICKING IN PERSONS (ACTIP) ON THE CASES OF TRAFFICKING IN PERSONS THROUGH DIGITAL TECHNOLOGY IN THE PHILIPPINES AND CAMBODIA

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ABSTRACT

A significant increase in the cases of human trafficking has been seen globally, totaling a 25% surge compared to the pre-pandemic period. According to the recent reports of the United Nations Office on Drugs and Crime (UNODC) in 2024, the 24% of human trafficking cases originate from East Asia and the rest of the Southeast Asian countries. In this paper, a comparative method was utilized through the lens of Neoliberal Institutionalism theory to assess the policy outcomes of the ASEAN Convention against Trafficking in Persons, Especially Women and Children (ACTIP) between the Philippines and Cambodia. The findings indicate that compliance differs between the Philippines and Cambodia due to the perceived costs and benefits of regional cooperation. Gaining reputational and developmental benefits, the Philippines highly complies compared to Cambodia, which is skeptical of institutional cooperation due to its historical distrust of multilateral mechanisms, weak legal alignment, and perceived high implementation costs.

Keywords: Comparative Politics, Non-Traditional Security Threats, Southeast Asia, Neoliberal Institutionalism, Trafficking in Persons

INTRODUCTION

Rising Trends in the Cases of Trafficking in Persons

According to the published report of the United Nations Office on Drugs and Crime (2024), cases of trafficking in persons have seen a significant increase since the COVID-19 pandemic. In 2019, a total of 49,692 victims were detected from 156 countries, and there was an increasing pattern until 2022 when a total of 74,785 were recorded. This rising trend of the detected cases of human trafficking is 25% higher compared to the pre-pandemic situation. However, it was noted in the same report that the collection of data during the pandemic was heavily impacted as well, especially during 2020 when the World Health Organization openly declared that the globe was in the midst of a pandemic. The detection mechanism of most entities during this time, such as institutions and authorities involved, had been disabled due to limited freedom of movement from the lockdowns. Hence, it is worth mentioning that the cases of trafficking in persons, given the consistent indicators, are higher than what was reported due to this factor. As illustrated in the figures below, it can be stated that there is indeed a worsening case of trafficking in persons globally as compared to the collected data from 2003 up until 2022 (United Nations Office on Drugs and Crime, 2023).



Figure 1. Total Victims Detected per 100,000 population, 2003-2020

Source: United Nations Office on Drugs and Crime. (2023). *Global Report on Trafficking in Persons 2023*. United Nations Publication.

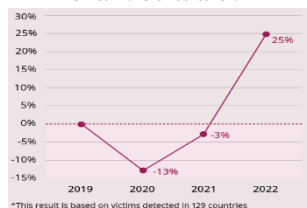


Figure 2. Global Trends of Detection Rates with 2019 as the Base Year

Source: United Nations Office on Drugs and Crime. (2024). *Global Report on Trafficking in Persons 2024*. United Nations Publication.

An important contributing factor to the increase in cases of human trafficking is the advancement of digital technology. Although this promising development with technology has been beneficial, it has also been riddled with disadvantages, which makes cyberspaces more threatening than ever, as organized crime groups utilize this new tool. In a study conducted by Mohamad et al. (2022), it was stated that more than half of the global population is internet users, specifically, 59.9% of the world is connected through the internet. This may be perceived positively as information and communication become more accessible to people throughout the globe; however, it is inevitable that this also presents vulnerabilities as individuals become more susceptible to criminal scams.

Thus, this paper focuses on one of the crucial dilemmas that countries in this interconnected world face, where digital technology has been taken advantage of by organized crime groups. To introduce human trafficking, this is referred to as Trafficking in Persons, which has been defined by Article 3, section (a) of the United Nations (2000) protocol through the General Assembly resolution 55/25 as follows: "(a) 'Trafficking in persons' shall mean the recruitment, transportation, transfer, harbouring or receipt of persons, by means of the threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for exploitation. Exploitation shall include, at a minimum, the exploitation of the prostitution of others or other forms of sexual exploitation, forced labour or services, slavery or practices similar to slavery, servitude or the removal of organs."

In Southeast Asia, there has been a shift in the methods used by traffickers, utilizing online fraud to exploit internet users (Santoso et al., 2025). This shift can be attributed to the impact of COVID-19 on the overall system of interaction between individuals, wherein almost all societies were forced to shift to an online mode of communication (Susanti et al., 2022). The exposure of vulnerable and targeted demographics, especially among women and children, has resulted in the alarming increase of human trafficking cases within the region. A total of 24% of trafficking cases come from East Asia, including the Philippines and Cambodia, as grouped by the UNODC (2024), while 39% of trafficked victims are women and 40% are younger girls. Hence, it is once again significant to explore this issue now that there is a prominent emergence of what is considered Non-Traditional Security (NTS) threats. This is defined as threats that cannot be fully resolved through conventional means, such as weapons or military power alone (Halili, 2023).

Efforts to Address the Issue of Trafficking in Persons

The need to combat human trafficking had long been recognized even before the COVID-19 pandemic struck. Its conduct is considered a human rights violation against its victims, and it is the international obligation of states to protect individuals from such a threat (International Organization for Migration, 2017). Several instruments are already present to address this dilemma, such as the UN Convention against Transnational Organized Crime and the Palermo Protocol, which is the mechanism of the United Nations to suppress and punish those who commit trafficking in persons, especially of women and children. In other existing conventions, protection against human trafficking is also enshrined for possible victims, such as the 1989 Convention on the Rights of the Child, Convention No. 29 on Forced or Compulsory Labor, and Convention No. 105 on the Abolition of Forced Labor.

Simultaneously, the United States Department of State, through the Trafficking Victims Protection Act (TVPA), also monitors all countries' efforts to combat human trafficking since the legislation was passed in 2000. In its full implementation, countries are ranked according to the provided standards of the United States in terms of protection of victims, prosecution, and prevention. The following rankings of the countries include Tier 1: Governments fully complied with minimum standards, Tier 2: Governments do not fully comply but significant efforts were made, Tier 2 (Watch List): Numbers of victims are alarming and there is a lack of evidence regarding government efforts, Tier 3: Governments did not comply with the minimum standards and there is a lack of evidence regarding the efforts to make significant developments (Gehring, 2022).

Regional instruments were formulated as well to address trafficking in persons within specific geographical contexts. Starting with the European Convention on Action against Trafficking in Human Beings, which serves as a framework for the collaborative effort of the European Countries (Mehra & Sharif, 2023). In Southeast Asia, the ASEAN Convention against Trafficking in Persons, Especially Women and Children (ACTIP) was signed in 2015. It is the existing major legal instrument to combat human trafficking within the region (Caballero-Anthony, 2018). However, before the adoption of the ACTIP, the Bali Process in 2002 was also implemented to provide an avenue for dialogues among the ASEAN member states, while states within the Greater Mekong sub-region joined the Coordinated Mekong Ministerial Initiative Against Trafficking in 2004.

However, despite such measures to address the issue of human trafficking, it remains pervasive and has even worsened in the post-pandemic world. Before the rampant technology-facilitated trafficking, multiple factors already contributed to the continuity of this dilemma. According to the discussion of Hannah Gould (2017), systemic causes are considered the major drivers of human trafficking, such as inequality, poverty, instabilities, and conflicts – these make individuals susceptible to exploitation. For Southeast Asian countries, they are not exempt from such elements that motivate the crime; in addition, there is also the emerging threat of technology, as cyberspaces have become a new sphere for illegal recruitment (Frada, 2024).

Since the ratification of the ACTIP of 2015, drastic changes have been observed. According to the report of the U.S. Department of State (2025) on the Global Trafficking in Persons, most Southeast Asian countries are included in Tier 2 and Tier 3. However, among all the Southeast Asian countries, only the Philippines was ranked Tier 1, while the lowest is Cambodia and Myanmar. Hence, it is important to discuss the fact that the recently created mechanisms for the regional approach in combatting human trafficking in Southeast Asia had an impact on its member states. But the crucial anomaly that must be addressed is the glaring differences in results; all Southeast Asian states are ranked in Tier 2 except the Philippines and Cambodia, which are in Tier 1, and the others are in Tier 3. With hopes to provide a nuanced approach to the foreign policy issues that may address transnational crimes such as human trafficking, this paper will comprehensively discuss the relevant factors that should contribute to future policies.

Thus, this paper will analyze the policy gap by comparing the approach of the Philippines and Cambodia, by addressing the main question: To what extent can Cambodia follow the Philippines to strengthen its national capacity in addressing digitally facilitated trafficking in persons through regional cooperation? Through the lens of Neoliberal Institutionalism theory, it is argued that despite the recognition of anarchy by the states, cooperation is still possible through the existence of international institutions that would shape rules and norms (Grieco, 1988). As long as there are present 'forces' in the institutions that would provide an absolute gain to the states involved, cooperation would be very much feasible. This is exemplified in this comparative analysis as the Philippines and

Cambodia, both members of the Association of Southeast Asian Nations (ASEAN), which adheres to the principle of non-interference, have ratified the ACTIP.

Theoretical Background

Neoliberal Institutionalism Theory in International Relations

Neoliberal Institutionalism is not completely at the other side of the coin of the Neorealist thinking (Whyte, 2012; Keohane, 1984). In fact, the two theoretical frameworks are considered to be more of siblings rather than an opposition of the other due to the similarities and differences that both of them share. One key feature these theories agree on is the anarchic nature of the international system or the absence of a central authority. And, despite the absence of such authority, it is not chaotic because the actors, which are the states, are rational. However, following this are a few major points of contention concerning how neorealists and neoliberals view important concepts in the anarchical international system. Placing an emphasis on Neoliberal Institutionalism, the first argument is its view on cooperation. While realists are pessimistic regarding cooperation, neoliberals believe in the benefits of international cooperation, especially when addressing challenges that are common to all.

The second claim of neoliberals is on the role of international institutions. Contrary to the claim of realists, neoliberals highlight the importance of institutions as an avenue for the creation of norms, action monitoring, and cost reduction. Lastly, a key point relevant to this analysis is that states primarily consider absolute gains when committing to international institutions. They are likely to engage in cooperation as long as it leads to mutual benefits. Thus, returning to the objective of this paper, Neoliberal Institutionalism Theory serves as a framework to explain the commitment of the Philippines and Cambodia to ACTIP by focusing on the key components such as the extent of institutional engagement fostered by both nations, their commitment to transparency and monitoring, and lastly, the incentives and absolute gains that both nations obtain in regional cooperation, or whether they perceive such benefits as crucial to their goals, which ultimately affect the human trafficking outcomes.

In addition, the figure below proposes a hypothesis using the Neoliberal Institutionalism Theory (Keohane, 1984) in International Relations: States that fulfill their obligations as aligned with ACTIP will more likely gain benefits from its cooperation, such as strengthening their capacity and decreasing their human trafficking cases.

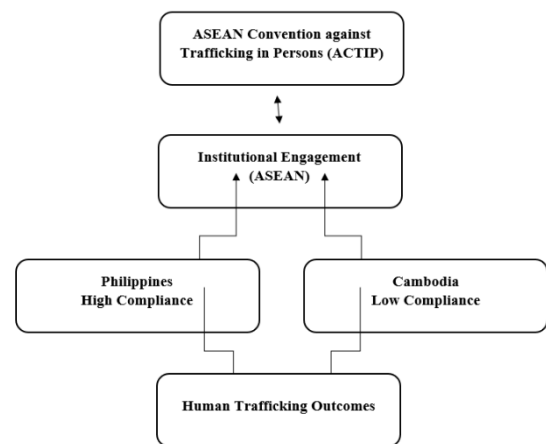


Figure 3. Conceptual Framework

METHODOLOGY

A comparative analysis approach was utilized to study the similar characteristics of the Philippines and Cambodia in terms of human trafficking; however, it had different outcomes. According to the report of the U.S. Department of State (2025) on the Global Trafficking in Persons, the Philippines has shown a significant improvement since its ratification of ACTIP, with it recently placed on the Tier 1 list, which is the only nation-state to be included among the ASEAN member states. And, despite most of the ASEAN member states being on Tier 2, Myanmar and Cambodia are the only ones lagging, both of them being placed under the Tier 3 list. However, an exception will be emphasized for Myanmar in this analysis due to the complexities that surround its case, especially the

instabilities it is experiencing within its domestic sphere, politically and economically (Tun, 2021); the hindrance in fully maximizing its mechanisms to address the issue of human trafficking would require a different approach and would delve away from the objective of this paper.

Document analysis served as the primary source, while published data were utilized, such as the United States Department of State in reporting the status of the countries in terms of handling the human trafficking cases, the United Nations Office on Drugs and Crime reports, ASEAN-Australia Counter Trafficking reports, and other articles available publicly (Morgan, 2022). However, one of the challenges, aside from the possible biased interpretation of the data, is the credibility of some state-produced reports, which might have been manipulated. In this case, reports from external entities are helpful, such as the ASEAN-Australian Counter Trafficking, the United Nations Office on Crime and Drugs, and other NGOs, due to the unbiased observation of the cases themselves.

Current Policies and Alternative Solutions

ACTIP as a Legal Framework and its Regional Goals

The ASEAN Convention Against Trafficking in Persons, Especially Women and Children is considered a legally binding agreement among the ASEAN member states that ratified the said convention (United Nations Office on Drugs and Crime, n.d.). The agreement was signed in November 2015 of November in Kuala Lumpur, Malaysia. It was stated that ACTIP is unlike the soft agreements that ASEAN member states had – in an instance, the early declarations that ASEAN had against human trafficking, wherein there was a lack of a rigid guide for the states to be able to cooperate. With ACTIP, it is considered a legally binding agreement due to the fact that it was ratified and ensures adoption among member states (Liberty Asia, 2017). However, just like most international agreements, ACTIP does not specify sanctions on states that do not comply, yet it is also argued that non-adherence also influences the relationship of the state with the other member states, and pressures economically, such as withdrawal of funding, may occur.

According to Sundram (2024), the regional goals of ACTIP include the following: 1.) enhancement of victim protection, 2.) repatriation and return of victims, 3.) law enforcement and prosecution, 4.) extradition, 5.) confiscation and seizure. Simultaneously, it emphasizes the strengthening of regional cooperation through: 1.) cross-border cooperation, and 2.) control and validity of documents. The implementation of these became possible through the monitoring of the ASEAN Secretariat, which is primarily responsible for supervising the adoption of the convention among member states, while the ASEAN Senior Officials Meeting on Transnational Crime (SOMTC) promotes, monitors, and reports to the ASEAN Ministerial Meeting on Transnational Crime (AMMTC) regarding the effectiveness of the convention. This is a mutual dynamic where ASEAN member states are required to report through their representatives as designated by the provisions of the convention regarding the progress of the implementation of the ACTIP domestically.

However, one thing that is often less emphasized is the representation that the member states gain through ASEAN, not just regionally, but also internationally (U.S. Mission to ASEAN, 2024). Collective representation results in multilateral partnerships instead of bilateral ones, as exemplified by how the United States and Australia provide funding to ASEAN to combat human trafficking, inadvertently benefiting all the member states. This is mostly crucial for ASEAN member states, as most nations are economically challenged and are in need of funding in order to fully implement their policies. Such is also the case with the Philippines and Cambodia, with both having similar dynamics domestically, especially in terms of their economies – coordination and cooperation under ASEAN through ACTIP should be beneficial.

The Philippines' Evolving Approach to Combating Human Trafficking

Before the Philippines was placed in Tier 1 by the United States Department of State, it went through challenges in addressing human trafficking. Along with the alarming cases of human trafficking that were recorded, it did not have an anti-trafficking law before 2003 (Gana, 2019). There existed only legislation that penalized the violation of the rights of individuals, such as migrant workers, children, and women. Such examples are the Labor Code of the Philippines and the Migrant Workers and Overseas Filipinos Act of 1995, which protected the rights of Filipino workers domestically and internationally. The 1992 Child Protection Law was already in effect as well.

The body created to implement the provisions of the Republic Act No. 9208, also known as the Anti-Trafficking in Persons Act of 2003, the main legal framework

in resolving human trafficking in the Philippines is the Inter-Agency Council Against Trafficking (n.d.). The agency is headed by the Department of Justice (DOJ), while the Department of Social Welfare and Development (DSWD) serves as its co-chair. Its council members also include several departments and agencies in the Philippines, including the Department of Foreign Affairs. Interestingly, three NGOs are also part of its members, which are the Coalition Against Trafficking in Women for the representation of women and their involvement in human trafficking, the Blas F. Ople Policy Center and Training Institute to represent the OFW sector, and lastly, the International Justice Mission to represent children.

With the existence of the Inter-Agency Council Against Trafficking (IACAT), addressing human trafficking became easier as it streamlined key functions, responsibilities, and goals (Gana, 2019). One example of this is the punishment for those who are officially caught doing the act of human trafficking as defined within the scope of trafficking in persons from the United Nations Convention. IACAT also promoted cooperation with external entities during its early planning, as stated in its mandates, and the existence of international conventions allowed for the establishment of standards and norms in combating human trafficking. However, within the regional scale, such as in Southeast Asia, mutual dynamics did not exist, and nations were not guided as to how coordination must be conducted (Lau, 2017). It wasn't until the ASEAN Convention Against Trafficking in Persons, Especially Women and Children (ACTIP) was signed by the 10 member states that the region had a clearer framework in terms of cooperation and coordination to address human trafficking issues, which will also be further discussed in the succeeding sections.

The Philippines and Its Commitment to ACTIP

During the pandemic, online recruitment became a prominent method of human trafficking in Southeast Asia, particularly in the Philippines, as crime groups increasingly exploit digital technologies (McGeough, 2022). Hence, the Philippines reiterated that through regional cooperation, more can be done to address this new mechanism of the longstanding threat. According to the National Strategic Action Plan of IACAT for 2023 to 2027 (2022), it will continue to anchor its approach to the provisions of the ACTIP in terms of resolving human trafficking. And aside from bilateral state-to-state coordination, IACAT heavily partners with third-party sectors as well, such as the ASEAN-ACT, the International Organization for Migration, and UNICEF. This has contributed greatly to the fight against trafficking in persons due to the benefits gained from proper coordination and trust among third-party sectors in terms of monitoring, repatriation of victims, and resource funding.

Lastly, due to the significant progress of the Philippines with its human trafficking cases and the commitment of the involved agencies, it remains at Tier 1 according to the recent report of the United States Department of State (2024). Due to this promising performance of the Philippines, it has recently led regional cooperation initiatives such as the drafting of the Bohol TIP Work Plan, which emphasized the role of digital technology in exacerbating the problem of human trafficking (ASEAN-Australia Counter Trafficking, 2024). Thus, one of the proposed plans from the Philippines is to heighten the monitoring among the involved member states and to also promote education among the vulnerable sectors.

Cambodia's Initial Response to Human Trafficking

In 1996, Cambodia enacted a law on human trafficking and was considered one of the countries to do so the earliest. Entitled the Law on Suppression of the Kidnapping, Trafficking, and Exploitation of Human Beings, this legislation was an attempt to address the early forms of human trafficking in the country and a response to its growing numbers. According to the study of Keo et al. (2014), the nature of human trafficking in Cambodia was mainly labor and sex trafficking; there was a particular demand, especially for the latter, which can be attributed to the arrival of the peacekeeping operations of the United Nations in Cambodia with the United Nations Transitional Authority in Cambodia (UNTAC). Western troops, particularly those from the United States, were largely the patrons of such services in the middle of the 1990's, resulting in the worsening condition of trafficking in the country (Rosas, 2011).

However, the domestic legislation itself proved to be ineffective due to the lapses that were identified in its provisions, and even if the law was amended to the Law on Suppression of Human Trafficking and Sexual Exploitation in 2008, which was supposedly more comprehensive, the same concerns remained (Ponlok, 2024). Despite both 1996 and 2008 laws on trafficking penalizing the conduct of trafficking, the definition of 'trafficking' itself was not defined, and the acts were narrowly identified, mostly focusing on prostitution (Keo et al., 2014). Even

the terms 'victim' and 'accomplice' were vaguely defined as well, causing loopholes with its own law. And, especially with the changing nature of trafficking, the narrow identification of trafficking to prostitution will be difficult now that there is the emergence of online conduct of trafficking (Kennedy et al., 2022).

Upon the implementation of the 2008 Law on Suppression of Human Trafficking and Sexual Exploitation, under the Ministry of Interior, the National Committee for Counter Trafficking (NCCT) was also established in 2009. The Ministry of Women's Affairs of Cambodia (2024) reported that the NCCT has set its goals to also improve the country's response to human trafficking by enhancing the prevention, protection, and prosecution mechanisms. It coordinates with both the national police and non-government organizations to track possible cases of human trafficking. The NCCT was also proactive when it came to external partnerships in order to address the issue, citing a willingness to work with regional and international groups. However, similar to the Philippines, the lack of a regional framework in Southeast Asia made cooperation vague in the early years of combating human trafficking.

Cambodia and Its Continuous Struggle with Human Trafficking

The ACTIP was ratified for Cambodia in 2016, and its National Committee for Counter Trafficking handles the human trafficking cases (ASEAN-Australia Counter Trafficking, 2021). However, despite its meticulous efforts to address the rising number of human trafficking within its borders, it is still ranked at Tier 3, according to the report of the United States Department of State (2024). The reason for its worsening status is due to the challenge fostered by online recruitment as one of the effects of COVID-19 within the region; hence, the government of Cambodia made it imperative to resolve this (Chheng, 2025). This realization may be considered as delayed, as the declaration of other ASEAN member states regarding the danger of human trafficking through online methods was made a few years back.

