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Assessment of Driver's Understanding of Traffic Control Devices: The Case of Tuguegarao-Alcala-Aparri Road

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ABTRACT

Effective traffic control plays a crucial role in directing and informing drivers through visual or tactile signs. However, human inaccuracy in reading and comprehending such signals causes the bulk of traffic accidents. In the Philippines, risky errors or decisions made by drivers, such as identification and judgment errors in response to traffic control devices present at the accident location, cause around 94 percent of motor vehicle collisions, as reported by the National Highway Traffic Safety Administration. This research assessed the comprehension of drivers regarding traffic control devices along the Tuguegarao-Alcala-Aparri road. Specifically, it focuses on evaluating how well drivers in the study area comprehended seven specific traffic signals, considering factors such as age, gender, years of experience, level of education, training method, and license type. By investigating the relationship between drivers' characteristics and their comprehension of traffic control devices, the objective of this study was attained, such that the majority of respondents were aged 16–25, accounting for 125 individuals, or 31.3%. Additionally, the data indicated that the majority of respondents were male, comprising 353 individuals, or 88.3%. Furthermore, most of the respondents identified as college students, with a frequency of 138, or 34.5%. Regarding driving experience, the majority had less than five years of experience, totaling 128 individuals, or 32%. It was also found that the majority of respondents possessed a professional license, with a frequency of 257, or 64.3%. Lastly, a majority of the respondents reported being self-taught, with a frequency of 184, or 46%. The researchers concluded that the relationship between the profile of the drivers and their understanding of traffic control devices is correlated and is considered to be a significant factor that affects the other variables. In response to the results of the study, the researchers suggested that the training for drivers must be strictly implemented and should be taken seriously to lessen the risks caused by it. Moreover, utilizing standard traffic control devices and placing them in their respective places can contribute to the resolution and mitigation of issues that contribute to traffic accidents, ultimately benefiting road users and the wider community.

Keywords: *Plagiarism, Intellectual Honesty, Academic Writing, Knowledge on Plagiarism, Practices Towards Plagiarism, Causes of Plagiarism, Turnitin.*

INTRODUCTION

Traffic control is a fundamental aspect of road management that ensures the efficiency and safety of road users, particularly in the presence of road disruptions and construction zones (Perrine, 2021). It involves the organization, arrangement, guidance, and control of both stationary and moving traffic, which includes vehicles, cyclists, and pedestrians. Traffic control systems, such as road signs and signals, play a crucial role in reducing delays and maintaining the orderly flow of traffic. These control methods are vital for the safety of road users and construction workers, as well as for preserving the quality of the local environment (Perrine, 2021).

Road safety is a multifaceted issue influenced not only by technological and environmental advancements but also by human factors. The reliability and understanding of traffic control devices, such as road signs and signals, are essential components in maintaining road safety. These devices serve the purpose of educating drivers about routes, directions, and potential hazards, contributing significantly to the safety and efficiency of transportation systems (ISO, 2000).

However, in the Philippines, particularly along the Tuguegarao-Alcala-Aparri road, there is a notable lack of discipline among drivers, leading to a disregard for the significance of traffic indicators. Many Filipino drivers exhibit insufficient training and unfamiliarity with the implemented transportation systems, resulting in a lack of understanding and compliance with various road and traffic devices (J. Fernandez, 2020). This non-compliance creates a range of issues and hazards, both for drivers and construction workers.

This research aims to address these challenges and provide possible solutions. We will assess the level of driver comprehension of traffic control devices within the specified scope of the Tuguegarao-Alcala-Aparri road. The assessment will take into consideration various factors such as age, gender, educational background, years of driving experience, mode of training, and license type. To gather this data, we will employ direct surveys and questionnaires distributed to a sample of drivers traveling along this route.

The importance of this study cannot be overstated, as the consequences of inadequate understanding and compliance with traffic control devices are severe. According to the World Health Organization (WHO), over 1.3 million lives are prematurely lost annually due to traffic accidents. In the Philippines, the Traffic Safety Country Report reveals that 77% of fatal road accidents within the age range of 15-64 years resulted in a staggering financial loss of $12,410,000 in the year 2016.

