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The Analysis of Differentiation of Driving Behavior towards Violations and Accidents based on Demographics Aspect at Lombok Island – West Nusa Tenggara

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Abstract: Based on the accident data's, which recorded that 2016 until 2019, there were everage 225 traffic accidents involving students and college student riders. From these accident data's, was found that the male rider dominated traffic accidents than female rider. This study aims to determine how a simple model can be done based on difference a demographic aspect such as differences of gender influences, differences of economic and social aspect on the driving behavior of student and college students on traffic accidents in Mataram City. The Structural Equation Modeling (SEM) method, with the help of the AMOS program was used in this study. The number of respondents in this study were 792 people, consisting of 391 students and 391 college students. The model in this study consisted of 3 variables, namely behavior, violations and accidents. Driving behavior has a significant effect on traffic violations with a probability value (P) = 0.000 (<0.001), and a testing value of C.R> 1.64. The size of the estimated value in the student group shows that the effect of behavior on violations in male student rider is 30.08% stronger than that of female rider. And the effect of behavior on violations among female students is 0.8% stronger than college students. Traffic violations have a significant effect on traffic accidents with a probability value of 0.000 (<0.01), and a test value of C.R> 1.96. Traffic violations on male students have an effect on accidents by 0.992, 50.1% stronger than female students. The effect of traffic violations on student rider on accidents is 2.44% stronger than female student rider. Gender differences have a significant effect on driving behavior based on the probability value (P) = 0.000 (<0.001). On the otherhand, the results of the analysis show that the driving behavior model of the community on the Mataram City based on the review of the economic and social aspects shows a model with a variety of patterns where the GRDP review follows the Polynomial model, based on the number of cityzen population, the tendency of the Exponential model and the review of the gender probability aspect follows the Logarithmic model pattern.

Keywords: College Student Rider; Driving Behavior Model; Gender; Student Motorcycle Rider

Introduction

Traffic accidents are influenced by a couple of factors, such as environmental factors, vehicle factors, road factors and human/driver factor (ability, discipline, emotionand driver behavior) (Sagberg, et al., 2015; Riaz, et al., 2018; Karyawan, 2021). One of the factors associated with human factors is gender and age (Hoff & Bashir, 2015; Czaja, et al., 2019). Most traffic accidents are caused by the driver to, so driver behavior has an obvious effect on accidents and traffic violations (Han & Zhao, 2020; Katrakazas, et al., 2020). Accident are often preceded by traffic violation behavior (Montoro, et al., 2018; Useche & Llamazares, 2022). A traffic violation can be defined as an intervening variable (*mediation variable*) between driving behavior that caused a traffic accident (Suteja, et al., 2018). Violations and traffic accidents in Mataram City mainly involved high school motorcyclists. Therefore, there is a strong need to study, how much influence driving behavior has on the traffic

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accidents of student's motorcycle riders in Mataram City. Based on the accident data's, which recorded that 2016 until 2019, there were everage 225 traffic accidents involving students and college student riders, and the male rider dominated traffic accidents than female rider. The data obtained shows that violations and accidents in Mataram-Lombok City mostly involve riders between 16 - 40 years old (70.9%). During the last three years, the number of traffic accidents in Mataram City-Lombok have increased significantly. Likewise, traffic accidents by gender indicate that accidents involving male drivers are more dominant than female drivers, and interestingly, most of the accidents were dominantly involving high school students' that using motorcycle (Karyawan, 2021).

Several methods can be used to analyze the effect of driving behavior on traffic accidents according to age and gender (Yang, et al., 2022; Maghelal, et al., 2023), one of which is the Structural Equation Modelling (SEM) method. Structural Equation Modelling (SEM) is a multivariate analysis used to understand the relationship between complex variables (Hair, et al., 2021). In this analysis, the researcher used the SEM method with the help of AMOS software. AMOS software's main advantage is it user friendliness.

Method

Research areas, samples, variables and indicators. A sample of 600 motorcyclist covering six sub-district in Mataram City was used to carry out this research work. Other several variables were used include: (1) Exogenous variable (dependent variable), such as driving behavior; (2) Intermediate variable (intervening variable), i.e.the traffic violation; (3) Endogenous variable (independent variable), the traffic accident
To measure the latent variables of this research, a manifest variable or an indicator is required.