In addition, one of the weaknesses that was found concerning Cambodia's response to human trafficking was its failure to adhere to its obligations that the ACTIP set. In the progress report submitted by ASEAN-ACT (2023) as one of the entities that aims to assist ASEAN member states in resolving the issue of trafficking, it was said that some human trafficking cases could have been addressed if Cambodia coordinated properly with other member states. This was also further elaborated in the most recent report of ASEAN-Australia Counter Trafficking (2024), detailed in the 'Giant Ocean' case, where 80 Cambodian men were trafficked to Taiwan. Despite the existing provisions in ACTIP regarding legal assistance and cooperation, Cambodia failed to adhere to the process of coordinating with the involved Singaporean agency that led the trafficking, resulting in a lack of prosecution of the involved criminals from Singapore.

Aside from the issue of trafficking in persons and other domestic factors that are affecting the mechanisms of Cambodia in addressing non-traditional security threats, to allow for a broader lens, it was stated in the assessment of the Asia Pacific Centre for the Responsibility to Protect (2018) that Cambodia has a very weak performance in terms of strengthening its commitments to regional and international organizations. This can be attributed to the perceived cost and benefit of allowing external organizational interventions by the Kingdom of Cambodia, which is more risky than beneficial for the nation. In the succeeding sections, data and evidence will be provided and interpreted utilizing the cost-benefit analysis, emphasizing the perceived costs and gains by the Philippines and Cambodia for their cooperation with ASEAN, through ACTIP, in combating human trafficking.

Data, Evidence, Analysis

Institutional Engagement with ASEAN to Address Human Trafficking

According to the published news from the Association of Southeast Asian Nations (2017), the Philippines is highly engaged with the organization in order to combat human trafficking. In the creation of ACTIP itself, the Philippines proposed most of the activities under its provisions to strengthen the regional response to human trafficking. The then Secretary General Minh from Vietnam expressed gratitude for the initiatives that the Philippines had in order to engage the region in improving the situation with one of the most alarming non-security threats that pervade Southeast Asia. However, the Philippine institutional engagement does not end with its participation in initiatives and policy-making, but also its commitment to coordination in order to resolve certain cases.

One of these is a human trafficking case that happened in Malaysia back in 2020, where a Filipina was illegally recruited by a Malaysian couple to be their

domestic helper (GMA News, 2020). With the coordination of the Philippine Embassy in Malaysia and the Malaysian Royal Police, the victim was successfully repatriated, and the suspects were properly convicted under the Malaysian jurisdiction, having to pay 232,976 in Philippine pesos for the damages that they caused to the victim. Following the successes of human trafficking cases, the Philippine National Police was also awarded by His Majesty Ibrahim Iskandar, the King of Malaysia, for the agency's continuous joint operations with the Malaysian Royal Police and cross-border collaborations to strengthen the monitoring of possible trafficking cases (Anas, 2024).

Furthermore, the Philippines isn't just committed to cooperation and coordination, but presents its willingness to align with ACTIP concerns by amending its legislation on anti-trafficking in 2022 (Republic Act 11862: Expanded Anti-Trafficking in Persons Act of 2022 | Philippine Commission on Women, 2022), where the law strengthens its provisions in joint investigations and enhancement of prosecution. The non-punishment clause is also maintained for the trafficked victims; this has only been retained by the Philippines, Malaysia, and Thailand at present. According to Lau (2017), ASEAN started as an organization that emphasized economic affairs, and despite its development in recent years, Cambodia seemed to have continuously perceived the regional organization as a channel for economic growth, rather than addressing security issues (Vannarith, 2018). This can be attributed to Cambodia's early disappointment with ASEAN's engagement in its border dispute with Thailand. Despite requesting mediation from ASEAN, there was a failure to address the issue, and both states were left with bilateral decisions (Rondonuwu & Suharmoko, 2011).

Hence, despite the ratification of ACTIP, Cambodia's engagement with ASEAN in addressing human trafficking remains relatively low due to its perceived benefits and priorities for economic partnerships rather than resolving security issues. Lastly, it will be too costly to implement with the goals of ACTIP, especially as reviewed by Liberty Asia (2017), that in terms of legislation, there are gaps between the provisions of ACTIP and national laws of Cambodia, especially in terms of non-punishment of victims, as Cambodia's laws interpret and punish all those involved in human trafficking, whether they consented or not. The implication of this is a lack of reporting from the victims as well when involved in trafficking, and most cases remain unresolved.

Transparency and Monitoring

In the report of the United States Department of State (2023), the Philippines excelled in transparency and case monitoring. One example is the establishment of a one-stop service by potential victims in areas such as Manila, a destination for most traffickers, which assists without requiring tedious procedures. In 2024, it was also reported that the Philippines had successfully monitored its human trafficking cases through effective international coordination and that this was consistently reported by the Department of Foreign Affairs (US Department of State, 2024). ACTIP also requires the states to accurately report to the ASEAN Secretariat and SOMTC, thereby strengthening the monitoring and transparency mechanisms for the Philippines across the region.

Additionally, according to the Council of ASEAN Judges (2024), the Philippines, with the Department of Justice leading the IACAT, has demonstrated greater transparency. This was exemplified by the Philippine National Police being lauded by the Malaysian government for its willingness to exchange intelligence to track potential cases of human trafficking (Anas, 2024). One challenge to transparency, however, is corruption, and the Philippines has long been considered a haven for such acts. For Cambodia, it was reported by the International Justice Mission (2022) that there is a gap when it comes to victim monitoring; authorities often overlook the indicators for possible trafficked victims, and services for those who were victimized were often not provided as well. In Ponlok's (2024) study, a lack of implementation by the authorities was identified, despite the clear goals that the NCCT aligned with ACTIP regarding monitoring and transparency. This was attributed to the economic challenges Cambodia faced and insufficient funding to implement its projects.

Consequently, there are additional economic benefits to the 'business' of trafficking; ASEAN-ACT (2024), through ACTIP, enables ASEAN member states to receive a total of USD 80 million. However, according to Jackson (2024), trafficking in Cambodia enables its politicians to profit from around 18.7 billion USD annually, especially from online recruitment, which is more than half of the country's GDP. Hence, there's a lack of transparency and monitoring by government officials themselves, owing to the benefits derived from the criminal conduct. Even in the most recent reports of the United States Department of State (2025), Cambodia fails to prosecute those who are possibly involved in larger trafficking scams.

Cost and Absolute Gains for Regional Cooperation

In reality, all the factors mentioned above were driven by the benefits that ASEAN member states perceive from cooperating with ACTIP's goals. In the Philippines, international and regional cooperation has yielded greater benefits despite potential costs. In Loewenstein's (1953) study, during the Cold War, international cooperation meant relinquishing a portion of a state's self-determination. Despite the end of the Cold War, as polarization resurfaces in the international system, perceptions of sovereignty being undermined by international and regional cooperation also return (Omeni, 2024). As for the Philippines, a portion of its sovereignty is not unduly costly relative to the benefits it gains from cooperating with other states in groups.

This was exemplified by the other agreements that it has, focusing on the regional ones, like the ASEAN Free Trade Agreement, where it helped in the significant growth of the Philippines in terms of gaining food security (Herath et al., 2014). In particular, given growing concerns about national security, the Philippines coordinates effectively with its regional counterparts to secure assistance (Lotilla, 2015). This is especially relevant, as most Southeast Asian member states are engaged in similar disputes with China, and the Philippines expects further support from its neighboring states. Hence, the Philippines closely aligns with the goals of ACTIP, even adjusting its policies and legislation to align with the regional framework, given the benefits it derives in the present, such as regional visibility and foreign funding. However, the perceived benefits extend not only to the present but also to the future, particularly given the risks it faces to maritime security from China.

The same cannot be said for the case of Cambodia, as it remains skeptical of regional and international cooperation, especially due to the factors of its past being detrimental to its present situation in human trafficking. Plenty of studies pointed out the fault of external interventions in the problem of Cambodia in human trafficking, one of which is conducted by Rosas (2011), detailing that the arrival of the United Nations Transitional Authority in Cambodia (UNTAC) increased trafficking in the form of prostitution. This was called out by the previous Cambodian Prime Minister as well, stating that the UNTAC had the worst legacy and said that the Western troops left nothing but 'AIDS' in the country.

Furthermore, Cambodia had previously been disappointed with ASEAN due to the lack of a settlement mechanism when it faced a conflict with Thailand over contested heritage sites (Chachavalpongpon, 2020). The lack of gains from its international and regional cooperation mirrors its compliance with ACTIP, and it continues to underperform, according to the United States Department of State (2025). In addition, Cambodia perceives overall cooperation with ASEAN member states as risky, given its close relations with China. According to Heng (2021), the Philippines and Vietnam advocated a multilateral approach to the South China Sea issue, whereas Cambodia maintained neutrality by refraining from criticizing China's assertiveness. Therefore, Cambodia is very careful in its relations with ASEAN member states, seeking to balance them with China, given existing issues with most ASEAN members. However, undeniably, due to Cambodia's lack of gains from its previous cooperation with international and regional organizations, it remains skeptical at present and instead retains its strong bilateral relations with China (Rim, 2025).

Table 1. Comparative Analysis of ASEAN Anti-Trafficking Compliance: Philippines and Cambodia

Category	Philippines (High Compliance)	Cambodia (Low Compliance)
ASEAN Institutional Engagement (includes cooperation, coordination, and alignment of national legislations with ACTIP)	-Active participation in coordination and cooperation -Stronger anti-trafficking laws aligned with ACTIP (Expanded Anti-Trafficking in Persons Act of 2022)	-Limited or inconsistent participation in coordination and cooperation -Laws not aligned with ACTIP and not updated (1996 Law on Suppression of the Kidnapping, Trafficking, and Exploitation of Human Beings; 2008 Law on Suppression of Human Trafficking and Sexual Exploitation)
Monitoring & Transparency (Reporting of cases and monitoring of victims)	-Monitors victims and prosecutes traffickers	- Lacks reporting and victim monitoring - Low prosecution of traffickers
Perceived Gains from Regional Cooperation	-Reputation and foreign aid	-Lower perceived benefits due to historic distrust, bringing sovereignty concerns

CONCLUSION

With the growing concerns regarding human trafficking in Southeast Asia, it is crucial to be able to assess the efforts of the Southeast Asian nations individually and also regionally, especially now that there are newer mechanisms utilized in its conduct that need further and stronger cooperation. Therefore, in this comparative analysis, the Philippines and Cambodia showcased that while both states ratified the ASEAN Convention Against Trafficking in Persons (ACTIP), their levels of compliance significantly differ due to how each perceives the costs and benefits of regional cooperation. Guided by the principles of Neoliberal Institutionalism, the Philippines exhibits high compliance by actively aligning its national laws with ACTIP, engaging in multilateral coordination, and gaining reputational and developmental benefits. Cambodia, on the other hand, remains skeptical of institutional cooperation due to its historical distrust of multilateral mechanisms, weak legal alignment, and perceived high implementation costs. Therefore, Cambodia can strengthen its national capacity in addressing trafficking in persons through digital technology by following the Philippines' strategic use of institutional engagement, provided that ASEAN creates a more trust-based and incentive-driven regional environment that addresses Cambodia's concerns.

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EVALUATING THE SUSTAINABILITY INITIATIVES AT LETRAN MANILA: A UNIT-BASED APPROACH

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ABSTRACT

This paper assessed the sustainability initiatives of Letran Manila using the Unit-Based Sustainability Assessment Tool (USAT). The findings indicate that while Letran demonstrates a commitment to sustainability through legal compliance and alignment with its recent institutional vision, it lacks a comprehensive institutional framework to effectively guide its units in implementing sustainable practices. This gap is evident in the limited integration of sustainability across key areas such as teaching, research, community engagement, operations and management, student involvement, and institutional policy. Achieving the Sustainable Development Goals (SDGs) at Letran presents a complex challenge, as it requires not only structural reforms but also value and behavioral changes among members of the institution. Success will largely depend on the strong and sustained commitment of the institution's leadership to fully implement and support sustainability initiatives across all levels of the Colegio de San Juan de Letran.

Keywords: Sustainability, Higher education, SDG, Letran

INTRODUCTION

Sustainable Development (SD) has become an integral part of both global and local practices aimed at mitigating and addressing climate-related issues. Across sectors and at the individual level, SD promotes a more responsible and acceptable way of operating to help solve environmental problems. The Sustainable Development Goals (SDGs) were established to guide efforts in addressing environmental degradation. These goals became a global priority following the adoption of the 2030 Agenda for Sustainable Development by the United Nations General Assembly in 2015. Today, the SDGs serve not only as a policy framework for governments worldwide but also as a benchmark for organizations, sectors, and businesses to align their practices with the principles of sustainable development.

Higher education institutions (HEIs) have a vital role to play in this global movement. They can benefit from the SD framework and are well-positioned to lead sustainability efforts through education, research, and community engagement. However, implementing sustainability initiatives can be complex and challenging. It often requires significant institutional and organizational transformation. In the context of the Philippines—where climate-related issues are becoming increasingly severe—there is a pressing need to adopt and implement sustainable development practices. The country faces recurring environmental challenges and has experienced major climate-related disasters over the past decades.

Colegio de San Juan de Letran, one of the oldest private educational institutions in the Philippines, has a crucial role in promoting sustainable development. Located in Intramuros, Manila, Letran is strategically positioned to influence neighboring higher education institutions and contribute to broader community responses within and beyond the walled city. Considering that Manila is a hazard-prone area, the active involvement of institutions like Letran is essential to advancing the goal of a more sustainable and resilient city.

Given this context, this paper assesses the status of sustainability initiatives and development at Colegio de San Juan de Letran—Manila. It seeks to answer the central research question: *What is the current status of sustainability initiatives at Letran Manila?* The study also identifies key sustainability initiatives, evaluates their implementation, and assesses the strengths and weaknesses of the institution's sustainability practices.

To conduct the assessment, this paper uses the Unit-Based Sustainability Assessment Tool (USAT) to evaluate sustainability initiatives across multiple units

of the institution, including Basic Education, Collegiate and Graduate Levels, Operations and Management, Community Service, Research, Student Affairs, and Institutional Policy units. The study employed data triangulation to validate and enrich the findings from the survey. The data covered in this assessment spans the period 2019 to 2024.

Higher Education and Sustainability Initiatives

Educational institutions are key drivers of knowledge creation and dissemination. They play a crucial role in educating future leaders and community members, while also fostering flexible and responsible learning environments. These institutions are increasingly recognized as catalysts for promoting sustainability-related initiatives, with a significant influence on shaping societal mindsets and behaviors. In particular, higher education institutions (HEIs) have emerged as pivotal agents in advancing the sustainability agenda (Basheer et al., 2025).

According to Žalėnienė and Pereira (2021), HEIs contribute to sustainability through various channels, including teaching and research, community outreach, awareness-raising, the formation of future professionals, and the implementation of sustainable practices. By adopting and modeling these practices, HEIs can lead by example and influence their members, which is essential for the success of sustainability efforts.

Many HEIs have adopted declarations, charters, and initiatives aimed at integrating sustainability into their institutional structures and engaging surrounding communities in sustainable development. Achieving this requires comprehensive organizational change—moving from the current status quo toward a system aligned with sustainable practices, supported by continuous monitoring and evaluation.

Duran and Mariñas (2024) presented an interesting case on how teachers incorporate sustainability into their teaching. Their study found that the more teachers care about environmental and social issues and perceive them as relevant and important, the more likely they are to integrate sustainability into their instruction. However, simply knowing about sustainability does not automatically lead to its inclusion in teaching. This provides an important perspective on how micro-level actors, such as professors and teachers, contribute to advancing and integrating sustainability in Philippine higher education.

The lack of knowledge and financial resources is perceived as one of the main barriers to sustainable development that needs to be addressed. Serafini, Morais de Moura, Rodrigues de Almeida, and Dantas de Rezende (2022)

identified several barriers to implementing the Sustainable Development Goals (SDGs) in higher education, including difficulties in mobilizing the academic community to engage with the SDGs, the absence of organizational structures and leadership responsible for coordinating the implementation process, challenges in integrating the SDGs into institutional systems, and the lack of indicators, tools, and reporting mechanisms to measure progress.

The integration of sustainability across all university levels remains unclear. Murano and John (2025) also argued that university sustainability management is more effective when guided by a structured framework. Institutional characteristics play a central role in effective sustainability implementation, particularly in terms of funding structures, location, governance, and educational focus, all while navigating complex bureaucracies and rigid organizational structures. Furthermore, they acknowledge that there is no universal education model for sustainable development nor a standardized methodology for achieving a carbon-neutral campus.

Sustainability Reporting (SR) is defined as “the practice to measure, disclose, and be accountable to internal and external stakeholders for organizational performance towards the goal of sustainable development” (Culemans, Lozano, & Alonso-Almeida, 2015). SR is a vital tool for assessing and enhancing an organization’s sustainability performance over time. In this context, this paper utilizes the Unit-Based Sustainability Assessment Tool (USAT) to evaluate the sustainability performance of Letran Manila and its various academic and administrative units. The tool provides an initial assessment that can inform targeted improvements and strategic planning for sustainability integration.

Unit-based Sustainability Assessment Tool (USAT)

This study utilized and adapted the Unit-Based Sustainability Assessment Tool (USAT), developed by Togo and Lotz-Sisitka (2009), to evaluate the extent to which various units at Colegio de San Juan de Letran engage in and adopt different sustainability practices. The USAT is specifically designed to assess sustainability efforts within universities, focusing on how functional units integrate sustainability into key areas such as teaching, research, daily operations, community engagement, and institutional policies and statements. The version adopted in this study aligns with the original design by Togo and Lotz-Sisitka (2009) and complements the United Nations Environment Programme’s (UNEP) initiative on Mainstreaming Environment and Sustainability in African Universities (MESA).

The USAT is structured around four key indicator areas to assess sustainability across different higher education units: (1) Part A: Teaching, Research, and Community Service. (2) Part B: Operations and Management. (3) Part C: Student Involvement. (4) Part D: Policy and Written Statements.

Part A focuses on the core mission of universities and evaluates aspects such as curriculum, teaching approaches, research, community service, examinations/assessments, and staff expertise. The curriculum component examines the integration of sustainability concerns and the inclusion of sustainability-related topics in academic courses. Teaching approaches are assessed based on how they foster critical thinking and awareness of sustainability. Research and scholarship activities are evaluated in terms of the extent to which faculty and students are engaged in sustainability-related work. Community engagement considers each department’s involvement in sustainability initiatives and its allocation of resources for community-based projects. Finally, staff expertise and willingness to participate are assessed to identify the level of faculty knowledge in sustainability and their readiness to engage in sustainability teaching, research, and community service.

Part B assesses the sustainability of institutional operations and management. It includes indicators on waste management, air pollution control, energy use, water conservation, landscaping, pest management, transportation, and sustainable purchasing practices. It also captures information on specific projects and the rationale behind their implementation. Part C evaluates student involvement in sustainability initiatives. This includes participation in voluntary sustainability-related activities, orientation programs, and career counseling focused on sustainability, and student governance and politics in support of sustainability goals.

Part D examines the institution’s policies and written statements regarding sustainable development. It focuses on how sustainability is embedded in higher education policy and how it is reflected in official institutional documents. These indicators are applied to assess the various units of Colegio de San Juan de Letran and their commitment to sustainability practices.

METHODS

This study employed a quantitative research design to evaluate the extent to which sustainability practices are integrated into the operations of various units at Colegio de San Juan de Letran. The assessment used the Unit-based Sustainability Assessment Tool (USAT) developed by Togo and Lotz-Sisitka (2009), a framework designed specifically for evaluating sustainability engagement in higher education institutions. The primary data collection instrument was the standardized USAT survey questionnaire (see appendices), which consists of four key components: (1) Part A: Teaching, Research, and Community Service. (2) Part B: Operations and Management. (3) Part C: Student Involvement. (4) Part D: Policy and Written Statements

Each component contains multiple indicators rated by respondents to determine the presence and level of implementation of sustainability-related practices. The indicators were assessed using a six-point ordinal scale (adapted from Uebersax, 2006), loosely based on the Likert scale. The scale is interpreted as follows: (1) X (Don’t know) – Respondent lacks information about the practice, though it may exist. (2) 0 (None) – No evidence of the practice; interpreted as 0% implementation. (3) 1 (A little) – Minimal evidence of the practice; about 25% implementation. (4) 2 (Adequate) – Moderate or regular performance; about 50% implementation. (5) 3 (Substantial) – Good performance; about 75% implementation. (6) 4 (A great deal) – Excellent performance; more than 75% implementation.

The translation of scale levels into approximate percentages is based on the GASU (Graduation Approach to Sustainability in Universities) framework (Lozano, 2006), which helps clarify the degree of integration and performance in each indicator.

Participants were selected using purposive sampling, targeting individuals with direct knowledge or involvement in sustainability-related areas within the institution. These included faculty members, administrators, and operations staff across various units. The Units involved are the 4 colleges and the graduate school, primary, secondary, and senior high school departments for Part A. For Part B, the Auxiliary Services Department participated in this study. The Department of Student Affairs answered for Part C. The Offices of Rector, Vice President for Administrative Affairs, Vice President for Academic Affairs, Planning and Quality Assurance participated in Part 4.

