American Journal of Environment and Climate (AJEC)

ISSN: 2832-403X (ONLINE)

VOLUME 5 ISSUE 2 (2026)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of Environment and Climate (AJEC)

Volume 5 Issue 2, Year 2026
ISSN: 2832-403X (Online)
DOI: https://doi.org/10.54536/ajec.v5i2.7212
https://journals.e-palli.com/home/index.php/ajec

Perspective of Student Commuters on Electric Vehicle Transportation: A Convergent-Parallel Approach

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Article Information

Received: January 02, 2026
Accepted: March 05, 2026
Published: July 17, 2026

Keywords

Climate change, Electric vehicles, Infrastructure, Mixed methods, Philippines, Student commuters, Sustainable transportation

ABSTRACT

This study employed a convergent-parallel mixed-methods approach to explore student commuters' perspectives on electric vehicle (EV) transportation in Davao City, Philippines. The research integrated quantitative data from 298 survey respondents and qualitative insights from in-depth interviews and a focus group discussion with 15 participants. Quantitative findings showed a generally positive perception of e-vehicles, particularly regarding environmental concern, attitude, and perceived safety. However, infrastructure and affordability were areas of concern. Qualitative results expanded these findings, revealing issues such as inconsistent government support, lack of charging stations, safety concerns due to unregistered e-vehicles, and varying affordability experiences. Despite these challenges, students expressed strong support for sustainable transportation and were optimistic about e-vehicle adoption, provided improvements are made in infrastructure, policy support, and technology. The study contributes to the understanding of e-vehicle acceptance among young commuters and offers insights for policymakers aiming to promote environmentally friendly urban mobility in alignment with sustainable development goals.

INTRODUCTION

Environmental issues, particularly global warming, have become increasingly severe. The United Nations has identified the transport sector as one of the main contributors to carbon emissions. It accounts for approximately one-fifth of global carbon emissions, three-quarters of which come from road transport (Ritchie, 2020). As the world leans towards achieving sustainable development goals, innovations in transportation come about, hence the fuel-independent electric vehicles. Adapting modernized transport vehicles promotes petroleum dependence, clean air, and a comfortable travel experience (Ozkan *et al.*, 2023). Electric vehicles could help reduce reliance on fossil fuels and carbon emissions, thereby contributing to air pollution. The effort to use electronic vehicles is generally accepted and supported in countries like the United States, Norway, California (Graham & Brungard, 2021), and even Pakistan (Asghar, 2020). However, some factors drive contradicting perspectives on the adaptation of electric vehicles in the context of the Philippines (Buenavista *et al.*, 2024).

The government's efforts in promoting electric car adoption, the effective government policies, and efficient communication play a significant role in shaping public attitudes and fostering confidence in using electric vehicles (Chonsalasin *et al.*, 2024). Policy interventions, public awareness campaigns, and strategies aimed at increasing public confidence in electric vehicles are the role of the government (Saflor *et al.*, 2024). This highlights the government's crucial role in the success of electric vehicle adoption. Moreover, Mendoza (2021) argued that the unit cost of a modernized public utility vehicle is at a high rate, and the high cost of modern public transportation appears to be more of an unsolvable issue than a solution. He added that as the unit cost of a modernized public utility vehicle increases, the fare price also increases, leading to a higher cost of living. Moreover, the purchasing cost of electric vehicles is much higher than that of diesel-powered vehicles due to their expensive batteries (Verma *et al.*, 2020). These batteries only last an average of 18.5 km before running out of power (Gaspay & Salison, 2024). In addition, electric vehicles are new to the Philippine market; hence, they still need further development in terms of cost optimization and technology, such as the availability of charging stations and developing batteries that will last longer (Sanguesa *et al.*, 2021). There is still limited availability of charging stations, repair shops, and auto-supply stores in the country (Guno *et al.*, 2021). Public transport vehicles are integral to the Philippines as they support the locals' daily lives (Andalecio *et al.*, 2020b). The evolution of public transport vehicles in the Philippines began with the kalesa, jeepneys from World War 2, buses, and trains (Presse *et al.*, 2024). Electric vehicles were recently introduced. However, electric vehicles are not yet fully established as major mode of transportation.

Although there are several studies about transportation modernization (Ashley *et al.*, 2024; Tiglao *et al.*, 2023; Sunio *et al.*, 2019), the researchers have not encountered studies that highlight the perspective of student commuters in the Philippines, especially in Davao City. Since students are a significant part of the educational population, their mobility behaviors often influence the city's transportation needs (Chikkabagewadi *et al.*, 2023). However, as this world undergoes an era of

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advancement (Calva, 2024), and it is unclear how these changes could affect daily commuting, the obstacles faced by student commuters persist regardless of these improvements. This lack of research emphasizes the need for a study that explores students' perspectives on transportation modernization. Therefore, conducting this study is still vital.

Accordingly, the findings of this study will be beneficial in achieving the following sustainable development goals: (1) Climate Action and (2) Sustainable Cities and Communities. Discovering cleaner, more efficient, and environmentally friendly public transportation. This highlights that the emission of greenhouse gases since transportation is one of the major causes, and urban air pollution can be reduced. This study also emphasizes support in mitigating the impact of climate change and attaining sustainable cities and communities. Hence, encouraging the implementation of various programs that aim to attain sustainable development goals (SDGs) can be improved by exploring the insights of student commuters on the adaptation of transportation modernization programs. The development of greener and healthier cities can be sped up by using these findings to inform policies that support eco-friendly transportation.

Research Questions

1.What is the level of perception of student commuters in terms of perceived authority support, perceived environmental concern, attitude, subjective norm, perceived behavioral control, affordability, infrastructure, perceived safety, and behavioral intention?

2.What are the lived experiences of student commuters concerning their perceptions of electric vehicle transportation?

3.How do the qualitative data corroborate with the quantitative data in this research?

MATERIALS AND METHODS

Research Design

This study applied a convergent-parallel mixed method design. A convergent-parallel method applies both quantitative and qualitative elements in acquiring data (Morse, 2009). In this method, the data were analyzed independently but interpreted concurrently (Creswell & Plano-Clark, 2011). The quantitative data and qualitative data were gathered and interpreted separately with the appropriate method. Subsequently, both data were compared and relate with each other to find out whether they corroborate. The results were then classified whether they are merging confirmation, merging discordance, or merging expansion.

Research Participants

The researchers collected data from 313 out of 1,659 students currently enrolled in the College of Teacher Education for the School Year 2024–2025. According to Cohen *et al.* (2018), for a population size ranging from 1,500 to 2,000, a minimum sample size of 306 to 322 is sufficient to achieve a 95% confidence level. In this study, the exact sample size was determined using the Raosoft sample size calculator, which recommended a minimum of 313 participants based on a 5% margin of error and a 95% confidence level. The researchers ensured that all participants had prior experience using electric vehicles for their daily commute to school, ensuring the relevance, accuracy, and validity of the data collected. Stratified random sampling was utilized for the quantitative phase, while purposive sampling was used for the qualitative phase.

A total of 298 out of 313 selected participants responded to the survey and presented data for the quantitative phase. To minimize biases, the participants were proportionally distributed across the seven academic programs that the College of Teacher Education offered. There were 103 respondents from the English program, 50 from Physical Education, 27 from Science, 25 from Social Science, 22 from Mathematics, 15 from Filipino, and 56 from the combined Elementary and Special Needs Education program.

Subsequently, in the qualitative phase, the researchers selected 15 from the 313 participants for interviews. According to Creswell (1998), 5 to 25 participants are recommended and enough for this study. Seven participated in a focus group discussion, while the remaining eight were interviewed individually through one-on-one in-depth interviews. Thus, all selected participants met the established inclusion criteria.

Research Instruments

The researchers used validated survey questionnaires for the quantitative phase. These questionnaires were pilot-tested and yielded a Cronbach's alpha threshold of 0.96, indicating very high internal consistency and reliability. Respondents answered multiple items using a 5-point Likert scale, with responses ranging from "strongly disagree"to "strongly agree." Further, the following descriptive ranges were used: 4.21–5.00 (Very High) Strong agreement; very favorable perception, 3.41–4.20 (High) General agreement; favorable perception, 2.61–3.40 (Moderate) Neutral to slight agreement; fair perception, 1.81–2.60 (Low) Disagreement; unfavorable perception, and 1.00–1.80 (Very Low) Strong disagreement; very unfavorable perception.

The instrument was designed to explore the levels of perception on the six (6) dimensions of PESTLE analysis, namely, Politics, Environmental, Social, Technological, Legal, and Economic. In alignment, the questionnaire adopted survey questionnaire from the study of Gumasing *et al.* (2024), features nine (9) indicators which are perceived authority support, perceived environmental concern, attitude, subjective norm, perceived behavioral control, affordability, infrastructure, perceived safety, and behavioral intention.

For the qualitative phase, the researchers utilized an unstructured interview where open-ended questions were asked to elicit responses from the participants. This

study used an interview guide questionnaire made by the researchers in which a pool of experts had validated. Seven (7) of the 15 participants of this study were interviewed through a focus group discussion. On the other hand, eight (8) participants were interviewed in-depth. A total of 15 participants were interviewed on the site at the University of Mindanao, Matina Campus. The researchers used the validated interview guide as a reference and imposed follow-up questions whenever necessary.

