



Model of users' expectations of drivers of sightseeing buses: confirmatory factor analysis



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ABSTRACT

Annually, more than 13 million students in Thailand ride sightseeing buses in making field trips. Resulting bus accidents may be attributed to the shortcomings of the bus drivers. This study investigates the users' expectations of drivers of sightseeing buses to advise tour bus businesses on how to improve travel safety in response to user needs. Two bus user groups (teachers and parents) in urban and rural areas were surveyed for their expectations of sightseeing bus drivers in terms of age, experience, education, driving license, driving skill pertaining to the route, training, and no drinking or smoking. Confirmatory factor analysis showed that all seven indicators affect the expectations of users in rural zones; albeit only five indicators were fitted with urban model by discarding experience and driving license indicators. Urban users gave the highest priority to 'no drinking or smoking'; while 'training' was of most concern to rural users. Additionally, multi-group analysis found that the variable structures of the users' expectations of sightseeing bus drivers are homologous for urban and rural groups with some variables having dissimilar significance depending on the geographical conditions of each area. It has been found that most accidents around the world were caused by driver negligence similar to those found in Thailand. So, these results and the potential interest of this work can also be useful to readers outside Thailand.

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1. Introduction

1.1. Background

Field trips allow students to acquire knowledge directly from existing educational sources outside the classroom. Such educational activity improves the learners' intellect and social skills by providing a more profound understanding of the objectives of a subject or topic. For this reason, the Thai government has implemented a policy that students take one field trip per academic year (Ministry of Education, 2009); there were 13,157,103 students at schools affiliated with the Royal Thai Ministry of Education in the year 2011 (Ministry of Education, 2011). The arrangement of a field trip includes booking sightseeing buses for group travel, and there may be associated risks of an accident depending on several indicators; e.g., the bus quality, the bus driver's behavior, geometry of the road and traffic conditions (Mirza et al., 1999).

Statistics for Thailand in 2011 show that 991 large buses were involved in accidents (Royal Thai Police, 2012), resulting in an average

of 1.4 deaths and 16.3 injuries per crash (Thailand Road Safety Research Center, 2012). The leading causes of accidents have been derived from numerous indicators such as buses not being suitable for use, damaged roads and hazardous road conditions and inconsiderate driving behavior on the part bus drivers. Jedwanna and Howimanporn (2011) found factors influencing a large-sized bus accident occurrence in Thailand caused by a driver by only 17.95% and vehicle only 10.26%; while the accident derived from mutual factors between driver and vehicle 12.82% and between driver and road condition 30.77%. Hensher (2013) reported that friendliness of the driver and the smoothness of the ride are the major Service Quality Indices and driver behavior is one of the chief factors affecting service operators.

1.2. The concept of users' perception of risk

Road risk refers to a chance of accidents occurring to road users or losses during a journey that can be classified into two types including (1) objective risk is the risk which can be measurable considered as "statistical risk" or "real risk"; and (2) subjective risk is relied on personal sentiment—also called "perceived risk" in which each individual shows different risk perceptions hinging on their experiences (Machin and Sankey, 2008; Mastracci et al., 2012; Siren and Kjær, 2011) that can be measured from methods of

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attitude measurement and psychological scaling (Sjöberg, 2000). According to previous studies relating to driver's risk perception and driving behavior (e.g. Machin and Sankey (2008), Maestracci et al. (2012), Şimşekoğlu et al. (2013), Siren and Kjaer (2011)) found that subjective risk exhibits positive relationship with driving behavior; however no studies identify the measurement of subjective risk of sightseeing bus users. Hence, this study purposefully considers subjective risk occurring to such users in the same concept with the study of driver's subjective risk. In this regard, the definition of "users' risk perception (subjective risk) is an individual passenger prediction of something that causes a likelihood of accidents"

Accordingly, this study investigates the users' expectations (subjective risk) of drivers of sightseeing buses to develop an approach for the recruiting, selecting and training drivers of sightseeing bus companies in accordance with users' needs relating to safe travel. As considering the basic concept in economics, users assign great importance to driver qualification (i.e. driver with high driving skills and route experiences) for each specific field trip. When bus owner can't provide drivers with such qualification, users will find another company. In business competition, if bus entrepreneurs do not improve their services, they have to quit the businesses. Hence, they need to improve and train the driver in response to the expected qualification of users to maintain the services (Cascetta and Carteni, 2013; Chang and Yeh, 2005; del Castillo and Benitez, 2012; dell'Olio et al., 2011).

1.3. Attributes characterizing the bus drivers

Previous studies have reported the interesting finding that bus drivers tend to be a major factor affecting a passenger's decision whether to use a bus for travel (de Oña et al., 2012; del Castillo and Benitez, 2012; dell'Olio et al., 2010; González-Díaz and Montoro-Sánchez, 2011; Hensher et al., 2010; Hensher, 2013; Hensher et al., 2003; Stradling et al., 2007; Wang et al., 2002), and factors that significantly affect the safe driving of cars and buses have been deduced. These factors include;

- **Age:** Chung and Wong (2011) noted that age affects the driving efficiency as a consequence of health problems. Additionally, Lourens et al. (1999) examined the relationship between age and accident rates and found that drivers aged 35–65 years have lower rates of accidents than other age groups. Phillips and Sagberg (2012) specified that aging is more likely to cause a crash owing to the phenomenon of microsleep. Clarke et al. (2006) and Karacasu and Er (2011) found that a younger group possibly poses increased accident risks over middle- and older-aged groups.
- **Experience:** Many researchers have reported that work experience has a reverse relationship with accident occurrence (Clarke et al., 2006; Tseng, 2012).
- **Driver's educational level:** Chung and Wong (2011) and Phillips and Sagberg (2012) presented minor relationships

Table 1
Indicators affecting bus drivers' behaviors.