The survey was distributed through both digital and printed formats. Respondents were informed of the purpose of the study and signed informed consent forms. Participation was voluntary, and responses were kept anonymous and confidential. To strengthen the validity of the findings, triangulation was applied. This involved the review and analysis of institutional documents, including curriculum guides, sustainability-related project reports, strategic plans, and official policies. These sources were used to verify and contextualize survey responses and assess the accuracy of the reported practices.

Responses were analyzed using descriptive statistics, focusing on mean scores for each indicator. No percentage conversions were used in the analysis, but interpretations aligned with the conceptual percentage ranges defined by Lozano (2006). To visualize performance across indicators within each USAT part, the study employed radar chart analysis (spider diagrams). By combining survey data, visual analytics, and supporting documentation, this mixed evidence approach ensured a more accurate and comprehensive assessment of sustainability practices at Colegio de San Juan de Letran.

RESULTS AND DISCUSSION

Teaching, Research, and Community Service

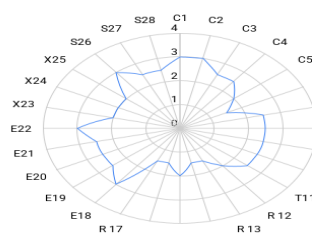


Figure 1. Sustainability Initiatives in Basic Education

The basic education units—comprising the Senior High School, Elementary, and Junior High School—were assessed as part of Letran’s sustainability evaluation. The results indicated that, on average, basic education demonstrated good performance across various sustainability initiatives. For curriculum indicators (codes C1–C6), the mean rating was 2.42, indicating a substantial level of performance, supported by good evidence. The teaching approach (codes T7–T11) had a mean rating of 2.5, also reflecting substantial performance. Research and scholarship activities (codes R12–R17) received a mean rating of 1.67, which suggests an adequate level, with evidence of regular performance. Community engagement (codes E18–E22) scored 2.7, indicating substantial performance. The assessment of sustainability topics (codes X23–X25) had a mean rating of 2.0, meaning adequate performance. Finally, staff expertise and willingness to participate (codes S26–S28) had a mean rating of 2.67, also denoting substantial performance.

Sustainability lessons and issues are substantially incorporated into the curriculum of both departments in the basic education unit. However, there is a need to enhance the inclusion of both local and global sustainability issues and challenges within the departments’ teaching programs. Teaching practices appear effective in fostering critical thinking skills and promoting informed, responsible student behavior concerning sustainability.

Among all assessed areas, research and scholarship were identified as the weakest, showing a lack of initiatives and institutional practices. Significant improvement is needed to engage students, faculty, and staff in research activities—from student outputs to faculty-led projects. It is recommended that sustainability be included in the department’s formal research agenda. In terms of community engagement, both departments displayed a strong commitment to integrating sustainability goals and collaborating with stakeholders to address pressing issues. This commitment could be further strengthened by expanding community partnerships and developing long-term projects that aim to produce lasting impacts.

The evaluation of sustainability initiatives within courses and projects is not yet well-practiced or fully integrated. Developing appropriate rubrics and indicators to assess sustainability learning outcomes and project results would be a valuable step in measuring and monitoring the departments’ sustainability efforts. Lastly, the survey revealed that staff and faculty members hold a positive attitude toward teaching and researching sustainability. With adequate support and opportunities from the department, their professional capacities can be further developed to strengthen sustainability practices and initiatives.

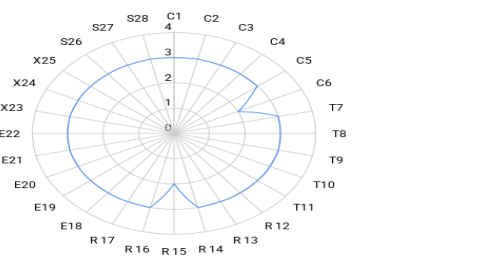


Figure 2. Sustainability Initiatives in Collegiate and Graduate Schools

The curriculum indicators (Codes C1–C6) received a mean rating of 2.9, interpreted as substantial, indicating that evidence shows good performance in integrating sustainability concerns into the curriculum. The teaching approach indicators (T7–T11) scored a mean of 3.08, also classified as substantial, demonstrating strong alignment with sustainability competencies such as critical thinking, informed decision-making, and problem-solving. Research and scholarship activities (R12–R17) had a mean rating of 2.6, which also falls within the substantial range but indicates relatively lower performance compared to other areas. Community engagement efforts (E18–E22) achieved the highest mean rating of 3.2, reflecting consistent involvement in sustainability-related activities. Assessment of sustainability topics (X23–X25) and staff expertise and willingness to engage (S26–S28) both had mean ratings of 2.73, suggesting substantial but improvable performance in these dimensions.

At the collegiate level, which includes all undergraduate colleges and the Graduate School, most indicators demonstrate a high level of engagement with sustainability in both course offerings and teaching methodologies. The Graduate School offers electives focusing on corporate sustainability and social responsibility. Across all academic programs, general education subjects such as Science, Technology, and Society, The Contemporary World, and the National

Service Training Program are part of the curriculum. While these courses are not mandated to explicitly cover sustainability topics, their content allows flexibility for instructors to incorporate relevant themes. This flexibility is a positive indicator of potential for integrating sustainability across disciplines.

In addition, several programs offer elective courses specifically addressing sustainability within their respective fields. Examples include Sustainable Tourism, Good Governance and Social Responsibility, Environmental Laws, Environmental Science, Risk, Disaster, and Humanitarian Communication, and Studies in Renewable Energy Resources. However, such courses are not available across all programs. It is therefore recommended that academic departments develop or integrate specialized sustainability-focused courses relevant to their disciplines.

While survey results suggest meaningful engagement in sustainability-related research, a review of research outputs reveals limited supporting evidence. Research activities explicitly aligned with the Sustainable Development Goals (SDGs) remain underexplored by faculty, students, and staff. Over the past five years, only three sustainability-related research publications have been produced by members of the Letran community. Of these, only one was authored by college-level faculty members—from the College of Engineering and Information Technology and the College of Liberal Arts and Sciences—while the remaining two came from the Senior High School Department. These publications addressed topics such as climate change awareness in public school textbooks, its perceived effects on Filipino youth, and the development of alternative energy sources.

In Luz y Saber, the Colegio’s open-access, semiannual international scholarly journal, three sustainability-themed articles have been published. Two of these focused on disaster risk reduction and management, while the third examined the United Nations SDG on women’s economic empowerment in the City of Manila.

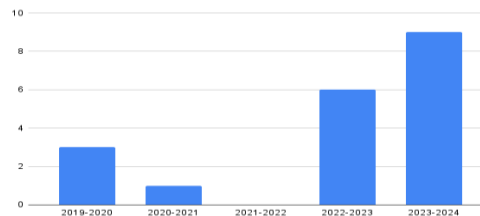


Figure 3. Number of Sustainability Initiatives in Community Service Activities

The data also highlight the significant impact of the COVID-19 pandemic on sustainability-related community engagement. The pandemic exposed gaps in community-based sustainability initiatives, with many units unable to sustain or adapt programs under pandemic constraints. While a resurgence in activities was observed in the later stages of the pandemic—mainly due to the easing of restrictions—most departments had minimal involvement in community sustainability efforts before and after the pandemic. Activities such as clean-up drives and tree planting were the most common, alongside a few seminars and workshops on disaster preparedness and sustainable living during the "new normal" period. Among these, clean-up drives remained the most consistently implemented initiative across different units.

Table 2. List of Sustainability Initiatives in Community Service Activities

Academic Year	Department/Unit	Activity/Project Title
2019–2020	College of Education Center for Community Development (CCD)	Clean-up Drive
		International Coastal Cleanup
2020–2021	College of Business Administration and Accountancy	Letran 2020 Tree Planting Project
		Sustainable Living in the New Normal Community
2021–2022	–	No recorded activity
2022–2023	Senior High School	Coastal Clean-Up
	College of Engineering and Information Technology	Shake Don't Rattle and Roll: An Earthquake Preparedness and Response Seminar
	College of Education (CED)	Tree Planting Part II
	LVC–DENR CED–ASD	Coastal Clean-Up International Coastal Clean-Up
2023–2024	Basic Education Senior High School	Trees for Tomorrow's Generation Let's Make it Green: Tree Planting Project 2023
	College of Business & Administration Accountancy	Growing Together: Hydroponics for Sustainable Community
		Roots to Riches: A Tree Nursery Activity

Graduate School	Tree Planting
College of Education (CED) Recognized Student Organizations (RSO)	Urban Gardening Workshop International Coastal Cleanup kaRAMPAligiran 2023
	E.A.R.T.H (Ecosystem Approach and Rejuvenation through Human Rights)

Despite these efforts, the overall assessment indicates considerable room for improvement. At present, there are no ongoing sustainability programs with substantial and lasting impacts on partner communities. As an educational institution, Letran is encouraged to strengthen community engagement by organizing more seminars, workshops, and collaborative projects with local stakeholders. These initiatives should aim to raise awareness and build practical skills that support sustainable lifestyles and community development.

In terms of evaluation, sustainability considerations are consistently included in course and project assessments, with all related indicators scoring a 3. However, documentation of these assessment practices is limited. It is therefore recommended that departments develop standardized tools and indicators for evaluating sustainability-related projects and events. This would ensure consistency, promote accountability, and better align departmental activities with institutional sustainability goals. Finally, staff members have shown substantial willingness to engage in sustainability-oriented teaching, research, and service. This reflects a supportive institutional culture that can serve as a strong foundation for scaling up sustainability initiatives across all levels of the Colegio.

Operations and Management

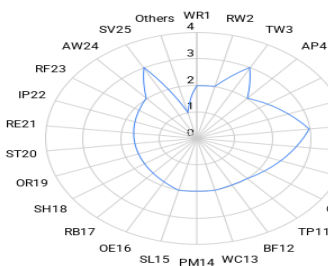


Figure 4. Sustainability Initiatives in Operations and Management

Most of the sustainable practices in operations and management are adequately implemented and practiced at the Colegio. Letran demonstrates a clear effort to comply with various environmental regulations and obligations aimed at addressing sustainability issues. These efforts include compliance with key laws such as Republic Act (RA) 9003 or the Ecological Solid Waste Management Act of 2000, RA 6969 or the Toxic Substances and Hazardous and Nuclear Wastes Control Act, RA 11285 or the Energy Efficiency and Conservation Act, and RA 9275 or the Philippine Clean Water Act. The Colegio performs relatively well in areas such as the handling of toxic materials and radioactive waste, energy conservation practices, and chemical control, although there remains room for improvement. In contrast, water conservation, pest management, and sustainable landscaping require better monitoring and more consistent enforcement of maintenance protocols.

Currently, most sustainability actions appear to be reactive or compliance-driven, rather than part of a broader, proactive strategy. Developing a comprehensive Sustainability Action Plan and strengthening monitoring and evaluation mechanisms—such as systems for tracking resource consumption, waste reduction, and maintenance schedules—will help the Colegio improve its adaptation to sustainability responsibilities. Initiatives such as implementing color-coded waste segregation, conducting waste management orientation sessions for all employees and students, and establishing clear procedures for proper waste disposal and the immediate reporting and repair of water leaks are recommended. Reducing the use of electrical appliances and implementing scheduled usage of air conditioning units are also encouraged.

In terms of transportation programs, the Colegio can promote the use of bicycles and e-bikes among employees and students by providing adequate parking facilities. Practices outlined in OE16-RF23 are not yet in place and should be considered for future implementation. Infrastructure-related sustainability practices, such as eco-friendly building construction and renovation based on ecological design principles, are yet to be adopted. Additionally, sustainable

procurement—purchasing from environmentally and socially responsible companies—has not yet been widely practiced and should be encouraged. It is also recommended that academic departments regularly conduct environmental awareness campaigns and waste management orientations for both employees and students.

Institutionalizing monitoring and evaluation through the adoption of established mechanisms or the development of localized systems is essential. Maintaining proper records and reporting will improve traceability and support continuous improvement. Overall, while the institution has made commendable progress in compliance and operational sustainability, many areas still require significant improvement. The development of a comprehensive Sustainability Action Plan—one that involves responsible units, academic and staff collaboration, and student participation—will help ensure that sustainability becomes an integral part of the institution's daily operations and long-term management.

Student's Involvement

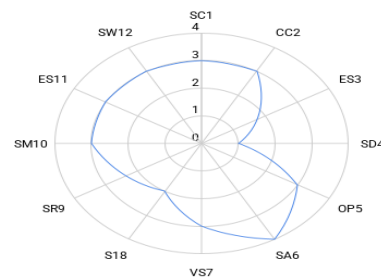


Figure 5. Sustainability Initiatives in Students' Involvement

In addition to evaluating how the curriculum integrates students into sustainability initiatives, the Unit-Based Sustainability Assessment Tool (USAT) also examined student involvement through institutional programs and activities. The assessment of student engagement in sustainability at the Colegio highlights several strengths, while also identifying areas that require improvement.

According to the Department of Student Affairs (DSA), various programs have been implemented to raise awareness of environmental and sustainability issues. The DSA also aims to establish itself as a student environmental center and has achieved a commendable performance rating in this regard. Furthermore, the Colegio offers career counseling services for the students that emphasize employment opportunities in the fields of environment and sustainability. Students are also actively involved in voluntary community service projects related to environmental concerns. These initiatives, often led by the student council, reflect a strong institutional effort to empower students to take leadership roles in addressing sustainability challenges. This also indicates a growing sense of responsibility and enthusiasm among students in contributing to environmental stewardship.

Despite these positive developments, there remain areas in need of further attention. Notably, the Colegio does not yet have an Environmental Student Society or any other student-led organization with a clear focus on sustainability. The presence of such groups would significantly enhance student engagement and foster peer-led initiatives across the campus. Additionally, there is currently no available data on the sustainability practices of students residing in on-campus dormitories or housing facilities. To address these gaps, it is recommended that the institution implement targeted improvements. These include: (1) Establishing and officially recognizing environmental student organizations. (2) Ensuring active student council involvement in campus-wide sustainability initiatives. (3) Enhancing sustainability efforts within student residences and dormitories. (4) Developing a unified sustainability action plan that aligns the efforts of all student organizations.

Moreover, there is currently no publicly available or general Sustainable Action Plan from either the Student Council or the Department of Student Affairs outlining long-term strategies for student participation in sustainability. Developing such a plan would provide clarity, direction, and consistency for future initiatives. It is also advisable to encourage all recognized student organizations to integrate sustainability-focused activities into their annual plans, as aligned with their respective missions and objectives. Finally, the Colegio should conduct regular student orientation and awareness programs related to sustainability, ideally organized in collaboration with or led

by the student council. These efforts would strengthen a culture of sustainability across the student body and ensure continuity in student-led environmental advocacy.

Policy and Written Statements

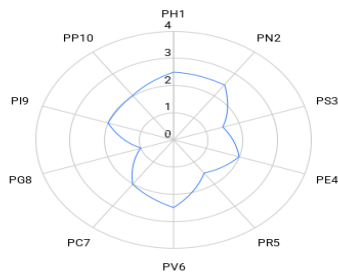


Figure 6. Sustainability Initiatives in Policy and Written Statements

This section examines the extent to which sustainability is embedded in the institutional policies, frameworks, and practices of the Colegio. Utilizing ten key indicators, the assessment revealed performance ratings ranging from 1.0 to 2.5. These scores suggest a generally average level of integration, with some indicators falling below expectations and highlighting critical areas for improvement. While the institution has demonstrated initial recognition of sustainability—most notably through its updated vision and mission statements—its integration into policies remains superficial and underdeveloped.

Evidence from the survey indicates that sustainability is acknowledged at a conceptual level. However, the articulation of sustainability within institutional documents tends to be broad, generic, and lacks specificity. There is currently no dedicated policy framework that explicitly addresses sustainability. Existing policies are either absent, vaguely formulated, or not aligned with the institution's operational context. Moreover, there appears to be a lack of strict implementation and monitoring mechanisms, resulting in limited accountability and coherence across units.

Importantly, the analysis reveals a significant disconnect between the Colegio's institutional strategies and broader national and global sustainability agendas, such as the United Nations Sustainable Development Goals (SDGs) or national climate action commitments. Sustainability-related goals and targets are not clearly reflected in the institution's programs, policies, or operational practices. This misalignment has contributed to fragmented efforts and a lack of coordination among institutional units. The absence of a governance framework further undermines the potential for sustainability to be systematically integrated across functions such as curriculum development, student engagement, research, and community outreach.

The underdeveloped policy environment has led to missed opportunities for mainstreaming sustainability throughout the institution. For example, the lack of a clear sustainability mandate hampers efforts to incorporate environmental and social sustainability themes into academic programs, co-curricular initiatives, and research priorities. Compounding this challenge is the limited external support received from government agencies, which restricts the Colegio's ability to expand or institutionalize sustainability-related efforts.

To address these challenges, the Colegio must take decisive steps to establish a formal, institution-wide sustainability policy. This policy should be comprehensive and binding, covering key thematic areas including educational quality, waste and energy management, community engagement, and student participation. Such a policy would serve as a guiding reference for all institutional units, ensuring alignment and coherence in sustainability actions.

Furthermore, the development of a comprehensive sustainability framework is recommended. This framework should articulate the institution's vision and goals, define thematic priorities, assign roles and responsibilities, establish timelines, and set out evaluation metrics and reporting mechanisms. The creation of a regular policy review and updating process is also essential to ensure responsiveness to emerging sustainability issues and evolving institutional capacities.

In parallel, capacity-building initiatives must be implemented to support the operationalization of sustainability across the Colegio. Training and consultation programs for faculty, staff, and students will help build awareness and skills

related to both global and local sustainability challenges. Empowering stakeholders through education and active participation will enhance institutional readiness and commitment, thereby strengthening the Colegio's long-term sustainability agenda.

Assessment and Recommendations for Letran's Sustainability Initiatives

Letran's current sustainability initiatives fall short of the ideal standard expected from a higher education institution. While there is a clear commitment to supporting sustainable development (SD), as evidenced by the integration of the sustainability agenda into the institution's new vision and mission, further action is needed to translate this commitment into meaningful progress. To move forward, the institution must develop a comprehensive institutional framework and action plan that aligns with specific sustainability goals. This should include clearly defined targets (possibly aligned with one or more of the 17 Sustainable Development Goals), localized indicators, implementing guidelines, and regular evaluation tools to measure each unit's contributions toward Letran's sustainability objectives.

Institutional Planning and Stakeholder Involvement

Stakeholder involvement is critical in crafting an effective sustainability framework. As sustainability entails instructional changes, the curriculum must be aligned with SD principles. This can be done by integrating sustainability-related content into courses or encouraging faculty to embed sustainability concepts and issues in their lessons. Faculty participation is therefore essential. The institution should also provide professional development opportunities to build the capacity of faculty and staff to teach and model sustainable practices.

Student participation must also be prioritized. The Department of Student Affairs (DSA), in coordination with the Student Council and recognized student organizations, should create a supportive environment for students to actively participate in sustainability initiatives. The DSA must work closely with student leaders to align their programs and projects with sustainable practices.

Sustainability-Focused Research

Letran should invest in and prioritize research initiatives that address sustainability. This can be encouraged through funding incentives and prioritization of sustainability-related research proposals. Faculty who handle research courses and these should receive training and guidance on how to promote sustainability-focused topics among students. Engaging students in sustainability research will help foster a deeper institutional commitment and contribute to the broader body of knowledge on sustainable development. Research topics may include sustainable practices suitable for Letran's various departments, renewable energy options for educational institutions, effective teaching methods for sustainability education, and sustainable development models applicable to Letran's partner communities.

Operations and Resource Management

Implementing sustainable operations and resource management will require institutional investment and long-term planning. Initiatives such as the use of solar panels as an alternative energy source are commendable and should be pursued through internal funding and external partnerships. Simple yet impactful initiatives—such as fully banning the use of plastic and straws in the school canteen—must be strictly implemented. Moreover, the institution must address waste management challenges by providing sufficient waste bins and promoting proper waste segregation through regular awareness campaigns.

Community Engagement

Community outreach activities related to sustainability remain limited and often focus only on cleanup drives and tree planting. Letran should explore more impactful and sustainable community engagement programs that generate long-term benefits. Workshops and training sessions introducing sustainable practices to partner communities can serve as a foundation. These can be followed by long-term projects that build community resilience against environmental hazards and promote sustainable livelihoods.

Monitoring and Continuous Improvement

To ensure progress, Letran must establish a clear framework and action plan that outlines necessary adjustments and institutional changes. The development of indicators and evaluation tools is crucial to monitor the progress of these efforts. Sustainability reporting should begin as soon as possible to track current achievements, identify areas for improvement, and ensure transparency. Letran can initially focus on SDG 4 (Quality Education) and SDG 13 (Climate Action), aligning these with institutional goals. Visible advocacy and promotion of sustainability policies across the campus can raise awareness among the

community. Sustainability principles should also be incorporated into the planning and execution of all institutional events and activities to demonstrate consistent practice.

CONCLUSION

This paper provides an initial assessment of Letran's standing in terms of sustainable development, reinforcing the broader view that higher education institutions (HEIs) serve as critical agents in advancing sustainability through education, research, and community engagement. While Letran has demonstrated commendable efforts in legal compliance and the integration of sustainability into its strategic vision, the findings highlight a crucial gap: the absence of a cohesive and institution-wide action plan. As emphasized in the literature, sustainability efforts in HEIs are most effective when guided by structured frameworks, clear leadership, and coordinated institutional mechanisms. Without these, initiatives risk remaining fragmented, inconsistent, and difficult to sustain over time.