Table 3. Research Variables and Indicators

Research Variable	Indicator	Symbol
Driving Behavior	Knowledge of driving	A1
	Driving skills	A2
	Emotion and physical conditions	A3
	Discipline in driving	A4
Traffic Violations	Completeness administration on riding	B1
	Violations of road marking and traffic sign	B2
	Precedes another vehicle from the left lane	B3
Traffic Accident	Perpetrator of violation	C1
	Victim of the violation	C2

The population in this study consist of motorcycle riders covering six sub-districts in Mataram City. The data obtained proofs that there is an estimated total population size of 459.314 motorcycle riders. The data was obtained from the 2019 official statistic motorcycle riders statistics. According to Sugiyono, (2010), the sample research number can be determined usingSlovin formula.

Data was collected through the use of questionnaires distributed to the motorcyclist respondents. The questionnaire used in carrying out this research study made use of a likert scale, 1 – 5, to measure the attitudes of respondents towards each question. The likert scale used in this research is as Table 4.

Table 4. Likert scale with score

Alternative Answer	Score positive	Score negative
Never	5	1
Ever	4	2
Sometimes	3	3
Often	2	4
Always	1	5

Result and Discussion

Respondent characteristics

Characteristics of respondents by age, it was found that the number of respondents with the age of 14 years was approximately 1 person (0.26%), respondents aged 15 years, about 37 people (9.44%), respondents aged 16 years amounted to 152 persons (38.78%), respondents aged 17 years of 171 persons (43.62%), 18-year-old respondents, 29 persons (7.40%), and 19-year-old respondents were 2 persons (0.51%). The results showed that 48.47% of students aged under 17 years had ridden a motorcycle. Respondents characterized by sex found that males and females distributed almost equally. Respondents of male sex numbered 207 respondents (52.81%) and female respondents were 185 respondents (47.19%). Characteristics of respondents based on riding licence show that the sample of 394 respondents consisted of 12.50% of respondents who did have riding licences and as many as 87.50% did not have riding licences.

Structural equation modelling (SEM) analysis with the AMOS program

The SEM process cannot be performed manually. In addition to the limitations of human capabilities, the complexity of the models and statistical tools used make manual calculations inefficient. So, it's necessary to use special software for calculation. Basic statistical tools of SEM include AMOS. Models analyzed with the help of AMOS program in this study can be seen in Figure 2.

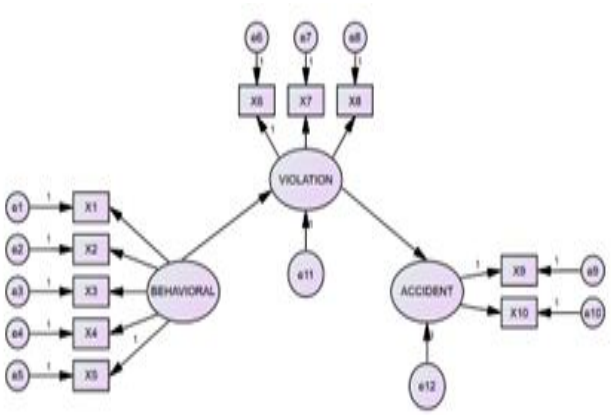

Figure 2. The Influence model of student driving behavior on traffic accidents

Modified SEM models

In AMOS, when the SEM model is determined to not be a fit, a recommendation is given to modify the model. Recommendations for model modifications will appear on the AMOS modification indices output.The fit model test recommendation to modify model can be summarized in the following Table 4.

Table 4. *Goodness - of – fit indices* of model's modification

Goodness of Fit Indices	Cut off Value	Result	Model Evaluation
Degree of Freedom (DF)	Positive (+)	24	Identified
X2 (Chi square)	≤ 38.885 [=CHINV (0.05, 24)]	27.668	Fit
Probability of Significance	≥ 0.05	0.274	Fit
CMIN DF	≤ 2.00	1.153	Fit
GFI	≥ 0.90	0.985	Fit
RMSEA	≤ 0.05	0.020	Fit
AGFI	≥ 0.90	0.966	Fit
TLI	≥ 0.90	0.992	Fit
NFI	≥ 0.90	0.969	Fit

Table 5. *Goodness - of – fit indices*and *Chi-Square Value*

Goodness of fit index	Cut of value
Degree of freedom (DF)	Positif (+)
Chi-square	Diharapkan kecil
Signifikasi probability	≥ 0,05
SMIN/df	≤ 2,00
GFI	≥ 0,90
RMSEA	≤ 0,05
AGFI	≥ 0,90
TLI	≥ 0,90
NFI	≥ 0,90

