REVIEW OF INTERNATIONAL GEOGRAPHICAL EDUCATION

ISSN: 2146-0353 • © RIGEO • 11(6), SPRING, 2021

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Research Article

The Saudi Version of the Dula Dangerous Driving Index among University Student drivers

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Abstract

Background: The behavior of dangerous driving is considered the main cause of increase in road accidents. The present study aimed at (1) studying the dangerous driving indexes among university students, (2) developing the Dula index to measure the behavior of dangerous driving of Saudi university students, (3) identifying the significant differences of dangerous driving behaviors according to the educational level and age, and (4) identifying the relationship between the behavior of dangerous driving and the impulsive behavior of drivers and the driving angry expressions.

Methods: The tools of the study, which were selected in a systematic stratified way, were applied to 640 Saudi university students to check the validity of the Dula index. The tools of the study included: the dangerous driving Dula inventory (DDDI), driver behavior questionnaire, barratt impulsiveness scale (BIS) and driving anger expression inventory (DAEI). Results: The results of this study showed that this tool, when associated with the barratt impulsiveness scale (BIS) and the driving anger expression inventory (DAEI), can have adequate psychometric properties through internal consistency, persistence and honesty. The factor analysis results concluded that the tool has three factors; namely, aggressive driving, negative emotions and dangerous driving. In addition, the study findings pointed out that the average scores of students dangerous driving were at a low level. There are no statistical differences in the behavior of dangerous driving according to age and educational level.

Recommendations: The study recommends the traffic departments in the Kingdom of Saudi Arabia to adopt this measurement to evaluate the behaviors of dangerous driving among drivers who are intending to obtain their driving license, especially teenagers.

Keywords

Dula dangerous driving index, university students, driving anger expression inventory and barratt impulsiveness scale.

To cite this article: Mohamed, A and Alkholy, A, (2021) The Saudi Version of the Dula Dangerous Driving Index among University Student drivers. *Review of International Geographical Education (RIGEO), 11*(6), 1124-1133. doi: 10.48047/rigeo.11.07.106

Submitted: 10-10-2020 • **Revised:** 14-12-2020 • **Accepted:** 18-02-2021

Introduction

Road accidents are considered the most dangerous challenges that the world faces during the twenty first century (Disassa & Kebu, 2019). It is mentioned that (Hayashi, Foreman et al., 2018) although the majority of road accidents can be predicted or avoided, more than 1.2 million people died annually because of it. The World Health Organization (WHO, 2015) reports further state that between 20-50 million people experience non-fatal injuries and that most of them become disable. The World Health Organization predicted that the number of injuries and deaths caused by road accidents will increase by 65% between 2000-2020. Many studies conducted in various countries such as America, India, Malaysia, Ethiopia, Iran and Chili indicate that road accidents cause direct and indirect economic losses (Disassa & Kebu, 2019; Khanipour, Tavallaii et al., 2015; Mohd Kassim, Abdul Hanan et al., 2019; Shinar & Compton, 2004; Valdivia-Peralta, Fonseca-Pedrero et al., 2014; Zhang, Houston et al., 2016). Moreover, the World Roads and Transport Authority estimate that the losses of road accidents are about 518 billion American dollars. This ratio represents 1-2% of the total domestic product growth of countries (WHO, 2009).

Using public transport has currently become a lifestyle in countries of the world. It is obvious that the number of vehicles is in continuous increase due to the pace of life and the development of the economic movement worldwide. Lots of young drivers show inappropriate behaviors while driving, especially being aggressive towards others (Chomeya, 2010). Many previous studies discovered that most road accidents are caused by aggressive or dangerous driving such as speed, racing, failing to observe traffic signs and seeking to face drivers (Mohd Kassim, Abdul Hanan et al., 2019). Martinez, Herczfeld et al. (1997) defines aggressive driving as a behavior of driving that might endanger individuals or their properties. Moreover, Nesbit, Conger et al. (2007) define it as any risky or undesirable deed that occurs on the road. The behavior of aggressive driving includes the following behaviors: flashing high beams, weaving in traffic, violence such as speeding behind other drivers on the road, facing other drivers with weapons, tailgating, honking, rude gesturing, high speed, using the of the vehicle shoulder to pass through other vehicles on the road (Dula & Ballard, 2003; Houston, Harris et al., 2003; Nesbit, Conger et al., 2007).