Author (year)	Type of risk	Dependent var.	Independent var.	Vehicle type	Analysis method	Significant variables
Bunn et al. (2013)	Objective	Injured (Dummy: yes/no)	Gender Age	Truck	Odd ratio	Gender Age
Phillips and Sagberg (2012)	Objective	Road accidents (Dummy: yes/no)	Frequency of driving Level of education Years having driver's license	Car	Logistic regression	Age Level of education Years having driver's license
Tseng (2012)	Objective	Having at least one at-fault accident (Dummy: yes/no)	Age Education Driver's experience in years Kilometers driven yearly Use of an automatic vehicle location system	Bus	Logistic regression	Drivers' experience in years Kilometers driven yearly Use of an automatic vehicle location system
Chung and Wong (2011)	Subjective	Perceived health condition compared with same generation (Worse/ similar/better)	Age Daily average working hours	Bus	Ordered logit model	Age Daily average working hours
Chen and Chen (2011)	Objective	Driver-injury frequency (3 level)	Gender Age	Truck	Logit model	Gender Age
Karacasu and Er (2011)	Objective	Fundamental faults in the accidents occurred (12 case)	Gender Age	All	Chi-squared test	Gender Age
Peck (2011)	Objective	Crash and violation (Number in 1 year)	Training	Car	Multiple regression	Training
Mayhew (2007)			Education Training	Car	Literature	Education Training
Clarke et al. (2006)	Objective	Types of accident (6 type)	Age Driver's experience	Car	Chi-squared test	Age Driver's experience
Chang and Yeh (2004)	Objective	Alcohol consumption	Fatal drunk driving accident	Car	Poisson regression models	Alcohol consumption
Abdel-Aty and Abdelwahab (2000)	Objective	Traffic accidents while driving under the influence of alcohol/drug	Alcohol/drug involvement	Car	Chi-squared test	Alcohol/drug involvement
Lourens et al. (1999)	Objective	Annual mileage with accidents	Sex Age Education	Car	ANOVA	Age

between educational background and crash incidence, while Lourens et al. (1999) found no relation between the two indicators.

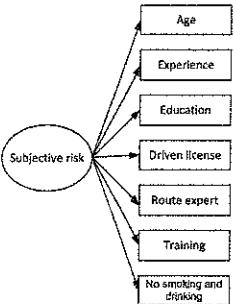
- **Training:** Peck (2011) found that training may increase a driver's ability to solve unexpected problems, subsequently making driving safer and reducing the accident risk. de Oña

et al. (2012), Román et al. (2014), and del Castillo and Benitez (2012) indicated manners of the driver is an important factor affecting user's quality perception and satisfaction.

- **No drinking and smoking:** Many previous studies show the driver significantly reduces the risk of road accidents (Abdel-Aty and Abdelwahab, 2000; Chang and Yeh, 2004).

Table 2

Example of differences of analysis method between this study and previous studies.

CFA Concept:	Regression Analysis Concept:	ANOVA Concept:	Chi-square test Concept:
It is a measurement mode comprising observed variables used for considering on whether each indicator can verify the factors of latent variable. It is also applied to confirm empirical and theoretical data (Byrne, 2012; Thompson, 2010).	It involves the study on relationship between a dependent variable (data collection is required) and independent variables (data collection is required) (Washington et al., 2003).	It encompasses the examination of relationship among dependent variables regarded as quantitative variables; while independent variables are categorical variables.	It involves the examination of relationship between two categorical variables.
Null hypothesis: The model that is a good fit to the data is easily rejected.  According to figure, subjective risk (users' perception) can be measured from 7 indicators having factor loadings that indicate the importance of each indicator and reflect the degree to which it can be factors of users' perception. Advantage: - It is easy to operate because all data can be gathered from users. - CFA offers a very strong analytic framework for evaluating the equivalence of measurement models across distinct group (e.g. area) (Brown, 2006). - CFA is the ability to estimate the relationships among variables adjusting for measurement error that mean they are perfectly reliable (Brown, 2006). Disadvantage: - The specification of CFA is strongly driven by theory or prior research evidence (Brown, 2006; Thompson, 2010). - It only confirms factors but cannot be used for prediction.	Null hypothesis: There is no significant linear correlation between a dependent variable and independent variables.  From figure above, it describes that objective risk (or variables on accident statistics such as number of accidents, number of injuries or deaths) depending on 7 variables that their regression coefficients reflect the influences of each variable. Advantage: - The model can be used for prediction. - Regression model outputs are relatively easy to interpret and communicate to others, numerical estimation of regression models is relatively easy (Washington et al., 2003). Disadvantage: - Large number of data from accident statistics is required for the analysis (Thailand doesn't have the statistics of sightseeing bus accidents. It shows only statistics of total bus accidents). - It has some limitations on technique used for detecting multicollinearity (Washington et al., 2003).	Null hypothesis: The population means of the first/second/third factor (gender/education/age) are equal. Advantage: It shows the simplicity in the analysis Disadvantage: The analysis results can only indicate whether means of dependent variables in each sub-group of independent variables are different. It cannot be used to compare the significance of each independent variable.	Null hypothesis: i.e. Driver's gender/education/age has a significant effect on the fundamental faults when an accident occurs Advantage: It shows the simplicity in the analysis Disadvantage: The analysis results can only indicate the relationship between independent variables and a dependent variable via a paired comparison. So, this method cannot verify the extent of significance of each independent variable.

