Measuring the Situational Awareness when Driving on Online Motorcycle Taxi Drivers in an Efforts to Reduce Work Accidents Using the QUASA Method

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Abstract. The increasing demand for online motorcycle taxi services has been followed by an increase in traffic accidents. According to data from the Indonesian National Police, an average of 3 people die every hour due to traffic accidents and 61% of these accidents are caused by human factors such as the ability and character of the driver. Seeing the many cases that have occurred, in this study it is necessary to analyze the level of alertness of online motorcycle taxi riders with the aim of knowing the level of alertness of online motorcycle taxi riders so as to reduce the accident rate using the Quantitative Analysis Of Situational Awareness (QUASA) method. The results showed that the characteristics of online motorcycle taxi drivers are overconfident. Based on the calculation, the level of alertness is 34.94%, the hit rate value is 0.617 and the false alarm rate is 0.498, the sensitivity value of 0.29 and the bias value of -0.135. The conclusion is that online Grab motorcycle taxi drivers tend to be less alert and overly confident so that they endanger themselves, their passengers and road users.

1. Introduction

Technological progress is something that cannot be avoided in this life, because technological progress will run in accordance with scientific advances [1]. One form of technological advancement that is now being enjoyed by the public is the innovation of shuttle services or ojek which was initially carried out in a conventional way, namely by waiting in a place to be converted into an internet-based motorcycle taxi, namely ojek online (ojol). Ojek are motorbikes that are made into public vehicles to ride passengers to their destination. The application system on an online motorcycle taxi is a medium designed to bring drivers and passengers together by utilizing an application on a smartphone. Transportation service users can quickly and easily call online motorcycle taxi drivers. The community as consumers of online motorcycle taxi users has made it a necessity in terms of traveling. There are various types of online motorcycle taxis in Indonesia that have now spread in various regions in Indonesia and Grab online motorcycle taxi has become the leader of the online transportation market in Indonesia with a market share percentage of 64% [2]. The great demand for online motorists and large profits for motorists has resulted in an increasing number of online motorcycle taxi drivers on the streets. This raises several problems in itself, one of which is a traffic accident. This problem is dominant because there are still many unscrupulous online motorcycle taxi drivers who are not vigilant in driving so that it endangers others and themselves. According to cognitive neuroscience experts, alertness is the ability to maintain attention on a task for a certain period of time.
According to data from the Indonesian National Police, an average of 3 people die every hour due to traffic accidents and 61% of these accidents are caused by human factors such as the ability and character of the driver. In 2016, there were 106,129 motor vehicle accidents that occurred [3]. This is in line with the arrival of online Grab motorcycle taxis in various cities, one of which is Medan. This significant increase indicates that the presence of the Grab online motorcycle taxi has an impact on the high number of traffic accidents. The rate of traffic accidents in Medan involving motorbike users reaches 75% of the total accidents of all transportation and of these motorbike users, 67% are Grab online motorcycle taxi drivers [4].

Human factors that cause accidents include driving style, driving skills, driving speed, and response to danger. The level of alertness of online motorcycle taxi drivers comes from the character of the rider himself and his behavior while driving [5]. The character of the rider can be in the form of seeking attention or sensation on the highway. This was done to highlight certain abilities when playing the role. The character of the driver is also impatient in traffic. Meanwhile, unsafe driving behavior such as rushing in driving, violating rules such as going against the direction, not being alert to traffic conditions, unsafe behavior such as the habit of using a mobile phone while driving.

Based on these problems, a study was carried out in the form of measuring the level of alertness when driving on Grab online motorcycle taxi drivers through a situational awareness analysis of online motorcycle taxi drivers. This research is important to do because of the high rate of traffic accidents caused by online motorcycle taxi drivers, so an analysis is needed to determine the level of alertness when driving on online motorcycle taxi drivers in an effort to reduce work accidents.

2. Research Methodology

2.1. Type of Research
This type of research is included in quantitative research using survey research methods. Survey research is research conducted on large or small populations, but the data studied is data from a sample taken from that population so that relative incidents, distribution, and relationships between sociological and psychological variables are found.

2.2. Object of Research
The object of research is the level of vigilance of Grab online motorcycle taxi drivers in the city of Medan.