Chomeya (2010) sees that aggressive behavior causes many dangerous problems in societies such as traffic jam, road accidents that negatively affect people's lives and their properties, disability and deaths. Dukes, Clayton et al. (2001) adds, the study of aggressive driving is not new. Nevertheless, this issue has not received attention until recently as a global concern (Shinar & Compton, 2004). The case of safety on roads is considered one of the important ones that should receive attention and concern worldwide. Through the past years researchers began to develop indexes and questionnaires to measure the various aspects of aggressive driving when it became a serious problem in America. Aggressive/dangerous driving is one of the common risky problems in the Kingdom of Saudi Arabia. The researcher witnessed lots of daily accidents on roads, within and outside the countries, during his stay in the Kingdom of Saudi Arabia since 2015. He also observed lots of impulsive behaviors while driving among teenagers and adults. In addition, he observed that lots of people are indifferent towards road regulations and that the phenomenon of drifting has become common among preparatory, secondary and university students.

The Kingdom of Saudi Arabia is considered one of the biggest countries in the world in terms of the increase in the number of road accidents that lead to relatively large number of deaths and injuries. Despite the difference in the numbers that determine the size of disaster caused by road accidents in the Kingdom, all of them amount to only one result (i.e. death or a permanent disability) as the recent statistics issued by the Saudi Ministry of Health (2020) point out 17 deaths are caused daily and 68 injuries. Other studies and reports showed a clear increase in the number of accidents. In 2009 there were 484.8 thousand accidents, which means that 1328 accident takes place daily and 55 accidents per hour. The rate of has increased by 3% in 2010 to reach 498.2 thousand accident, i.e. 1365 accident daily and 57 accident per hour. In 2011 the number of accidents increased by 9% to reach 44 thousand accident, i.e. 1491 accident daily and 62 accident per hour, while in 2012 the number of accidents increased to 589 thousand accident which equals 1614 accident daily and 67 accident per hour. In 2012, Makkah Al-Mukarramah headed the other regions in the number of casualties and injuries by about 25% of the total number of casualties and 27% of the total injuries. According to the data of the Department of Statistics and Information, Al-Riyadh had the highest number of accidents with a percentage of 28% of the total number of road accidents in the Kingdom. The ratio of road accident casualties in Saudi Arabia is about 17 people daily, one person per minute. Moreover, the number of injured people is more than 68 thousand one annually and the financial losses exceeded 13 billion annually. Studies proved that

most accidents happen because of the mistakes of humans, particularly high speed, running a red light, non-qualified drivers and using vehicles for other purposes through aggressive behavior while driving such as drifting. The increase in the ratio of accidents affects the health efforts made and occupies one third of the hospital's capacity. 30 hospital beds out of 100 are occupied by the injured people due to car accidents. Heron-Delaney, Kenardy et al. (2013) mention that road accidents are important to consider not only because of its damage to health (death and injuries) or the financial losses but also because of its psychological impact which involves depression, concern and post-traumatic stress (Gouveia, de Oliveira et al., 2021).

To the researcher's knowledge, there are no studies conducted in the Kingdom of Saudi Arabia on the translation and codification of indexes or questionnaires to identify or measure the behavior of dangerous/aggressive driving among teenagers and the youth. Thus, the aim of the current study was to identify the psychometric and factor analysis properties of the Saudi version through applying the Dula Dangerous Driving Index (DDDI) on a non-clinical sample of Saudi university students.

Methods:

Sample and Procedures:

The research sample consisted of students from Prince Sattam Bin Abdulaziz University, Wadi Al-Dawasir branch. The number of the research sample reached 640 participants who completed three questionnaires within the Faculty of Arts and Sciences. The sample was chosen through the method of systematic stratification where 40 students were selected from each of the 8 levels in the Departments of Islamic Studies and Arabic Language within the Faculty. The data were obtained from March 2019 till April 2019. Implementation was carried out through coordinating with the heads of the two departments and the schedules facilitators. The whole sample was composed of males only because females do not drive cars in that area. The ages of the research sample ranged between 18 to 30 years old with an average of 21.10 and a standard deviation of 2.18. Participants in this study are volunteers whose names are not known and who holds a driver's license.