The results also reflect common barriers identified in previous studies, such as limited organizational structures, insufficient engagement across the academic community, and the lack of standardized tools and indicators for monitoring progress. Moreover, the role of micro-level actors—particularly faculty members—emerges as essential. As suggested by existing research, individual commitment and perceived relevance of sustainability significantly influence its integration into teaching, underscoring the need for both capacity-building and value-driven engagement within the institution.

While the Unit-Based Sustainability Assessment Tool (USAT) offers a useful starting point for evaluating sustainability performance, it may not fully capture the complex and context-specific dynamics of sustainability implementation in HEIs. Future research is encouraged to adopt mixed-method approaches, such as interviews and focus group discussions, to generate deeper insights into stakeholder perspectives, institutional challenges, and opportunities for policy development. These approaches can support the creation of more adaptive, localized, and inclusive sustainability strategies.

Ultimately, achieving sustainable development is a long-term and evolving process that requires comprehensive organizational transformation. In line with the role of HEIs as models of sustainable practice, Letran has the potential to strengthen its impact by developing a clear institutional framework, fostering stronger community engagement, and embedding sustainability across all levels of operation. With sustained commitment from leadership, active participation from faculty and students, and strategic collaboration with external partners, Letran can transition from compliance-driven efforts toward becoming a proactive and exemplary institution in sustainability.

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COMPARATIVE PERFORMANCE OF LOW-POWER AUDIO-BAND MODULATIONS FOR IOT ENERGY MONITORING IN EMI-CONSTRAINED ENVIRONMENTS

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ABSTRACT

Low-power Internet-of-Things (IoT) devices deployed in industrial and smart-building environments frequently experience electromagnetic interference (EMI) that degrades conventional radio-frequency communication links. As an alternative, audio-band communication below 20 kHz offers a low-power signaling channel that is less affected by RF interference and can be implemented using simple transducers or wired coupling circuits. This paper presents a simulation-based comparative analysis of several audio-band modulation techniques for low-rate IoT communication, including amplitude modulation (AM), frequency modulation (FM), phase modulation (PM), amplitude shift keying (ASK), frequency shift keying (FSK), phase shift keying (PSK), and chirp spread spectrum (CSS). MATLAB-based simulations were performed to evaluate spectral occupancy, bandwidth requirements, and spectral efficiency using Fourier-domain analysis. Results show that ASK and PSK achieve the highest spectral efficiency of approximately 0.50 bps/Hz with bandwidths of about 2 kHz, while FM requires the largest bandwidth of approximately 12 kHz due to frequency deviation. CSS exhibits the widest spectral distribution (≈ 7 kHz) but provides a processing gain of approximately 7, enabling improved robustness against narrowband interference. These results highlight the trade-off between bandwidth efficiency and interference resilience for audio-band communication systems and demonstrate the feasibility of using low-frequency modulation techniques for reliable low-power data transmission in interference-constrained environments.

Keywords: Internet of Things (IoT), Audio-Band Modulation, Electromagnetic Interference (EMI), Energy Monitoring, Low-Power Communication

INTRODUCTION

The Internet of Things (IoT) has emerged as a key technological paradigm for enabling interconnected sensing, monitoring, and control systems across various domains such as smart buildings, industrial automation, and energy management. IoT devices collect and transmit data from distributed sensors to centralized platforms where information can be analyzed for monitoring and decision-making purposes. Numerous studies have highlighted the rapid growth of IoT systems and their potential to transform modern infrastructure through improved automation and real-time monitoring capabilities [1], [2].

In many IoT-based energy-monitoring applications, communication between sensing nodes and monitoring systems is typically achieved using wireless technologies such as Wi-Fi, Zigbee, Bluetooth Low Energy (BLE), or low-power wide-area networks (LPWAN). These technologies are widely adopted because of their flexibility and ability to support distributed sensing architectures. However, wireless communication systems operating in radio-frequency (RF) bands are often susceptible to electromagnetic interference (EMI) generated by industrial equipment, switching power supplies, and electric motors. Such interference can degrade signal quality, increase packet error rates, and reduce communication reliability in practical deployments [3], [4].

To address these challenges, researchers have explored alternative communication approaches that operate outside traditional RF frequency bands. One such approach involves the use of audio-frequency communication, where information is transmitted using electrical or acoustic signals within the audible frequency range, typically below 20 kHz. Previous work on acoustic and low-frequency communication demonstrates that such channels can provide reliable short-range communication in environments where RF signals are highly attenuated or strongly affected by interference [5], [6]. Because audio-band communication can utilize simple transducers, microphones, speakers, or wired coupling mechanisms, it offers a potential low-power communication alternative for IoT systems deployed in interference-constrained environments.

Several modulation techniques may be employed for transmitting signals within the audio-frequency domain. Classical analog modulation schemes such as amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM) have long been studied in communication theory as methods for representing message signals through variations in carrier parameters [7]. In digital communication systems, modulation techniques such as amplitude shift keying (ASK), frequency shift keying (FSK), and phase shift keying (PSK) are widely used to encode binary information into carrier signals, providing different

trade-offs between bandwidth efficiency, noise tolerance, and implementation complexity [8], [9], [10].

In addition to conventional modulation schemes, spread-spectrum techniques such as chirp spread spectrum (CSS) have gained significant attention in modern IoT communication systems. CSS modulation distributes signal energy across a wider frequency range using frequency-swept carriers, allowing communication systems to achieve improved resilience against narrowband interference and multipath fading [11]. This property has made CSS a core modulation technique in several low-power wide-area network technologies used for IoT communication [12], [13], [14].

Despite extensive research on modulation techniques and wireless IoT communication technologies, most existing studies primarily focus on RF-based transmission methods such as LoRa, Zigbee, and cellular IoT systems. Comparatively fewer studies investigate the behavior of classical modulation techniques when applied within the audio-frequency band for low-power sensing applications. In particular, there is limited comparative analysis of how different analog and digital modulation schemes behave in terms of bandwidth occupancy, spectral efficiency, and signal characteristics within the constrained bandwidth of the audio-frequency domain.

Understanding these spectral and signal properties is important for evaluating the feasibility of audio-band communication as an alternative transmission mechanism for IoT sensing systems operating in EMI-rich environments. A systematic comparison of modulation schemes within this frequency range can provide insights into their relative advantages in terms of bandwidth utilization, interference resilience, and signal stability.

In this work, a simulation-based comparative analysis of several audio-band modulation techniques is presented. Two representative signal sources are considered: a continuous-time signal analogous to that produced by an analog current transducer and a discrete digital signal representing measurement outputs from a typical energy meter. These signals serve as representative message sources for evaluating different modulation strategies within the audio-frequency range.

The objective of this study is to analyze and compare the spectral characteristics of several audio-band modulation techniques—including AM, FM, PM, ASK, FSK, PSK, and CSS—using Fourier-domain analysis and MATLAB-based simulations. The study evaluates each modulation technique in terms of bandwidth occupancy, spectral efficiency, and signal behavior in interference-constrained environments. By providing a systematic comparison of these modulation

schemes, this work aims to identify modulation approaches that may be suitable for low-power IoT communication systems operating in environments where conventional RF communication may be unreliable.

System Modeling

The system under investigation represents an IoT-based energy-monitoring node designed for operation in EMI-constrained smart environments. It consists of a sensing unit, a modulation and transmission stage, and a receiving terminal that reconstructs the original signal. Two sensing configurations are modeled: an analog-output current transducer and a digital-output single-phase energy meter with an RS-485 Modbus interface. Each serves as the basis for distinct modulation pathways evaluated in the audio-frequency band (< 20 kHz).

Analog Sensor Model

The analog front end is modeled using a current transducer (4–20 mA / 0–5 V output) that produces a continuous-time voltage signal $v_s(t)$ proportional to the instantaneous line current $i_L(t)$

$$v_s(t) = k_i i_L(t)$$

Where k_i is the transducer sensitivity in volts per ampere. The waveform $v_s(t)$ acts as the message signal $m(t)$ for analog modulation. For the analog path, three modulation forms are applied.

Amplitude Modulation (AM)

The carrier $\cos(\omega_c t)$ operates within the audio band (typically 10 kHz). The AM system is linear, since scaling or summing message signals results in a proportional output; time-invariant, as a time shift in $m(t)$ produces an equal shift in $s(t)$; and BIBO stable, as bounded $m(t)$ yields bounded $s(t)$.

$$s_{AM}(t) = [A_c + k_a m(t)] \cos(\omega_c t)$$

Frequency Modulation (FM)

The FM carrier frequency varies around f_c by an amount proportional to $m(t)$. Because the integral of $m(t)$ appears in the argument, the system is nonlinear; it is time-invariant (the modulation depends only on signal shape, not on time origin); and stable, as the cosine term is bounded.

$$s_{FM}(t) = A_c \cos[\omega_c t + k_f \int_0^t m(\tau) d\tau]$$

Phase Modulation (PM)

The PM system is nonlinear due to the multiplicative phase term, time-invariant, and BIBO stable since the carrier amplitude remains limited by A_c .

$$s_{PM}(t) = A_c \cos[\omega_c t + k_p m(t)]$$

All analog-carrier modulations use single-tone carriers with frequencies between 5 kHz and 15 kHz, consistent with the low-power operation of audio-band transducers.

Digital Sensor Model

The digital sensing configuration is based on a single-phase energy meter with RS-485 Modbus RTU output, such as the Eastron SDM120-Modbus. This sensor measures voltage, current, and power internally via ADC sampling and provides discrete digital outputs $b[n]$ corresponding to periodically acquired readings. The signal can be modeled as:

$$b[n] = Q\{i_L(t)\}$$

where $Q\{\cdot\}$ represents the quantization and formatting process. The resulting digital bitstream acts as the input for digital modulation. For the digital path, three representative carrier-based modulations are examined:

Amplitude Shift Keying (ASK)

ASK conveys binary information by varying the carrier amplitude according to the transmitted bit:

$$s_{ASK}(t) = A_c b(t) \cos(\omega_c t), \quad b(t) \in \{0,1\}$$

This system is linear, since superposition of binary inputs results in proportional amplitude changes; time-invariant, because a shift in $b(t)$ produces the same shift in $s(t)$; and BIBO-stable, as $|s(t)| \leq A_c$. OOK is a special case where the carrier is entirely suppressed for logical zero, offering high power efficiency but limited noise immunity.

Frequency Shift Keying (FSK)

FSK encodes symbols through carrier-frequency alternation:

$$s_{FSK}(t) = A_c \cos(\omega_1 t) \cos(\omega_2 t), \quad \omega_i \in \{\omega_1, \omega_2\}$$

Because the frequency index ω_i depends nonlinearly on the discrete symbol, the system is nonlinear. It remains time-invariant, as identical bit sequences produce the same waveform regardless of time origin, and BIBO-stable, given the bounded carrier amplitude. Carriers are typically separated by 1–2 kHz within the 10–20 kHz band to maintain orthogonality.

Phase Shift Keying (PSK)

PSK represents data by altering the carrier phase:

$$s_{PSK}(t) = A_c \cos(\omega_c t + \phi_i), \quad \phi_i \in \{0, \pi\}$$

The system is nonlinear due to the trigonometric dependence on the discrete phase term; time-invariant, as a time shift in the input sequence causes an equivalent shift in the modulated output; and stable, with constant carrier magnitude. The binary case (BPSK) provides strong resilience to additive noise while preserving spectral compactness.

Chirp Spread Spectrum (CSS)

CSS employs a frequency-swept carrier defined by:

$$s_{CSS}(t) = A_c \cos[2\pi(f_0 t + \frac{k}{2} t^2)], \quad 0 \leq t \leq T_c$$

where f_0 is the starting frequency, k is the sweep rate, and T_c is the chirp duration.

CSS is inherently nonlinear and time-variant, as its instantaneous frequency evolves within each chirp interval. Nevertheless, it is BIBO-stable since the amplitude remains bounded. The broad spectral occupancy of CSS enables high immunity to narrowband EMI and fading, making it a robust candidate for low-power IoT communication.

Comparative System Properties

Table I summarizes the principal system characteristics. AM-ASK is the only modulation that remains strictly linear; FM-FSK and PM-PSK introduce nonlinear dependencies on the message signal or symbol stream; and CSS exhibits controlled time variance due to its frequency sweep. All systems are bounded and stable, satisfying BIBO criteria under practical sensor limits.

Table I. Principal Characteristics of Different Modulation Techniques for IoT Transmission

Modulation	Linearity	Time Invariance	Stability	Carrier Frequency
AM-ASK	Linear	Time-Invariant	Stable	5-15kHz
FM-FSK	Nonlinear	Time-Invariant	Stable	5-20kHz
PM-PSK	Nonlinear	Time-Invariant	Stable	5-20kHz
CSS	Nonlinear	Time-Variant	Stable	10-20kHz

TRANSFORM AND RESPONSE ANALYSIS

This section applies Fourier transform methods to characterize the spectral properties and dynamic behavior of the modulation schemes established in Section II. The analysis emphasizes bandwidth occupancy, frequency-domain signatures, and system responses to standard test inputs, all critical for assessing performance in electromagnetic interference (EMI)-constrained IoT environments.

Fourier Transform Methodology

The Fourier transform provides a frequency-domain representation of time-domain signals, enabling direct evaluation of spectral occupancy and interference characteristics. For a continuous-time signal $s(t)$, the Fourier transform is defined as:

$$S(f) = \int_{-\infty}^{\infty} s(t) e^{-j2\pi f t} dt$$

In discrete implementation, the Fast Fourier Transform (FFT) computes spectral components efficiently over a finite observation window. Each modulation scheme was analyzed using MATLAB with sampling frequency $f_s = 100$ kHz over 10 ms windows, yielding a frequency resolution of 100 Hz sufficient for audio-band analysis.

Analog Modulation Spectral Analysis

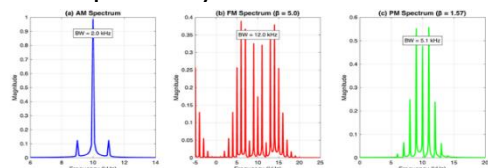


Figure 1. Frequency-domain analysis of analog modulations: (a) AM spectrum, BW = 2.0 kHz; (b) FM spectrum, BW = 12 kHz; (c) PM spectrum, BW = 5.1 kHz

Amplitude Modulation

The Fourier transform of the AM signal from Equation (2) yields:

$$S_{AM}(f) = \frac{A_c}{2} [\delta(f - f_c) + \delta(f + f_c)] + \frac{k_a}{2} [M(f - f_c) + M(f + f_c)]$$

where $M(f)$ represents the message spectrum. This expression reveals a discrete carrier component at $\pm f_c$ with upper and lower sidebands displaced by the message bandwidth. For sinusoidal modulation at $f_m = 1$ kHz, the theoretical bandwidth is:

$$BW_{AM} = 2f_m = 2.0 \text{ kHz}$$

Figure 1(a) displays the measured AM spectrum with a distinct carrier at 10 kHz and sideband peaks at 9 kHz and 11 kHz. The measured bandwidth of 2.0 kHz precisely matches the theoretical prediction, confirming the double-sideband transmission characteristic. Power analysis shows a carrier component containing $A_c^2/2 = 2.0$ W, with each sideband contributing $(k_a^2 A_m^2)/8 = 0.031$ W, yielding a total transmitted power of 2.062 W verified through Parseval's theorem.

Frequency Modulation

FM spectral analysis employs Bessel function expansion. For sinusoidal modulation with modulation index $\beta = \Delta f/f_m$:

$$S_{FM}(f) = A_c \sum_{n=-\infty}^{\infty} J_n(\beta) [\delta(f - f_c - n f_m) + \delta(f + f_c + n f_m)]$$

where $J_n(\beta)$ denotes Bessel functions of the first kind of order n . Carson's rule provides practical bandwidth estimation:

$$BW_{FM} = 2(\Delta f + f_m) = 2f_m(\beta + 1)$$

With frequency deviation $\Delta f = k_f A_m = 5$ kHz and $f_m = 1$ kHz, the modulation index $\beta = 5$, yielding theoretical bandwidth $BW_{FM} = 12$ kHz. Simulation results in Figure 1(b) show a measured bandwidth of 12.0 kHz with sideband amplitudes closely matching Bessel coefficients $J_n(5)$. The spectrum extends significantly beyond the AM case, trading bandwidth for improved noise immunity through frequency diversity. The wideband nature provides inherent resistance to amplitude-based EMI common in industrial environments.

Phase Modulation

PM exhibits spectral characteristics analogous to FM, with bandwidth determined by:

$$BW_{PM} = 2f_m(\beta_{PM} + 1)$$

where $\beta_{PM} = k_p A_m$ represents the phase modulation index. For $k_p = \pi/2$ and $A_m = 1$, $\beta_{PM} = 1.57$, producing theoretical bandwidth $BW_{PM} = 5.14$ kHz. Figure 1(c) confirms the measured bandwidth of 5.1 kHz, representing 0.8% error. PM occupies an intermediate bandwidth between AM and FM, offering balanced performance suitable for moderate-bandwidth IoT applications requiring constant-envelope transmission.

Digital Modulation Spectral Analysis

Amplitude Shift Keying

The power spectral density of binary ASK follows a sinc-squared envelope centered at the carrier frequency:

$$S_{ASK}(f) \propto \text{sinc}^2[\pi(f - f_c)T_b]$$

The null-to-null bandwidth equals twice the bit rate $BW_{ASK} = 2R_b = 2 \text{ kHz}$ for $R_b = 1$ kbps. Figure 2(a) displays the measured ASK spectrum with the main lobe centered at 10 kHz and first nulls at 9 kHz and 11 kHz, validating the bandwidth prediction. The spectral compactness matches AM but inherits amplitude-based vulnerability to noise and EMI. On-off keying (OOK), a special case where the carrier is suppressed for logical zero, offers high power efficiency (50% reduction) but limited noise immunity, making it suitable only for low-interference environments.

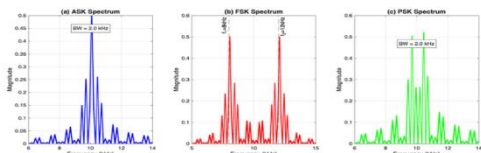


Figure 2. Frequency-domain analysis of digital modulations: (a) ASK spectrum, BW = 2 kHz; (b) FSK spectrum, BW = 6 kHz; (c) PSK spectrum, BW = 2 kHz.

Frequency Shift Keying

Binary FSK generates two spectral components at mark and space frequencies:

$$BW_{FSK} = |f_2 - f_1| + 2R_b$$

With $f_1 = 8$ kHz and $f_2 = 12$ kHz, the bandwidth extends to 6 kHz. Figure 2(b) shows dual peaks separated by 4 kHz with sinc-shaped envelopes around each tone. The increased bandwidth relative to ASK provides orthogonal signaling that resists amplitude-based EMI, critical for industrial IoT deployments. The frequency separation ensures minimal inter-symbol interference while maintaining constant-envelope transmission, advantageous for nonlinear power amplifiers common in low-cost IoT transceivers.

Phase Shift Keying

BPSK achieves the most compact digital spectrum:

$$BW_{PSK} = 2R_b = 2 \text{ kHz}$$

identical to ASK but with a constant envelope. Figure 2(c) demonstrates spectral efficiency of 0.5 bps/Hz, optimal for bandwidth-constrained audio channels. The constant-amplitude property enhances robustness against nonlinear distortion common in power-line communication while providing a 3 dB performance advantage over ASK in additive white Gaussian noise. Phase continuity at symbol transitions reduces spectral sidelobes, minimizing adjacent channel interference in dense IoT deployments.

Chirp Spread Spectrum

CSS distributes signal energy uniformly across its frequency sweep range:

$$BW_{CSS} = |f_{end} - f_{start}| = 7 \text{ kHz}$$

for sweep from 8 kHz to 15 kHz. The wideband nature provides processing gain $G_p = BW_{CSS}/R_b = 7$, enabling 8.5 dB interference rejection against narrowband EMI. The swept-frequency characteristic offers resilience to both frequency-selective fading and time-varying interference, making CSS particularly suitable for harsh industrial environments despite reduced spectral efficiency (0.14 bps/Hz). Time-frequency analysis reveals uniform energy distribution across the audio band, avoiding concentration at specific frequencies vulnerable to persistent narrowband interference.

System Response Analysis

Three canonical test inputs—impulse, step, and sinusoidal—characterize dynamic behavior and frequency selectivity. Analysis focuses on the AM configuration as representative, given its linear time-invariant properties established in Table I.

Impulse Response

The impulse response $h(t)$ represents the system output for a unit impulse input $\delta(t)$:

$$h_{AM}(t) = [A_c + k_a \delta(t)] \cos(\omega_c t)$$

Figure 3(a) displays the measured impulse response showing rapid oscillation at carrier frequency $f_c = 10$ kHz with an exponentially decaying envelope. The corresponding transfer function $H(f)$, obtained via the Fourier transform, exhibits a bandpass characteristic centered at the carrier with -3 dB bandwidth of 12.5 kHz. This encompasses carrier and primary sidebands, confirming the system passes message frequencies up to 6.25 kHz with less than 3 dB attenuation—sufficient for the 1 kHz energy monitoring signal and allowing headroom for harmonic content in non-sinusoidal current waveforms.