2.3. Research Variable
The research variables are divided into 2, namely as follows:

- Dependent variable is a variable whose value is influenced by the value of other variables. The dependent variable in this study is the level of alertness of online motorcycle taxi drivers.
- Independent variables are variables that affect the dependent variable either positively or negatively. The independent variables in this study are the individual characteristics and driving behavior of online motorcycle taxi drivers.

In driving activities, there are 2 factors that affect the driver's awareness, namely individual characteristics and driving behavior. Factors of individual characteristics include seeking sensation / attention and impatience while driving, namely haste, behavior that violates rules, unsafe behavior and unawareness of traffic conditions [6].

Based on these calculations, a minimum sample of 100 respondents was obtained. The questionnaire design can be seen in Table 1.
| Research Variable       | Sub Variable       | Descriptor                                                                 | Number of Items in the Questionnaire | Item Number on the Questionnaire |
|-------------------------|--------------------|----------------------------------------------------------------------------|---------------------------------------|----------------------------------|
| Individual Characteristics | 1. Seeking Sensation | Challenged to go faster in order to get passengers                          | 1                                     | 3                                |
|                         |                    | Doing adrenaline-seeking or thrill-seeking things                           |                                       |                                  |
|                         |                    | Do not give priority to pedestrians / vehicles who immediately cross        |                                       |                                  |
|                         | 2. Impatience      | Do not provide distance from other vehicles when driving                    | 1                                     | 2                                |
|                         |                    | View applications while driving                                             |                                       |                                  |
|                         |                    | View applications while driving for more than 5 seconds without reducing speed| 1                                     | 16                               |
|                         | 1. Haste           | View applications while driving at speeds greater than 40 km / h            | 1                                     | 17                               |
|                         | 2. Driving Behavior Violates Rules | Against directions following location directions from the app | 1                                     | 9                                |
|                         |                    | Drive with more than 1 person                                                | 1                                     | 1                                |
|                         |                    | Drive when sleepy                                                           | 1                                     | 4                                |
|                         |                    | Pick up passenger calls directly even in the middle of the road             |                                       | 1                                |
|                         | 3. Unsafe Driving Behavior | Typing messages in the app while driving                                    | 1                                     | 8                                |
|                         |                    | Don't move sideways when viewing apps                                       |                                       |                                  |
|                         |                    | If the motorbike engine has stopped on the road, it does not mean you have |                                       |                                  |
|                         |                    | to go to the garage as soon as possible                                      |                                       |                                  |
|                         |                    | When you see the application, suddenly you can hear the sound of an         |                                       |                                  |
|                         |                    | ambulance or fire siren but do not immediately step aside                   |                                       |                                  |
|                         | 4. Driving Behavior Unconsciousness of traffic conditions | Not paying attention to pedestrians who want to cross when using the        |                                       | 1                                |
|                         |                    | application                                                                |                                       |                                  |
|                         |                    | Can handle unexpected situations even on unfamiliar roads                   |                                       | 1                                |

Table 1. Situational awareness questionnaire statement
Knowing that it just changed the traffic light to red, but will keep going forward
Focus on seeing the application and want to turn, forget to turn on the turn signal
Forgot to turn off the turn signal when you focus on seeing the application
Heavy rainy weather, keep running the journey

| Statement | Weight |
|-----------|--------|
| 1          | 12     |
| 1          | 13     |
| 1          | 14     |
| 1          | 19     |
| **Total**  | **20** |

2.4. Method of Collecting Data
The data collection methods used in this study are:

- **Primary Data**
  Primary data in this study were obtained through a questionnaire. Questionnaires were distributed to obtain situational awareness data on online motorcycle taxi drivers. The sampling technique used is Accidental Sampling which is included in the Non Probability Sampling. Accidental Sampling is a sampling technique based on chance, in which anyone who accidentally meets the researcher can be used as a sample, if it is considered that the person who happened to be met is suitable as a data source. Determination of the representative sample size is dependent on the number of indicators multiplied by 5 to 10 [15]. The number of samples in this study were:
  \[
  \text{Samples} = \text{number of indicators} \times 5 \\
  = 20 \times 5 \\
  = 100
  \]

- **Secondary Data**
  Secondary data in this study were obtained through document inspection of online grab motorcycle taxi companies. Data collection is done by examining and viewing documents or company records that will be used as a tool to analyze problems. Secondary data is an overview of the company accessed from the official Grab website. Other secondary data is the population of Grab online motorcycle taxi riders in Medan and the number of accidents that have occurred to Grab online motorcycle taxi drivers in Medan.