Measurements:

Dula Dangerous Driving Index (DDDI)

This measurement was prepared to detect and identify dangerous and aggressive driving. This measurement consists of 28 phrases which are distributed on three dimensions: aggressive driving 7 phrases, negative cognitive emotional driving 9 phrases and dangerous driving 12 phrases (Dula & Ballard, 2003). The responses of the sample were recorded on LIKERT SCALE which consists of five levels (always, frequently, occasionally, rarely, never). This measurement is considered one of the self-report measurements that can be relied on in evaluating the behavior of dangerous/aggressive driving.

Driver Behavior Questionnaire (DBQ)

There are various and different versions of the driver behavior questionnaire (Martinussen, Hakamies-Blomqvist et al., 2013). The study relied on an upgraded version of the original copy which consisted of 28 phrases (Lawton, Parker et al., 1997; Parker, Reason et al., 1995). This questionnaire consisted of four basic factors; namely, errors which includes 8 phrases, lapses which includes 8 phrases, ordinary violations which includes 6 phrases and aggressive violations which includes 6 phrases. The responses of the sample were recorded on Likert Scale which consists of five levels (always, frequently, occasionally, rarely, never).

Barratt Impulsiveness Scale(BIS-11)

This tool is considered one of the self-report tools which consists of 30 phrases that measure impulsiveness. It consists of three dimensions (Attentional Impulsiveness which consists of 8 phrases, Motor Impulsiveness

which consists of 11 phrases and Non Planning Impulsiveness which consists of 11 phrases**).** The higher the degree gets the increase in impulsivity.

Driving Anger Expression Inventory (DAX)

Driving Anger Expression Inventory is considered a tool used to measure the ways through which people express their anger while driving on the road (Deffenbacher, Deffenbacher et al., 2001; Deffenbacher, Lynch et al., 2002). This inventory consists of 49 phrases distributed over four sub-factors: Verbally Aggressive Expression (VAE) which consists of 12 phrases, Physically Aggression Expression (PHAE) which consists of 11 phrases, using the Vehicle for Aggressive Expression (VAE) which consists of 11 phrases, and Adaptive/Constructive Expression (ACE) which consists of 15 phrases.

Statistical Analysis:

The researcher wanted to check the validity of the four following hypotheses: (a) what are the indications of the internal consistency of Dula Dangerous Driving Index?, (b) what are the indications of the reliability of DDDI on Saudi university students?, (c) what are the indications of DDDI's factor analysis (exploratory and confirmatory)?, what are the indications of the concurrent validity (DAX, BIS, MDBQ) of DDDI on Saudi university students?. The statistical analysis and treatments of the study's four hypotheses by using the statistical package for the social (SPSS version 24, IBM, Chicago, Illinois, USA). The confirmatory factor analysis was carried out by using the AMOS version 24, IBM, Chicago, Illinois, USA and it was applied on a sample of 640 students who were randomly divided into two. The first half of the sample was used for exploratory factor analysis while the other half was used for the confirmatory factor analysis.

Results:

Factor analysis

Exploratory factor analysis

The data set was first screened in order to select those items that correlate relatively low (less than 0.30) or relatively high (higher than 0.90) with other items. None of the items attracted attention because of extremely high or low inter-correlations. Following, EFA using principal axis factor analysis was conducted in the present study to test the construct validity and investigate the factor structure of the DDDI scale by examining the relationships between items using the first half of the sample. Principal axis factoring was conducted with oblimin rotation because an underlying theoretical structure was hypothesized and it was assumed that the dimensions or factors describing the structure might be inter-correlated. The Kaiser-Meyer-Olkin measure (KMO) verified the sampling adequacy for the analysis, KMO = 0.786, which is well above the acceptable limit of 0.5 (Field, 2013). Bartlett's test of sphericity ($\chi^2 = 1562.04, df = 378, p = 0.000$) indicated that correlations between items were sufficiently large for EFA. Three eigenvalues were ≥1, thus meeting Kaiser's criterion when determining the number of factors. Factor loadings from the three-factor solution oblique EFA are presented in Table 1.