Data Collection

For the quantitative phase, data collection was established by distributing a survey questionnaire while considering respondents' preferences and accessibility. The data collected was encoded and used statistical software to analyze the results. On the other hand, the data collection for the qualitative phase was established by contacting the chosen participants and setting an appointment at a convenient time. The participants were interviewed, which was eventually done once they gave permission. Further, the researchers applied effective communication skills and social literacy to lighten the atmosphere during the interview. The data collection for the qualitative phase was guided by the researchers' interview guide, and probing questions were asked to gather more data. The data was recorded through digital recording device. The were then transcribed and translated for analysis and formulating themes. The researchers prepared consent forms and required letters to request the participation of the chosen students in this study. Participation is voluntary, and the data gathered for the quantitative and qualitative phases were handled with confidentiality.

Data Analysis

In analyzing the data, descriptive and inferential statistics were applied in the quantitative phase. Kaur *et al.* (2018) described descriptive statistics as a tool for describing the relationship between variables in a sample or population, providing an ordered summary of data. Meanwhile, the researchers used thematic analysis to analyze the qualitative data. Thematic analysis is appropriate for a qualitative descriptive study (Vaismoradi *et al.*, 2013). This approach involved searching for themes and defining meanings between the gathered data (Braun & Clarke, 2006). The researchers analyzed insights through thematic analysis. The researchers grouped the qualitative data based on patterns and perceived themes. Lastly, the data from both methods were compared to find whether they corroborate or contradict.

RESULTS AND DISCUSSION

Level of Perception of Student Commuters

Presented in this table are the level of perception of the students for different indicators. The overall mean score of 3.88 suggests that the respondents generally agree with the statements related to transportation modernization. This indicates a positive perception toward the ongoing efforts to improve public transport in Davao City.

Perceived environmental concern, recorded the highest mean score (M = 4.45, SD = 0.50) and indicates a very high environmental awareness among students and recognize the role of electric vehicles in addressing issues like climate change caused by vehicle emissions. This implies that respondents expressed concern about the harmful effects of carbon emissions and viewed electric vehicles as a positive solution to this issue.

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These findings suggest that students in Davao City are generally supportive of transportation modernization, particularly when it enhances convenience, safety, and environmental sustainability. The high scores in some indicators reflect the positive impact of new transport systems such as e-jeepneys or bus rapid transit initiatives. This highlights their support towards the electric vehicle adoption in the city

Table 1: Level of Perception of Student Commuters

Indicators	Mean	Standard Deviation
Perceived Authority Support	3.82	0.788
Perceived Environmental Concern	4.44	0.499
Attitude	4.19	0.647
Subjective Norm	3.66	0.826
Perceived Behavioral Control	3.84	0.896
Affordability	3.69	0.865
Infrastructure	3.51	1.168
Perceived Safety	3.98	0.837
Behavioral Intention	3.82	0.843
Overall Mean	3.88	0.566

Lived Experiences of Student Commuters Concerning their Perceptions of Electric Vehicle Transportation

Perceived Authority Support

This table presents the extent of government support for the adoption of electric vehicles in the city. It highlights the local government's initiatives to promote electric vehicles while also identifying key challenges, such as financial constraints and safety concerns.

Government Support Exists

The responses indicates that barangays support electric vehicle adoption by offering free charging services that assist vehicle owners. This local initiative reflects how community-level support is crucial in sustaining e-vehicle

Table 2: Perceived Authority Support

Theme Name	Illustrative Participant Quotes
Government Support Exists	"Barangay is supporting those efficient EV vehicles… free battery charging." (IDI 2) "There's a poster... promoting that it's better to use an e-vehicle." (IDI 8) "It seems like the LGU is trying to install charging stations." (IDI 6)
Support is Inconsistent	"They are lacking in giving budgets…they are supportive but not to the extent of 100%." (IDI 5) "In our barangay, it hasn't really been fully implemented yet." (FGD 1)
Financial Barriers Exist	"I think full support can't really be provided across all areas because the government still can't afford it. In our area, for example, electric vehicles aren't really used yet because we live in an uphill area, so they consume more energy. That's why people still prefer gasoline-powered vehicles." (FGD 4) Based on what I've observed, they do promote safety, of course, but they don't really promote the efficient use of e-vehicles. I think one reason is that e-vehicles themselves aren't very accessible. Even though they're eco-friendly and an efficient means of transportation, the financial aspect of using or promoting them comes first, right? So, it's like they can't really promote something that even they can't afford."." (IDI 4)
Safety & Awareness Concerns	"The e-vehicle in our area is not yet registered or does it not need registration in order to travel to cities, which is dangerous because if ever there's an accident or like the e-bike or e-vehicles that we commonly see are like quiet, they don't make a sound so they aren't easily heard if ever, for example, on the highway, they can't be seen or heard either."(FGD 3)

usage. The results emphasize that the government assistance fosters the implementation of electric vehicles. The result is parallel with the study of Qiu *et al.* (2019) and Zhuge *et al.* (2019) that the charging discount subsidy in local areas in China has increased electric vehicle use and the interest in electric vehicles increases by reducing upfront cost through subsidies. Also, the responses show that the government can bolster the adoption of electric vehicles by actively promoting their use through print media and by developing charging stations to support their use. The findings aligned with the study of Jamaludin *et al.* (2021), which highlighted that educating consumers about electric vehicles will help overcome misconceptions among the public.

Support is inconsistent

Results showed that government support for electric vehicles is still limited. There is an uneven implementation of the adoption of e-vehicles between barangays as shown in the responses between IDI 5 and FGD 1. The financial aspect remains a cause of concern for uneven implementation as the government struggles to fully support electric vehicle adoption. Some areas have more budget for significant infrastructure as well as technological development. The result of this study is supported by the study of Xue *et al.* (2021), emphasizing that socio-economic factors differ from place to place, and wealthier countries have strong purchasing power for electric vehicles. The significance of financial incentives was also highlighted in the study. Similarly, Kresnawan *et al.* (2022), pointed out that countries differ in their readiness to implement policies that support the adoption emphasized the difference in readiness to implement policies that support the adoption of e-vehicles. Meanwhile, in the Philippine context, as a developing country, the transition towards e-vehicle use remains limited, making government support especially crucial.

Financial Barriers Exist

The government support for electric vehicle use comes with financial constraints. IDI 4 expressed that promoting electric vehicles is hard if the budget is limited. Moreover, FGD 4 stated that the local government still struggles to promote full adoption of electric vehicles with the same reason, financial constraints. These findings are consistent with the study of Krishna (2021) that identified cost of purchase and ownership as barriers that limits adoption. The operating cost of electric vehicles is perceived to be expensive due to reliance on local energy sources. In line with this, Tarei *et al.* (2021), emphasized that owning and purchasing electric vehicles can be financially demanding. Thus, participants of this study perceived affordability as one of the limitations of electric vehicle adoption as the government struggles to provide subsidies for owning these vehicles.

Safety and Awareness Concerns. This indicates that the adoption of electric vehicles comes with safety concerns. Some consumers are doubtful about the safety of electric vehicles and are worried about the government policy to address these concerns. The response of FGD 3 expressed the lack of regulations for electric vehicles. These vehicles are used as a public utility vehicle without being properly registered. Furthermore, the quiet sound of electric vehicles is perceived as dangerous particularly within the highway. The result highlights the lack of policy intervention by the government. The result is

consistent with the findings of Buenavista *et al.* (2024). The government is not seen as fully committed to promoting and enabling the adoption of electric public transportation by implementing specific regulations to facilitate and support the technology in the country. In addition, the study of Andrade *et al.* (2023) found similar results. Some cities in Brazil have inadequate safety measures and poor connectivity between lanes. This has triggered concerns among the participants, which is why policy intervention by the government is essential.

Perceived Environmental Concern

Presented in Table 2 is the perception of student commuters on the effect of using E-vehicles in our environment as revealed through in-depth interviews (IDIs) and focus group discussions (FGDs). It outlines three main themes: Environmental Impact, Limitations of e-vehicles, and its long-term and short-term views. Participants strongly point out that e-vehicles contribute to reducing carbon dioxide emissions and greenhouse gases, aligning with Sustainable Development Goals (SDGs). Nevertheless, some also expressed concerns regarding the environmental implications of lithium mining and energy sourcing needed to produce e-vehicles. Despite these challenges, various participants highlighted the long-term environmental impact and benefits of adapting e-vehicles despite their cost, reflecting a largely positive outlook on EVs as a sustainable mode of transportation.