Note: □ is observe variable, ○ is latent variable.

As summarized in Table 1, most relevant studies have focused on private cars and buses, and the drivers of sightseeing buses have been overlooked. The analysis methods employed in prior research include logistic regression, multiple regression, ordered logit approaches, chi-squared testing, and analysis of variance (ANOVA). This study applies CFA, a statistical analysis technique, to confirm whether indicators affecting users' expectations of drivers of typical buses, as determined in previous studies, can be applied to drivers of sightseeing buses. So, an example of differences of analysis method between this study and previous studies can be illustrated in Table 2.

2. Methodology

2.1. Confirmatory factor analysis

CFA is a technique used to verify or ensure that relationships among indicators are as expected through the analysis of structural validity. In the measurement, researchers must know the structural relationships of factors, or know which types of relationships should exist or which factors have strong relationships with one another, and can therefore be grouped in the same component. In other words, if factors are non-correlated, they will be grouped in different components. CFA has been commonly considered as applying a measurement model to the analysis of structural equation modeling (SEM), which can determine the relationships between latent variables and observed variables as demonstrated in Fig. 1. In the figure, ξ is the vector of latent exogenous variables; X is the vector of observed variables; λ is the factor loadings; and δ is the error variance and covariance. In terms of validating the model construction, the component analysis of statistical values was conducted to examine the validity of the model in line with empirical data as illustrated in Table 3, in which five indicators, namely χ^2/df , the standardized root-mean-

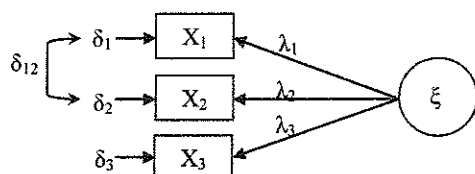


Fig. 1. Parameters of the measurement model (modified (Brown, 2006)).

square residual (SRMR), the root-mean-square of the approximation (RMSEA), the comparative fit index (CFI), and the Tucker-Lewis index (TLI) were applied.

2.2. Multi-group CFA

Multi-group analysis is an analysis of invariance across groups (e.g., gender, areas, races and culture), and has been widely applied in measuring model validity (Brown, 2006; Koh and Zumbo, 2008). Such studies have examined whether model parameters of Population A are homogenous with those of Population B. CFA predominantly comprises the following.

- (1) *Testing invariance of form* checks that the theoretical model is consistent with the empirical data of each population group comprising a number of variables in the model; the specified characteristics of structural relationships among variables are similar for all groups; the parameter matrices in the measurement model are of similar size; and all the groups have equivalent matrix forms and matrix modes (Cheung and Rensvold R. B., 2002).
- (2) *Testing invariance of parameters in a model* measures the variability of parameter matrices as the next step of testing equal form. It involves gauging the invariance of parameter matrices serving the least restriction (i.e., posing the fewer specific requirements) to gauging those serving the greatest restriction as follows (Brown, 2006).
 - *Testing invariance of the factor loading matrix* to examine the homogeneity of the relationships among the group of latent variables and observed variables as shown in Fig. 2 (A) and (B) for the equal loading group, and Fig. 2(C) and (D) for the unequal loading group.
 - *Testing invariance of the intercept matrix* to compare the intercepts between two groups as illustrated in Fig. 2 (A) and (C) for equal intercepts, and Fig. 2(B) and (D) for unequal intercepts.
 - *Testing invariance of the indicator error variance matrix* to measure the internal consistency of observed variables among groups or to imply that, for all groups, the observed variables can be appropriately used as indicators of the latent variables.
 - In assessment of the model of measurement invariance testing, the study applies a likelihood-ratio test, which is a test of the heterogeneity of chi-squared for each null

Table 3

Formulas, descriptions, and cut-off values of model fit indices.

Model fit index	Formula	Description	Cut-off value
$\chi^2(df)$	$F_{ML}(N-1)$	The statistical values used to test the null hypothesis that covariance matrices of a sample group and population group are equivalent. If the results are statistically significant, the model form is not fitted. Additionally, significant results can be readily obtained for a reasonably large sample group whereas chi-squared for a small sample group (less than 100 individuals) is too high and the model is less reliable	$p > 0.05$
χ^2/df Kline (2005)	-	Proportions between χ^2 values and degrees of freedom	< 3
SRMR ^a Wu et al. (2009), and Hu and Bentler (1999)	$\sqrt{\frac{\sum_i \sum_j r_{jk}^2}{p^*}}$	The average of residuals based on a comparison of variance-covariance obtained by a sample group and estimated parameters	≤ 0.08
RMSEA ^b Steiger (2007)	$\sqrt{\frac{\chi^2 - df}{df(N-1)}}$	The values of fitness between the model form and covariance matrix of population	≤ 0.07
CFI ^b Hu and Bentler (1999)	$1 - \frac{\max\{(\chi^2 - df)/N, 0\}}{\max\{(\chi^2 - df)/N, (\chi^2_B - df_B)/N\}}$	Comparison of the χ^2 values among the models which are a logical subset of each other to test a specification on whether sub-models are inaccurate from the main models	≥ 0.90
TLI ^b Hooper et al. (2008)	$\frac{(\chi^2_B/df_B) - (\chi^2_T/df_T)}{(\chi^2_B/df_B) - 1}$	Comparison of the χ^2 values among the models which are a logical subset of each other to test a specification on whether sub-models are inaccurate from the main models	≥ 0.80

Note:

^a r_{jk} = standardized residuals from a covariance matrix with j rows and k columns; p^* = number of nonduplicated elements in the covariance matrix.