Table 1:
Pattern matrix and communalities (h2) for DDDI scale

Items	Factor loadings after rotation			Communalities
	Factor 1	Factor 2	Factor 3	
Item1	0.125	0.528	0.204	0.336
Item2	0.339	0.524	0.140	0.410
Item3	0.173	0.604	0.163	0.422
Item4	0.181	0.312	0.613	0.507
Item5	0.244	0.157	0.628	0.478
Item6	0.128	0.173	0.623	0.434

Item7	0.182	0.149	0.508	0.314
Item8	0.112	0.127	0.725	0.554
Item9	0.515	0.172	0.220	0.343
Item10	0.711	0.412	0.187	0.710
Item11	0.206	0.347	0.489	0.402
Item12	0.262	0.466	0.131	0.304
Item13	0.540	0.225	0.145	0.363
Item14	0.561	0.182	0.117	0.361
Item15	0.622	0.121	0.195	0.440
Item16	0.178	0.263	0.512	0.362
Item17	0.130	0.614	0.110	0.406
Item18	0.144	0.563	0.177	0.369
Item19	0.357	0.541	0.143	0.441
Item20	0.630	0.395	0.119	0.566
Item21	0.572	0.281	0.135	0.425
Item22	0.255	0.559	0.255	0.443
Item23	0.693	0.366	0.214	0.660
Item24	0.489	0.307	0.231	0.386
Item25	0.585	0.134	0.255	0.425
Item26	0.252	0.688	0.167	0.565
Item27	0.550	0.186	0.302	0.428
Item28	0.498	0.219	0.195	0.334
Eigenvalue	4.85	4.23	3.19	total variance=
variance explained	17.33%	15.11%	11.38%	43.81%

After the oblimin rotation, the first factor consisted of 12 items related to the (RD), the second factor consisted of 9 items related to the (NE), and the third factor consisted of 7 items related to the (AD).

Confirmatory factor analysis

CFA was conducted using the three-factor model deemed to be the best fit from the EFA to determine how well the theoretical models of these as separate constructs fit the data. The data analytic program Amos v.24 was used to run CFA. A maximum likelihood approach was utilized. Several indices indicated a good model fit for the construct, they include: the ratio of chi-square to degree of freedom ($\chi 2$ /df) < 5.0, root mean square error of approximation (RMSEA) ≤0.08, comparative fit index (CFI) > 0.9, Tucker Lewis Index (TLI) > 0.9, and p > 0.05 for the chi-square test (Hou, Al-Tabbaa et al., 2014). Hair, Black et al. (2010) suggested that model fitness can be decided by at least a minimum of three different indices. Fit Indices for Confirmatory Factor Model presented in Table 2.

Table 2:
Fit Indices for Confirmatory Factor Model

Goodness of fit indices	Value	Acceptable value
Chi-square	620.19	Chi-square/degrees of freedom < 5
degrees of freedom	347	
Chi-square/degrees of freedom	1.787	
Tucker Lewis Index (TLI)	0.952	TLI ≥ 0.90
Comparative Fit Index (CFI)	0.966	CFI ≥.90
Incremental Fit Index (IFI)	0.967	IFI ≥ 0.90
Goodness of Fit Index (GFI)	0.974	GFI ≥ 0.95
Root Mean Square Error of Approximation (RMSEA)	0.063	RMSEA < 0.08

A good relationship between items and respective factors are shown by a standardized factor loading greater than 0.5 as well as a p-value of less than 0.05 and it therefore further proves the validity of the construct.