Table 3: Theme Name

Theme Name	Examples of coded interview data
Environmental Impact	"I think it's necessary to mitigate climate change because it's one of the many steps that can help reduce the release of greenhouse gases into the environment." (IDI 1) "Unlike normal vehicles that emit smoke, electric vehicles are better since they're not noisy and don't produce smoke, so they have a significant impact and can help reduce carbon dioxide." (IDI 3) "It does reduce our carbon dioxide emissions." (IDI 4, 5, 6, 7) "It does support…sustainable development goals, which is…climate change." (IDI 2)
Limitations of EVs	"Mining! Why did I mention mining? Because most electric vehicles use lithium, which is a rare mineral essential for making batteries one of the most important components of an EV. Furthermore, lithium is not abundantly available in all areas. Therefore, extensive mining operations are needed to extract it from specific regions. This highlights how mining contributes significantly to climate change." (IDI 7)
Long-term vs Short-term View	"The cost doesn't really matter what matters is it pays off in the long run. The goal should be to recover the investment over time while still gaining benefits. (FGD 2)

Environmental Impact

The responses of student commuters to the effect of using e-vehicles indicate that e-vehicles have various effects on our environment. Several participants emphasized that using e-vehicles reduces carbon dioxide emissions and greenhouse gases, aligning with Sustainable Development Goals (SDGs). Participants mentioned that e-vehicles reduce carbon dioxide emissions, contributing to maintaining a healthy environment. They stated that electric vehicles are better since they are not noisy and do not produce smoke, contributing to clean air and a healthier environment. This reflects growing environmental awareness and aligns with global discourses on climate action and reducing carbon footprint. The participants' responses indicate a clear awareness of how e-vehicles align with broader sustainability efforts and contribute to the United Nations Sustainable Development Goals (SDGs), particularly those related to climate action and affordable clean energy. The findings from this study support the idea that e-vehicles have a great impact on our environment. This supports the study of Dalvi *et al.* (2022), which found that electric vehicles are seen as a more sustainable option in our polluted environment, since traditional fuel-powered vehicles contribute significantly to carbon emissions. The study also agrees with Hsieh *et al.* (2022), who emphasized that electric vehicles emit no direct tailpipe pollutants, such as nitrogen oxides and particulate matter, significantly improving air quality and public health outcomes.

Limitations of EVs

This response of student commuters expressed concerns regarding the environmental implications of lithium mining and energy sourcing needed to produce e-vehicles. As stated, that most electric vehicles use lithium, a rare mineral essential for making batteries, which is one of the most important components of an e-vehicle. Therefore, extensive mining operations are needed to extract it from specific regions. This indicates that despite the positive effect of e-vehicles on the environment, they still contribute to environmental health and degradation in the extraction of resources such as lithium in e-vehicle production. This concern underscores the importance of addressing the full life cycle of e-vehicles, from production to disposal, in policy and industry planning. The findings of this study support the idea that, despite its positive effects on the environment, the resources used for its production still hurt the environment. This supported the study of Vieira et al. (2025), demonstrating that battery-electric vehicles generate approximately 40%

more greenhouse gas emissions during production than internal combustion engine vehicles, due chiefly to the extraction and processing of battery materials. This concern is consistent with the findings of Balaram *et al.* (2024), who emphasized that lithium, while essential for battery-powered electric vehicles, poses significant environmental challenges.

Long-term vs Short-term View

The responses of the participants emphasize that, despite the challenges e-vehicles present, it still highlights the long-term environmental impact and benefits of adopting EVs, despite their cost, reflecting a largely positive outlook on EVs as a sustainable mode of transportation. FGD 2 states that despite its cost what matters is it pays off in the long run. The willingness to overlook initial costs in favor of future benefits suggests a forward-thinking perspective among participants and points to an emerging public support for sustainable transport solutions. The findings of this study are consistent with the studies conducted by Bibak & Tekiner-Moğulkoç (2020), Mohammad *et al.* (2020), and Lamedica *et al.* (2019) that one of the advantages of electric vehicles is the possibility of using their battery to deal with fluctuations in electricity demand and regulate the power grid in real time, contributing to the integration of intermittent renewable energy sources, such as solar energy. The results also supported the study of Li and Wang (2023), which identified quieter rides, lower maintenance expenses, smoother performance, quicker acceleration, and the convenience of home charging as advantages of electric vehicle transportation that can outweigh the upfront cost.

Attitude

Table 3 presents participants' attitudes towards electric vehicle (EV) adoption, revealing three main themes: Progressive Thinking, Realism & Readiness, and Policy Gaps. Many viewed e-vehicles positively for their environmental and economic benefits, describing the shift as forward-thinking. However, concerns emerged about inadequate infrastructure, demographic challenges, and the government's short-term planning. These insights reflect optimism about e-vehicles and awareness of the barriers to effective implementation.

Table 4: Attitude

Theme Name	Illustrative Participant Quotes
Progressive Thinking	"So, for me, I would like to say yes when it comes to making a smart decision. It's because using electric vehicles in our area is very helpful. It's a very good decision, especially since it can help reduce our carbon emissions, especially considering the issues we have in our area." (FGD 6) "Yes. Like I said earlier, they won't need to use gas anymore and gas prices nowadays are increasing. So they can save more, and aside from that, it can also help with climate change." (IDI 3) "Yes, it is a smart and forward-thinking decision because it not only benefits the climate or the environment, but it can also benefit the economic aspect. If you think about it, if you spend a lot on a certain project, like here with e-vehicles, since they don't require gasoline, the long-term costs are much lower. So, in the long run, you will save money. It's eco-friendly, it helps combat and mitigate the adverse effects of climate change. Plus, it can benefit you economically because you'll save in the long run." (IDI 4)
Realism & Readiness	"Yes, some parts of the city are not yet ready for that kind of advancement due to some factors like the condition of the roads and infrastructure to support it." (IDI 8) "In our locality, we can say no for now, because here in Mandug, the roads are not yet very developed. Usually, our road is the main route for trucks that transport things like pebbles for building and other materials coming from the mountains." (FGD 1) "This is also based on our place there are a lot of people in our area, it's crowded, and there are a lot of tricycles there. And as I've said, one way to help address climate change is to transition to e-vehicles." (FGD 4) "In general, when else should we start transitioning, right? Like in other countries, they're already using electric vehicles. So they use e-vehicles, and their places aren't that polluted. So.. for the Philippines, or overall in my opinion, if we shift, I think it's really a wise decision although, yes, it's costly. But for me, it's still a wise decision to transition or switch to using e-vehicles." (FGD 2) Since we're talking about making a smart decision and when it comes to smart decisions, we can see that it's time bounded. We are time-bounded because we're in the 21st century, and we aim for change when it comes to transportation or our daily lives. So why settle for traditional vehicles if the government can also offer e-vehicles." (FGD 5)

Policy Gaps	"Mostly, sadly… our government mostly pushes for short-term solutions to each problem. So, let's say that in the context of e-vehicles, the government has implemented them or pushed the masses to use e-vehicles for a more sustainable future. The problem, though, is that laws take time to be implemented. And if we want to push for this type of adaptation and mitigation regarding the use of e-vehicles, laws should first be enacted. As I said in the first question, there should be specific rules and standards set, and clear rights for the users of e-vehicles when it comes to their use. (IDI 7)

Progressive Thinking

The response of student commuters on attitudes toward e-vehicle adoption indicates that e-vehicles have a positive view in the context of environmental and economic benefits. Participants viewed e-vehicles positively for their environmental and economic benefits, describing the shift as forward-thinking. They pointed out that the adaptations of e-vehicle lessen carbon emission which is necessary to mitigate climate change. Further, it promotes a sustainable future. Meanwhile, the adoption of e-vehicle has economic benefits for it does not require the use of expensive gasoline and helps riders reduce expenses. Thus, the adoption of e-vehicles is perceived as a smart and forward-thinking decision. The result of this study supports the idea that adoption of e-vehicles is an innovative and forward-thinking decision since e-vehicles play a key role in cutting down greenhouse gas emissions. It supports the study of Evans (2024), who argued that adopting e-vehicles is a wise and strategic decision due to their significant contribution to reducing greenhouse gas emissions.

Realism & Readiness

The participant's comment highlights the current infrastructure and readiness constraints at the local level, reflecting a realistic and grounded perspective on the adoption of e-vehicles. There are certain areas of the city are not yet prepared for development because of certain elements that enable its adaptation. The participant agrees that although the idea of e-vehicles may seem attractive, their effective adoption hinges on how well-prepared the current environment is. Furthermore, the worry about insufficient infrastructure raises the possibility that initiatives to encourage the use of e-vehicles may encounter major obstacles in the absence of the required planning and upgrading. The participants' responses reflect also how demographic characteristics such as population density, road usage, and community development can influence the readiness of a locality for adopting e-vehicles. Accordingly, the participant's viewpoint emphasizes how important preparedness is in assessing the viability and efficacy of innovative technology projects like electric cars. The result of this study aligns to the study conducted by Lanzini (2024), which confirms that consumers' unwillingness to adopt e-vehicles is influenced by perceived infrastructure inadequacy, specifically the absence of dependable and accessible charging stations. This existing limitation was also mentioned by Saflor *et al.* (2024), while also emphasizing the importance of developing educational efforts tailored to specific communities, particularly in areas where limited infrastructure and local economic conditions contribute to doubts or hesitation about e-vehicle use.

Policy Gaps

The participant's response emphasized that while the government has shown interest in promoting e-vehicle use, the supporting legal and infrastructural frameworks remain lacking. The government mostly pushes for short-term solutions to each problem. Although the government appears to support the adoption of e-vehicles as part of a sustainable future, such efforts are often described as superficial or reactive. Furthermore, it emphasized the absence of long-term commitment. It pointed out that laws take time to be implemented, underscoring the need for establishing a legal framework before encouraging widespread e-vehicle use. This delay in policy implementation is viewed as a major barrier that hinders the effectiveness and credibility of e-vehicle-related programs. This emphasized the need to address policy gaps to have a successful implementation of e-vehicle adoption. The result confirms the findings of Jing *et al.* (2019), which emphasize that the success of e-vehicle adoption depends on the alignment between government policies and manufacturers' responses. Lack of consistency or foresight within the government leads to hesitation among manufacturers to invest or commit to long-term e-vehicle development strategies. The results also support the study of Qadir *et al.* (2024), which emphasizes that the lack of long-term, integrated e-vehicle policies weakens implementation and undermines stakeholder trust.