Moreover, human errors in reading and responding to traffic control device signals are a primary cause of traffic accidents. According to the National Highway Traffic Safety Administration, approximately 94% of motor vehicle collisions result from risky decisions and errors made by drivers, including misinterpretation and misjudgment of traffic control devices. Specifically, in the Cagayan Valley, the number of traffic collision deaths is alarmingly high, with the City of Tuguegarao experiencing one of the region's highest accident rates. According to Tuguegarao police data, 297 traffic collisions occurred from January through September 2018 alone.

Recognizing the urgency of addressing these challenges, the Tuguegarao City Road Safety Code has been enacted, aiming to institutionalize routine road inspections and maintenance, improved placement of road signage, and enhanced access for vulnerable road users, including pedestrians, individuals with disabilities, cyclists, and motorbike riders.

This research is particularly significant as no prior study has been conducted in the study area. By exploring the usage and significance of traffic control devices, our study aims to contribute to the development of a more effective traffic management system, with the ultimate goal of reducing the aforementioned associated issues and improving road safety both locally and globally.

Objectives of the Study

This study was conducted to evaluate the comprehension of traffic control devices among

drivers traveling along the Tuguegarao-Alcala-Aparri road stretch. Specifically, it seeks to achieve three main goals: first, to gauge drivers' understanding of traffic control devices and analyze how this comprehension varies in relation to their personal profiles, including age, gender, and educational attainment; second, to assess drivers' understanding of traffic control devices with respect to their driving characteristics, encompassing the length of driving experience, license type, and mode of training; and third, to ascertain which of the independent variables, among those studied, holds the most significant influence on their comprehension of traffic control devices.

MATERIALS AND METHODS

Research Design

This study employed a descriptive and correlational research design. Descriptive correlational studies "describe the variables and the relationships that occur naturally between them" (Sousa, 2007). The descriptive section is used to assess the level of understanding of respondents to traffic control devices and to describe the profile of the respondents. The correlational approach is then used to analyze the relationship between the respondents' profiles and level of understanding to traffic control devices.

Sampling Technique

In this research, the following populations are considered: drivers among privately owned vehicles and publicly used vehicles. For a population that are large and especially for those having unknown individuals, the necessary sample size to be considered as follows. Sample size formula adopted from (Krejecie and Morgan, 1970).

$$N = \frac{z^2 * (p) * (1-p)}{c^2}$$

$$N = \frac{1.96^2 * (0.5) * (1-0.5)}{0.05^2}$$

$$N = \frac{0.9604}{0.0025}$$

$$N = 384.16$$

Where:
N = sample size
z = 1.96 for 95% confidence level
p = percentage picking a choice, expressed as decimal (0.5 for sample size needed) c = confidence interval, expressed as decimal (0.05)
correction for finite population:

Research Instruments

This research adopted the questionnaire utilized by Fernandez, et al in their study titled "Understanding traffic signs by drivers in the City of Manila, Philippines". The questionnaire consisted of three sections. A research questionnaire to gather the respondents' understanding of traffic control devices consists of three parts. The first part is the personal background of the respondents which sought to obtain information about the drivers' gender, age, and educational background. The second part is the driving characteristics of the respondents specifically it sought to obtain information length of training experience, license type and mode of training. The third part assessed the understanding of traffic signs by the drivers. It has thirty (30) multiple choice questions of different traffic signs which included 15 regulatory signs, 10 warning signs, and 5 informative signs. A pilot test was conducted to determine its reliability and validity. A Cronbach alpha of 0.825 was obtained on the said test.

Data Processing and Analysis

Researchers sought permission from the dean of the college for the conduct of the study through the course in-charge. Thereafter letters of request to the three (3) municipal/city

mayors were also submitted for the same purpose.

Researchers implemented data gathering activity after permissions were granted. Data gathering was conducted between February 13, 2023, and April 28, 2023. After the data gathering, manual data extraction was carried out by reviewing the supplied questionnaires. The frequency in each independent variable was retrieved from this stage. The information obtained was tallied and examined. Following the methodical collection of all necessary data from the study's field, it was organized on excel sheets and analyzed using SPSS software.