Table 3:
Results of CFA of the

Dimensions	Items	loadings	standard error (SE)	z value	Dimensions	Items	loadings	standard error (SE)	z value
AD	4	0.622	0.079	5.268	RD	9	0.704	0.062	8.012
	5	0.576	0.063	6.080		10	0.742	0.073	7.395
	6	0.619	0.048	8.687		13	0.568	0.056	6.670
	7	0.582	0.051	7.573		14	0.657	0.060	7.682
	8	0.690	0.054	9.027		15	0.496	0.058	5.219
	11	0.767	0.074	7.716		20	0.717	0.075	6.881
	16	0.628	0.072	5.245		21	0.641	0.068	6.559
NE	1	0.543	0.070	3.419		23	0.720	0.068	7.673
	2	0.508	0.056	5.502		24	0.622	0.071	5.919
	3	0.547	0.065	5.384		25	0.574	0.051	7.243
	12	0.774	0.074	7.629		27	0.536	0.057	9.561
	17	0.743	0.067	8.142		28	0.635	0.068	6.500
	18	0.655	0.080	5.727	All z values in this table are significant at (0.01) level				
	19	0.676	0.071	9.542					
	22	0.699	0.087	5.807					
	26	0.582	0.062	4.551					

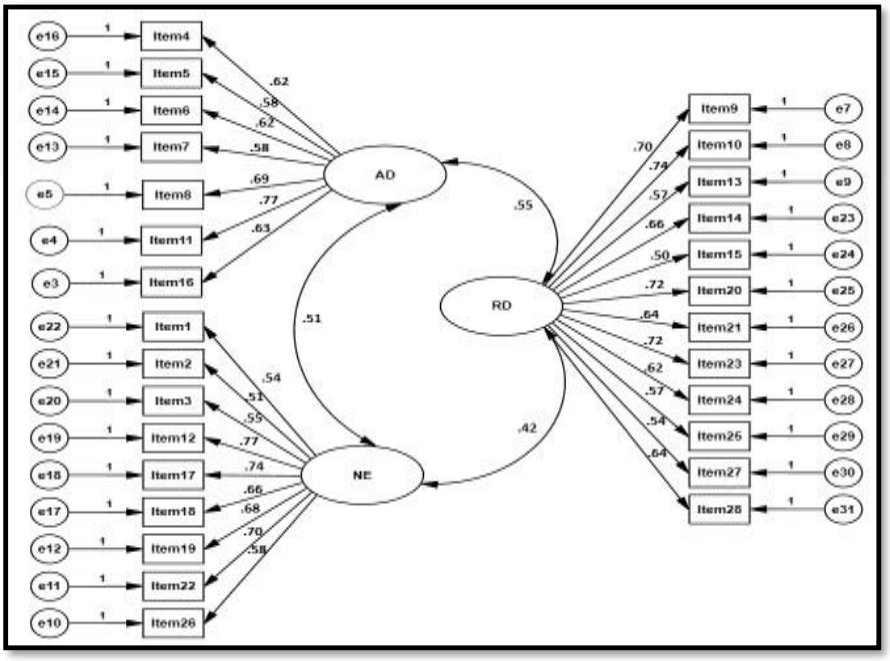

Figure 1. CFA model with standardized factor loadings

Composite reliability of the domains was calculated with a value of 0.7 and above was considered acceptable (Ghozali, 2014). Composite reliability for DDDI scale domains (AD, NE, RD) are equal to (0.868, 0.855, 0.865) respectively.

Internal consistency

Pearson correlation coefficient between the degrees and dimensions of items and between the degrees of the three sub-dimensions and the total score of the index was calculated as shown in table 4.

Table 4:
Internal consistency for DDDI

AD		NCE		RD	
Items	correlation with dimension	Items	correlation with dimension	Items	correlation with dimension
4	0.486	1	0.645	9	0.591
5	0.601	2	0.322	10	0.554
6	0.394	3	0.486	13	0.659
7	0.330	12	0.462	14	0.441
8	0.385	17	0.658	15	0.530
11	0.543	18	0.329	20	0.605
16	0.711	19	0.559	21	0.450
corr. Between dimension and scale = 0.425		22	0.406	23	0.421
		26	0.678	24	0.605
		corr. Between dimension and scale = 0.431		25	0.535
				27	0.515
				28	0.466
				corr. Between dimension and scale = 0.692	

All correlation coefficients are significant at (0.01)

The values of correlation coefficient were all higher than 0.3 and statistically significant at level 0.01 which shows that this index has internal consistency.

Reliability

The DDDI reliability factor was calculated by using the Alpha Cronbach Coefficient as shown in table 5.