Subjective Norm

Table 4 presents the level of influence of student commuters on utilizing e-vehicle as their daily mode of transportation. It outlines three main themes: Influence of Peers/Family, Self-motivation, and Limited peer influence. Participants emphasized that they were influenced by using e-vehicles as their daily mode of transportation through neighbors, peers, and family members. Additionally, some are also driven by self-motivation driven by environmental and personal values. Nevertheless, despite these influences some are also driven by limited peer influence which can hinder the adaptation of e-vehicles.

Table 4: Subjective Norm

Theme Name	Illustrative Participant Quotes
Influence of Peers/Family	"One of our neighbors have electronic vehicle…encouraged to also do the same." (IDI 4) "My father inspires me to use e-vehicles." (IDI 6) "My family has one other than bao-bao and as far as I know, bao-bao is an electric vehicle because it uses both the electric and the uh diesel side. So, yes." (IDI 7) "I would say I'm the one who encourages the most."(IDI 8)
Self- Motivation	"More on self-reflection when it comes to using EV vehicles. My family doesn't tell me to ride an EV vehicle …nor do my peers, because in our area, they are just available. EV vehicles are available, so I just use them or take the opportunity to use EV vehicles for transportation. It's not really about people influencing me to ride them. For me, it's because it's more efficient, and I can also make a positive impact on the environment." (IDI 2)
Limited Peer Influence	"No one really tells me… because we live in a rural area." (IDI 1) "It's not a topic always brought up." (FGD 5)

Influence of Peers/Family.

The participants' responses reveal that peers and family members play a significant role in shaping their interest and decisions regarding using e-vehicles. They expressed motivation after seeing their neighbor using an e-vehicle. This suggests firsthand exposure to someone within the community successfully using an e-vehicle builds trust and interest. Additionally, it indicates that family members are important role models, particularly when they are early adopters of technology. Many participants shared how observing the behavior and choices of those around them, particularly neighbors and family, encouraged them to consider adopting e-vehicles. This influence is rooted in verbal encouragement and visible benefits others experience, such as fuel savings and convenience. Furthermore, participants also acknowledged that owning or being familiar with hybrid or electric vehicles through family ownership helped reduce doubts or hesitation. The findings strongly supported the study of Tebbe (2025), who demonstrates that e-vehicles in a person's neighborhood, workplace, or family increased the likelihood of further e-vehicle purchases in those environments. Similarly, Stockkamp *et al.* (2021), who identified social influence, including peer and family dynamics, as a significant non-technical factor associated with consumers' adoption of e-mobility.

Self-Motivation

The responses of the participants reveal that self-motivation plays a vital role in the decision to use e-vehicles, especially in cases where external influence is minimal or absent. As stated, that utilizing e-vehicles is more about self-reflection. This statement reflects a strong internal motivation based on individual values rather than social influence. Moreover, the data indicate that while external influence can encourage e-vehicle adoption, internal motivation rooted in personal values and reflections can be equally, if not more, powerful. This insight underscores the importance of fostering environmental awareness and individual responsibility as key drivers in promoting sustainable transportation choices. The result of this study supported the findings of Higueras *et al.* (2020), which identifies personal environmental concern as one of the most critical factors influencing e-vehicle purchase intent outweighing external pressures like price incentives or social influence. It is also consistent with the study of Rahman and Thill (2024), confirming environmental concern and personal values as among the most influential psychological factors. These underscore that personal environmental concern and individual values are central drivers of e-vehicle adoption, often surpassing external incentives or social pressures in influence.

Limited Peer Influence

The participants' responses emphasized minimal peer influence in utilizing e-vehicles, particularly in areas where such topics are not part of everyday conversation. As mentioned, that no one tells him about using e-vehicles since they live in rural areas. This highlights the geographic and social factors contributing to limited peer interaction regarding e-vehicles. In more remote or rural settings, the exposure to e-vehicle users is reduced, and so is the opportunity for casual peer discussions that might otherwise influence attitudes and behavior. These findings support the study of Rakesh and Singh (2024), which showed that in less urbanized areas like Jharkhand, the impact of social influence on e-vehicle adoption is significantly reduced due to a lack of peer familiarity and limited local adoption. The result is also consistent with Wang *et al.* (2024), showing that e-vehicles do not often come up in local discussions, making them less visible and less talked about among peers. This supports the idea that when e-vehicles are not part of everyday conversations or social exchanges, individuals are less likely to be influenced by others to consider using them.

Perceived Behavioral Support

Table 5 presents the perceived behavioral support. Perceived behavioral support refers to how individuals

or communities view the availability of external support, such as government policies, infrastructure, financial assistance, and social encouragement that enables or influences them to adopt a certain behavior, like using electric vehicles (EVs).

Table 5: Perceived Behavioral Support

Theme Name	Examples of coded interview data
Accessibility and Efficiency	"In my barangay… electric vehicles (EVs) are readily available daily. This consistent availability makes it convenient for me to ride an EV when going home from school. Because these vehicles are always accessible, they offer a more efficient and practical mode of transportation for my daily commute. "(IDI 2) "Accessibility and efficiency… You won't get stuck in traffic" (IDI 4)
Convenience vs Limitation	"So, it was manageable and convenient for me because I was already on my way home at that time, and there were no jeepneys available since none were on duty. It wasn't like I had to rent the whole vehicle either, because we still paid per person. The e-vehicle I rode took shortcuts… so I got home quickly. There was no fixed route, and for me, it was also comfortable to sit in. Even though our road is rough, I didn't feel any bouncing or discomfort. So yes, it was convenient and very manageable." (FGD 1) "Yeah, it's more convenient for me, especially with e-bikes in our area. They're good if you're getting off in a specific place. Also, in downtown, there are times when I get home really late, like around 12 or 1 AM, and I usually still see those small e-vehicles, the baobao. They also don't have a fixed route, so you can just tell the driver exactly where you want to get off." (IDI 8)
Charging Issues	"I think no, because EVs usually need to be charged, right? So, if the distance I'm going to is far, there's a chance the battery might run out halfway. So, it's not convenient. But in terms of how quiet it is, it's more convenient compared to regular vehicles that are noisy because of the engine." (IDI 3)
Manageability Concerns	It's very convenient because you just have to sit" (IDI 4) "Tricycle has their own city ordinances… manageable…convenient." (IDI 7)

Accessibility and Efficiency

The insight highlights the positive impact of consistent e-vehicle availability on daily transportation habits. In this case, the accessibility of e-vehicles within the respondent's barangay enhances convenience and encourages regular use, particularly for commuting to and from school. This suggests that when e-vehicles are integrated into local transport systems, they are perceived as efficient and practical alternatives, supporting greater adoption and reinforcing sustainable mobility behaviors at the community level. In addition, the observation from participant emphasizes accessibility and efficiency as significant advantages of e-vehicles. Its compact size enables easier navigation through traffic congestion, allowing commuters to save time and reach their destinations more quickly. This practical benefit positions e-vehicles as a convenient alternative to traditional vehicles, potentially increasing their appeal and adoption among daily commuters seeking efficient transportation solutions. The result of this study aligns with the findings of Wang *et al.* (2024), who noted that in traffic-heavy environments, the maneuverability of smaller e-vehicles offers substantial commuting advantages. Micro-EVs, being an eco-friendly and compact mode of transportation, are highly useful in complex urban environments.

Convenience vs. Limitation

The response highlights the convenience of e-vehicles, particularly in situations where traditional public transport is unavailable. The per-head payment system, flexible routes, and ability to take shortcuts contribute to quicker and more efficient travel. Despite rough road conditions, the respondent noted comfort and minimal disruption during the ride. While the flexibility and accessibility of e-vehicles address certain limitations in transport availability, these benefits may still depend on specific circumstances such as time of travel and location. The findings of this study support Cueto *et al.* (2021), who highlighted that electric tricycles serve as a convenient substitute for traditional public transportation due to their adaptable routes, ease of access in less-served locations, and effectiveness for short, on-demand travel, particularly beneficial during late hours or in areas with rough road conditions.

Charging Issues

The response of the participant revealed that charging-related issues are a major concern affecting the practicality and appeal of e-vehicles. These concerns center on the lack of accessible charging stations, the time required to recharge, and the potential for batteries to run out of power during travel. This makes e-vehicles feel less convenient compared to traditional vehicles.

Although the participant acknowledged that e-vehicles are quieter and more comfortable in terms of noise, the fear of being stranded due to a drained battery remained a key issue. This highlights that while they have advantages, such as reduced noise and environmental impact, unresolved challenges in charging infrastructure and battery performance continue to limit their wider acceptance and consistent use, particularly for users who travel long distances or lack access to reliable charging options. The findings of this study align with the study of Jamaludin *et al.* (2021), which highlighted that the driving range of electric vehicles is one of the top concerns that hinders their adoption. Further, it sparks a fear of getting stranded, which adds time, inconvenience, and stress to a journey. Range anxiety can be caused by the unavailability of charging stations within areas.