Table 6. Analysis results

Gender	Degree of freedom	Chi-square tabel	Chi-square hitung	Evaluasi
Male (Student)	25	≤ 34.382	85.196	Fit
Female (Student)	25	≤ 34.382	80.101	Fit
Gender	Degree of freedom	Chi-square tabel	Chi-square hitung	Evaluasi
Student (Male)	25	≤ 34.382	57.351	Fit
Student (Female)	25	≤ 34.382	50.364	Fit

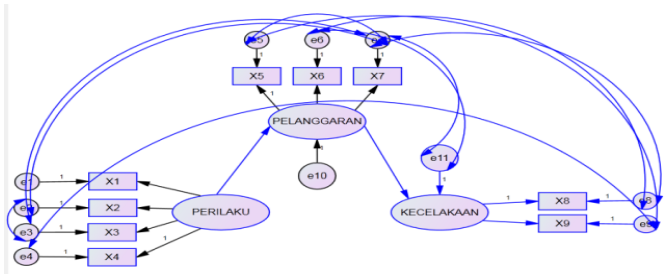

Figure 3. Model After Modification for male students

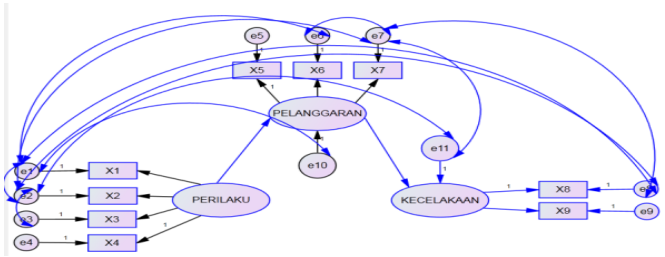

Figure 4. Model After Modification for female students

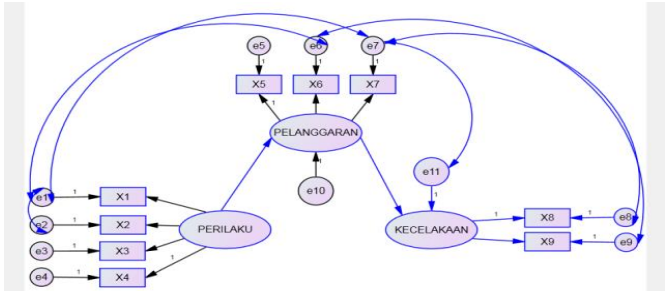

Figure 5. Model After Modification for male college students

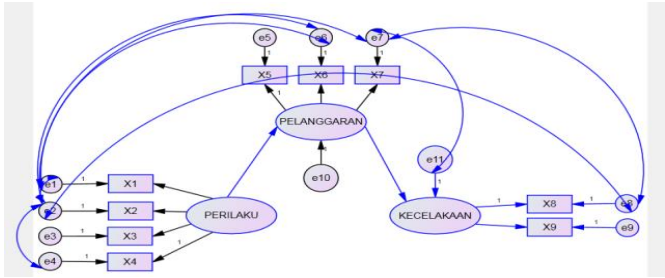

Figure 6. Model After Modification for female college students

Analysis of indicator relationship with variables and inter-variables

The results of the data analysis of the indicator's relationship with variable and the inter-variable is presented in Table 7.

Table 7. Value of Significance of *Loading Factor*

		Estimate	SE	CR	P
Violations	← driving behavior	2.157	309	6.976	***
Accident	← violations	0.578	089	6.507	***
X5	← driving behavior	1.478	219	6.750	***
X4	← driving behavior	1.226	166	7.400	***
X3	← driving behavior	1.386	205	6.757	***
X2	← driving behavior	0.781	214	3.656	***
X1	← driving behavior	1.000			
X6	← violations	1.000			
X7	← violations	0.780	078	9.990	***
X8	← violations	0.774	115	6.744	***
X9	← accident	1.000			
X10	← accident	0.973	140	6.951	***

Regression Weights: (Group number 1 - Default model)

From the above output display, since all P values are ***, it can be concluded that all indicators can explain all constructs. Likewise, there is a significant relationship between constructs. In addition to the probability value (P), a relationship is considered significant if it has a CR (Critical Ratio) value ≥ 1.96. In the table above, all CR values have ≥ 1.96, indicating that the relationship between the indicator and the construct, and the relationship between constructs is significant.

Table 8. Output Standardized Regression Weight

Relationship	estimate
Violations ← Riding behavoior	0.439
Accident ← Violations	0.375
X5 ←Behavior	0.454
X4 ←Behavior	0.675
X3 ←Behavior	0.454
X2 ←Behavior	0.246
X1 ←Behavior	0.574
X6 ← Violations	0.655
X7 ← Violations	0.787
X8 ← Violations	0.416
X9 ← Accident	0.740
X10 ← Accident	0.674

Source: Output of AMOS V. 22.0

In the table above, the loading factor number shown in the column estimates > 0.5, it showing a close relationship between constructs. For examples result shown in Table 9.