2.5. Method of Data Processing
The method used in data processing is Quantitative Analysis of Situational Awareness (QUASA) with the Situational Awareness technique. In identifying the driver's behavior while driving, the Driver Behavior Questionnaire (DBQ) is used. This questionnaire is used because it has various categories to differentiate driving habits and behavior [7].

3. Result

3.1. Data Collection
The questionnaire was distributed to 100 respondents, namely Grab online motorcycle taxi drivers operating in the city of Medan. Table 2 shows a statement accompanied by a weight for each statement in the questionnaire.

The weights used at the level of confidence (Perceived accuracy) are:
• Very Unsure (25%)
• Not sure (50%)
• Confident (75%)
• Very Confident (100%)

3.2. Data Processing

3.2.1. Validity Test. The validity test in this study analyzed the items, namely correlating the score of each item with the total score which is the sum of each item score. The validity test uses SPSS by looking at the Corrected Item-Total Correlation by submitting 20 statements to 100 respondents. Based on the results of the validity test with a significance of 5%, df = n-2, namely df = 98, then the r table for the validity test is 0.1966. The results of the validity test for 20 statement items were declared valid because the whole r count > r table. So it can be concluded that there is no relationship between the statement items that overlap each other. The following is a recapitulation of the results of the validity test using SPSS shown in Table 2.

| Statement | Value of r Count | r Table  | Conclusion |
|-----------|------------------|----------|------------|
| 1         | 0.4412           | 0.1966   | Valid      |
| 2         | 0.2575           | 0.1966   | Valid      |
| 3         | 0.2513           | 0.1966   | Valid      |
| 4         | 0.3769           | 0.1966   | Valid      |
| 5         | 0.2011           | 0.1966   | Valid      |
| 6         | 0.3713           | 0.1966   | Valid      |
| 7         | 0.3636           | 0.1966   | Valid      |
| 8         | 0.2314           | 0.1966   | Valid      |
| 9         | 0.2197           | 0.1966   | Valid      |
| 10        | 0.2436           | 0.1966   | Valid      |
| 11        | 0.2154           | 0.1966   | Valid      |
| 12        | 0.2828           | 0.1966   | Valid      |
| 13        | 0.2208           | 0.1966   | Valid      |
| 14        | 0.4086           | 0.1966   | Valid      |
| 15        | 0.2402           | 0.1966   | Valid      |
| 16        | 0.2284           | 0.1966   | Valid      |
| 17        | 0.2633           | 0.1966   | Valid      |
| 18        | 0.2732           | 0.1966   | Valid      |
| 19        | 0.2769           | 0.1966   | Valid      |
| 20        | 0.3334           | 0.1966   | Valid      |

3.2.2. Reliability Test. Reliability test is carried out to see to what extent the measurement results using the same object will produce the same data. Reliability test is carried out jointly on all statements. The results of the reliability test using SPSS are stated in the Cronbach’s Alpha coefficient in Figure 1.

| Cronbach’s Alpha | N of Items |
|------------------|------------|
| 0.405            | 20         |

Figure 1. Reliability test results

Based on Figure 2, it is obtained that the Cronbach’s Alpha value for 20 statement items is 0.405. By using a confidence level of 95% and α = 5%, the reliability value is high (reliable) where 0.405 > 0.1966.
3.2.3. *Situational Awareness Calibration*. Basically, the principle of Situational Awareness calibration concerns the extent to which one can judge the truth that comes from the results of observations or own decisions. Situational Awareness Calibration assesses the level of correspondence between self-perception and actual circumstances as a proportion of correct responses [8]. Here is a calculation to get actual accuracy and perceived accuracy

\[
\text{Total score} = \text{number of statements} \times \text{number of respondents} = 2000
\]

- **Actual accuracy**
  \[
  \text{Actual accuracy} = \frac{\text{number of respondent's answers is right}}{\text{Total score}} \times 100\%
  \]
  
  Actual accuracy = 53.6%

- **Perceived accuracy**
  \[
  \text{Perceived accuracy} = \frac{\text{Total score of respondents' confidence}}{\text{Total confidence level score}} \times 100\%
  \]
  
  Perceived accuracy = 65.15%

Based on the above calculation results, it can be seen that the actual accuracy is 53.6% and the perceived accuracy is 65.15%. Value Actual accuracy that is lower than the perceived accuracy and has a difference that amounted to 11.55.