Manageability

The participants' insights reflect how e-vehicles are perceived as highly convenient and manageable in local contexts. As shared, e-vehicles are very convenient and do not need special training to manage, operate, or navigate when using them. This sentiment emphasizes the intuitive nature of e-vehicles and accessibility, even for users without formal driving experience. Additionally, one participant highlighted that bao-bao (a local term for a three-wheeled small e-vehicle) vehicles are reliable, comfortable, and capable of transporting passengers and goods. Because these vehicles function similarly to tricycles already governed by local ordinances, they are seen as practical and easy to manage within the community. These findings align with Hussain and Qureshi (2024), who found that when users perceive e-vehicles as useful and simple to operate, adoption is more likely. These insights highlight that the simplicity, everyday usefulness, and seamless fit of e-vehicles within existing community practices significantly influence their acceptance and adoption.

Affordability

Table 6 presents the perspectives of student commuters on electric vehicles in terms of affordability as their mode of transportation. Affordability in the context of electric vehicles refers to an individual's or household's financial capacity to purchase, utilize, and maintain an e-vehicle. This includes the upfront cost of the vehicle, access to financing or subsidies, and the ongoing expenses for charging, maintenance, and repairs. This also highlights the capability of the consumers to afford the fare cost of electric vehicle as their daily mode of transportation.

Mixed Fare Perception

Table 6: Affordability

Theme Name	Illustrative Participant Quotes
Mixed Fare Perception	"It's not very cost-efficient, not friendly to low-income people." (IDI 1) "It's really expensive especially if only a few passengers ride it." (FGD 1) "E-vehicles are really more expensive." (FGD 2, & 6) "The more convenient it is, the more expensive it becomes." (FGD 4 & 5) "It's costly since the purchase is expensive." (FGD 7) "For me, it's better because gas prices are rising. If you use a regular vehicle, the cost will also increase. So… I feel like this (electric vehicle) is cheaper since it doesn't consume gas and gas prices, as we know, can go up or down unpredictably." (IDI 2)
Limited Regulation	"If left unsupervised, there really needs to be specific rules." (FGD 5) "Since they invest a large amount …so they'll also look for ways to recover what they invested." (IDI 1) "Possible that it would overprice…electricity is also increasing." (IDI 2)
Value vs Cost	"It's really efficient in the long run." (IDI 4) "Yes, but not so, most likely 2-3 pesos of increase. But I think for me it's not that disadvantageous." (IDI 5) "E-vehicles are more expensive than traditional ones. But it's okay." (IDI 6)
Perceived Cost Efficiency	"I guess yes. It has a stronger build and many capabilities. It also reduces the amount of diesel that needs to be used every time it's operated, which is a common issue for most drivers because, again, we are in an era of inflation, and the prices of diesel, gasoline, and so on have really gone up." (IDI 7) "Actually, the fare cost of the e-vehicle is just right since it's understandable that there are really differences between gas and their batteries." (IDI 8)

The responses of the participants reflected mixed perceptions regarding the cost of e-vehicles, particularly in the context of fare affordability and financial feasibility for both users and operators. They expressed concern that their existing vehicles would be rendered useless, resulting in wasted investment. As mentioned, that many drivers and operators disagree with modernization due to the high costs involved. This statement captures the financial dilemma faced by traditional vehicle owners who are being pushed toward modernization yet lack

the resources to afford the transition. This is consistent with the study of Krishna (2021), which highlighted the higher upfront cost of electric vehicles. The participants' responses also highlighted that e-vehicles are cheaper than traditional gasoline-powered vehicles, particularly regarding long-term usage and fuel savings. This view is primarily influenced by the rising and unpredictable fuel costs, making conventional vehicle operation more expensive. The results of this study supported the study conducted by Balinado *et al.* (2023), which pointed out the consumer's preference for electric vehicles for their economic benefits. It also supports the study of S *et al.* (2022), which labeled electric vehicles to have low maintenance costs and an advantage over internal combustion engines.

Limited Regulation

The responses of the participants demonstrate growing concerns over the limited regulation surrounding electric vehicles, particularly regarding pricing, usage, and industry oversight. The absence of clear and consistent policies is perceived as a potential risk, with participants emphasizing the need for stronger government supervision. These insights suggest that without robust policy frameworks, the e-vehicle industry may face affordability, fairness, and equitable access challenges, potentially hindering its long-term sustainability and public acceptance. The findings of this study support the study of Agpaoa *et al.* (2024), in which the absence of strong regulatory measures, modernization efforts, particularly those requiring substantial investments, such as electric vehicles, leads to increased fares that could burden low- to middle-income commuters, ultimately reducing accessibility and weakening long-term public support.

Value Over Cost

The responses of the participants reveal a strong recognition of the principle of value over cost when it comes to the utilization of e-vehicles. While participants acknowledged that its fares are generally higher than traditional public transportation, many still expressed a willingness to pay the additional amount due to the perceived long-term benefits. These reflect a growing appreciation for sustainable and efficient transport solutions, especially among individuals who value quality and impact over minimal cost differences. The findings of this study are aligned with the study of Rani *et al.* (2024), who found the same result, that is the tendency of consumers' inclination towards electric vehicle adoption if consumers perceive driving e-vehicles as convenient and beneficial for them. The results highlight that when users perceive tangible benefits whether environmental, economic, or practical they are more open to accepting slightly higher fares in favor of long-term value.

Perceived Cost Efficiency

The responses of the participants indicate a perception of cost efficiency in using e-vehicles, particularly when comparing their fare rates to those of traditional modes of transportation. While some participants acknowledged that e-vehicles can be slightly more expensive, others emphasized that the cost is relatively the same as regular transport. Further, the participants recognized that electric vehicles help minimize dependence on costly diesel, making them a sensible choice for everyday transportation. The results of this study supported Buhmann *et al.* (2024), who emphasized that perceived affordability and cost savings are crucial elements in predicting consumers' intention to adopt e-vehicles. Also, result is consistent with the study of Krishnan and Koshy (2021), that higher petrol or diesel cost relative to cheap electricity persuades consumers to use electric vehicles. These perspectives indicate that the economic appeal of e-vehicles during financially challenging times contributes to their growing acceptance and potential for wider use.

Infrastructure

Presented in Table 7 are the participant responses related to the current state of infrastructure supporting e-vehicle use in the city. The findings highlight a common concern among student commuters: the lack of formal infrastructure, particularly charging stations, which are rarely seen or completely absent in many areas. While some communities have come up with their own solutions, such as charging at home or relying on local mechanics, these alternatives remain informal and inconsistent. The responses also reveal that infrastructure development is uneven, with urban areas having better access compared to places. Overall, the data suggests that although there is growing interest in e-vehicles, the absence of reliable and accessible infrastructure continues to pose a significant barrier to their wider adoption.

Table 7: Infrastructure

Theme Name	Illustrative Participant Quotes
Lack of Infrastructure	"I've never seen one yet." (IDI 1) "It's not common yet." (IDI 3) "Our place has parts that are paved, but also parts that are rough and uneven. So, I think, in general, not all places in the Philippines can support or have enough infrastructure to support the use of EV vehicles. Because, of course, we are living in a developing country. (IDI 4)

Community Alternatives	"Our area is there's enough infrastructure when it comes to supporting the EV vehicles in different area because our barangay is big. So, there's different charging stations in the areas as well. (IDI 2) "A friend of mine has an e-bike. What he does before using it is he makes sure it's fully charged. That way, his trip won't be affected. He has a charging station at home because the e-bike comes with its own charger when he bought it." (FGD 5) "In our family, yes, because we have a personal mechanic. That person knows how to handle e-vehicles. He knows how to handle the motor part because we have our own personal mechanic. We have the infrastructure to support the use of e-vehicles." (IDI 7)
Unequal Development	"We have them in our area, but only for the vehicle batteries. There aren't really charging stations; they just charge the batteries at shops." (FGD 4) "Yes, there are various mechanical shops in our area. Also, the operators of the e-bikes there the drivers are not the owners of the e-bikes, they just rent them from certain operators. So if their unit breaks down, they're given another unit while the broken one is repaired. The operators are also the ones who handle the charging." (IDI 8)

Lack of Infrastructure

The responses of the participants highlight a major barrier to electric vehicle adoption which is the lack of adequate infrastructure in their communities. Many noted the limited availability or complete absence of essential components such as charging stations, reliable roadways, and maintenance support. A common point raised was the nonexistent charging infrastructure, with one respondent stating they had never seen a charging station in their area. These issues point to broader infrastructural gaps, particularly in rural or developing regions, which hinder the practical use and sustainability of electric vehicles. This finding aligns with existing literature which underscores the barriers affecting the adaptation of e-vehicles. In the study conducted by Guno *et al.* (2021) emphasized that the availability of charging stations, mechanic/repair shops, and auto-parts supply stores are one of the barriers in the adaptation of e-vehicles. This result is also consistent with the study of Noel *et al.* (2020), which found that limited public charging stations hinder e-vehicle adoption. Without reliable support structures, even the most advanced technology may fail to reach its intended impact. For policymakers and stakeholders promoting transportation modernization, addressing this gap is essential.

Community Alternatives

The responses of the participants demonstrate that even in the absence of formal infrastructure to support e-vehicles usage, local communities have developed informal solutions to meet their mobility and energy needs. While this suggests a somewhat better-developed context, it may still reflect a decentralized system of informal or semi-formal arrangements rather than institutionalized infrastructure. These community alternatives reflect both the adaptability and limitations of grassroots efforts in bridging service gaps left by public and private sectors. The result of this study echoes the insights of Noel *et al.* (2020), highlighted that charging infrastructure remains one of the most persistent barriers, leading users to adopt informal methods that are not integrated into the national transportation framework. Thus, home and work charging infrastructure is more important. The result also confirms the findings of Visaria *et al.* (2022), emphasizing that home charging for e-vehicles appears as the most critical location for charging. While these community alternatives are a testament to local resilience and creativity, they should not be seen as replacements for formal infrastructure. Instead, they underscore the urgent need for coordinated efforts between government, private investors, and local communities to scale up safe, accessible, and standardized e-vehicle support systems.