Statistical Tool and Treatment

Likert Scale

This study adopted the basis of the survey questionnaires used by Fernandez, et al (2021). The scale used is a five-point Likert scale. 5=Very Good, 4=Above Average, 3=Average, 2=Below Average, and 1=Poor. Table 1 shows the scale and description used to analyze the respondents' level of understanding on traffic control devices. The range of scores (or 18 below) is also patterned to the study of Fernandez, et al (2021). Respondents who scored 60% and below are considered to have poor mastery, 61-70% (or 19-21), 71-80% (22-24), 81-90% (25-27) and 91- 100% (28-30) are below average, average, above average and excellent mastery, respectively.

Table 1. Scoring Range of 5-point Likert Scale of the Survey

Scale	Range of Scores	Statistical Description
1	18 and below	Poor
2	19 to 21	Below Average
3	22 to 24	Average
4	25 to 27	Above Average
5	28 to 30	Excellent

Descriptive statistics such as frequency, percentage and mean, were used to analyze the profile variables and the level of understanding of respondents on traffic control devices. The test of relationships was examined using Pearson Product Moment Correlation. Further, the associational part of the study investigated the relationship of the level of understanding of respondents on traffic control devices when respondents are grouped according to their personal background and according to their characteristics as drivers. Likewise, the discriminant analysis part revolved around determining what profile variable could predict high level of understanding on traffic control devices.

RESULTS AND DISCUSSION

Drivers' Understanding of Traffic Control Devices

Table 3. Level of Understanding on Traffic Control Devices of Respondents

Respondents' Score	Frequency (f)	Percent (%)	STATISTICAL DESCRIPTION
18 & below	29	7.2	POOR
19-21	60	15.0	BELOW AVERAGE
22-24	132	33.0	AVERAGE
25-27	147	36.8	ABOVE AVERAGE
28-30	32	8.0	EXCELLENT
Total	**400**	**100.0**	

Table 2 presents a comprehensive overview of the respondents' level of understanding concerning traffic control devices. The study findings indicate that a significant majority of the respondents possess an above-average understanding, which accounts for 36.8% or a frequency of 147. This suggests that the majority of the participants have a solid grasp of the concepts and regulations pertaining to traffic control devices.

Conversely, a small proportion of respondents demonstrate excellent understanding, comprising 8% or 32 individuals. These

respondents display a commendable level of knowledge and comprehension regarding traffic control devices, showcasing a deeper understanding and familiarity with the subject matter.

On the other hand, the study reveals that a minority of respondents exhibit a poor understanding of traffic control devices. This category consists of 7.2%, or 29 individuals, who struggled to grasp the essential concepts and guidelines related to traffic control devices. Their limited understanding may indicate a need for targeted educational interventions or additional support in this particular area.

The distribution of respondents' understanding levels highlights the importance of effective educational programs and initiatives aimed at enhancing knowledge and awareness of traffic control devices. By identifying the gaps in understanding and tailoring interventions accordingly, policymakers and educators can strive towards promoting safer and more informed behaviors on the roads.

These findings provide valuable insights into the current state of understanding among the study participants and can serve as a basis for future research and targeted interventions to further enhance awareness and compliance with traffic control devices.

Relationship of Respondents' Age, Gender, Educational Attainment, and their Level of Understanding

The hypothesis of the study suggests that there is no significant relationship between respondents' scores on their understanding of traffic control devices and their profile variables.

However, the results presented in Table 3 indicate that there are significant relationships between respondents' understanding and their age (r = -.338, p = 0.000) as well as educational attainment (r = -.230, p = 0.000). These findings suggest that age and educational attainment have a notable impact on respondents' scores, indicating that individuals who are older and have higher levels of education tend to have a better understanding of traffic control devices. On the other hand, the analysis did not reveal a significant relationship between gender and understanding (r = -.029, p = 0.567), implying that respondents' scores are not influenced by their gender. In summary, the study's hypothesis is not supported regarding the impact of age and educational attainment, but it is supported regarding gender, as it does not significantly affect respondents' scores on their understanding of traffic control devices.

Table 3. Relationship of Respondents' Level of Understanding and their profile variables

Variables	r - value	Prob.	Decision
RESPONDENTS SCORE			
Age	-.338	0.000	Reject Ho
Gender	-0.029	0.567	Accept Ho
Educational Attainment	-.230	0.000	Reject Ho

The analysis of the data yielded interesting findings. It was observed that there is indeed a significant relationship between respondents' understanding and their age as well as their educational attainment. This implies that respondents' age and educational background are influential factors in determining their level of understanding regarding traffic control devices. On the other hand, no significant association was found between respondents' gender and their scores. This suggests that regardless of gender, individuals' scores were not affected when it came to their understanding of traffic control devices.