^b χ^2_T = χ^2 values of the target model; df_T = df of the target model; χ^2_B = χ^2 values of the baseline model; df_B = df of the baseline model.

hypothesis by evaluating a model fit and considering the significant degrees of freedom. Its notification of non-significance employs a model of fitness of the sample groups (A.Bollen, 1989; Cheung and Rensvold R. B., 2002).

3. Research design

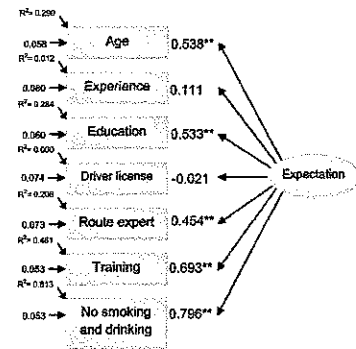
3.1. Conceptual framework

The study aims to confirm the indicators relating to the drivers of sightseeing buses that affect users' expectations (subjective risk). Seven indicators were obtained, comprising five indicators from the reviews of previous research on other vehicle types, namely age, experience, educational level, training, and drug abuse, and two other indicators, namely holding an appropriate driving license and driving skills pertaining to the route (hereafter referred to as route skills), which are conceivably considered by the authors as leading indicators that might affect the behaviors of drivers of sightseeing buses. Unlike normal bus drivers usually driving in the same routes each day, the focused attention on route skill attribute was demonstrated in this study as sightseeing bus drivers is expected to familiarize in different routes, in that they need to drive more carefully in the accident risk areas and have ability to suggest whether route should be avoided. The skilled drivers who can frame the route plans could affect users' perception on safety confidence along the journey. Likewise, most customers are children who have less self-help than adults when an accident occurs, so it is important to select skilled and knowledgeable drivers to reduce accident risks. The similarities/differences of expectations of drivers of sightseeing buses were compared for urban and rural residents as illustrated in Figs. 3–4.

These attributes have been found in relevant to the studies on normal buses. From prior analysis, all the above attributes should also be related to the sightseeing cases because of the similarity of vehicle size and the number of passenger that lead to the same driver responsibility. However, since there are no studies on sightseeing bus for school trips, it is important to study if this latter type of trips is affected by the same attributes as normal buses and if there are some new attributes that can be relevant to the top of those listed above.

3.2. Sampling, study area and surveying

The province of Nakhon Ratchasima was selected as the study area. The province had 495,656 students (3.77% of Thai students) in



$\chi^2 = 33.890$, $df = 13$, $p = 0.0013$, $\chi^2/df = 2.61$, RMSEA = 0.058, CFI = 0.988, TLI = 0.962, SRMR = 0.026
** Significant at $p < 0.01$ and standardized coefficient obtained using Mplus 6.12

Fig. 3. CFA for the urban area. $\chi^2 = 33.890$, $df = 13$, $p = 0.0013$, $\chi^2/df = 2.61$, RMSEA = 0.058, CFI = 0.988, TLI = 0.962, SRMR = 0.026 ** Significant at $p < 0.01$ and standardized coefficient obtained using Mplus 6.12

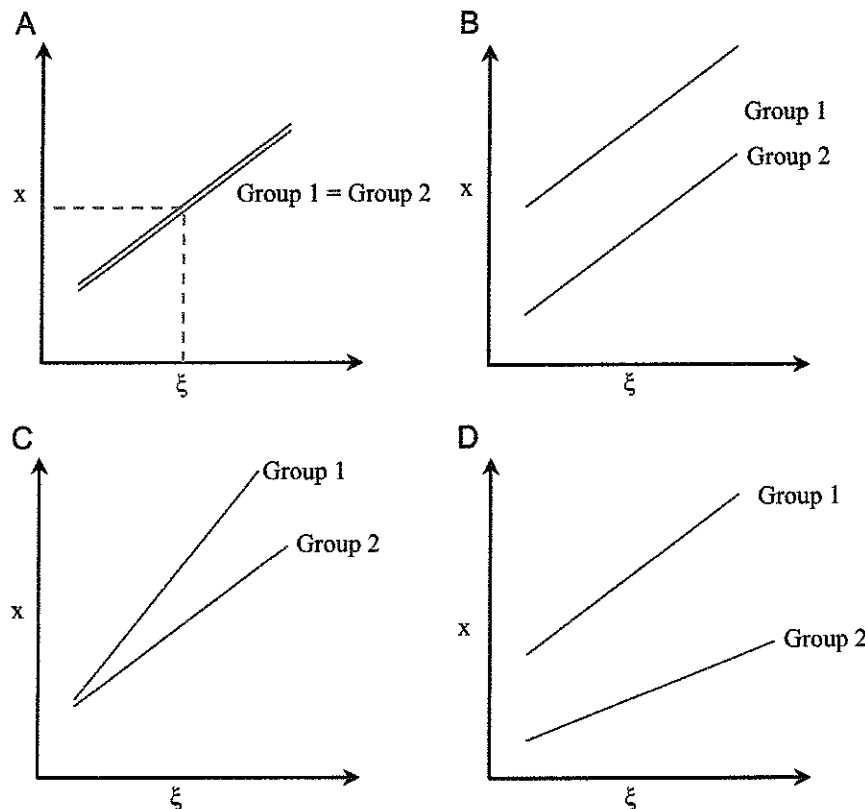


Fig. 2. Graphical depictions of various forms of measurement invariance and noninvariance (Brown, 2006). (A) Equal loadings and intercepts. (B) Equal loadings, unequal intercepts. (C) Unequal loadings, equal intercepts. (D) Unequal loadings and intercepts.