Unequal Development

Student commuters revealed unequal access to e-vehicle infrastructure across communities. While some urban areas have made slight progress, others rely on informal solutions. These findings demonstrate that the support of the government to provide enough infrastructure to support e-vehicles is crucial. This supports the study of Barkenbus (2020), which mentioned that Governments can play a key role in improving infrastructure to support the widespread use of electric vehicles. One of the most effective ways to do this is by increasing the number of charging stations, which would help ease the common concern of "range anxiety", the fear of running out of power due to limited charging options. Additionally, charging infrastructure development is crucial for ensuring convenient and accessible charging options, further bolstering the appeal of e-vehicles. This allows the consumers to trust e-vehicles in their daily transportation and reduce their anxiety when it comes to safety concerns. The findings also support the insights of Qadir *et al.* (2024), who emphasizes that expanding charging infrastructure across diverse locations such as residential areas, public spaces, highways, and workplaces is a critical step in encouraging broader adoption of electric vehicles. These builds trust among consumers as they feel less anxiety. By making charging more accessible and convenient, potential users may feel more confident

in transitioning to e-vehicles.

Perceived Safety

Presented in Table 2.8 are student commuters' perceptions of the safety of e-vehicles, which emerged as a significant theme in the study. Safety is a key consideration for users when adopting new modes of transportation, and the responses reflect a mix of comfort, concern, and caution. While some participants shared positive views, describing e-vehicles as comfortable and safer than traditional options, others raised issues related to quiet operation, weak lighting, and battery limitations. These insights reveal the nuanced ways people evaluate e-vehicles not just on performance or convenience, but on how secure they feel while using them.

Table 8: Illustrative Participant Quotes

Theme Name	Examples of coded interview data
Comfortability	"It's comfortable. The ones in our area have good EV vehicles. For example, the tricycles are very comforting because they have foam seats, which make it more comfortable for me. And when it comes to safety, yeah, it's safe because it's like riding a motorcycle." (IDI 2) "Comfortable because they don't make noise." (IDI 6) "It's comfortable, but when it comes to safety, I think it's still a bit concerning for now. (IDI 7)
Safety Concerns	"It has a weak horn, so it's prone to accidents." (FGD 5) "It has the same issues…there's no charging station to go with directly." (IDI 5)
Battery Limitations	"It will compromise the safety of the passengers." (IDI 3) "In the middle of the road power outrage or low battery can occur." (IDI 4) "We couldn't get home because we ran out of battery." (IDI 8)

Comfortability

The responses of participants perceived e-vehicles as comfortable and offered quiet experience compared to traditional vehicles aside from contributing to environmental, community safety. Others even stated that they felt safer on e-vehicles than on traditional modes of transport. However, this sense of safety was not universal as other participants admitted that despite the comfort, e-vehicles still felt "quite scary" in certain situations, indicating a gap between perceived comfort and actual feelings of security. The findings of this study align with the study of Gumasing *et al.* (2022), who noted that e-vehicles are quieter than traditional diesel and petrol-powered vehicles, resulting in a substantial reduction in noise pollution. This quieter operation benefits both commuters and residents in nearby areas.

Safety Concerns

The responses of student commuters regarding the adaptation of e-vehicles emphasized that, despite their benefits, safety concerns remain a significant challenge. While the vehicles are perceived as comfortable, their current safety features may still require improvement. Further, the response of student commuters mirrors other comparable safety issues with traditional vehicles. One problem of e-vehicles that has been highlighted because of its comparability towards traditional vehicles is the availability of its charging station because just like fuel powered vehicles that use gas to run, e-vehicles can also run out of power. This lack of infrastructure creates anxiety among commuters, especially during long-distance travel or when operating in less urbanized areas where access to charging points is scarce. The results of this study are consistent with the findings of Greene *et al.* (2019), stating that the shortage of charging stations is a significant obstacle to the expansion of the plug-in electric vehicle market and heightened range of anxiety among drivers.

Battery Limitations

The responses of student commuters revealed significant concerns regarding the battery limitations of e-vehicles, particularly the risk of power loss mid-trip. These issues were consistently highlighted as barriers that affect their trust and comfort in using EVs for daily transportation. This illustrates the anxiety associated with traveling in areas that lack sufficient charging stations. This fear of being stranded reflects a broader issue of range anxiety, commonly found in e-vehicle related literature. These findings align with Wang *et al.* (2024), who emphasize that insufficient charging stations increase the likelihood of mid-trip power loss, thereby undermining user confidence and hindering e-vehicle adoption. This highlights the critical need for expanded and accessible charging infrastructure to support wider adoption. Similarly, it supported the study of Liu *et al.* (2022), emphasizing the importance of strategically locating charging stations by developing models that identify optimal placement.

Behavioral Intention

Presented in Table 9 are behavioral intentions regarding the use of e-vehicle. Student commuters generally expressed a positive inclination toward electric vehicle adoption, primarily driven by sustainability, environmental benefits, and health-related motivations. Many respondents emphasized that their willingness to use electric vehicles stems from the potential for long-term environmental impact, even at a higher cost. Conversely, conditional

willingness emerged due to concerns about infrastructure readiness, battery limitations, and safety. These insights highlight the complex, multidimensional factors that shape behavioral intentions toward EV usage in the local context, particularly in areas such as Davao City.

Table 9: Behavioral Intentions

Theme Name	Illustrative Participant Quotes
Willingness to Use	" E-vehicles can help mitigate environmental factors such as climate change." (FGD 5) "I would like to continue using e-vehicles as my daily mode of transportation. It's very helpful, especially for addressing environmental issues, and it also improves safety." (FGD 6) "If it's fully implemented in our area or here in our City, I would use it as my daily mode of transportation." (FGD 7) "Yes, I'm willing to continuously use EV vehicles as my daily mode of transportation because, one, it's efficient; two, it's convenient; three, it's safe; and number four, the most important thing is that I would be part of a larger initiative, which is a sustainable future." (IDI 2) "I am willing to continuously use EV vehicles as my daily mode of transportation because, as I've said earlier, it's mainly because of its benefits, right? So, one of which is that it's eco-friendly and helps mitigate the adverse effects of climate change." (IDI 4)
Conditional Use	"For me, yes, especially if the features of e-vehicles can be improved, particularly those related to our main concerns like the lights, horn, or other components that affect performance. And just like what others have said, it shouldn't be solely based on others' opinions. What's important is that we continue to use e-vehicles, so people don't remain unaware of their existence. At the same time, these e-vehicles exist for the purpose of helping to mitigate the environmental problems caused by traditional vehicles." (FGD 1) "Yes, if it's fully implemented in our area or here in Davao City. Once it's implemented, I will use it as my daily mode of transportation, except when I'm in a hurry, because it's not that convenient when you're rushing since it runs slower." (FGD 7) "Taking into account… They easily run out of battery… they should improve their energy capacity." (IDI 1)
Doubts on Safety	"No. Because honestly, I don't feel comfortable with its safety since it's small. And aside from that, I'm not sure if the EV's battery can last until I reach my destination." (IDI 3)
Comfort and Ride Experience	"The e-vehicle runs more swiftly compared to a regular motorcycle, and also, I feel more comfortable because, like what was mentioned earlier, it's quite unlike motorcycles that need to start the engine before moving, and while running, the engine keeps making noise and there are emissions too. Even if you're inside, you can still inhale it. Whereas with an e-vehicle, when you ride it, it's like you're just sliding toward your destination and it's not that noisy, it's just swift." (IDI 8)

Willingness to Use

The responses of participants expressed a strong willingness to use e-vehicles due to their alignment with environmental sustainability. Participants consistently point out that electric vehicles are perceived as solutions to pressing environmental concerns such as climate change and pollution. The result of this study aligns with Mastria *et al.* (2023), who found that green perceived value positively influences sustainable purchase decisions. Similarly, it aligned with Li *et al.* (2022) who emphasized that pro-environmental motivation linked to self-image drives consumers to view e-vehicle use as part of a green and low-carbon lifestyle, further shaping their behavioral intentions. The consumers' perception of the positive impact of e-vehicle to sustainability encouraged them to use e-vehicles.

Conditional Use

The responses of the participants emphasized that their willingness to use e-vehicles is conditional and largely depends on improvements in infrastructure, battery performance, and overall vehicle features. While there is openness to the continued use of e-vehicles, this acceptance is not absolute and is shaped by the practical limitations currently observed. These responses show that while environmental awareness and willingness to adopt electric vehicles exist, actual usage is dependent on key conditions being met. These includes those that are related to functionality, convenience, safety and infrastructure readiness. The findings of this study are aligned with the study of K *et al.* (2022), who identified that the lack of infrastructure to support electric vehicles was found to be a barrier in terms of adopting electric

vehicles. The result was also similar with the study of Pamidimukkala *et al.* (2023), found out that the limited availability of support centers and maintenance facilities for electric vehicles, compared to the widespread services for traditional vehicles, leads to dissatisfaction among current e-vehicle owners.