These results align with a previous study conducted by Wontorcyk and Gaca in 2021. Their research similarly revealed that older individuals, those with higher levels of education, and professional drivers exhibited a

higher level of comprehension when it came to interpreting symbolic and text-based regulatory signs.

These findings contribute to the existing body of knowledge on the relationship between demographic factors and understanding of traffic control devices. Further research could explore the underlying factors that contribute to the observed association between age, educational attainment, and understanding, providing valuable insights for improving educational initiatives and traffic safety measures.

Table 4. Symmetric Measures Results for Phi & Cramer's V for Respondents' Score and their Age and Educational Attainment

Nominal by Nominal	Phi	Cramer's V	Significance	Interpretation
AGE	.690	.345	.000	High association
EDUCATIONAL ATTAINMENT	.817	.334	.000	High association

Table 4 presents the results of the Phi and Cramer's V tests conducted in this study to examine the strength of association between variables. These tests utilized the chi-square test to assess the relationship between age, educational attainment, and the respondents' level of understanding. The table provides evidence of a strong association between age, educational attainment, and the respondents' comprehension of traffic control devices. Therefore, it can be inferred that as respondents grow older and achieve higher levels of education, their understanding and comprehension of traffic control devices also tend to increase. This finding suggests that age and educational attainment significantly impact the respondents' scores in terms of comprehension.

Relationship of Respondents' Experience in Driving, License Type, Mode of Training, and their Level of Understanding

Table 5. Relationship of Respondents' Level of Understanding and their Characteristics as Drivers.

Variables	r - value	Prob.	Decision
RESPONDENTS' SCORE			
Experience in Driving	-.214	.000	Reject Ho
License Type	.166	.001	Reject Ho
Mode of Training	.023	.648	Accept Ho

Table 5 displays the correlation between respondents' comprehension of traffic control devices and their driver characteristics. The study discovered a robust link between the respondents' understanding of traffic control devices and their driving experience, as well as the type of license they possess. However, no significant connection was found between their level of understanding and the mode of training they underwent as drivers. This implies that drivers acquire knowledge primarily through their driving experiences and the type of license they obtain from the transportation office.

The result of this study on the association of driving experience to their level of understanding is similar to K. Appiah Boateng et al., (2016). Their study revealed that "the driving experience had a part to play in traffic sign comprehension as from their results drivers who had driven more understood the traffic signs better". Henceforward, similar study to J. Joseph Fernandez, (2020) on the association of driving experience to their license type stated that "considering that every driver who possess a license must undergo the same test and have the proper knowledge when it comes to traffic signs and its meaning". It infers that the license type has a connection to understanding of traffic control devices.

The non-association of the respondents' level of understanding to traffic control devices and that of the mode of training, it negates the previous study of J. Joseph Fernandez, (2020) in which their results shows "that the main

contributing factor affecting the level of understanding of drivers is the mode of training. This signifies that the influence on driver's level of understanding in our study do not contribute more on the mode of training.

Table 6. Symmetric Measures Results for Phi & Cramer's V for Respondents' Score and their Experience in Driving and License Type

Nominal by Nominal	Phi	Cramer's V	Significance	Interpretation
Experience in Driving	.586	.262	.134	High association
License Type	.524	.262	.156	High association

Table 6 presents the test results for Phi and Cramer's V, which were conducted to assess the strength of association between respondents' level of understanding of traffic control devices and their experience in driving and license type. In order to further investigate this association, chi-square tests were performed on Phi and Cramer's V. The findings of the study indicated a strong connection between respondents' experience in driving and their license type and their level of understanding of traffic control devices. These results corroborated the outcomes of the previous test, ultimately leading to the rejection of the null hypothesis.

Predictors of High Level of Understanding on Traffic Control Devices Based on Respondents Profile Variables and Drivers' Characteristics

Table 7. Chi-square test results

Tests	Function 1	Function 2	Function 3
Eigenvalue			
Value	.178[a]	.017[a]	.005[a]
Percentage	88.7	8.3	2.6
Canonical R	.389	.128	.072
Wilk's Lambda	.830	.978	.994
Chi-square	73.452	8.885	2.403
df	24	15	8
p-value	.000	.883	.966

To determine the discriminating factors of levels of organizational performance (good, better, best), a discriminant analysis was run using the profile variables, organizational system thinking and professional learning community assessment scores of the respondents. The results are shown in Tables 7 and 8.