2011, which is second only to the number of students in the capital city of Bangkok (Ministry of Education, 2011). The province, one of 77 in Thailand, includes the largest city (Nakhon Ratchasima) in the northeast of the country and is the country's third largest region, covering more than 20,494 km². Traveling from the city of Nakhon Ratchasima to other regions in the province is convenient as the province is the gateway to the country's northeast and approximately 259 km from Bangkok. The province has many tourist attractions that are seemingly suitable for school field trips in terms of history, geography, community studies, and science.

The survey was carried out by holding face-to-face interviews because this format provides clear results and can be used to efficiently select sample groups corresponding to the study purpose. Additionally, the survey participant can be observed simultaneously, improving the accuracy of data collection within the survey schedule. The study area was classified into seven zones covering the overall provincial area. There were 966 participants in the survey, including teachers and parents. The questionnaire asked the participants to score their expectations of sightseeing bus drivers related to seven indicators with the question 'I think it is important that ...'; each expectation was scored on an integer scale of 1–5, with a value of 1 being the 'unimportant', 3 'immaterial', and 5 'very important', and the seven questions relating to the seven indicators were as follows:

- Q1: Drivers should be between the ages of 30 and 45 years
Q2: Drivers should have at least 5 years of driving experience

Q3: Drivers should have no lower than a secondary-school qualification

Q4: Drivers should possess a license appropriate for the vehicle

Q5: Drivers should have route knowledge and route skills

Q6: Drivers should attend training courses arranged by companies and/or other organizations

Q7: Drivers should not drink or smoke while driving

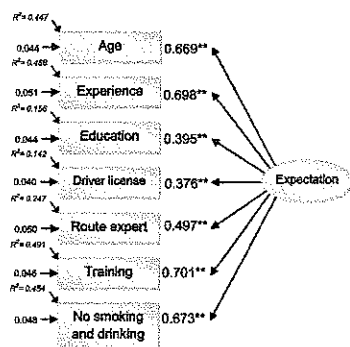
4. Results

4.1. Descriptive statistics

Survey results on the expectations of bus drivers are presented for 966, or 96.6% of the 1000 survey participants (respondents); incomplete questionnaires were excluded. Table 4 shows that 47.31% of respondents were male. In terms of education levels, respondents had highest levels of education corresponding to primary school (10.04%), Matayom 3 (secondary school, grade 9) (10.04%), Matayom 6 (high school, grade 12) or a vocational certificate (15.94%), diploma certificate (4.14%), a bachelor's degree (53.93%), and higher than a bachelor's degree (9.73%). In terms of status, 54.24% and 45.76% of participants were teachers and parents respectively. Finally, 74.84% of respondents were rural residents and 25.16% were urban residents. Due to Thailand's Education Expansion Policy aiming to provide equal access education for all areas, the number of rural schools was significantly greater than urban schools leading to a larger rural sample group.

Table 5 illustrates the scores of the user's expectations of bus drivers obtained by interviewing school board members, teachers and parents. The results were categorized into urban and rural zones. It was found that in urban areas, the indicator 'route skills' had the highest average score of 4.74 (SD=0.535), followed by 'the driver holding the appropriate license for the vehicle' (average=4.70, SD=0.484); meanwhile, the lowest average score was for 'education not lower than secondary school' (average=4.21, SD=0.910). In rural areas, there are two indicators had the highest average score, 'route skills' again (average=4.65, SD=0.638) and 'the driver holding the appropriate license for the vehicle' (average=4.65, SD=0.667). Akin to the urban zone, 'education not lower than secondary school' had the lowest average score (average=4.02, SD=1.054).

For Table 6, a test of hypothesis "whether expectations of each indicator differ between urban and rural areas" was conducted using a *t*-test. The first step involved examination of equality of variances of each question by Levene's Test and found a significant



$\chi^2 = 33.890$, $df = 13$, $p = 0.0013$, $\chi^2/df = 2.61$, $RMSEA = 0.058$, $CFI = 0.988$, $TLI = 0.962$, $SRMR = 0.026$
** Significant at $p < 0.01$ and standardized coefficient obtained using Mplus 6.12

Fig. 4. CFA for the rural area. $\chi^2 = 33.890$, $df = 13$, $p = 0.0013$, $\chi^2/df = 2.61$, $RMSEA = 0.058$, $CFI = 0.988$, $TLI = 0.962$, $SRMR = 0.026$ ** Significant at $p < 0.01$ and standardized coefficient obtained using Mplus 6.12

Table 4
Characteristics of the sample group.