Doubts on Safety

The participants' responses reveal that safety concerns remain a significant barrier to fully adopting e-vehicles, particularly among student users. These doubts are closely tied to the perceived limitations in vehicle size and power, which affect their confidence in using e-vehicles as a regular mode of transportation. The result is consistent with the study of Yankun (2020), which stated that safety risk and convenience risk of electric vehicles affect willingness to use. The result is also consistent with the study of Ha *et al.* (2023) which found that safety concerns serve as a push factor that negatively impacts individuals' willingness to adopt electric vehicles, reinforcing the idea that perceived risks can hinder user acceptance.

Comfort and Ride Experience.

The statement underscores key points related to comfort, such as the quiet operation, smooth ride quality, and the absence of emissions. It was also emphasized that, unlike motorcycles, which require loud engine startup and emit smoke during operation, e-vehicles offer a noise-free and smoke-free experience. The findings of this study align with those of Liu *et al.* (2020), who found that individuals are more willing to use electric vehicles due to their comfortable driving experience, low emissions, and minimal noise. The participant's response affirms that e-vehicles are environmentally friendly and significantly enhance the commuting experience. The absence of engine noise and harmful emissions contributes to physical comfort and a perceived well-being. A better passenger comfort influences the consumers' willingness to use e-vehicles. These factors reinforce the positive perception of e-vehicles and demonstrate how environmental improvements directly influence the daily experiences of passengers.

Data Integration

Presented in Table 10 is the integration of the quantitative and qualitative data. Both quantitative and qualitative data were collected simultaneously and analyzed independently. The results were then merged to determine whether the findings corroborated (Merging Confirmation), extended (Merging Expansion), or contradicted (Merging Discordance) each other. The integration yielded the following insights:

Table 10: Integration of Quantitative and Qualitative Results Across Dimensions

Dimension	Quantitative Result	Qualitative Result	Integration Type
Perceived Authority Support	High (M = 3.83)	Mixed: support is seen but hindered by budget, regulation, and uneven implementation	Merging Expansion
Perceived Environmental Concern	Very High (M = 4.45)	Strong support; adds insights about lithium mining and sustainability framing	Merging Expansion
Attitude	High (M = 4.19)	Positive attitude; qualitative adds ideas on policy gaps and infrastructure readiness	Merging Expansion
Subjective Norm	High (M = 3.66)	Confirms social influence; adds nuanced differences in peer/family vs. self-motivation	Merging Confirmation
Perceived Behavioral Control	High (M = 3.84)	Supports general agreement but reveals charging anxiety and traffic behavior nuances	Merging Expansion
Affordability	High (M = 3.69)	Confirms price concern; adds variability (some say cheaper, others say costly)	Merging Expansion
Infrastructure	High (M = 3.51)	Strongly confirms lack of charging stations and poor roads	Merging Discordance
Perceived Safety	High (M = 3.98)	Generally, agrees but qualitative reveals issues on soundless EVs and lack of registration	Merging Expansion
Behavioral Intention	High (M = 3.82)	Confirms intention; adds long-term mindset and optimism despite challenges	Merging Expansion

Note. Quantitative results are based on Likert scale means; qualitative results summarize thematic analysis; integration type follows a mixed methods framework.

Merging Confirmation

Two dimensions, Subjective Norm and Infrastructure, exhibited merging confirmation, meaning both data strands strongly aligned.

Quantitative findings revealed a moderate influence of subjective norms (M = 3.66), which was affirmed by qualitative insights showing how peers and family members influenced students' adoption of e-vehicles. Participants cited neighbors or family who owned e-vehicles as motivational factors, confirming the role of social pressure and modeling. The quantitative and qualitative findings regarding the indicator subjective norm were found to support each other. Quantitative data revealed that respondents moderately agreed with statements related to subjective norms, indicating a noticeable influence from social factors. This was further reinforced by qualitative data, which highlighted those social influences, particularly from family and peers, can significantly motivate individuals to consider using electric vehicles as mentioned by IDI 4,6,7, & 8.

These results are consistent with the findings of Abbasi *et al.* (2021), who reported that Malaysian consumers' decisions to purchase and use electric vehicles were strongly affected by the opinions of close social circles, especially family members. Additionally, intrinsic motivations rooted in personal values and environmental concern also emerged as influential factors through the statement of IDI 2. This agrees with the study of Zhao *et al.* (2022), which states that green self-identity positively influences personal norms, suggesting that individuals with strong environmental values are more likely to engage in sustainable behaviors, such as adopting electric vehicles. Whilst IDI 1 and FGD 5 noted that electric vehicle use is not a topic always brought up.

Merging Discordance

Similarly, Infrastructure received the lowest mean rating among all dimensions (M = 3.51), which still falls under a 'High' descriptive level. The qualitative data negates the high and positive perceptions revealed in the quantitative result, highlighting the lack of charging stations, poor road conditions, and unequal development.

The qualitative data result aligns with the findings of Guno *et al.* (2021), which revealed that charging stations infrastructure as well as mechanical shops for electric vehicles in the Philippines are still underdeveloped. It is also consistent with the findings of Navarro and Latigar (2022), which pointed out that Mindanao is still lacking in terms of road infrastructure development. Some areas in Mindanao have good road conditions while the majority are categorized as "poor".

The result aligned with the findings of K *et al.* (2022), who identified insufficient infrastructure as a significant barrier to the adoption of electric vehicles. This is also consistent with the study of Pamidimukkala *et al.* (2023), which highlights that the limited number of support centers and maintenance facilities for electric vehicles, in contrast to the well-established services for conventional vehicles, contributes to user dissatisfaction. Furthermore, IDI 2, FGD 5, and IDI 7 also mentioned the informal charging setup and the presence of localized infrastructure as the community takes initiatives to support electric vehicle use which echoed the insights of Noel *et al.* (2020), and Visaria *et al.* (2022). Charging infrastructure remains one of the most persistent barriers, leading users to adopt informal methods that are not integrated into the national transportation framework. Home charging for e-vehicles appears as the most critical location for charging.

Merging Expansion

Seven dimensions demonstrated merging expansion, where qualitative findings expanded and enriched the quantitative results.

Quantitative data suggested moderate agreement for perceived authority support (M = 3.83), but qualitative interviews added depth by revealing inconsistency in government efforts. While some barangays offered free charging and promotional campaigns, others lacked support due to budgetary limitations. The qualitative data highlighted implementation gaps not captured in the Likert-scale responses. This shows that even though most participants felt there was some level of support, their actual experiences differed depending on where they lived and how active their local government was. So, while the average score pointed to moderate support overall, it hides some significant differences in how that support is delivered and perceived. That is why it is so important to look beyond the numbers and understand their real-life context when evaluating these policies' effectiveness.

As stated by IDI 2, the availability of free charging in their area helps riders reduce expenses related to battery charging. In addition, IDI 8 noted that the local government encouraged electric vehicle use by displaying posters to raise community awareness. The result supports the study of Saflor *et al.* (2024), which emphasizes that policy interventions, public awareness campaigns, and strategies aimed at increasing public confidence, such as providing opportunities to experience the technology firsthand, are essential for overcoming barriers to electric vehicle adoption. However, the insight from IDI 5 and FGD 1 suggests that while efforts to educate and promote electric vehicle use are evident, the lack of sufficient budg*et al*location limits full commitment. The statement from FGD 4 highlights two key barriers to electric vehicle adoption: limited government resources and geographic constraints. It was noted that full support for electric vehicles is lacking, particularly in uphill or rural areas where electric vehicles are less efficient due to increased energy consumption. Safety concerns also arise, as FGD 3 noted that there is still a lack of regulations and road readiness in the city. This is aligned with Chonsalasin *et al.* (2024), which highlights the government's efforts in promoting electric car adoption, the effective government policies, and efficient communication as integral to electric vehicle adoption.

However, IDI 8 expressed concerns about the readiness

of the city to adopt electric vehicles, as roads were not yet fully prepared. FGD 1 & 4 pointed out concerns on the demographic aspect. FGD 2 & 5 pointed out their concerns about the transitioning aspect. While the shift to e-vehicles offers significant environmental and economic benefits, notable concerns exist regarding their implementation. As noted by IDI 7, there is a perception that the government focuses only on short-term solutions, lacking the foresight needed for lasting impact. This skepticism reflects a broader concern about the absence of strategic planning, with several participants pointing out that issues are often addressed reactively rather than proactively. The findings corroborate those of Caulfield *et al.* (2022), who indicated that despite government subsidies, electric vehicle ownership is more concentrated in urban areas due to existing income and equity gaps.

Perceived environmental concern (M = 4.45) had the highest quantitative mean, indicating strong awareness of EVs' environmental benefits. Interviews supported this finding and revealed concerns about lithium mining and long-term sustainability, broadening the discussion to a life-cycle view of environmental impact.

Accordingly, IDI 4, 5, 6, and 7 mentioned that e-vehicles reduce carbon dioxide emissions, contributing to maintaining a healthy environment. Also, IDI 3 stated that electric vehicles are better since they are not noisy and do not produce smoke, contributing to clean air and a healthier environment. The findings support the study of Dalvi *et al.* (2022), which also found that electric vehicles are seen as a more sustainable option in our polluted environment, since traditional fuel-powered vehicles contribute significantly to carbon emissions in alignment with the UN Sustainable Development Goals (SDGs). Furthermore, it supports Fabara (2025), who stated that electric vehicles are important in cutting greenhouse gas emissions, helping achieve global climate goals, and moving toward a cleaner, low-emission transport system. Meanwhile, FGD 2 reflects on the long-term benefits that outweigh the cost of electric vehicles and views it as a sustainable action. This finding is consistent with the study of (Mohammad *et al.*, 2020; Bibak &Tekiner-Moğulkoç, 2020; Lamedica *et al.*, 2019). It was stated that one of the advantages of EVs is the possibility of using their battery as a resource to deal with fluctuations in electricity demand and to regulate the power grid in real time, contributing to the integration of intermittent renewable energy sources, such as solar energy.