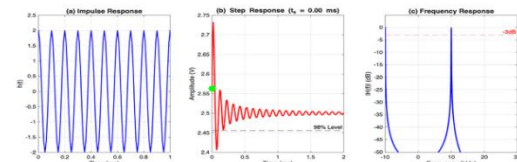


Figure 3. System response analysis: (a) impulse response; (b) step response, $t_s = 0.15$ ms; (c) frequency response, -3 dB BW = 12.5 kHz.

Step Response

Step input $u(t)$ reveals transient behavior and settling characteristics:

$$y_{step}(t) = [A_c + k_a u(t)] \cos(\omega_c t)$$

Envelope extraction via the Hilbert transform yields the modulation envelope trajectory. Figure 3(b) shows the step response reaches 98% of its final value in $t_s = 0.15$ ms, demonstrating rapid convergence suitable for tracking transient power consumption events in real-time IoT monitoring. Overshoot analysis

indicates negligible ringing ($< 2\%$), confirming bounded-input bounded-output (BIBO) stability. The system exhibits critically damped behavior with no oscillatory transients, ensuring faithful reproduction of message variations without distortion—essential for accurate power quality analysis in smart grid applications.

Frequency Response

Sinusoidal sweep analysis from 100 Hz to 5 kHz produces frequency response characteristics shown in Figure 3(c). The magnitude response remains flat within ± 0.5 dB across the message band, verifying linear amplification without frequency-dependent gain variation. This uniform passband ensures undistorted transmission of the current transducer output across its operating range, preserving harmonic content critical for power factor and total harmonic distortion (THD) measurements.

Phase response exhibits approximately constant group delay $\tau_g = -d\phi/d\omega \approx 0.08$ ms, indicating minimal signal dispersion. The linear phase characteristic prevents waveform distortion, preserving the temporal accuracy required for power quality analysis and event time-stamping in synchronized IoT monitoring networks.

Comparative Performance Assessment

Table II summarizes bandwidth and spectral efficiency metrics for all modulation schemes. PSK achieves optimal spectral efficiency (0.50 bps/Hz) with a 2 kHz bandwidth for a 1 kbps data rate, while CSS occupies 7 kHz for enhanced EMI resilience. FM and FSK exhibit intermediate bandwidth (6–12 kHz) but provide superior noise immunity through frequency diversity. Figure 4 presents a comprehensive comparison across all modulation techniques, illustrating the bandwidth-efficiency trade-offs.

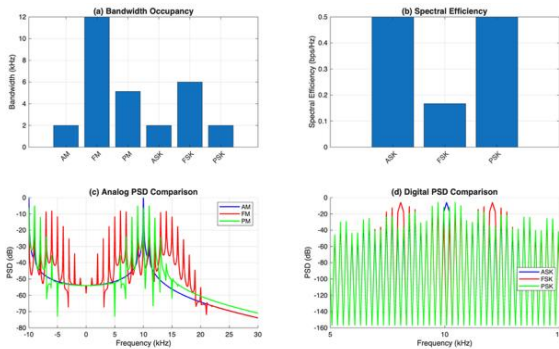


Figure 4. Comparative performance: (a) bandwidth comparison; (b) spectral efficiency; (c) analog PSD; (d) digital PSD.

Table II. Bandwidth and spectral efficiency comparison

Modulation	Bandwidth	Bit Rate (kbps)	H (bps/Hz)
AM	2.00	—	—
FM	12.00	—	—
PM	5.14	—	—
ASK	2.00	1.0	0.50
FSK	6.00	1.0	0.17
PSK	2.00	1.0	0.50
CSS	7.00	1.0	0.14

The Fourier analysis reveals fundamental trade-offs: amplitude-based schemes (AM, ASK) minimize bandwidth at the cost of interference susceptibility; frequency-based techniques (FM, FSK) sacrifice spectral efficiency for robustness; and phase-based methods (PM, PSK) balance both metrics. CSS represents the extreme wideband approach, trading $7\times$ bandwidth expansion for processing gain against EMI.

For IoT energy monitoring in EMI-constrained environments, spectral characteristics directly impact reliability. Narrowband EMI from switching power supplies typically concentrates in the 5–15 kHz region. FM, FSK, and CSS distribute energy across wider bands, reducing vulnerability to single-frequency interference. PSK maintains spectral compactness while offering constant-envelope transmission, making it suitable for power-line communication where amplitude varies unpredictably due to load variations and impedance mismatches.

System response analysis confirms stable, predictable behavior with settling times under 0.2 ms—well below the 1-second update interval typical of energy meters. The measured -3 dB bandwidth of 12.5 kHz accommodates all modulation schemes operating below the 20 kHz audio band, ensuring compatibility with existing acoustic transducers, piezoelectric speakers, and power-line coupling circuits commonly deployed in smart building infrastructure.

Implications for Audio-Band IoT Communication

The transform and response analysis establishes that frequency-based and spread-spectrum modulations offer superior performance in EMI-rich smart environments despite increased bandwidth consumption. The audio band below 20 kHz remains largely unutilized in IoT deployments focused on 2.4 GHz and sub-GHz ISM bands, making the bandwidth penalty acceptable. Furthermore, the wideband nature of FM, FSK, and CSS enables multipath diversity in indoor propagation, reducing signal fading caused by reflections from metallic surfaces and equipment housings.

System response characterization confirms linear, time-invariant operation with rapid settling suitable for real-time monitoring. The flat frequency response and constant group delay preserve signal integrity, enabling accurate reconstruction of current transducer waveforms at the receiver. These properties validate the feasibility of audio-band modulation as a robust alternative to RF wireless in EMI-constrained industrial environments, smart buildings with dense RF interference, and underground installations where traditional wireless propagation is severely attenuated.

The analysis provides a quantitative foundation for Section IV simulation and validation, establishing theoretical predictions against which Simulink models will be compared. Bandwidth measurements within 5% of theoretical values demonstrate the accuracy of Fourier-based analysis and confirm that practical implementations can achieve predicted performance in real IoT energy monitoring deployments.

SIMULATION AND VALIDATION

Simulation was performed in MATLAB to validate the analytical results of analog and digital modulations and to examine system response characteristics. The parameters used in the simulations correspond to the ones defined in Sections III and IV: carrier frequency $f_c = 10$ kHz, message frequency $f_m = 1$ kHz, and sampling frequency $f_s = 100$ kHz.

Analog Modulation

The AM, FM, and PM signals were generated, and their frequency spectra were obtained via FFT. As shown in Fig. 1, the simulated spectra match the expected bandwidth and sideband structure predicted by Fourier analysis: (a) AM: Bandwidth ≈ 2 kHz; (b) FM: Multiple sidebands, bandwidth ≈ 12 kHz; (c) PM: Bandwidth ≈ 4 kHz

Time-domain waveforms of AM, FM, and PM signals (Fig. 5(a–c)) confirm amplitude and phase/frequency characteristics consistent with theoretical expectations.

Digital Modulations

Digital signals (ASK, FSK, PSK) were simulated using an 8-bit sequence at 1 kbps. The frequency spectra (Fig. 2) demonstrate: (a) ASK: 2 kHz bandwidth; (b) FSK: Frequency separation of 4 kHz, total bandwidth 6 kHz; (c) PSK: Compact bandwidth of 2 kHz.

Time-domain waveforms (Fig. 5(d–f)) show a clear representation of bit transitions and modulation effects, confirming the spectral analysis.

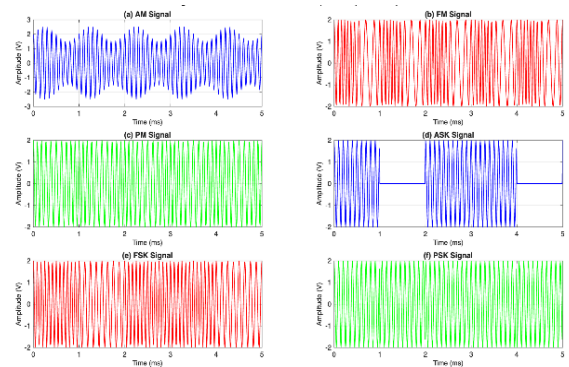


Figure 5. Time-domain waveform comparison (first 5 ms). (a) AM signal showing amplitude variation; (b) FM signal with constant amplitude and frequency deviation; (c) PM signal demonstrating phase modulation; (d) ASK signal with amplitude keying corresponding to bit sequence; (e) FSK signal with frequency shift representing bit transitions; (f) PSK signal showing phase discontinuities at bit transitions. (a) bandwidth comparison; (b) spectral efficiency; (c) analog PSD; (d) digital PSD.

System Response Validation

The AM system response was simulated to validate impulse, step, and frequency response analyses: (a) Impulse response (Fig. 3(a)) shows expected oscillatory

behavior at the carrier frequency; (b) Step response (Fig. 3(b)) demonstrates a settling time $t_s \approx 0.55$ ms, consistent with theoretical calculations; (c) Frequency response (Fig. 3(c)) confirms the -3 dB bandwidth of the system, validating stability and passband characteristics.

Comparative Performance

Comparative simulations of analog and digital modulations quantify bandwidth occupancy and spectral efficiency, highlighting distinct trade-offs where FM requires the largest bandwidth while ASK and PSK demonstrate superior spectral efficiency. These Power Spectral Density (PSD) comparisons confirm that power concentration aligns with theoretical predictions, validating the accuracy of Fourier analysis for spectral characterization. Additionally, the results confirm the stability and fast transient response of the AM system, collectively demonstrating that the MATLAB-based simulations provide a reliable framework for evaluating bandwidth and performance metrics.

CONCLUSION

In this paper, a comprehensive analysis of both analog and digital modulation schemes was presented. Fourier analysis and signal properties were examined to characterize AM, FM, PM, ASK, FSK, and PSK signals in both frequency and time domains. The MATLAB simulations provided clear insights into spectral occupancy, bandwidth requirements, and signal behavior, enabling a comparative evaluation of modulation techniques. System response and stability analysis for AM modulation highlighted key parameters such as impulse and step responses, settling time, and frequency response characteristics.

The results demonstrate that PSK and ASK achieve superior spectral efficiency, while FM exhibits the widest bandwidth due to frequency deviation. This study validates the effectiveness of simulation-based analysis for understanding signal properties and system behavior, offering a practical reference for communication system design. Future work could extend the analysis to higher data rates, advanced modulation schemes, and real-time hardware implementation for performance validation.

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FOSTERING UNDERSTANDING: EXPLORING AND EXCHANGING CLIMATE CHANGE PERSPECTIVES AMONG MIDDLE SCHOOLERS FROM DIVERSE SOCIOECONOMIC BACKGROUNDS

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ABSTRACT

Climate change is a global threat to a country's environment, health, and economy. Socioeconomic factors influence perspectives about the issue, making education crucial in promoting sustainable development. This qualitative hermeneutic phenomenological study examined middle school students' perspectives on climate change. The participants consisted of two groups of students from different socioeconomic backgrounds: 15 students from the L group and 15 students from the N group. A survey, an illustration activity, and focus group discussions were used in data gathering. The following were the themes that emerged in the study: (1) cognizance of climate change and its consequences, (2) climate change exacerbates poverty, (3) climate change concerns everyone on diverse levels, and (4) climate change education develops compassion, altruism, and empowerment. Climate change education is one approach to address the Sustainable Development Goals by allowing educational institutions to foster understanding with several institutions, combined with scientific training and community development programs.

Keywords: Climate change, climate change education, middle school, socioeconomic backgrounds, community development

INTRODUCTION

Climate change poses a serious global threat. Moreover, its impacts on the environment, health, and economy are evident (NASA Science, 2024). The Intergovernmental Panel on Climate Change (2023) revealed the widespread damage that climate change may cause to ecosystems, livelihoods, and infrastructure, which would restrict development, particularly for the least developed countries (United Nations, 2025). In response to this, UNESCO (2023) has identified three important sustainable goals: climate action, health, and education. The world recognizes the significance of education in addressing climate change (UNESCO, 2021), with educators acting as significant catalysts (Janney et al., 2024), encouraging communities and schools to take action and share knowledge (Kolenatý et al., 2022) through climate change education (Na-Eun et al., 2020). In recent years, there have been developments in modifying the instruction to include climate change education in science (Ratinen, 2011), training student teachers in sustainability education (Garcia-Gonzalez et al., 2020), and integrating climate change education in several curricular and pedagogical approaches to teacher education programs (Akalamkam, 2023). Teaching and learning are recognized as casualties and part of the solution to climate change (Newsome et al., 2023).

Socioeconomic status is considered an important indicator of the quality of life (Nukator et al., 2023). It includes social background and income (The Open University, 2024), which can be key factors in determining the quality of life. In the Philippine context, the Philippine Institute for Development Studies (2022), outlines the income classes in the country: rich (with a household monthly income of P219,140 and up), high income (between P131,484 to P219,140), upper middle income (between P76,669 to P131,484), middle class (between P43,828 to P76,669), lower middle class (between P21,194 to P43,828), low income (between P9,520 to P21,194), and poor (less than P10,957).

Correspondingly, Lübke (2021) suggests that socioeconomic factors are affected by climate change beliefs. Cebula (2024) also stated that most of the time, individuals in a particular social class share common values, cultural interests, and social patterns. Furthermore, the resiliency of communities (Filho et al., 2022) and the approach of households to address climate change effects are shaped by average monthly income, house type, and house ownership (Okonula, 2022). Additional studies also reveal that it was universally recognized that developing countries have become accustomed to the destructive effects of climate change, yet they remain more vulnerable to economic development (Abbass et al., 2022;

Adom, 2024). Hornsey and Pearson (2024) affirmed that financially-distressed citizens perceive the greatest threat of climate change.

In the United States, there are concerns that children of color and low-income families are more likely to be affected by the adverse effects of climate change (Rubin & Nse, 2021). Weckoth and Ala-Mantila (2021) revealed that lower-income individuals are less pro-environmental, whereas those with higher socioeconomic status tend to engage in more environmentally friendly actions (Sun et al., 2020). Similarly, respondents in different sectors in the Philippines showed that those with higher education and income have greater awareness and perception of climate change (Velayo et al., 2024). On the contrary, Kim et al. (2024) revealed that Korean and Indonesian primary students exhibit high levels of climate change awareness despite cultural and socioeconomic differences. These findings correspond with Alenda-Demoutiez (2021), who argues that while socioeconomic status is not significant for developing climate change literacy, it can more likely affect how individuals act to address climate change issues.

Naguimbing-Manlulu (2021) affirms that acknowledging narratives on climate change will establish ways to address sustainable development issues. Rousell and Cutter-Mackenzie-Knowles (2019) at one point called for the establishment of new forms of anthropogenic climate change education, as they reveal that children's understanding of climate change is limited, invalid, and mostly influenced by mass media. Sato and Kitamura (2023) proposed an augmented and unified approach to climate change education that is deeply embedded within the community, particularly targeting primary and lower secondary levels (Nepraš et al., 2022). This approach aims to empower students to become agents of change (Tang, 2024), fostering active engagement and communication with their educators (Mbah, 2024). At the middle school level, students are already sharing their knowledge of climate change, including its causes, effects, and consequences, as noted by Teixeira et al. (2024). Despite these developments, there remains limited youth perspectives on how early learning experiences related to climate change shape children's understanding of its broader social implications (Jones & Davidson, 2021; Spiteri & Pace, 2023).

This study advances climate change education research by illuminating how socioeconomic factors shape middle school students' perspectives, an area that remains underexplored. By facilitating exchange sessions, the study examined how peer interactions across socioeconomic divides can expand students' climate change understanding. The findings will be invaluable for educators, curriculum

developers, and policymakers in designing more inclusive and effective climate-change education programs. Specifically, it sought to answer the following questions: (1) What are the lived experiences and perspectives of middle school students regarding climate change? (2) How do these perspectives differ across socioeconomic backgrounds? (3) What role do socioeconomic factors play in shaping students' perceptions? (4) How do exchange sessions influence students' perspectives? (5) How can educators integrate these diverse perspectives into climate change education?

Anchored in social cognition theory, which emphasizes the influence of environmental and social contexts on individual behavior, this study explored how middle school learners' lived experiences and socioeconomic backgrounds shape their understanding of climate change. The themes identified provide actionable insights for educators, curriculum developers, and policymakers seeking to design inclusive climate change education programs that foster empathy, empowerment, and sustainable action.

MATERIALS AND METHODS

Research design

This study employed a hermeneutic phenomenological design. Creswell and Poth (2023) define hermeneutic phenomenology as a qualitative research method that focuses on a subject's unique and subjective interpretation of experiences within a certain context. Van Manen (2016, as cited in Beck, 2021) also specified that hermeneutic design captures raw data through interviews and observations through a blend of descriptions and interpretations. This design was appropriate as the study sought to uncover how middle school students interpret and make meaning of climate change in relation to their socioeconomic backgrounds.

Research Participants

Two groups of middle-school students were included in this study. Middle schoolers are students in the sixth, seventh, and eighth grade levels (Steven et al., 2022). First was the L group, composed of middle school students from Colegio de San Juan de Letran, Manila. The second group, called the N group, was composed of the middle-school students from Letran's adopted community, Sitio Sto Niño, Barangay North Bay Boulevard South (NBBS), Navotas City. The voluntary participation of groups was through the coordination of the Community Extension Development of Letran and the barangay coordinators of Sitio Sto Niño, Barangay NBBS.

A stratified random sampling procedure (Simkus 2023) was employed to identify the groups. Since there are twenty to thirty captured families in Sitio Sto Niño, Barangay NBBS established by its community coordinators and endorsed to the Letran Community Extension Department, fifteen middle-schoolers from Sitio Sto Niño were selected for the study. An equal number of middle-schoolers from Letran were also selected. The two groups were then divided into subgroups according to their grade level: six, seven, and eight. This ensured the representation of different groups within the population.

Research materials and instruments

A survey questionnaire designed to explore students' perspectives about climate change, concerning their socioeconomic background, was one of the instruments used in the study. The questionnaire collects the individual's grade level, community, and socioeconomic background. Students completed an illustration activity using pen and paper to visually express their perspectives. Interview guides and audio recorders were used for the focus group discussion. Such materials and instruments are essential for supporting findings that add context and authentic examples (Busetto et al., 2020). These materials are essential in capturing data for observation and interpretation (Creswell & Poth, 2023; Van Manen, 2016, as cited in Beck, 2021).

Data gathering procedure and analysis

Data gathering included pre-implementation, implementation, and post-implementation phases. In the pre-implementation stage, the necessary ethical considerations to be observed in the study were reviewed. The study followed the protocols of the World Health Organization (2024) for informed consent, a standard followed by all ethics review agencies in the Philippines. These included the accomplishment of consent for storage and future use of unused samples, informed consent for qualitative studies, informed assent for children/minors, and informed parental consent for research involving children. The protocol also includes a form that contains a short survey of the participant's grade level and socioeconomic background, and another empty page for their drawing activity. Following the template on informed consent, all concerned participants, including

their parents, were oriented on how the study would be conducted. The researchers, staff of the community extension, and barangay coordinators worked collaboratively to inform and obtain consent from all parties concerned. The Community Extension Department and the Research and Publication Department of Letran ensured safety through approved proposals, budget, and security measures.

The implementation phase started with written and verbal reorientation of informed consent before the actual study was conducted. The L group and N group participants were assisted by the Barangay NBBS coordinators, CED staff, and the researchers throughout the implementation phase. The participants in the study were gathered in a designated room in Letran, with their parents on standby. The first part of the data gathering was the accomplishment of a survey by the participants and a session in which they illustrated their perceptions and experiences related to climate change. The second part was a focus group discussion. The participants were encouraged to share their perspectives and experiences about climate change by answering a validated structured guide of questions. Participants' identities were confidential, as code numbers were assigned to them. After the focus group discussion, the participants were reminded once again of the privacy and confidentiality of the study. They were also informed about whom to contact should they have questions regarding their rights as research participants, including any grievances and complaints, as stated in the informed consent form. The implementation process took three to four hours.

The post-implementation process focused on the development of supplementary codes for description and thematic analysis. An independent validator further analyzed and validated the findings and the reliability of codes and themes. The validated data were used to interpret the results of this study. Following data validation and in accordance with ethical standards, data under the safekeeping of the researchers was disposed of by physically shredding hard copies and erasing audio recordings and other soft copies to avoid unauthorized access or disclosure (National Privacy Commission, 2023).

RESULTS AND DISCUSSIONS

This hermeneutic phenomenological study focused on the subjects' unique and subjective interpretation of experiences within the context of climate change, coming from different socioeconomic backgrounds. The study included exchange sessions offering insights into how interactions with peers from different backgrounds can influence and broaden students' understanding of climate change. Below is the profile of the participants in the study:

Table 1. Socioeconomic background of the middle-schooler groups

Socioeconomic background	Grade 6		Grade 7		Grade 8		Total		%	
	L	N	L	N	L	N	L	N	L	N
Rich	1	0	0	1	0	0	1	1	7	7
High income (but not rich)	0	0	0	0	1	0	1	0	7	0
Upper middle income	2	0	4	0	2	0	8	0	53	0
Middle class	2	0	1	0	1	0	4	0	27	0
Lower middle class	0	0	0	1	1	1	2	7	13	
Low income (but not poor)	0	2	0	3	0	3	0	8	0	53
Poor	0	3	0	0	0	1	0	4	0	27

Table 1 shows the socioeconomic backgrounds of the L group and N group middle-schoolers. The majority of the L group are in the upper half of the socioeconomic levels, with twenty-seven percent (27%) as the middle class and fifty-three percent (53%) as the upper middle class. One of the fifteen L group students comes from a high-income background, while the other participant belongs to a rich socioeconomic background. One L group participant is from the lower middle class level. On the other hand, the majority of N group participants belong to the last three socioeconomic levels, with thirteen percent (13%) in the lower middle class, fifty-three percent (53%) in the low income, and twenty-seven percent (27%) in the poor sector. One participant belongs to a rich socioeconomic background.