Table 5:
Reliability coefficients for DDDI scale

Dimension		Reliability
1	AD	0.767
2	NE	0.702
3	RD	0.752
Total scale		0.838

The above table shows that all reliability values were higher than 0.7 (Hair, Black et al., 2010) which shows that the measurement is reliable.

Concurrent Validity:

Statistical correlations between the total score of the sample on the DDDI index and on the following indexes: DBQ, BIS, DAX as shown in table 6.

Table 6:
Correlations of Saudi version of DDDI total score with MDBQ, BIS-11, and AAX

Variables		AD	NE	RD	DDDI
DBQ	Errors	0.541	0.353	0.627	0.630
	Lapses	0.548	0.402	0.616	0.650
	Ordinary Violations	0.518	0.497	0.650	0.689
	Aggressive Violations	0.572	0.347	0.685	0.670
	DBQ	0.629	0.459	0.742	0.760
BIS	Non Planning Impulsiveness	0.024	0.090	0.010	0.023
	Motor Impulsiveness	0.312	0.293	0.384	0.410
	Attentional Impulsiveness	0.359	0.261	0.437	0.428
	BIS-11	0.358	0.241	0.427	0.421
DAX	Verbally Aggressive Expression	0.548	0.285	0.550	0.574
	Physically Aggression Expression	0.532	0.189	0.525	0.517
	Using the Vehicle for Aggressive Expression	0.548	0.373	0.677	0.672
	Adaptive/Constructive Expression	0.080	0.214	0.087	0.151
	DAX	0.556	0.334	0.597	0.618

Discussion and Conclusion

This study is carried out to identify the psychometric properties of the final upgraded version of DDDI which consists of 28 phrases as to check how valid it is in measuring the behavior of dangerous/aggressive driving in the Kingdom of Saudi Arabia, especially among youth and teenagers. The findings of the factor analysis showed that the factorial structure of the index was good. The results of the confirmatory factor analysis identified a three dimensional model which consists of: dangerous driving, negative cognitive and emotive driving and aggressive driving. In addition, the results revealed that the values of correlation between total score of the index, phrases and three dimensions is higher than 0.3 and has a statistical significance which shows that this index has internal consistency. The values of Alpha Cronbach of all three dimensions were higher than 0.7 (as can be seen in table number 5) which proves the reliability of the index. The results of the concurrent validity, on the other hand, revealed high and significant correlations between DDDI and the DBQ and DAX indexes and between some sub-dimensions as shown in table 6. As a result, the findings showed high correlations between the DDDI index and the driver behavior questionnaire (DBQ) were the value of correlation was 0.760 and the values of the total score correlation of the DBQ with the dimensions of aggressive/dangerous driving were 0.629 and 0.742 respectively. Moreover, the results also showed that the correlation values of all the DBQ dimensions (errors, lapses, ordinary violations, aggressive violations) with the dangerous driving index were high (0.630, 0.650, 0.689, 0.670 respectively). The total value of the correlation between DDQ

and DAX was 0.618 while the correlation of DDX with the sub-dimensions was achieved with the dangerous driving dimension after using … in aggressive … with a high value of (0.677). The results did not show a clear correlation between the DBQ and BIS. All of these results prove the validity and reliability of this tool and its relevance to measure the behavior of dangerous driving among the teenagers and youth of the Kingdom of Saudi Arabia.

Our findings showed a reasonably good fit for the DDDI scale, giving confirmatory details for the factor structure for the three domains. All the fit indices (χ2 /df, RMSEA, CFI, TLI, GFI) are within acceptable values and therefore supported the construct validity.The study recommends the Ministry of Health in the Kingdom of Saudi Arabia to adopt this index (DDDI) in educating those who wish to hold a driving license on the dangerous behaviors that endanger the lives of drivers and others. It also recommends changing this version into an electronic one through which one can evaluate the preparedness of those youth and teenagers to commit such dangerous and aggressive behaviors while driving which necessitates educating them, changing their attitude and delaying their attainment of a driver's license until they join an awareness program presented by the Ministry.

Acknowledgements

The researcher thanks the Deanship of Scientific Research at Prince Sattam Bin Abdulaziz University for their support for this research, project No. 2020/02/11978 as well as all the participants in the study.

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