Table 9. Squared Multiple CorrelationsValue

	Estimate
VIOLATIONS	0.814
ACCIDENT	0.285

Source: Output of AMOS V. 22.0

The estimated value of the violation variable is shown in table 8 above [0.814], it can be interpreted that the BEHAVIOR variable affects 81.4% of the VIOLATION variable, while the rest (100% - 81.4% = 18.6%) is influenced by other factors, it is shown with error (e11) where the variable is outside this study. Likewise, the number 0.285 can be interpreted as a VIOLATION variable which affects 28.5% of the ACCIDENTS variable while the rest is indicated by an error (e12). The table above shows that only the X9 and X7 indicators have an effect of above 50%, 54.8% and 62%, respectively. On the one hand, gender and age analyzes for student and college student respondents also showed a difference in significance value (chi-square) between the "behavioral" and "offense" relationships. On the other hand, the gender and age variables also show differences in the significance value (chi-square) of driving behavior on traffic violations and accidents. From 195 male and 179 female respondents, the results of the analysis showed that the significant effect of driving behavior on violations and accidents was 6% lower for female drivers. Students under 17 years of age are more sensitive to traffic violations than others, this condition is different from college studentsresponden.

Overall, the relationship between the behavioral variables on violations or violations with accidents is significant because the probability (P) value is <0.05. and C.R values greater than 1.64, respectively. Thera are a very strong relationship between behavior and violations for both male college students and female college students is shown by an estimate value greater than 0.5, namely 0.981 for students and 0.989 for female students. Analysis of the Effect of Gender Differences on Driving Behavior shown that the estimated value of the relationship between behavior and violation variables in men is 0.994 and 0.695 women (> 0.5), this means that a very strong relationship between behavior and violation is dominated by male drivers, both in students and college students.

Based on data analysis on the model of the influence of driving behavior on violations and accidents on students and students, it is found that the driving behavior model of the community on the Mataram City based on the review of the economic and social aspects shows a model with a variety of patterns where the GRDP review follows the Polynomial model, based on the number of citizen population, the tendency

of the Exponential model and the review of the gender probability aspect follows the Logarithmic model pattern.

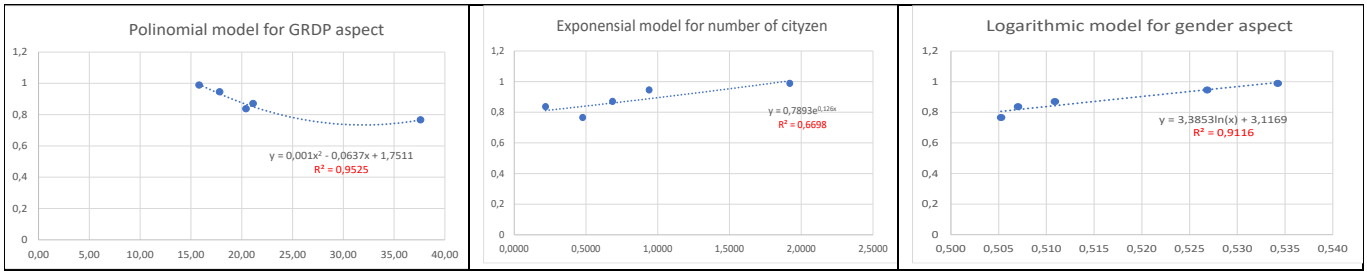

Figure 7. A SimpleModel the Influence of Driving Behavior to Violations and accident for several aspect

Conclusion

Based on the data analysis and discussions that have been done, few main conclusions are: (1) Driving behavior has a significant effect on traffic violations with a probability value (P) = 0.000 (<0.05), and a CR test value> 1.64, where the estimated value shows the effect of behavior on violations on male students is 30.08% stronger than female students, and the effect of behavior on violations in female college students is 0.8% stronger than male college student; (2) Traffic violations have a significant effect on traffic accidents with a probability value of 0.000 (<0.05), and a CR test value> 1.96, where male students have a 50.1% stronger effect on accidents than female students, while Traffic violations by male college students against accidents were 2.44% stronger than female college students, this means that there is a significant difference (chi-square) between behavior and violations based on gender; (3) A simple model shows that the tendency of changes in the income value or gross regional domestic product (PDRB) of the region and the number of populations give a higher impact of violations and a greater potential for accidents.

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