The following themes were developed by considering the objectives of the study and the information gathered via transcription, quotation selection (particularly those that captured exchange of ideas), and coding (Naeem et al., 2023).

Cognizance of climate change and its consequences

The participants exhibited awareness of climate change through their illustrative and verbal responses. This affirms the study of Teixeira et al. (2024) that students can communicate about climate change because of their prior

knowledge enhanced by teacher talk and scaffolding (Studhalter et al., 2021), resulting in expression of concern towards this global issue (Jones & Lucas, 2023). The subthemes below are the results of the participants' illustrations and dialogue projecting cognizance and concerns on climate change and its consequences.

Climate change as extreme weather patterns

One significant finding of the focus group discussion is that middle-schoolers are aware of climate change, especially those in the eighth grade, from both groups.

L8.6 presented his/her drawing in this manner.



Figure 1. Drawing Representation of Climate Change as Extreme Weather Patterns by Participant L8.6

L8.6 stated: "Climate change refers to long-term shifts in temperature, weather patterns, and natural disasters that may lead to human activities like burning fossil fuels and deforestation."

Below is the illustration of N8.2.

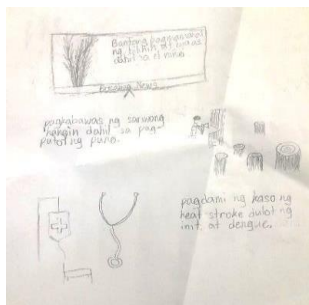


Figure 2. Illustration of the Effects of Climate Change by Participant N8.2

N8.2 stated: "It is about the threat of a shortage of food and rice due to El Niño. Second, the reduction in fresh air due to tree cutting, and the increase in cases of heat stroke caused by the heat."

While most of the seventh and eighth graders from both groups described climate change as extreme weather patterns, such as very high temperatures or flooding caused by heavier rains, as what the schools would teach them, one or two from both groups in the eighth grade would expound their understanding.

Climate change results in persistent adversities

Abbass et al. (2022) affirm that climate change threatens various sectors worldwide. Worse, it can also contribute to psychological strain (Taylor, 2020). In one of the discussions, N6.3 expressed: "I experience extreme heat because I attend classes for the afternoon shift; we only have an electric fan."

This is the drawing of N6.3.

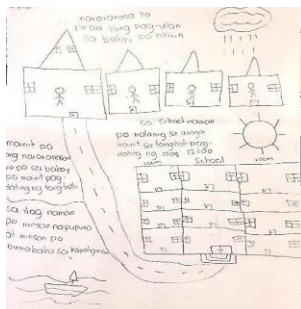


Figure 3. Drawing Depicting Extreme Heat and Flooding as Effects of Climate Change by Participant N6.3

N6.4 prompted to respond: "Yes, it's too hot at home, and then when it floods, you can't go out."

N6.5 seconded: "Many people fainted because of extreme heat."

In another group, several respondents mentioned their family's opinion about climate change.

Interviewer: *Somebody mentioned his parents can't go to work when it is flooding, what does climate change mean to you then? Is it good? Is it bad? Does it affect everyone? What do you think?"*

N7.1: "It's bad, because the people in our place were affected by the flood."

Interviewer: "How about you Number 2, what's your opinion about climate change

N7.2: "It's difficult because it's flooded."

Interviewer: "When flooding occurs and enters the house, what should be done?"

N7.2: "Be ready."

Interviewer: "So, we need to be prepared for climate change, right? Does anyone want to add anything? Number 5, what do you think climate change is? What does it mean to you? Do you think it affects you?"

N7.5: "Yes, because of the changes in the country and for every year."

Interviewer: "It feels like it happens year after year. Does it get better every year or does the effect get worse?"

N7.5: "It gets worse."

Climate change unfavorably affects education.

Ideally, schools are children's safe spaces, providing areas for academic, socio-civic, and emotional development, bringing communities together, and addressing the needs of the learners (Mishra & Close, 2020). However, it was also observed in different studies that the rates of learning and mental health, including academic-health concerns such as asthma, get worse because of climate change (Sheffield et al., 2017; Cianconi et al., 2020). It also affects academic task undertaking and student learning (Leal Filho et al., 2023). Both groups of participants communicated how their school endeavors are distressed by climate change.

L6.6 mentioned: "It's always raining in our place, and it's always hot, it's always flooding, too. My feelings are a bit mixed, so I often get a fever."

N7.5 in the other group mentioned: "No face-to-face classes due to strong storm."

L7.9 shared his/her drawing, mentioning: "My illustration shows the rains, and we don't have classes because of the rains."

L7.7 also showed his/her illustration, stating: "There's a storm happening outside our condominium, which means we're having online class sessions."

Below is the drawing of L7.7.



Figure 4. Participant L7.7's Drawing Depicting Online Classes During a Storm

The findings identified cognizance of climate change and its consequences as the first theme. Data showed that the participants exhibited awareness of climate change in practically the same manner, regardless of their diverse socioeconomic backgrounds. This contradicts the study of Velayo et al. (2024) that those with

higher income have greater levels of awareness and perception of climate change; however, their findings on how higher education correlates with higher levels of awareness were supported in this study with the way eighth-grade participants from both groups expounded their understanding of climate change. Notably, participants in the N group from the lower half of the socioeconomic levels expressed their persistent adversities brought by climate change. Additionally, responses from both groups of participants revealed how their education is negatively affected by climate change.

The negative responses of the two groups towards online classes in the post-pandemic correlate with the argument of Alshathry & Alojail (2024), which cites students' dissatisfaction in terms of service quality and student-student interaction, with other issues such as accessibility, engagement, distractions, and support (Farrelly et al., 2023). Bautista and Aranas (2023) also reported in EDCOM 2 that the Philippine education system faces challenges with resources to "achieve learning outcomes through level-appropriate, technology-enhanced/mediated, and evidence-based learning delivery modes" (p. 9). Nevertheless, the mentioned studies posted their recommendations, seeking effective strategies in online learning that will help improve engagement and performance (Akpen et al., 2024).

Climate change exacerbates poverty

The impacts of climate change, especially on the poor sector, are evident in several studies (Smith, 2022; Dang et al., 2024; Adom, 2024), with its economic, social, and political implications (Knight, 2024). Both groups of participants communicated how they witnessed and experienced poverty as one of the negative effects of climate change. When the groups were asked how their socioeconomic background influences their perception of climate change, these were the related responses:

N6.4: "We experience things differently. When we are sick, we can't handle it, but they [referring to the L group] can handle it. It's difficult because our houses are so close together."

From N7.4 in the other group: "Our place got flooded, so my mother and father couldn't go to their workplace."

This is the drawing of N7.4.



Figure 5. Illustration of Flooding and Its Impact on Family Livelihood by Participant N7.4

N7.5 seconded: "I'm sad because I feel sorry for my siblings who have nothing to eat because my mother and father can't go to work because of the flood."

L7.7 responded: "I notice(d) they experience more hardships rather (sic) than us in (when it comes to) climate change because, for example, it's hot outside they don't have AC (air conditioning) on and it can be really (sic) hot for them rather than us because we can stay at home [with air conditioning unit]."

N8.1 who is from the other group, responded: "We are more affected by climate change because for us [when temperature is too high], it's literally just the wind and that's it."

N8.2 seconded: "We also have some air in our place, but they [referring to the L group] have air conditioning, so they are better than us."

Most responses from the N group were expressions of struggles with the effects of climate change. They cited experiences that they perceived were caused by their socioeconomic background. This is attested in the study of Lübke (2021), suggesting that socioeconomic factors influence climate change beliefs. The participants' common values and social patterns were evident (Cedula, 2024) as they mentioned how their families were affected when adverse weather patterns occurred. However, their resilience (Filho et al., 2022) was also noticeable as they recognized what was lacking in their community in terms of solutions to climate-related issues. Truly, financially distressed citizens perceive the highest threat of climate change (Hornsey & Pearson, 2024). Interestingly, the exchange

session made an impact on the L group, specifically on the response of L7.7, as a realization of the adversity of their fellow human beings and students. Woolrych et al. (2020) cited the importance of awareness and taking others' perspectives in communication.

Climate change concerns everyone on diverse levels

This part of the focus group discussions relates to the perception of climate change, as they heard the perception of their counterpart from the partner community

N6.1 started answering in their group: "There is no difference between the poor and the rich, the perception is just slightly different because the rich can slightly change the effects because they have things that can help avoid the effects of climate change."

L6.7 seemed to agree as s/he responded: "Even if you have a nice house, it can be flooded."

L6.9 however, has a different view: "We are not severely affected by climate change because we can pay for the artificial machines like aircon, those things that can affect climate change. In my opinion we are in the same place on the (sic) earth so we are affected the same."

L6.10 seconded: "We are trying to go somewhere so we can avoid experiencing floods."

The dialogue revealed how the participants' perceptions are influenced by their socioeconomic background. Most of the L group members have coping strategies from the impacts of climate change. It was remarkable to note that one participant from the L group understands that, despite economic differences, everyone can be affected by climate change. Another remarkable observation was the response of a member from the N group, showing awareness of this point, acknowledging the insights of an L group member. Still, the N student recognized that those in the upper half of socioeconomic levels can slightly mitigate the effects of climate change because of their privileged status.

Below is the discourse shared in another group.

N7.3: "I notice(d) that even if you're rich or broke, we still experience the same thing."

L7.7: "Yes because we have lots of privileges. When it is really hot or cold outside you can just stay inside our house...or everywhere."

L7.8: "I feel that we still experience the same thing even in both public and private but we simply deal with the situation differently because of our socioeconomic background."

It was noticed that this group shared similar ideas with the other group. Interestingly, N7.3 responded like the members of the L group, unlike his/her peers in the N group. Upon reviewing the participant's profile, it was found that this student belongs to the rich socioeconomic level. In another group, below is the exchange of ideas after hearing the perception of their counterparts in another community:

N8.4: "Nothing, because we live in the same country, so I think we have the same feelings [about climate change]."

L8.9: "I don't think I experience the real challenges of climate change because I have access to air conditioners and I also have access to a home that can withstand strong storms."

L8.10: "For me, even if you are financially stable, you still can't avoid diseases or problems like floods or extreme heat, you can't control them."

The latter's exchange of ideas showed how their answers were shaped less by their socioeconomic background and more by their observations in their communities. L8.9 may have considered his/her higher socioeconomic background as an advantage in temporarily resolving difficulties brought about by climate change, yet s/he acknowledged that s/he may not have yet experienced the real challenges of climate change. Similarly, L8.10 emphasized that socioeconomic background may not be a guarantee to shield one from the effects of climate change. In contrast, N8.4, who came from the lower half of the socioeconomic level, expressed belief that everyone is compromised by the

adverse effects of climate change. Despite being at the eighth-grade level, the students showed awareness not only of their communities but also of others. Once again, the exchange session provided an opportunity for awareness and encouraged taking others' perspectives.

The findings show that middle-schoolers have similar perspectives on climate change regardless of their socioeconomic backgrounds. Climate change remains a concern for everyone, but at diverse levels, since they have different encounters based on the community they belong to. Kim et al. (2024) reported the same findings that there are high levels of awareness of climate change among individuals despite cultural and socioeconomic differences. This also affirms the study of Alenda-Demoutiez (2021), stating that socioeconomic status is not significant for developing climate change literacy, but more likely to affect how individuals act to address climate change. It was also observed that middle-schoolers in the higher grade levels exhibit more awareness of the impacts of climate change across different communities.

Climate change education develops compassion, altruism, and empowerment

This theme emerged from the common responses of the participants in the study. They were based on the responses from the previous questions in the focus group discussion, as well as their responses to this final question on how the exchange session influences their perception about climate change.

L6.8: "...it's just disheartening because it seems like they really struggled a bit with climate change due to their challenges and difficulties in their areas."

L6.8: "If you are rich, it does not mean you understand climate change better because we don't know the feeling of those struggling with floods and strong winds."

L6.7 seconded: "Yes, because we in the middle class thought that we were not very affected by climate change, but I was really surprised by the situation of the poor with climate change, because they have no ability to change or stop the way they feel about climate change."

The dialogue appears to indicate realization and awareness among the participants, particularly in showing compassion towards their fellow students coming from significantly different socioeconomic backgrounds. In an interview by Illing (2019) with Yale professor Paul Bloom, the latter stated: "Compassion means I give your concern weight; I value it. I care about you, but I don't necessarily pick up your feelings. ... [I]f I feel compassion for you, I'll be invigorated. I'll be happy and I'll try to make your life better" (Vox, January 16, 2019). These statements encapsulated the demeanor of the L group towards the N group as observed during the focus group discussions. Vieten et al. (2024) stated that compassion is "generally positive in terms of health and well-being" (p. 4) than empathy. Furthermore, empathy can be unregulated, leading to burnout while compassion "can counteract negative aspects of empathy" (Dowling, 2018, as cited in Vieten et al., 2024).

Concerning compassion, other dialogues below show answers to the final question in the study on how the exchange session influenced their perception of climate change.

L7.10 responded: "I had reached a deeper understanding, thanks to this session. It enhanced my comprehension of how climate change can affect those people, those in the province or public school."

L7.8: "It changed because before, I thought that the poor were more affected than us who are wealthy, but that's not the case; and what I realized is that whether rich or poor, Filipinos still experience the same things from climate change."

L6.8: "It's just sad because it seems like they really struggled a bit with climate change due to their challenges and difficulties in their areas."

L6.8: "...so it seems sad so that's why my family and I try to help as much as possible, as any way that we can. (Be)cause we know the struggles and we are trying to help in any ways that we can with them. Because they can't do anything about their problems since climate change is happening so let's just help."

Following the N group's responses about the difficulties they were facing due to climate change, the L group's responses, which were characterized by compassion and altruism, emerged. Several studies showed that compassion

motivates altruism. A common definition of altruism is an action done to help another person (Cambridge University Press & Assessment, 2025). The exchange sessions provided an opportunity to take the perspectives of others. The study of Kappelmayer et al. (2022) showed that children who are self-aware and responsive to others are more likely to develop compassion and affective empathy, which benefits both individual and societal well-being. Additionally, the study of Maalouly et al. (2024) suggested that dialogue may positively influence altruistic behavior. However, Koessler et al. (2023) found that perspective-taking may encourage pro-environmental thoughts, feelings, and intentions, but it might not be enough to elicit actual behavior. For this reason, the researchers recommend that future studies examine how perspective-taking affects other kinds of pertinent behaviors. Additionally, educators may consider incorporating climate change lessons and dialogues that will develop compassion into altruism, which will benefit the community.

Lastly, below is a dialogue in response to the question of how they describe their drawings about climate change based on their economic status.

N8.3 responded: "I'm just at home. Like, I just stay in the tree because it's so hot, it's okay."

Below is the drawing of N8.3:

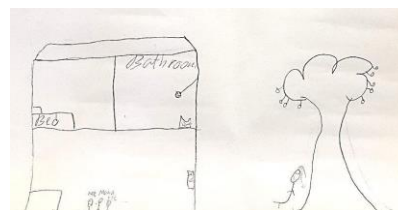


Figure 6. Participant N.8.3's Drawing Showing Safety at Home During Climate Change

N8.1 described his/her drawing: "It's hot at school, but it's fun to study."

Below is the drawing of N8.1.

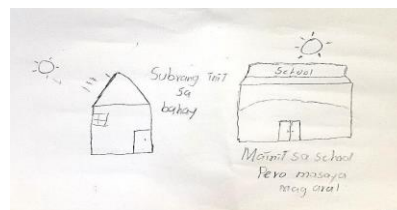


Figure 7. Participant N.8.1's Drawing Depicting School Experience During Hot Weather

The interviewer asked another participant in the study: "Are you affected? You said you are poo. Aree you affected by climate change?"

N8.5: "I do not, because we can go to many places even if we are poor. When it's too hot, ma'am, I immediately go to a big tree. I hang out under a tree."

Below is the illustration of N8.5.



Figure 8. Illustration of Seeking Shade Under a Tree During Hot Weather by Participant N.8.5

Based on the dialogue, the N group appears to have a sense of empowerment through both nature and education, despite the challenges of climate change. They manage to temporarily ease their concerns by utilizing what is readily accessible in their community. Olsen (2023) communicated that empowerment is a remedy for helplessness. Possibly, the children are given the chance to interact with their physical and emotional surroundings on their terms, which becomes their moments of empowerment (Canning, 2022).

In summary, middle-schoolers from diverse socioeconomic backgrounds demonstrated awareness of climate change and its consequences, such as

extreme weather patterns, persistent adversities, and unfavorable educational effects. They also perceived that climate change exacerbates poverty and concerns everyone on diverse levels. And lastly, they demonstrated that exchanging perspectives as a form of climate change education develops compassion, altruism, and empowerment.

When children participate in various educational programs, the results are positive, particularly in their interactions with the community, parents, and educators (Tongson, 2017). Such programs indeed empower children (Canning, 2022; Olsen, 2023; Paterson-Young et al., 2024). In the context of climate change education, exchange sessions will equip students with essential knowledge, attitudes, and skills necessary for climate change action. With a combination of scientific training and social programs, institutions can produce students who are equipped with global climate action and development (Tasquier et al., 2022; Wagner et al., 2024; Miller et al., 2024).

As the global community calls for action on climate change, educational institutions play a vital role in modifying the curriculum, training teachers, and empowering learners in addressing the Sustainable Development Goals by redirecting teaching and learning. Students assimilate climate change education through fostering understanding with several institutions through augmented awareness of climate change and its consequences, poverty reduction, social inclusion, and cultivating compassion and altruism. This will immerse learners in becoming empowered and ethical citizens in the future.

CONCLUSION

This study examined how middle school learners' understanding of climate change is shaped by their lived experiences and diverse socioeconomic backgrounds. While students across groups demonstrate comparable levels of awareness, the intensity of their experiences differs. They recognize that climate change exacerbates poverty and affects individuals in diverse ways. Notably, engaging in perspective exchange as a form of climate change education fosters compassion, altruism, and a sense of empowerment among learners. Thus, climate change education emerges as a viable approach to advancing sustainable development goals, enabling educational institutions to promote deeper understanding through inter-institutional collaboration, scientific training, and community development initiatives toward balanced economic, social, and environmental prosperity.

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ASSESSING THE EFFECTIVENESS OF GOOGLE WORKSPACE AS A LEARNING MANAGEMENT SYSTEM

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ABSTRACT

This study examines the effectiveness of Google Workspace as a Learning Management System (LMS) at Colegio de San Juan de Letran-Manila. As educational institutions in the Philippines have been increasingly adopting digital tools to support HyFlex and remote learning, understanding how educational platforms like Google Workspace influence teaching, learning, and administrative efficiency has become essential for the Colegio. Data from this research were collected through a cross-sectional survey of students, faculty, and staff using stratified sampling and analyzed using descriptive statistics and Likert-scale evaluations. The researchers focused on three key areas: user satisfaction with Google Workspace features, the platform's impact on collaboration and communication, and its role in the learning of students and the work efficiency of the employees. The results of this research indicated that Google Workspace is perceived as an effective LMS by all key stakeholder groups, offering high usability, functionality, and positive effects on both academic and institutional efficiency. Despite network connectivity issues and the influence of the stakeholders on platform engagement, the results affirm Google Workspace's value as an effective LMS for the Colegio. Furthermore, this study highlighted both the strengths of Google Workspace and identified specific areas for improvement, particularly concerning network infrastructure.

Keywords: Google Workspace, learning management system, educational technology, digital learning

INTRODUCTION

A Learning Management System (LMS) is described as a software application that enables companies and educational institutions to administer, track, and deliver educational courses and training materials (Hawley, 2024). LMS platforms have proven to be highly relevant in various industries, such as well like financial services, manufacturing, healthcare, retail, supply chain, beverage, franchise, and real estate. According to Rouse (n.d.), an LMS is a software application designed for the administration, documentation, tracking, reporting, automation, and delivery of educational courses, including training programs and learning materials. She further describes it as a centralized platform that allows users to access course content, submit assignments, and take assessments—all in one system. Additionally, LMS platforms often include features such as gamification, discussion boards, and performance analytics, which help enhance learner engagement and track progress more effectively (Indeed Editorial Team, 2023). According to Zimmerman (2023), LMS software streamlines training processes, reduces costs, and enables personalized learning paths through mobile compatibility, integrations with other systems, and easy content updates, making it an essential tool for modern learning and development strategies.

During the COVID-19 pandemic, mandatory closures to prevent the spread of the virus forced different institutions to rapidly adopt Learning Management Systems to continuously deliver education to learners as face-to-face classes were not possible. This caused a major educational crisis, with UNESCO estimating that approximately 1.6 billion learners were affected by these closures in April 2020 (Markelova, 2020). This sudden shift to remote learning was characterized by massive dependence on technology, especially on LMS platforms like Moodle, Canvas, Blackboard, and Google Classroom, which were implemented regardless of institutional resources or lack of faculty training in using them.