Samples categories	Urban area		Rural area		Total	
	N	Percent	N	Percent	N	Percent
Gender						
Female	125	51.44	384	53.11	509	52.69
Male	118	48.56	339	46.89	457	47.31
Education						
Primary school	11	4.53	49	6.78	60	6.21
Matayom 3 (Grade 9)	14	5.76	83	11.48	97	10.04
Matayom 6 (Grade 12) /vocational certificate	32	13.17	122	16.87	154	15.94
Diploma	18	7.41	22	3.04	40	4.14
Bachelor's degree	155	63.79	366	50.62	521	53.93
Higher than bachelor's degree	13	5.35	81	11.20	94	9.73
Status						
Teacher	122	50.21	402	55.60	524	54.24
Parent	121	49.79	321	44.40	442	45.76
Total	243		723		966	

Table 5
Mean and standard deviation.

Qualifications of drivers	Urban area		Rural area		Total	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
Age of 30–45 years	4.43	0.635	4.27	0.836	4.31	0.793
Driving experience of at least 5 years	4.44	0.589	4.49	0.730	4.48	0.697
Education to at least Matayom 3 (Grade 9)	4.21	0.910	4.02	1.054	4.07	1.023
Having license appropriate for the vehicle	4.70	0.484	4.65	0.667	4.66	0.626
Having route skills	4.74	0.535	4.65	0.638	4.67	0.614
Being trained by the company or other agencies	4.47	0.712	4.39	0.834	4.41	0.805
No smoking or drinking	4.66	0.804	4.46	0.998	4.51	0.957

Table 6
Independent samples test.

Qualifications of drivers	Levene's test for equality of variances ^a		t-test for equality of means ^b			Do the expectation scores differ between urban and rural areas? ^c
	F	p-value	t	df	p-value	
Age of 30–45 years	12.27	0.000 ^{***}	3.14	544.2	0.002 ^{***}	Yes
Driving experience of at least 5 years	7.40	0.007 ^{***}	–1.06	510.9	0.290	No
Education to at least Matayom 3 (Grade 9)	4.46	0.035 ^{**}	2.46	2.65	477.2	No
Having license appropriate for the vehicle	8.40	0.004 ^{***}	1.42	571.5	0.156	No
Having route skills	10.86	0.001 ^{***}	1.98	491.2	0.049 ^{**}	Yes
Being trained by the company or other agencies	7.65	0.006 ^{***}	1.43	482.5	0.152	No
No smoking or drinking	19.21	0.000 ^{***}	3.14	512.0	0.002 ^{***}	Yes

^a H_0 : Variance of expectation score in rural area = Variance of expectation score in urban area.^b Equal variances not assumed.^c H_0 : Average expectation score in rural area = Average expectation score in urban area.

*** Significant at 95% confident.

Table 7
Matrix correlation, Cronbach's Alpha, KMO index and Bartlett's test of sphericity.

Indicators		Matrix correlation						
		f1	f2	f3	f4	f5	f6	f7
Urban area								
f1	Age of 30–45 years	1						
f2	Driving experience of at least 5 years	0.053	1					
f3	Education to at least Matayom 3 (Grade 9)	0.507 ^{***}	0.020	1				
f4	Having license appropriate for the vehicle	–0.093	0.170 ^{**}	–0.140 [*]	1			
f5	Having route skills	0.324 ^{***}	0.016	0.199 ^{***}	0.128 [*]	1		
f6	Being trained by company or other agencies	0.336 ^{***}	0.126 [*]	0.403 ^{***}	0.081	0.304 ^{***}	1	
f7	No smoking or drinking	0.441 ^{***}	–0.078	0.414 ^{***}	–0.056	0.485 ^{***}	0.545 ^{***}	1
Cronbach's alpha = 0.661, KMO = 0.708, Bartlett's test of sphericity: $\chi^2 = 343.898$, $df = 21$, $p < 0.0001$								
Rural area								
f1	Age of 30–45 years	1						
f2	Driving experience of at least 5 years	0.465 ^{***}	1					
f3	Education to at least Matayom 3 (Grade 9)	0.517 ^{***}	0.280 ^{**}	1				
f4	Having license appropriate for the vehicle	0.251 ^{**}	0.412 ^{***}	0.087 [*]	1			
f5	Having route skills	0.259 ^{***}	0.394 ^{***}	0.191 ^{***}	0.420 ^{***}	1		
f6	Being trained by company or other agencies	0.472 ^{***}	0.398 ^{***}	0.467 ^{***}	0.248 ^{***}	0.343 ^{***}	1	
f7	No smoking or drinking	0.448 ^{***}	0.407 ^{***}	0.355 ^{***}	0.254 ^{***}	0.332 ^{***}	0.601 ^{***}	1
Cronbach's alpha = 0.794, KMO = 0.811, Bartlett's Test of sphericity: $\chi^2 = 1448.177$, $df = 21$, $p < 0.0001$								

* Pearson correlation is significant at the 0.05 level (two-tailed).

** Pearson correlation is significant at the 0.01 level (two-tailed).

difference of variances of expectation scores between all items with a 95% confidence interval. According to the t-test results, expectations of drivers were disparities between urban and rural groups in three indicators including "Age of 30–45 years", "Having route skills", and "No smoking or drinking" at 95% confidence level with p -values of 0.002, 0.049, and 0.002, respectively. Hence, the study required multi-group confirmatory factor analysis to confirm components of users' expectations of drivers in each area.