3.2.4. *Situational Awareness Calibration Curves*. Situational Awareness Calibration is a tool used to determine how far a person judges the truth of an observation and to assess the level of conformity between the actual accuracy and perceptions the respondent has as the correct proportion of tires [9]. Actual accuracy and perceived accuracy data are shown in the following curve.

![Figure 2. Calibration curves](image)

From the curve in Figure 3, shows that online Grab Medan motorcycle taxi drivers have over confident characteristics, meaning that the driver feels very good and is very confident, but in fact the way he drives is not yet suitable.

3.2.5. *Level of Vigilance*. The alertness level formula is the total result of the calculation of the confidence level score multiplied by the score of the correct answer on each statement. The calculation of the alertness level is shown in the following calculation.

\[
\text{Alert level} = \frac{\text{Total (confidence level score} \times \text{number of correct answers})}{\text{Total Score}} \times 100\%
\]

Alert level = 34.94%
From the calculation results, it can be seen that the level of alertness of Grab online motorcycle taxi drivers is still low, namely 34.94%.

3.2.6. **Signal Detection Theory (SDT)**. Signal Detection Theory (SDT) is a perceptual assessment model that describes and analyzes how people perform in tasks where they must detect certain types of stimuli. Based on data processing, the probability of hit rate, miss rate, false alarm rate and correct rejection alarm is calculated as follows.

- Probability Hit Rate \( = \frac{\text{Correct answer answered right}}{\text{Number of statements with correct answers} \times \text{number of respondents}} = 0.617 \)
- Probability Miss Rate \( = 1 - \text{Hit Rate} = 0.383 \)
- Probability False Alarm Rate \( = \frac{\text{Wrong answers that weren't answered right}}{\text{Number of false statements} \times \text{number of respondents}} = 0.498 \)
- Probability Correct Rejection Rate \( = 1 - \text{False Alarm Rate} = 0.502 \)

Based on the curve in Figure 3. It can be seen that online Grab motorcycle taxi drivers can distinguish between true and false statements. This is indicated by the value of the hit rate is greater than the false alarm rate.

![ROC-curve on online ojek riders](image-url)

**Figure 3.** ROC-curve on online ojek riders

3.2.7. **Sensitivity Calculations**. Sensitivity (d) indicates a person's ability to distinguish between signals and non-signals. The sensitivity displayed on the normal curve aims to identify how well a person is able to distinguish between signal and noise.

\( \alpha = 10\% \)

The area of acceptance is \( \alpha / 2 \leq z \leq 1-\alpha / 2 \).

The results of the calculation can be seen in Figure 4.
Conclusion: Respondents' sensitivity can differentiate between signal and noise.

3.2.8. Calculation of Responses and Biases
Responses (k) and bias (C) explain the setting of criteria for acceptance or rejection, bias is also more indicative of a person's strategy for dealing with ambiguous stimuli.

\[ \alpha = 10\% \]

The bias is denoted by C and is obtained by calculating the following:

\[ C = -0.135 \]

The results of the calculation can be seen in Figure 5.

Conclusion: Respondents of online motorcycle taxi drivers have responses and biases so they can face ambiguous stimuli.

4. Analysis and Discussion

4.1. Situational Awareness Calibration Curve Analysis
Grab online motorcycle taxi drivers have over-confident characteristics, which means that drivers feel good about driving and feel confident, but in fact what they are doing is not yet appropriate. The actual accuracy value which is lower than the perceived accuracy has a difference of 11.55. The resulting difference should be 0, which means that how to drive is in line with self-perception in driving. This difference is the deviation that occurs on the well calibrated line. A difference of 11.55 indicates a sufficiently large deviation away from the well calibrated line. So it can be concluded that online motorcycle taxi drivers tend to pay less attention to safety to the point of endangering themselves and other road users because their driving behavior is still not as appropriate but thinks it is right.
4.2. Vigilance Level Analysis
From the calculation, it can be seen that the level of alertness of Grab online motorcycle taxi drivers is still low, namely 34.94%. This level of alertness is still far from the level of alertness that is said to be safe. Where the alertness level is a percent, it should be close to a perfect count of 100%. Traffic violation behavior is influenced by the level of vigilance of drivers seriously. So a low level of alertness, namely 34.94%, indicates that the number of traffic behavior is not good and tends to get risks that cause danger. The dangers posed by online motorcycle taxi drivers apply to themselves and others.