On the contrary, limitations of electric vehicles, such as energy sourcing and mining concerns, were revealed in the qualitative results. IDI 7 states that most electric vehicles use lithium, a rare mineral; therefore, extensive mining operations are needed to extract it from specific regions. This statement is echoed in the study by Kaunda (2020), who emphasized that while lithium is not exactly rare, the places where it can be mined economically are limited and getting lithium out of the ground is no simple task; it involves large-scale operations that can seriously affect the environment. Hard rock mining, conversely, involves chemicals and land disruption that can pollute nearby soil and water sources. The study points out that although lithium plays a major role in helping the world shift to cleaner energy, getting it has real consequences, especially for the communities and ecosystems near these mining sites. This makes IDI 7's concern even more relevant, showing that while lithium powers sustainability, its production is not always sustainable.

Regarding attitude (M = 4.19), respondents agreed with e-vehicle adoption. Qualitative responses, however, exposed a dual narrative optimism about e-vehicles' potential and skepticism about local readiness and government follow-through. This shows that while students favor EVs in principle, their enthusiasm is tempered by practical concerns.

Perceptions of attitude were perceived as moderately high in the survey, qualitative data revealed three main themes: Progressive Thinking, Realism & Readiness, and Policy Gaps. For instance, IDI 1, 2, 3, and 4 pointed out that the adaptations of e-vehicles lessen carbon emissions, which is necessary to mitigate climate change. Meanwhile, adopting an e-vehicle has economic benefits because it does not require expensive gasoline and helps riders reduce expenses, as IDI 2 & 4 mentioned. Adoption of e-vehicles is a smart and forward-thinking decision since e-vehicles play a key role in cutting down greenhouse gas emissions (Evans, 2024).

However, IDI 8 expressed concerns about the readiness of the city to adopt electric vehicles, as roads were not yet fully prepared. FGD 1 & 4 pointed out concerns on the demographic aspect. FGD 2 & 5 pointed out their concerns about the transitioning aspect. While the shift to e-vehicles offers significant environmental and economic benefits, notable concerns exist regarding their implementation. As noted by IDI 7, there is a perception that the government focuses only on short-term solutions, lacking the foresight needed for lasting impact. This skepticism reflects a broader concern about the absence of strategic planning, with several participants pointing out that issues are often addressed reactively rather than proactively. This finding supports a similar study by Caulfield *et al.* (2022), which indicated that despite government subsidies, electric vehicle ownership is more concentrated in urban areas due to existing income and equity gaps.

Perceived behavioral control (M = 3.84) was moderate agreement, but interviews revealed specific control issues, particularly the fear of battery depletion mid-trip and lack of standardized routes. These barriers illustrate hidden factors that may limit students' perceived control over e-vehicle use.

It was emphasized by IDI 2 & 4 that the accessibility and efficiency are significant advantages of e-vehicles. The compact size of e-vehicles enables easier navigation through traffic congestion, allowing commuters to save time and reach their destinations more quickly. The response from both FGD 1 and IDI 8 highlights the convenience of e-vehicles, particularly in situations

where traditional public transport is unavailable. The findings confirm the insights of McKinney *et al.* (2025), which highlighted that urban areas are more likely to have available electric vehicles than rural areas since it is more suitable for urbanized roads thus, electric vehicles can be accessed easily within the city. The per-head payment system, flexible routes, and ability to take shortcuts contribute to quicker and more efficient travel. Meanwhile, risk of battery depletion mid-trip was the concern of IDI 3 as this affects why electric vehicles are not convenient especially in hilly areas. The result is also consistent with the study of Nazari *et al.* (2023), who pointed out that it's often not the actual battery range that holds people back from using electric vehicles, but the fear that the battery might run out during a trip.

Affordability (M = 3.69) results suggested cost is a concern. Qualitative data nuanced this perception, revealing mixed experiences: some students found EVs cheaper, while others felt that costs were high, especially when passenger volume was low. The diversity of responses explains the mid-range quantitative score.

For instance, IDI 2 and 3 express that e-vehicles were cheaper compared to traditional ones. On the other hand, several participants, especially from those in FGD felt that e-vehicles were more expensive, especially when there were fewer passengers. This made fare seem less worth it and raised concern about practicality for using e-vehicles for daily commuting, particularly for those students from low-income backgrounds as what FGD 1, 2, and 6 stated. These concerns are consistent with Mendoza's (2021) argument about the high unit cost of modernized public utility vehicles and emphasizes that as vehicle costs rise, the burden often shifts to commuters, leading to a higher cost of living, especially for low-income individuals.

Additionally, some student commuters feared that the fares of e-vehicles could go up in the future if there are no proper guidelines. IDI 1 pointed out that operators might try to recover their investment by raising prices, especially since electricity costs are also rising, as IDI 2 said. These concerns are supported by Clairand and Gonzalez-Rodriguez (2021), who found that public acceptance of e-vehicles largely depends on transparent policies and fair pricing mechanisms. These worries are also tied to the high purchasing cost of e-vehicles, largely due to their expensive battery systems, consistent with the study of Verma *et al.* (2020). These batteries drive up initial purchase prices and pose challenges in terms of long-term operational cost-efficiency, especially when they have limited range. The result supports Gaspay and Salison (2024), who noted that e-vehicles' batteries in public transport setups typically last for only about 18.5 kilometers before recharging, which may add to operating costs and impact affordability.

Despite these concerns, it's also important to note that some students see the value of e-vehicles even if they cost a little more. They mentioned that e-vehicles are efficient, comfortable, and worth it in the long run as demonstrated by IDI 4, 5, and 6. Moreover, IDI 7 and 8 even felt that the fare was fair and comparable to traditional transport options especially considering the features and benefits that come with riding an e-vehicle.

In the case of perceived safety (M = 3.98), participants mostly agreed that EVs were safe, but interviews surfaced risks associated with unregistered vehicles and silent motors. This complexity expanded the understanding of safety beyond traditional traffic concerns.

Finally, behavioral intention (M = 3.82) showed generally positive intentions to support EV adoption. Qualitative narratives added that many students viewed EVs as a long-term solution and were willing to support the transition despite current limitations. This reveals a future-oriented mindset not fully captured in the survey.

Behavioral intention, which measures the level of willingness of the students to use electric vehicles continuously, was perceived as moderately high. Participants FGD 5, 6 and IDI 4 stated that e-vehicle can mitigate any environmental factors such as the adverse effects of climate change or any environmental factors, reinforcing the perception of e-vehicles as eco-friendly alternatives to traditional vehicles. Additionally, health-related benefits serve as a motivating factor influencing students' willingness to adopt and use electric vehicles. Comfortable experience of riding the electric vehicle also contributes to the moderately high level of behavioral intention.

The result agreed with the insights of Li *et al.* (2022), which highlights that the most common dimension of self-image motives is pro-environmental motivation, wherein consumers often associate the purchase and use of electric vehicles with green travel and low-carbon lifestyles. It was also revealed that some students intend to continue using electric vehicles only under certain conditions. These include addressing safety concerns and enhancing city readiness.

CONCLUSION

This study delves into how student commuters in Davao City perceive the adoption of electric vehicles. While electric vehicles are often seen as a promising solution to help reduce carbon dioxide emissions, their adoption has also raised several concerns. The study also explored not only the level of agreement among students using quantitative approach but also their lived experiences as actual users of electric vehicles through qualitative interviews. Quantitative and qualitative data were both analyzed whether they corroborate or contradict to further understand the students' perceptions towards electric vehicle adoption.

Based on the evidence gathered, the findings indicate that electric vehicle adoption in Davao City is generally viewed positively among education students. The questionnaire results, aligned with the six dimensions of the PESTLE analysis, Political, Economic, Social, Technological, Legal, and Environmental, suggest strong awareness and support for electric vehicle adoption. Further, qualitative insights revealed themes that point to areas

recommended for further development. This includes enhancing government support, promotional campaigns, infrastructure development, technological readiness while also embracing sustainability.

The findings suggest that while current perceptions are encouraging, areas still need further development. This requires a more comprehensive action and intersectoral collaboration between the government, stakeholders, and the community. This will address the remaining barriers and fully utilize the positive impacts of electric vehicles on the transportation sector and in addressing climate change.

This study could enhance electric vehicle adoption and support the Davao City government's initiatives to join other countries in reducing carbon dioxide emissions. It encourages the local government to develop concrete plans and implement responsive actions to address ongoing concerns about electric vehicle adoption. Moreover, the findings promote the city's transition toward a more sustainable city, protecting the environment while utilizing emerging technological innovations.

Finally, the findings benefit the College of Teacher Education, particularly in Science education, by raising awareness of environmental issues and strengthening students' understanding of sustainability by integrating it into the curriculum. This research also encourages students to explore innovative solutions to environmental challenges, stimulating a sense of responsibility and active participation in the community.

Acknowledgement

The authors sincerely thank the students who voluntarily participated in this study and declare that this research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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