In Table 7, Cronbach's alpha was used to measure the reliability of the tool, and values greater than 0.5 were accepted (George and

Mallery, 2003). In both urban and rural areas, Cronbach's alpha coefficients of observed indicators are more than 0.5. The correlation analysis results of the seven observed variables in the measurement model of the user's expectation of bus drivers illustrate that the correlations among all 21 pairs of variables are not equal to zero at a significance level of 0.01 with positive coefficients in the range of 0.126 to 0.545. 0.087 to 0.601 and for urban and rural areas, respectively. Therefore, the findings elicit the actual relations among observed variables with the same directions (i.e., all coefficients were positive). Considering the

Table 8

Tests of measurement invariance of users' Expectations in urban and rural areas.

Model	χ^2	df	χ^2/df	p	RMSEA (90% CI)	CFI	TLI	SRMR
1. Equal form	33.890	13	2.61	0.0013	0.058(0.034–0.082)	0.988	0.962	0.026
2. Equal factor loadings ^a	183.204	24	7.63	< 0.0001	0.117(0.102–0.133)	0.910	0.842	0.089
3. Equal indicator intercepts ^a	195.765	28	6.99	< 0.0001	0.111(0.097–0.126)	0.905	0.857	0.084
4. Equal indicator error variance ^a	201.875	29	6.96	< 0.0001	0.111(0.097–0.120)	0.902	0.858	0.085

Note: χ^2 = chi-squared statistic; df = degrees of freedom; p = level of significance; RMSEA = root mean square of approximation; CFI = comparative fit index; TLI = Tucker–Lewis index; SRMR = standardized root mean square residual.

^a Model is inconsistent with empirical data.

results of Bartlett's test of sphericity, as popularly applied in testing whether a correlation matrix remains an identity matrix, the value of chi-square in rural areas is 1448.177 ($df=21$, $p < 0.0001$), and the correlation therefore statistically differs from zero at a significance level of 0.01. These results are consistent with the analysis results of the Kaiser–Meyer–Olkin (KMO) index, which approaches 1 ($KMO=0.811$). In urban areas, chi-square was 343.898, and the correlation was therefore not equal to zero ($df=21$, $p < 0.0001$) at a significance level of 0.01; thus, the result is in line with the result of the KMO index approaching 1 ($KMO=0.708$). The findings indicate that the correlation matrix of observed variables is not an identity matrix with adequate relationships among variables in conducting the CFA to test the construct validity.

4.2. Confirmatory factor analysis

CFA of users' expectations of bus drivers using Mplus version 6.12 showed that the measurement model has construct validity; statistical values were chi-square = 33.890, $df=13$, $p=0.0013$, chi-square/ $df=2.61$, RMSEA = 0.058, CFI = 0.988, TLI = 0.962, and SRMR = 0.026. When comparing such values with criteria listed in Table 3, all statistical values of the measurement model are judged to be within the range of agreement; hence, it is concluded that the model of users' expectation of bus drivers in the form of the CFA theoretically has construct validity. According to Figs. 3 and 4, the relationships between variables in the model are comprehensively explained as follows. The expectation model can be deduced from seven observed variables: (1) age, (2) experience, (3) educational level, (4) license ownership, (5) route skills, (6) training, and (7) no drinking or smoking. After obtaining the urban and rural models independently, only five variables are found to exist in the urban model at a significance level of 0.01; thus, such variables denoted as indicators specify the expectations of bus drivers in urban areas. In terms of factor loading coefficients (β), the observed variable with the highest factor loading is no drinking or smoking ($\beta=0.796$), followed by training ($\beta=0.693$), age ($\beta=0.538$), educational level ($\beta=0.533$), and route skills ($\beta=0.454$) as the indicator with the lowest value.

For rural areas, all seven variables statistically indicate the user's expectations of bus drivers in rural areas with a confidence interval of 99%. In terms of factor loading coefficients (β), the maximum factor loading was found for training ($\beta=0.701$), followed by experience ($\beta=0.698$), no drinking or smoking ($\beta=0.673$), age ($\beta=0.669$), route skills ($\beta=0.497$), educational level ($\beta=0.395$), and license holder ($\beta=0.376$).

4.3. Invariance analysis

In examining invariance in the measurement model, for urban and rural groups, the study tests (1) invariance in the model (equal form), which refers to the number of variables and forms of variables in both groups and can be referred to as 'configural

invariance'; (2) invariance in factor loadings or equal factor loadings that are generally exemplified as 'metric invariance' or 'weak factorial invariance'; (3) invariance in indicator intercepts, which is also known as 'scalar invariance' or 'strong factorial invariance'; and (4) invariance in the indicator residual or 'strict factorial invariance' (Brown, 2006). The analysis results based on Multi-group CFA are demonstrated in Table 8 as following details.

In test 2, which measured invariance of the structural parameters in factor loadings of observed variables under equal form (test 1), the χ^2 value of 183.204 insignificantly differs from zero at the 0.05 level ($p < 0.0001$), with $\chi^2/df=7.63$, RMSEA = 0.117, CFI = 0.910, TLI = 0.842, and SRMR = 0.089. These values indicate that the model unfitted the empirical data. Thus, under invariance of the model form, the parameters in the factor loading matrix of observed variables in a measurement model of users' expectations of bus drivers manifestly prescribe the dissimilarities of invariance between zones.

In test 3, which investigates the invariance underlying test 2 together with the invariance of indicator intercepts of observed variables, the χ^2 value is 183.204, and the correlation is insignificantly different from zero at the 0.05 level ($p < 0.0001$), with $\chi^2/df=6.99$, RMSEA = 0.111, CFI = 0.905, TLI = 0.857, and SRMR = 0.084. These indicators confirm the unfit of the model to the empirical data. It is thus implied that under invariance of indicator intercepts of observed variables, a measurement model of users' expectations of bus drivers has discrepancies in variance between areas.