4.3. Analysis of Signal Detection Theory
Based on the calculation, the hit rate value is 0.617. This shows the reception of the right signal and the correct response of Grab online motorcycle taxi drivers of 0.617. The miss rate value is 0.383. This indicates acceptance of the right signal and the wrong response of Grab online motorcycle taxi drivers. The false alarm rate is 0.498. This shows the reception of the wrong signal and the wrong response of Grab online motorcycle taxi drivers. Correct rejection rate of 0.502. This shows that the reception of the wrong signal and the response of the Grab online motorcycle taxi drivers is correct. In the four values above, it can be seen that the dominant values are the hit rate and the correct rejection. The value of the hit rate when added with the miss rate will produce a value of 1. Similarly, the false alarm with the correct rejection rate will produce a value of 1. On the ROC curve, it can be seen that the hit rate is greater than the false alarm rate. This shows that online Grab motorcycle taxi drivers can distinguish between true and false statements.

4.4. Sensitivity Calculation Analysis
Based on the results of the calculations made, the sensitivity value was 0.29. When plotted on the curve, the value 0.29 falls into the area of acceptance (-1.645 < x < 1.645). So it can be concluded that the sensitivity of Grab online motorcycle taxi riders is good because respondents are sensitive in distinguishing signal and noise. It is said to be a signal like when a few seconds after the turn of the traffic light which is green which means the road changes to a red light which means stopping, the driver understands that it is a signal to stop even though it has just turned into a red light.

4.5. Analysis of the Calculation of Responses and Biases
Based on the results of the calculations performed, the response value is -0.01 and the bias value is -0.135. When plotted on the curve, the value -0.135 is included in the area of acceptance (-1.645 < x < 1.645). So it can be concluded that online motorcycle taxi drivers have good responses and biases so that they can face problems such as ambiguous stimuli. Online motorcycle taxi drivers can state properly the true statement is true, while false statements are false.

4.6. Research Recommendations
Based on the above analysis, it was found that Grab online motorcycle taxi drivers were able to distinguish between true and false statements, were sensitive in distinguishing signal and noise and were able to properly state the true statements were true, while false statements were false. It's just that online motorcycle taxi drivers tend to be less alert and overly confident so that they endanger themselves, their passengers and road users.

Recommendations that can be given to motorists are:

- Motorists should be more vigilant in driving because it can endanger themselves and others. To increase awareness, drivers should need adequate rest, adopt a healthy lifestyle (eat regularly & exercise) and do other positive activities.
Recommendations that can be given to the Grab Online Ojek Company are:

- Reviewing the granting of permits in the form of specific conditions for prospective online motorcycle taxi drivers and reviewing old online motorcycle taxi drivers while driving.
- It is necessary to provide counseling to online motorcycle taxi drivers about good driving procedures and increase the level of alertness in the form of SENSE, which is a program consisting of Stress management, Exercise, Nutrition, Supplement and Evaluation. This counseling can work with regulators who can help provide the material.
- There is a need for a survey/Training Needs Assessment (TNA) before counseling to grant permits or for those already registered so that they can find out and overcome the gaps between knowledge, skills, attitude and performance shown.
- The need for strict implementation of regulations from the Grab company in providing a maximum limit of working hours/day so as to avoid fatigue which results in a low level of vigilance which risks human error.
- The need for strict sanctions from the Grab company for its partners who have a bad driving history (have had an accident) or a low level of alertness.

5. Conclusion
The conclusions from the research are: the actual accuracy value (53.6%) is lower than the perceived accuracy (65.15%) and the difference is 11.55%. This shows the over-confident characteristics of Grab online motorcycle taxi riders, which means that drivers feel good about driving and feel confident, but in fact what they are doing is not yet appropriate. The alertness level of 34.94% indicates that the number of traffic behavior is not good and tends to get risks that cause harm to oneself and others. The hit rate (0.617) is greater than the false alarm rate (0.498). This shows that online Grab motorcycle taxi drivers can distinguish between true and false statements. The sensitivity of Grab's online motorcycle taxi drivers is good because respondents are sensitive in distinguishing signal and noise. Online motorcycle taxi drivers have good responses and bias so they can deal with ambiguous stimuli.

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