Research by Habibi et al. (2021) from Indonesia highlights how the expansion of mobile-LMS (m-LMS) facilitated distance learning for over 44 million students during the early months of the pandemic, promoting "functional and organized" online education despite connectivity challenges. In addition, Canani & Seymour (2021) emphasized in a case study conducted in South Africa that LMS served as vital communication hubs ("notice boards") and fostered institutional resilience—but also exposed inequalities related to device availability, data costs, and infrastructure.

In the Philippines, to sustain coursework delivery and student engagement during the COVID-19 pandemic, Legarde (2022) stated that Philippine schools immediately transitioned to fully web-based learning, using LMS to connect teachers and students despite limited ICT infrastructure. The study emphasized investing in ICT preparedness and capacity building to support this shift.

Colegio de San Juan de Letran – Manila also had to adapt to the "New Normal" brought about by the COVID-19 pandemic. To mitigate the impact of the health crisis on its learners, Letran Manila adopted Google Classroom as its Learning Management System (LMS) to facilitate remote teaching and learning. Google Classroom is a free, cloud-based digital learning platform that is part of Google Workspace for Education, and includes applications for video conferencing, word processing, and collaboration. The use of this platform also entailed utilizing the entire Google Workspace suite—such as Google Meet, Google Docs, Google Drive, and Gmail—for a more effective and efficient delivery of instruction and communication.

While the adoption of Google Workspace supported the continuity of learning during the pandemic, it also brought to light both its strengths and limitations. Understanding the advantages and disadvantages of this platform is essential to evaluating its overall effectiveness in supporting remote education.

Gana (2024) stated that in a country like Nigeria, Google Classroom is a practical and affordable solution for online learning, as it only requires a free Google account and does not entail any cost for schools. He noted that "Google Classroom is an effective and affordable online learning solution in Nigeria because it has many features and benefits that meet the needs and challenges of online learners and educators in Nigeria". He further explained that the platform's suite of features—such as its paperless structure, real-time communication tools, collaborative capabilities, and opportunities for creative and personalized instruction—address many of the challenges faced in the Nigerian context.

Furthermore, Gana (2024) also emphasizes that Google Classroom streamlines the entire assignment workflow—from creation and distribution to feedback—enabling teachers to track student performance, provide targeted support, and boost engagement through peer and instructor interaction, multimedia learning, and self-paced study.

Further, Google Classroom facilitates real-time communication through features such as announcements, comments, and private messaging, which help maintain student engagement (Luxwisp, 2024).

Luxwisp (2024) also added that one key advantage of Google Classroom is its accessibility. As a web-based platform, it can be accessed from any internet-connected device—whether a computer, tablet, or smartphone—allowing students to participate in learning from virtually any location. This flexibility helps remove physical barriers and supports a more inclusive educational environment.

While Google Classroom promotes accessibility as one of its key advantages, this same feature can also present a disadvantage. In countries with unreliable or limited internet access—such as the Philippines—its dependence on a stable internet connection poses a significant challenge for both teachers and students.

In the Philippines, remote learning during the COVID-19 lockdowns was significantly impeded by infrastructure challenges. According to a study by Teräs et al. (2020), at one University of the Philippines campus, approximately 41% of undergraduate students lacked internet access, while 51% of faculty relied on capped mobile data, resulting in unreliable connectivity and frequent disruptions during synchronous classes. A qualitative study of Cahapay & Rotas (2020) with Philippine university students revealed that unstable internet, along with power interruptions and inadequate learning resources, were among the most significant challenges encountered during remote instruction.

Moreover, data from the Department of Education and the Department of Information and Communications Technology indicate that as of September 2, 2022, only 1.8% of public schools in the Philippines were connected to free public Wi-Fi. Additionally, historical records show that only about 26% of public schools had any form of internet connectivity, highlighting the significant challenges in implementing synchronous online learning nationwide.

Additionally, Google Classroom is lacking in advanced analytics, gradebook flexibility, built-in quizzes/tests, forums, and gamification found in full-featured LMS platforms like Moodle or Canvas. For instance, Park (2025) highlights that Classroom does not offer detailed analytics, robust activity logging, or extensive engagement tools, whereas Canvas provides "detailed insights into student progress," advanced assessment options, peer-review activities, and multiple customization features.

Another notable drawback of Google Classroom is its inability to schedule the same assignment across multiple classes at once—teachers must create or schedule the assignment separately for each class (Park, 2025). This can be a challenge for teachers, especially with limited knowledge and training on the use of an LMS, particularly with Google Classroom.

Although many studies have discussed LMS and the use of Google Classroom during the pandemic, most of them focus on its general effectiveness, accessibility, and role in keeping education going across different countries. These studies identify both the strengths and challenges of LMS use, but few look closely at the actual experiences of teachers and students within a specific institution, especially in private higher education settings in the Philippines. Much of the existing research discusses internet access, infrastructure, and platform features in broad terms, without showing how these factors affect everyday teaching, student participation, and the overall learning process. Because of this, there is a need to examine how Google Classroom is really being used in a particular school setting, such as Colegio de San Juan de Letran – Manila, to better understand the strengths, limitations, and areas that may need further improvement based on the experiences of its users.

Significance of the Study

With the increased integration of different digital platforms in educational institutions, the understanding of their impact, specifically the Google Suite, on students' learning and engagement, and employee efficiency and effectiveness, is vital. The findings of this study will provide teachers with guidelines on how to effectively utilize Google Workspace to enhance their teaching strategies and communication styles in a virtual setting. Moreover, the findings will also provide data on how Google Workspace aids in employee performance in executing tasks. Lastly, it will also be relevant to Colegio de San Juan de Letran in improving the allocation of digital tools and addressing issues and concerns with regard to the utilization of digital management systems and tools.

Research Questions

How effective is Google Workspace for Education as an educational resource at Colegio de San Juan de Letran in enhancing student learning, improving faculty efficiency, and fostering collaboration among students, faculty, and employees?

Theoretical Background

Theoretical Contribution

The study is based on the Technological Pedagogical Content Knowledge (TPACK) framework. According to Mishra & Koehler (2006), the TPACK framework highlights the teacher's need for a holistic understanding of technology, pedagogy, and content to be perceived as effective. Koh et al. (2014) also added that teachers who are proficient in technological tools achieve greater success in meeting their subject matter's learning outcomes. Therefore, it plays a relevant role in the way teachers engage with their students and in delivering the content of their subject matter. Technological resources such as computers, television units, and other infrastructure can significantly impact a teacher's overall performance and experience, improve lesson delivery, and engage students' participation. Nonetheless, the lack or absence of these technological resources can cause frustration and stress to its users. In addition, other factors like technical support and proficiency may also be an issue.

Literature Review

Based on the study by Akcil et al. (2021), institutions are working to effectively maintain the distance learning of students by utilizing the infrastructures, digital tools, and equipment they have developed. In the 21st century, teachers need to be equipped to effectively incorporate instructional technology into their teaching methods. However, even with significant investments in technology at schools, training and professional development for teachers in technology integration and pedagogical practices often fall short. As Lossec & Millar (2021) stated, the pandemic served as a catalyst for a significant surge in users as governments across the globe scrambled to find solutions that would facilitate remote learning. The global health crisis created an urgent need for educational continuity, and technology emerged as a crucial tool to ensure that students could continue their education from home. As a result, the demand for online learning platforms and resources skyrocketed, leading to a rapid increase in user numbers. Given the widespread use of Google Classroom, teachers are increasingly familiar with its capabilities and feel a sense of ownership over their accounts. However, the platform's extensive features necessitate formal training programs for schools to ensure educators can effectively utilize all its tools. Moreover, based on Fauziah & Nugroho's (2024) study, educational technology is often overlooked because educators and school staff may not have a sufficient understanding of available tools, such as Google Workspace for Education. Additionally, they also stated that if educators and school staff were more technologically proficient and could effectively integrate technology into their teaching, students would likely embrace it more readily, leading to a more engaging learning experience. Lastly, Balsicas et al. (2022) reiterated that many students find online courses challenging due to the complexity of navigating various learning platforms across different higher education institutions in the Philippines. The need to adapt to multiple platforms can be overwhelming and can hinder the learning process. Additionally, both students and teachers often struggle to keep up with the fast-paced nature of online learning. The asynchronous nature of online courses can make it difficult to stay engaged and motivated, especially without the in-person interaction and structure provided by traditional classrooms. These factors collectively contribute to the challenges students and teachers face in achieving success in online learning environments.

METHODS

Research Design

This study employed a quantitative research design to evaluate the effectiveness of Google Workspace as a Learning Management System (LMS) within the academic and administrative environment of Letran Manila. The quantitative approach was selected to allow for the collection and analysis of measurable data related to users' experiences with the platform—specifically in terms of accessibility, functionality, usability, and its overall impact on educational outcomes, communication, and collaboration.

This research design enabled the researchers to systematically analyze how well Google Workspace addresses the educational and administrative needs of the institution. The findings aim to provide evidence-based insights that will support

institutional decisions regarding the continued implementation and optimization of the platform.

Respondents of the Study

The survey was distributed to members of the Letran Manila community who use Google Workspace in their academic or work-related activities. The target respondents included users from different departments and roles (students, faculty, and administrative staff) from different departments and levels to ensure broad representation across user groups.

From a total student population of 3,687, a sample of 973 students participated in the study. These were composed of 147 students from the Elementary level (K–6), 171 from Junior High School (Grades 7–10), 267 from Senior High School (Grades 11–12), 341 from the Collegiate level (1st to 5th year), and 47 from the Graduate School, including both MBA and DBA programs.

For the employee population, which totaled 370 individuals, 263 participated in the survey. This group consisted of 142 faculty members, 93 non-teaching personnel, and 28 administrators. Respondents came from various units to ensure representation across different roles and responsibilities within the institution.

Based on these figures, the student response rate was 26.39% (973 out of 3,687), while the employee response rate reached 71.08% (263 out of 370). In total, the study gathered 1,236 responses from a combined population of 4,057, resulting in an overall institutional response rate of 30.47%.

Although the student response rate was moderate, it falls within an acceptable range for large-scale survey research in educational settings. The high participation rate among employees strengthens the reliability of insights related to faculty and administrative use of Google Workspace. While non-response bias cannot be completely ruled out, the wide distribution of respondents across academic levels and job roles supports the representativeness of the data collected.

Research Instrument

A cross-sectional survey method was utilized for data gathering, allowing the researchers to capture the perceptions and experiences of participants at a specific point in time. The primary data collection tool was a structured questionnaire, adapted from the study of Sayed et al. (2022), titled "Exploring Architecture Students' Behaviour in Using Google Workspace for Design Studio Learning During the COVID-19 Pandemic." In their research, the instrument was used to examine students' experiences in using Google Workspace in terms of ease of use, communication, collaboration, task management, and overall satisfaction during remote learning.

Although the original instrument by Sayed et al. (2022) was designed for architecture students in design studios, it was modified to fit the context of Colegio de San Juan de Letran – Manila. Items specific to design studios were reworded for general academic and administrative tasks, statements were adjusted for students, faculty, and non-teaching staff, and minor revisions improved clarity. Additional questions were added to capture experiences across all groups and to address institutional support, collaboration, and administrative efficiency. The adapted questionnaire was reviewed for content validity and later tested for reliability using Cronbach's alpha. These changes were made to ensure that the tool remained relevant to the objectives of the study while still being grounded in an existing research instrument.

Data Analysis

Collected data were analyzed using descriptive statistics, specifically mean and standard deviation, to measure central tendencies and variability in user responses. These analyses provided insight into the overall effectiveness and user satisfaction with Google Workspace as an LMS within the institution.

RESULTS AND DISCUSSION

Table 1. Internal Consistency Reliability for Google Workspace Constructs (Administrators Group, n = 28)

Construct	No. of Items	Cronbach's α	Avg. r	S/N	Interpretation
Performance Expectancy	5	.93	.74	14.0	Excellent
Effort Expectancy	5	.85	.58	6.9	Good
Social Influence	5	.51	.26	1.8	Poor
Facilitating Conditions	6	.63	.26	2.1	Questionable
Hedonistic Value	4	.94	.80	16.0	Excellent
Learning Value	4	.95	.84	21.0	Excellent
Habit	4	.90	.71	9.9	Excellent
Behavioral Intention	4	.91	.71	9.7	Excellent

To assess the internal consistency of the measurement scales, Cronbach's alpha (α) coefficients were computed for each of the eight constructs. As shown in Table 1, the *Performance Expectancy* scale demonstrated excellent reliability, $\alpha = .93$, with a high average inter-item correlation ($r = .74$), indicating strong internal consistency among its five items. Similarly, the *Learning Value* ($\alpha = .95$), *Hedonistic Value* ($\alpha = .94$), *Habit* ($\alpha = .90$), and *Behavioral Intention* ($\alpha = .91$) scales also demonstrated excellent reliability, each exceeding the commonly accepted threshold of .90. Therefore, these scales are considered highly consistent for measuring the administrators' perceptions and intentions related to the use of Google Workspace.

The *Effort Expectancy* construct showed good internal consistency, $\alpha = .85$, with an average inter-item correlation of $r = .58$, suggesting that the items reliably reflect perceptions of ease of use of the Google Workspace. The *Facilitating Conditions* scale yielded a lower but acceptable alpha of .63, indicating questionable reliability. This suggests some item heterogeneity or potential influence of the reverse-coded item (connectivity issues, see Table 4, item 21), though the scale still warrants further analysis with caution.

In contrast, the *Social Influence* scale showed poor internal consistency, $\alpha = .51$. Inspection of item statistics revealed that item 14 (see Table 4) was negatively correlated with the first principal component and likely introduced measurement error. This suggests the need for item revision or reverse scoring to improve reliability in future use.

Table 2. Internal Consistency Reliability for Google Workspace Constructs (Faculty Group, n = 142)

Construct	No. of Items	Cronbach's α	Avg. r	S/N	Interpretation
Performance Expectancy	5	.94	.76	15.0	Excellent
Effort Expectancy	5	.97	.85	29.0	Excellent
Social Influence	5	.79	.50	5.1	Acceptable
Facilitating Conditions	6	.84	.56	7.5	Good
Hedonistic Value	4	.94	.79	15.0	Excellent
Learning Value	4	.94	.81	17.0	Excellent
Habit	4	.92	.76	13.0	Excellent
Behavioral Intention	4	.92	.75	12.0	Excellent

Cronbach's alpha coefficients were computed to assess the internal consistency of each construct measured in the survey for the faculty group. As shown in Table 2, results indicated that all constructs demonstrated acceptable to excellent reliability. *Performance Expectancy* yielded a Cronbach's alpha of .94, indicating excellent internal consistency. *Effort Expectancy* exhibited the highest reliability with $\alpha = .97$. *Hedonistic Value*, *Learning Value*, *Habit*, and *Behavioral Intention* also demonstrated excellent reliability, each with α values of .92 or higher. *Facilitating Conditions* showed good reliability ($\alpha = .84$), while *Social Influence* had acceptable internal consistency ($\alpha = .79$). All alpha values exceeded the recommended minimum threshold of .70 for internal consistency (Nunnally & Bernstein, 1994). Average inter-item correlations ranged from .50 to .85, supporting the one-dimensionality of each scale. These results support the reliability of instruments in capturing the intended constructs among faculty respondents.

Table 3. Internal Consistency Reliability for Google Workspace Constructs (Faculty Group, n = 142)

Construct	No. of Items	Cronbach's α	Avg. r	S/N	Interpretation
Performance Expectancy	5	.96	.84	26.0	Excellent
Effort Expectancy	5	.94	.77	17.0	Excellent
Social Influence	5	.83	.51	5.3	Good
Facilitating Conditions	6	.91	.69	13.0	Excellent
Hedonistic Value	4	.95	.83	19.0	Excellent
Learning Value	4	.96	.84	22.0	Excellent
Habit	4	.94	.79	15.0	Excellent
Behavioral Intention	4	.95	.83	20.0	Excellent

In the same manner, Cronbach's alpha coefficients were computed to assess the internal consistency of the survey constructs among nonteaching staff. As shown in Table 3, all eight constructs demonstrated good to excellent levels of reliability. *Performance Expectancy* ($\alpha = .96$), *Effort Expectancy* ($\alpha = .94$), *Facilitating Conditions* ($\alpha = .91$), *Hedonistic Value* ($\alpha = .95$), *Learning Value* ($\alpha = .96$), *Habit* ($\alpha = .94$), and *Behavioral Intention* ($\alpha = .95$) all exhibited excellent internal consistency ($\alpha \geq .90$), indicating strong agreement among their respective items. *Social Influence* ($\alpha = .83$) showed good reliability, suggesting consistent responses but comparatively lower cohesion among items than the other constructs. These results confirm that the instrument used was highly reliable for measuring the targeted constructs among the non-teaching staff group.

Table 4. Descriptive statistics summary of responses from administrators

	Mean	SD
Performance Expectancy	4.64	0.44
1. I find Google Workspace applications useful for my work tasks.	4.80	0.42

2.	Using Google Workspace improves my overall work performance.	4.60	0.52
3.	Google Workspace helps me complete my tasks more efficiently	4.70	0.48
4.	My productivity increases when I use Google Workspace.	4.60	0.52
5.	I can use Google Workspace without spending excessive time on it.	4.50	0.53
Effort Expectancy			
6.	I find it easy to learn how to use Google Workspace.	4.78	0.33
7.	My interactions with Google Workspace are straightforward and clear.	4.8	0.42
8.	I consider Google Workspace user-friendly.	4.9	0.32
9.	I can quickly become proficient in using Google Workspace.	4.6	0.48
10.	Using Google Workspace does not pose significant challenges in my work.	4.7	0.52
Social Influence			
11.	Colleagues encourage me to use Google Workspace in my work.	3.8	0.57
12.	People whose opinions I respect prefer that I utilize Google Workspace.	4.4	0.52
13.	My supervisors advocate for the use of Google Workspace.	4.2	0.63
14.	I would only use Google Workspace if it were absolutely necessary for my job.	4.3	0.95
15.	I would use Google Workspace primarily if required by my organization.	2.7	1.25
Facilitating Conditions			
		4.38*	0.39*
16.	have access to the resources needed to use Google Workspace effectively.	4.15**	0.39**
17.	I feel confident in my ability to utilize Google Workspace.	4.5	0.53
18.	Google Workspace integrates well with other tools I use in my work.	4.4	0.52
19.	My team provides effective support when I face challenges with Google Workspace.	4.4	0.63
20.	My organization offers sufficient resources for using Google Workspace effectively	4.4	0.70
21.	I often face connectivity issues that affect my ability to use Google Workspace.	3.0**	0.94**
Hedonistic Value			
		4.35	0.46
22.	Using Google Workspace for my work tasks is an enjoyable experience.	4.3	0.48
23.	I find using Google Workspace to be engaging and interesting.	4.3	0.48
24.	I do not feel frustrated or overwhelmed when using Google Workspace	4.4	0.52
25.	Google Workspace provides a level of interactivity that enhances my work experience.	4.4	0.52
Learning Value			
		4.4	0.57
26.	Using Google Workspace is a valuable investment of my time and effort.	4.5	0.53
27.	Google Workspace facilitates knowledge sharing and collaboration with colleagues.	4.4	0.70
28.	Google Workspace allows me to control my workflow and pace.	4.4	0.52
29.	Google Workspace helps me track my progress through tasks and projects.	4.3	0.67
Habit			
		4.45	0.54
30.	Using Google Workspace has become a regular part of my work routine.	4.6	0.52
31.	I consistently engage with Google Workspace applications for my tasks.	4.4	0.70
32.	I feel reliant on Google Workspace to support my work.	4.5	0.53
33.	Using Google Workspace feels natural and intuitive to me.	4.3	0.67
Behavioral Intention			
		4.25	0.60
34.	I plan to continue using Google Workspace applications in the future.	4.4	0.70
35.	I intend to incorporate Google Workspace into my daily work activities.	4.3	0.67
36.	I prefer using Google Workspace over other platforms for my work needs.	4.0	0.67
37.	I plan to use Google Workspace applications regularly in my job.	4.3	0.67

Note: *mean and standard deviation were computed using only items 16 to 20.** Item 21 was reverse coded before analysis so that higher scores consistently reflect more favorable facilitating conditions

Table 4 shows the descriptive statistical analysis conducted to examine how administrators at Colegio de San Juan de Letran perceive the effectiveness of Google Workspace in relation to three core areas: enhancing student learning, improving faculty efficiency, and fostering collaboration between institutional stakeholders (students, faculty, and employees). The analysis covered eight key constructs aligned with the conceptual framework, including *Performance Expectancy*, *Effort Expectancy*, *Learning Value*, *Habit*, *Facilitating Conditions*, *Social Influence*, *Hedonistic Value*, and *Behavioral Intention*.