Test 4, as a measurement of invariance in test 3 together with invariance of parameters in the variance–covariance matrix of the residuals of observed variables, has a χ^2 value of 201.875, which significantly differs from zero at the 0.05 level ($p < 0.0001$), with $\chi^2/df=6.96$, RMSEA = 0.111, CFI = 0.902, TLI = 0.858, and SRMR = 0.085; these values indicate not good fitting of the model to empirical data. Consequently, under invariance of the model parameters in the variance–covariance matrix of the residuals of observed variables, a measurement model of users' expectations of bus drivers seemingly elicits the differences of variance between areas.

In conclusion, the measurement model of users' expectations of bus drivers statistically has invariance similarities between areas in terms of the model form but dissimilarities between areas in terms parameters in the factor loading matrix of observed variables; meanwhile, there is variance in indicator intercepts and parameters in the variance–covariance matrix of the residuals in the measurement of observed variables.

5. Discussion and conclusion

This study attempts to confirm the potential indicators affecting the users' expectations of drivers of sightseeing buses by surveying 996 respondents. CFA of urban and rural zones indicates the construct validity of the model consistent with empirical data according to seven indicators: (1) age; (2) experience;

(3) educational level; (4) license holder; (5) route skills; (6) training; and (7) no drinking or smoking.

5.1. Age

Driver's age indicator was confirmed by CFA as an indicator expected by urban and rural users. Its priority given by users from both areas was similar in the third rank thus consistent with the study of Chen and Chen (2011) found that truck drivers age below 25 and over 50 have a greater risk of accidents. The indicator was also mentioned in other studies such as Phillips and Sagberg (2012), Chung and Wong (2011), Karacasu and Er (2011), Clarke et al. (2006), and Lourens et al. (1999).

5.2. Experience

CFA confirmed driver's experience indicator as one of users' expectations as similar to the study of Tseng (2012) and Clarke et al. (2006). Just for rural area, users gave the priority of indicator in the second rank. A reason is that such area lacks the skilled drivers since most of them move to work in urban area. So, urban users did not expect proficient bus drivers as believed that all of the hired drivers had driving experiences.

5.3. Educational level

CFA confirmed that education indicator was expected from urban and rural users as one of driver qualification. In urban area, users gave the priority to the indicator in the fourth order; while it was in the sixth rank in rural areas. It may be that users expected drivers to know only traffic rules which do not need to have a high level of academic knowledge as consistent with the study of Phillips and Sagberg (2012), who found that academic level of a driver only slightly affected the driver's behavior.

5.4. License holder

License holder indicator was confirmed by CFA only in rural areas as shown in the seventh rank. It is more likely that users believed drivers who have license must be required and selected in recruitment process by bus companies in urban areas, thus being different from rural areas in which such process cannot be implemented due to lack of drivers with local driving license together with operation of bus services provided by small companies. Drivers holding a license usually choose to work with large companies according to job security reason.

5.5. Route skills

The confirmation of route skills indicator was indicated by CFA as similar to the study of Tseng (2012). The indicator was given the priority in the fifth order from users of both areas since sometimes a field trip travel may need the route skills of drivers in challenge road such as mountain route, etc.

5.6. Training

Training indicator was confirmed by CFA in both rural and urban areas that was prioritized in the second rank for urban area and in the first rank in rural areas as similar to the study of Peck (2011) that found that training possibly tends to increase the self-perception of drivers, promote cautious driving, and help drivers to efficiently solve problems.

5.7. No drinking or smoking while working

CFA confirmed indicator related to no drinking or smoking while working in urban and rural areas. The first priority of indicator was presented in urban areas but it was in the fourth rank in rural areas. The drinking and smoking behaviors of drivers can be viewed into two ways: (1) from the perspective of safety as mentioned by Chang and Yeh (2004) and Abdel-Aty and Abdelwahab (2000) and (2) to set a good example to students.

According to the results, sightseeing bus companies should recruit and select drivers who possess driving qualifications consistent with the users' needs as follows. (1) Provide bus drivers with an appropriate age range 30–45 years. (2) Consider experience in driving school buses of at least 5 years. (3) Provide bus drivers with suitable levels of education at least Matayom 3 (Grade 9). (4) Rigorously check licenses appropriate for the vehicle. (5) Match difficult routes with skilled bus drivers, especially routes with higher rates of accidents. (6) Arrange driver training relating to, for example, safe driving, bus maintenance, customer service, and foreign languages. (7) Select bus drivers who do not smoke or drink, thus creating a good image for the company.

With regard to the analysis of invariance between urban and rural groups, the measurement model of users' expectations of bus drivers has similarity to the model form but discrepancies of invariance between zones in relation to the parameters in the factor loading matrix of observed variables; nevertheless, variance in indicator intercepts and parameters in the variance-covariance matrix of the residuals in measuring observed variables coexisted in the model. Hence, the variable structures relating to user expectations of drivers of sightseeing buses are analogous in urban and rural areas with only some indicators being given a dissimilar priority depending on the specific conditions of each areas similar to the study of Bordagaray et al. (2013) that found the dissimilarity of perception on bus service quality in each line depending on user characteristics. Román et al. (2014) also indicated the significant difference of quality perception of urban and interurban passengers.

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