The test of eigenvalues reveals two discriminant functions that could explain group classification of the respondents. Function 1 can explain 88.7 percent of the variations in group classification, while Function 2 could explain 8.3 percent and Function 3 could explain 2.6 percent. Consequently, the canonical correlation of Function l is bigger (0.301) than the other (0.150 & 0.072). As suggested, Function 1 could adequately explain variations in the group classification.

The Wilks` lambda indicates the existence of a difference between groups, that is, the effect of the variables of the model upon the discrimination between groups. As shown, Function 1 has Wilk's lambda of 0.830 whose associated chi-square value of 73.452 is highly significant (p =0.000) at df = 4. On the other hand, Function 2 has a Wilk's lambda of 0.978 and chi-square value of 8.885 (p =0.883) at df = 15 while Function 3 has a Wilk's lambda of 0.994 with a chi-square of value of 2.403 (p = 0.966) at df = 8. It means that there are significant differences in group composition based on the campus organizational performance level.

The standardized canonical coefficients and structure coefficients for the two discriminant functions are shown in Table 9. Three variables are entered into the discriminant function equation. The highest factor loading in Function 1 is age, with 0.667 and 0.822, respectively. It means that for every standard deviation unit increase in the age of a respondent, the chance of being classified as a

Table 8. Standardized and structure coefficients.

Predictors	Function 1 (Age)		Function 2 (Education)		Function 3 (Experience)	
	Standardized Coefficients	Structure Coefficients	Standardized Coefficients	Structure Coefficients	Standardized Coefficients	Structure Coefficients
Age	.677	.822	.050	.291	-.160	-.213
Educational Attainment	.482	.553	-.142	.296	.223	.296
Experience	.107	.439	.747	.733	.429	.147

respondent with a higher level of understanding is 0.822 units. Thus, this function is labeled "age". On the other hand, the variable Educational Attainment heavily loads Function 2 with coefficients of -.142 and 0.296, respectively. It means that for every standard deviation unit increase in his or her educational attainment, the probability of his or her level of understanding increases by 0.296 units. Likewise, experience is in Function 3 with coefficients of .429 and .147, respectively. This also means that for every standard deviation unit increase in his or her experience, his or her level of understanding of the traffic control devices increases by 147 units.

Hence, age, educational attainment, and experience are catalysts for a higher level of understanding of traffic control devices. All three variables can predict a high score for the level of understanding of the respondents. This finding is consistent with previous research showing that K. Appiah Boateng et al., (2016) study further establishes that drivers' understanding of traffic signs is significantly influenced by these variables.

CONCLUSIONS

From the study analysis and results obtained, the majority of respondents were male, ranging in age from 16 to 25 years old, college students, had less than five years of driving experience, had a professional license, and were self-taught in driving.

The study found that the majority of drivers had an above-average level of understanding of traffic control devices. This suggested that the majority of the participants have a solid grasp of the concepts and regulations pertaining to traffic control devices but not excellent which may attribute to some of the misconceptions as other regulatory signs are not excellently mastered by the drivers.

Remarkably, this study revealed that there was a significant relationship between respondents' understanding and their age as well as their educational attainment, but not gender. The study also revealed that there was a connection between the driving experience, the type of license, and the respondents' understanding. Also, no association was found between the mode of training and their level of understanding.

Lastly, the study found that the respondents' age, educational attainment, and driving experience contributed mostly to their level of understanding of traffic control devices.

RECOMMENDATIONS

Based on the findings of the study, the researchers have formulated several key recommendations. First, it is essential for land transportation authorities to rigorously enforce the Comprehensive Driver's Education (CDE) program. Second, there is an imperative need to enhance the quality of driver's license exams to ensure they adequately assess a candidate's

understanding of road rules and safety measures. Third, addressing confusing traffic control devices by updating or modifying them is necessary to enhance clarity and reduce ambiguity on the roads. Finally, it is recommended that continuous evaluation and improvement of driver education programs be undertaken to ensure they align with current road safety standards.

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