Enhancing Student Learning

Administrators reported highly favorable perceptions regarding Google Workspace's capacity to support their work. The construct *Performance Expectancy* received strong agreement ($M = 4.64$, $SD = 0.44$), with high ratings on items such as "Google Workspace applications are useful for my work tasks" ($M = 4.80$) and "Google Workspace helps me complete my tasks more efficiently" ($M = 4.70$). These responses suggest that administrators view the platform as instrumental in promoting efficient operations and timely services, both of which indirectly support instructional quality and student experience. Furthermore, high scores on *Learning Value* ($M = 4.40$, $SD = 0.57$) indicate that administrators recognize the platform as not only productive but intellectually enriching. Notably, the item "Google Workspace facilitates knowledge sharing and collaboration with colleagues" ($M = 4.40$, $SD = 0.70$) highlights the platform's role in fostering a learning-conducive institutional culture—even outside the classroom context.

Improving Faculty Efficiency

Administrator responses underscore the usability and seamless integration of Google Workspace into routine workflows. *Effort Expectancy* was the highest-

rated construct overall ($M = 4.78$, $SD = 0.33$), with items such as "Google Workspace is user-friendly" and "I can quickly become proficient in using Google Workspace" both receiving mean scores of 4.90. These findings suggest that minimal training or technical support is required. This is crucial for supporting time-pressed faculty in adopting and maintaining digital tools. The construct of *Habit* ($M = 4.45$, $SD = 0.54$) indicates that Google Workspace is already integrated into the daily routines of administrators. This pattern, if mirrored by faculty, can promote long-term gains in instructional planning, communication, and content delivery. *Facilitating Conditions* ($M = 4.15$, $SD = 0.39$) further reinforces this view, with administrators agreeing that they have adequate resources and support to sustain platform use. However, the relatively lower score for connectivity reliability (Item 21: $M = 3.00$, $SD = 0.94$) points to occasional infrastructure issues that may inhibit faculty efficiency.

Fostering Collaboration

While the *Social Influence* construct yielded a moderate mean ($M = 3.80$, $SD = 0.57$), administrators agreed that peer and leadership encouragement is present (e.g., "Colleagues encourage me to use Google Workspace", $M = 4.40$). Items reflecting external compliance-based motivation, such as "I would only use it if required by my organization", received lower scores. This suggests that usage is more internally than externally driven. Meanwhile, the previously mentioned item on knowledge sharing (item 27: $M = 4.40$) and strong ratings on *Facilitating Conditions* and *Hedonistic Value* ($M = 4.35$, $SD = 0.46$) suggest that Google Workspace provides a collaborative and enjoyable environment. Participants also found the platform engaging (e.g., "Google Workspace enhances my work experience", $M = 4.40$), further indicating its potential to strengthen connections across institutional roles.

Finally, *Behavioral Intention* ($M = 4.25$, $SD = 0.60$) reflects a strong willingness among administrators to continue using the platform, with most respondents expressing their intent to integrate it into their daily activities (e.g., "I plan to use Google Workspace regularly in my job", $M = 4.30$). This long-term commitment bodes well for the sustainability of the platform as a digital backbone for communication, collaboration, and instructional support.

Table 5. Descriptive statistics summary of responses from faculty

	Mean	SD
Performance Expectancy		
1.	4.5	0.65
1.	4.6	0.67
2.	4.4	0.78
3.	4.6	0.69
4.	4.6	0.69
5.	4.5	0.82
Effort Expectancy		
6.	4.5	0.66
7.	4.5	0.66
8.	4.6	0.72
9.	4.6	0.70
10.	4.5	0.72
Social Influence		
11.	3.9	0.80
12.	4.4	0.81
13.	4.4	0.81
14.	3.5	1.35
15.	2.9	1.46
Facilitating Conditions		
16.	4.3	.64
17.	4.5	0.70
18.	4.4	0.66
18.	4.4	0.76
19.	4.4	0.79
20.	4.4	0.85
21.	3.8	1.28
Hedonistic Value		
22.	4.2	0.78
23.	4.3	0.80
23.	4.2	0.85
24.	4.1	0.87
25.	4.1	0.89
Learning Value		
26.	4.4	0.7
27.	4.4	0.76
27.	4.5	0.72
28.	4.4	0.75

29. Google Workspace aids in tracking student progress through assignments and assessments.	4.4	0.78
Habit	4.5	0.68
30. Using Google Workspace has become a regular part of my teaching routine.	4.6	0.76
31. I consistently engage with Google Workspace applications in my academic work.	4.6	0.70
32. I feel compelled to use Google Workspace to enhance my teaching.	4.3	0.85
33. Utilizing Google Workspace feels intuitive and natural to me.	4.4	0.72
Behavioral Intention	4.4	0.73
34. I plan to continue using Google Workspace applications in my future courses.	4.5	0.72
35. I intend to integrate Google Workspace into my daily teaching activities.	4.5	0.74
36. I prefer using Google Workspace over other platforms for my teaching needs.	4.2	0.98
37. I anticipate using Google Workspace applications regularly in my academic practice.	4.4	0.79

To examine the perceived effectiveness of Google Workspace in the educational practices of faculty at Colegio de San Juan de Letran, descriptive statistics were computed for each construct. The results, as shown in Table 5, reveal generally high levels of agreement across all dimensions, suggesting that faculty respondents view Google Workspace as an effective tool for teaching and learning.

Enhancing Student Learning

The construct *Performance Expectancy* had a high overall mean of 4.5 (SD = 0.65), indicating that faculty perceive Google Workspace as beneficial in enhancing student learning outcomes. The means of individual items ranged from 4.4 to 4.6, with the highest-rated items reflecting improved productivity and efficiency in facilitating learning tasks. Similarly, *Learning Value* received a high mean rating of 4.4 (SD = 0.70), indicating that faculty members consider Google Workspace a worthwhile investment of time and effort. They particularly value its usefulness in tracking student progress and supporting personalized teaching approaches.

Improving Faculty Efficiency

The construct *Effort Expectancy* was also rated highly, with a mean of 4.5 (SD = 0.66), indicating that the faculty find GW easy to learn, use, and integrate into their teaching routines. The average rating for *Facilitating Conditions* was 4.3 (SD = 0.64), reflecting positive perceptions of institutional support and infrastructure, though some variability was noted due to connectivity issues (M = 3.8, SD = 1.28). The *Habit* construct, with a mean of 4.5 (SD = 0.68), further supports the notion that Google Workspace has become a routine and intuitive part of faculty members' instructional practices.

Fostering Collaboration

The construct *Social Influence* had a comparatively lower mean of 3.9 (SD = 0.80), indicating moderate perceptions of peer encouragement and institutional pressure to use the platform. While most items within this construct received relatively high scores (e.g., "My department encourages the integration of Google Workspace in our course," M = 4.5, SD = 0.70), items indicating external pressure or obligation (e.g., "I feel pressured to use Google Workspace because it's expected by the institution," M = 2.9, SD = 1.46) received notably lower ratings. This may suggest that usage is largely voluntary and internally motivated. Nevertheless, the presence of social and departmental support remains evident.

The highest-rated item in the *Learning Value* construct was the statement that Google Workspace facilitates knowledge sharing and discussion among faculty and students (M = 4.5, SD = 0.72). This suggests that the faculty respondents value Google Workspace also for its role in promoting collaborative learning environments.

User Satisfaction and Continued Use

The *Hedonistic Value* construct, with a mean of 4.2 (SD = 0.78), reflects generally positive experiences in terms of enjoyment, engagement, and interactivity when using Google Workspace. Lastly, *Behavioral Intention* was rated highly (M = 4.4, SD = 0.73), indicating a strong intention among faculty members to continue integrating Google Workspace into their future academic practices.

Table 6. Descriptive statistics summary of responses from nonteaching faculty/employees

	Mean	SD
Performance Expectancy	4.6	.62
1. I find Google Workspace applications beneficial for my work tasks.	4.7	.62
2. Using Google Workspace improves my overall work performance.	4.6	.66
3. Google Workspace helps me complete my tasks more efficiently.	4.6	.64
4. My productivity increases when I use Google Workspace.	4.5	.67
5. I can use Google Workspace without spending excessive time on it.	4.5	.74
Effort Expectancy	4.4	.64
6. I find it easy to learn how to use Google Workspace.	4.5	.65

7. My interactions with Google Workspace are straightforward and clear	4.5	.67
8. I consider Google Workspace user-friendly.	4.5	.69
9. I can quickly become proficient in using Google Workspace.	4.4	.70
10. Google Workspace does not pose significant challenges in my work.	4.2	.83
Social Influence	4.1	.71
11. Colleagues encourage me to use Google Workspace in my work.	4.2	.78
12. People whose opinions I respect prefer that I utilize Google Workspace.	4.2	.78
13. My supervisors advocate for the use of Google Workspace.	4.2	.86
14. I would only use Google Workspace if it were absolutely necessary for my job.	3.9	1.12
15. I would use Google Workspace primarily if required by my organization.	4.0	1.04
Facilitating Conditions	4.2	.66
16. I have access to the resources needed to use Google Workspace effectively.	4.4	.69
17. I feel confident in my ability to utilize Google Workspace.	4.3	.68
18. Google Workspace integrates well with other tools I use in my work.	4.4	.72
19. My team provides effective support when I face challenges with Google Workspace.	4.3	.78
20. My organization offers sufficient resources for using Google Workspace effectively.	4.3	.74
21. I often face connectivity issues that affect my ability to use Google Workspace.	3.6	1.10
Hedonistic Value	4.3	.67
22. Using Google Workspace for my work tasks is an enjoyable experience.	4.4	.71
23. I find using Google Workspace engaging and interesting.	4.4	.71
24. I do not feel frustrated or overwhelmed when using Google Workspace.	4.2	.76
25. Google Workspace provides a level of interactivity that enhances my work experience.	4.4	.69
Learning Value	4.4	.65
26. Using Google Workspace is a valuable investment of my time and effort.	4.4	.70
27. Google Workspace facilitates knowledge sharing and collaboration with colleagues.	4.5	.67
28. Google Workspace allows me to control my workflow and pace.	4.3	.71
29. Google Workspace helps me track my progress through tasks and projects.	4.4	.70
Habit	4.4	.68
30. Using Google Workspace has become a regular part of my work routine.	4.5	.71
31. I consistently engage with Google Workspace applications for my tasks.	4.4	.74
32. I feel reliant on Google Workspace to support my work.	4.3	.75
33. Using Google Workspace feels natural and intuitive to me.	4.3	.78
Behavioral Intention	4.4	.66
34. I plan to continue using Google Workspace applications in the future.	4.5	.67
35. I intend to incorporate Google Workspace into my daily work activities.	4.4	.70
36. I prefer using Google Workspace over other platforms for my work needs.	4.3	.74
37. I plan to use Google Workspace applications regularly in my job.	4.4	.70

The descriptive statistics of non-teaching staff's responses, as shown in Table 6, provide insights into their perceptions of the effectiveness of Google Workspace as an educational resource at Colegio de San Juan de Letran.

Improving Workplace Efficiency

Among the constructs measured, *Performance Expectancy* received the highest overall mean (M = 4.6, SD = 0.62), indicating that non-teaching personnel perceive Google Workspace as highly effective in supporting the completion of work-related tasks efficiently and productively. *Effort Expectancy* (M = 4.4, SD = 0.64) was also rated highly, suggesting that staff found the platform easy to learn, intuitive, and minimally challenging to use. This ease of use likely facilitates broader adoption and regular usage, reinforcing GW's role in enhancing workplace efficiency. Similarly, *Facilitating Conditions* (M = 4.2, SD = 0.66) indicated that institutional support and infrastructure are perceived as generally adequate, although some concern was noted regarding connectivity issues (Item 21, M = 3.6, SD = 1.10).

Fostering Collaboration and User Satisfaction

While *Social Influence* received a slightly lower mean score (M = 4.1, SD = 0.71), the responses still indicate that encouragement from colleagues and supervisors plays a role in the adoption of GW for work. The constructs of *Learning Value* (M = 4.4, SD = 0.65) and *Hedonistic Value* (M = 4.3, SD = 0.67) suggest that non-teaching staff find the use of Google Workspace not only beneficial to their professional development but also enjoyable and engaging. These perceptions support continued usage and positive attitudes toward the platform. Additionally, *Habit* (M = 4.4, SD = 0.68) and *Behavioral Intention* (M = 4.4, SD = 0.66) reflect the integration of Google Workspace into the daily routines of non-teaching staff and their intention to maintain or even increase usage in the future.

Table 7. Descriptive summary of responses from students

	Mean	SD
Performance Expectancy	4.5	.61
1. I find Google Workspace applications useful for my learning.	4.7	.61
2. Using Google Workspace enhances my learning performance.	4.5	.68
3. Google Workspace helps me complete my learning tasks more quickly.	4.6	.71
4. Using Google Workspace increases my overall learning productivity.	4.5	.76
5. Using Google Workspace does not require excessive time from me.	4.3	.85
Effort Expectancy	4.4	.65
6. Learning how to use Google Workspace is easy for me.	4.4	.73
7. My interactions with Google Workspace are clear and understandable.	4.5	.71
8. I find Google Workspace easy to use.	4.5	.69
9. It is easy for me to become skilled at using Google Workspace.	4.4	.75
10. Using Google Workspace does not create significant challenges for my learning.	4.2	.92
Social Influence	4.2	.71
11. People important to me believe I should use Google Workspace for my studies.	4.2	.84
12. Those whose opinions I value prefer that I use Google Workspace.	4.2	.83
13. My teachers encourage the use of Google Workspace in my learning.	4.4	.72
14. I would only use Google Workspace if it were absolutely necessary for my studies.	4.0	1.11
15. I would only use Google Workspace if it were required in our subjects and by my teachers.	3.9	1.16
Facilitating Conditions	4.3	.61
16. I have access to the necessary resources to effectively use Google Workspace.	4.4	.71
17. I feel confident in my ability to use Google Workspace effectively.	4.4	.75
18. Google Workspace integrates well with other educational technologies I use.	4.5	.72
19. My teachers provide effective support when I encounter challenges with Google Workspace.	4.4	.77
20. The Colegio provides adequate support for using Google Workspace in my studies.	4.4	.75
21. I often experience connectivity issues that hinder my ability to use Google Workspace effectively.	4.0	1.04
Hedonistic Value	4.3	.70
22. Using Google Workspace for Education applications is an enjoyable experience.	4.4	.75
23. I find using Google Workspace to be engaging and interesting.	4.4	.76
24. Using Google Workspace does not leave me feeling frustrated or overwhelmed.	4.2	.89
25. Google Workspace provides a high level of interactivity that enhances my learning experience.	4.4	.77
Learning Value	4.5	.64
26. Learning through Google Workspace is a valuable use of my time and effort.	4.4	.71
27. Google Workspace enables me to easily share knowledge and engage in discussions with others.	4.5	.71
28. Google Workspace empowers me to control my own learning pace.	4.4	.78
29. Google Workspace helps me track my progress and understanding through quizzes, assignments, and assessments.	4.5	.70
Habit	4.4	.65
30. Using Google Workspace has become a regular part of my learning routine.	4.5	.72
31. I consistently engage with Google Workspace applications in my studies.	4.4	.70
32. I feel the need to use Google Workspace to support my learning.	4.4	.78
33. Using Google Workspace feels natural and intuitive to me.	4.4	.72
Behavioral Intention	4.4	.66
34. I plan to continue using Google Workspace applications in the future.	4.5	.70
35. I intend to incorporate Google Workspace into my daily academic activities.	4.4	.73
36. I prefer using Google Workspace over other platforms for my learning needs.	4.3	.83
37. I plan to use Google Workspace applications regularly in my studies.	4.5	.71

Table 7 shows the descriptive statistics analysis of student perceptions on the effectiveness of Google Workspace as an educational resource in enhancing student learning, improving faculty efficiency, and fostering collaboration among students, faculty, and employees. The study examined student perceptions across multiple constructs of *Performance Expectancy*, *Effort Expectancy*, *Social Influence*, *Facilitating Conditions*, *Hedonistic Value*, *Learning Value*, *Habit*, and *Behavioral Intention*.

Enhancing Student Learning

Students reported very positive perceptions regarding the role of Google Workspace in supporting and enhancing their learning experiences. The overall mean score for *Performance Expectancy* was high ($M = 4.5$, $SD = 0.61$), suggesting that students perceive Google Workspace applications as beneficial to learning productivity, efficiency, and task completion. This is further supported by strong item-level agreement, particularly on statements such as "I find Google Workspace applications useful for my learning" ($M = 4.7$, $SD = 0.61$).

Students also rated *Effort Expectancy* favorably ($M = 4.4$, $SD = 0.65$), indicating that they generally found Google Workspace easy to learn and operate. High agreement with items such as "I find Google Workspace easy to use" ($M = 4.5$, $SD = 0.69$) and "Learning how to use Google Workspace is easy for me" ($M = 4.4$, $SD = 0.73$) suggests that the platform does not present unnecessary

technical challenges. This ease of use likely contributes to sustained engagement, learning satisfaction, and a lower barrier to entry for digital tools, which makes GW an accessible platform that can support diverse learners.

Additionally, the construct *Learning Value* received the highest composite mean ($M = 4.5$, $SD = 0.64$). This indicates that students strongly value GW for facilitating meaningful engagement, knowledge sharing, and self-paced learning. The hedonistic aspect of learning was also favorably rated (*Hedonistic Value*, $M = 4.3$, $SD = 0.70$), reinforcing that students found GW enjoyable and engaging rather than overwhelming or frustrating. These results indicate that Google Workspace is perceived by students as an effective learning resource that enhances both the quality and enjoyment of academic engagement.

Improving Faculty Efficiency

While the primary respondents were students, their perceptions indirectly inform Google Workspace's effectiveness in supporting faculty teaching practices. The construct *Facilitating Conditions* ($M = 4.3$, $SD = 0.61$) reflects students' confidence in the technological and instructional support they receive. Notably, students agreed that teachers provide effective support (e.g., "My teachers provide effective support when I encounter challenges with Google Workspace," $M = 4.4$, $SD = 0.77$) and that the institution offers adequate infrastructure for seamless use. These findings suggest that faculty members are leveraging the platform effectively, thereby contributing to more efficient delivery of instruction and management of learning tasks.

Fostering Collaboration Between Students, Faculty, and Employees

Perceptions related to *Social Influence* ($M = 4.2$, $SD = 0.71$) and *Habit* ($M = 4.4$, $SD = 0.65$) offer insights into how embedded Google Workspace is in the institutional culture. Students indicated that important individuals in their academic life (teachers, peers) support the use of the platform. This aligns with collaborative practices where applications like Google Docs, Classroom, and Sheets facilitate shared workspaces and group accountability. Furthermore, the strong agreement with habitual use ("Using Google Workspace has become a regular part of my learning routine," $M = 4.5$, $SD = 0.72$) illustrates its integration into everyday academic interactions.

The construct *Behavioral Intention* also yielded a strong mean ($M = 4.4$, $SD = 0.66$), with students expressing clear intent to continue using Google Workspace in future learning endeavors. This implies sustained engagement and continued reliance on collaborative digital tools across institutional roles.

DISCUSSION

Google Workspace has been an effective Learning Management System among students, faculty, non-teaching faculty/employees, and administrators at Colegio de San Juan de Letran-Manila. Its perceived utility, ease of use, positive impact on learning and work efficiency, and strong user satisfaction are evident across all key stakeholders. The high reliability of most constructs, coupled with consistently positive mean scores for "Performance Expectancy," "Effort Expectancy," "Learning Value," "Hedonistic Value," "Habit," and "Behavioral Intention," indicates that Google Workspace is an efficient platform for the institution and has been helpful in its operations for teaching, learning, and administrative tasks. While the "Social Influence" construct revealed that internal motivation often outweighs external pressure, and persistent connectivity issues remain a challenge, the overall findings point to a positive trajectory for Google Workspace as a central digital tool. The study effectively highlights both the strengths of Google Workspace and specific areas for improvement, particularly concerning network and connectivity issues.

Nevertheless, in terms of actual learning benefits, the platform was rated very highly. Students view it as something that supports meaningful learning, allowing them to work at their own pace, and even makes learning more enjoyable. Aside from being useful, they also found it engaging and not stressful to use.

The findings also show that Google Workspace supports collaboration. According to the students, their teachers and classmates encourage using it. They have also made it part of their routine, using it often for group work and assignments. Their regular usage of Google Workspace suggests that it is deeply integrated into their academic experience.

Finally, students said they plan to keep using the platform in the future. Their positive experience with it and its usefulness in learning and collaboration make it a tool they're likely to continue relying on in school.

It is important to note that the interpretations in this section are based mainly on descriptive results, particularly the mean scores and the general patterns seen across the different groups. The study did not use inferential statistical tests to determine if the differences in responses among the sample groups were statistically significant. Similarly, the relationships among the different constructs were not examined. Because of this, the discussion focuses on overall trends and shared perceptions rather than direct comparisons between groups. Future studies may explore these areas further by using inferential analysis.

CONCLUSION

Based on the data gathered in this study, it is clear that Google Workspace has been successfully integrated into both the academic and administrative workflows at Colegio de San Juan de Letran. Elevated mean scores across key constructs—such as Performance Expectancy, Effort Expectancy, Learning Value, Hedonic Value, Habit, and Behavioral Intention—reflect a consistently positive perception regarding the platform's usefulness, ease of use, and overall user satisfaction. Many also noted how Google Workspace helped them communicate more easily, stay organized, and work better together, which has been especially helpful in hybrid and remote learning environments.

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Guide to Contributors

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4. The article should contain approximately 6000 – 7000 words (including abstract, tables/figures, and references) and should be typed in a 12-point font, Garamond, double-spaced, with one-inch margin on all sides.
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