

Quality variations of psychometrics for cross-cultural research

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ABSTRACT

The study examined the quality variations of psychometrics for cross-cultural research by considering structural validity, discrimination, and reliability. Participants consisted of 450 undergraduate students from Thailand, Indonesia, and Australia by using random sampling process. The instruments were driving aggression evaluative forms which contain 0.85 alpha coefficients. For statistics, researchers used mean, standard deviation, correlation coefficient among point-per-questions and total score, and Cronbach's alpha. The result showed that the structural validity of the original evaluation form which was translated once from Thai to English and another one which was translated twice including Thai to English and English to Indonesian had similar total components and cumulative percentiles. Discrimination and correlation among point-per-questions met the criteria without differences. Every form had the level of reliability from Cronbach's alpha analysis greater than the criteria.

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1. INTRODUCTION

For many decades, cross-cultural research study has been continuing, burgeoning in the areas of behavioral and social sciences, such as psychology, sociology, management, marketing, and political science. Particularly, the number of psychological studies has been consistently increasing with the focus being on examining similarities and differences across cultures [1]. In psychology, cross-cultural study is the apparent and systematic comparison among psychological variables in various cultural conditions to identify characteristics, origins, and processes that exhibit behavioral differences [2]. As culture can define behaviors, expressions, utterances, and relationship [3], cultural differences result from physical, environmental, and situational differences which affect individual behaviors [4], [5]. All these lead to academic deviation in concepts, thoughts, and definitions in different cultures. Although there is no official agreement upon these concepts, the issue itself exhibits controversiality and misunderstanding among researchers [6].

The instruments for cross-cultural research are considered important. Many attempts to study the quality of the instruments, such as: i) Navigating cross-cultural research methodological and ethical considerations [7]; ii) A methodological guide for translating study instruments in cross-cultural research (adapting the 'connectedness to nature' scale into Chinese) [8]; iii) Towards cross-cultural environmental psychology (a state-of-the-art review and recommendations) [9]; iv) Optimism-pessimism, conspiracy theories and general trust as factors contributing to COVID-19 related behavior a cross-cultural study [10].

There are various definitions of "culture" in general. However, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) defines "culture" holistically. "Culture" refers to a "set of spirits, objects, wisdom, and emotions of society or people" including arts, literature, way of life, social, value system, traditions, and beliefs [11].

The idea of cross-cultural study originated from Greece during the medieval period [11]. However, the systematic way of cultural study came from humanity sciences and the aim of this study was to understand human differences and cultural factors/conditions that affected human behaviors [11]. The idea of cross-cultural study never fails to accept identity, personality, and ethnicity. The fundamental agreement of the research tends to compare things visually, even though it is distinctively different. Nowadays, human research can proceed through cross-cultural methods to compare different cultures boundlessly. This type of research can focus on targets systematically instead of trying to answer the probability and causes of cultural changes [12].

Cross-cultural study has become considered as a new form of psychological and behavioral science in U.S. and European countries in the past decade. This type of study supports the application of behavioral sciences which makes it beneficial and universal. Cross-cultural study is a part of mainstream psychology and plays a huge role in behavioral studies. Moreover, the basic idea of sociopsychology, research methodology, and data analysis can be applied to cross-cultural studies as well [13]. Apart from that, cross-cultural studies can be done in both quantitative and qualitative ways depending on the scope of that topic. For quantitative research, it refers to the structural framework which researchers would like to explore. On the other hand, qualitative research is more open to finding answers [14]. However, any types of research would require effective instruments.

Further, cross-cultural research has some important points. Firstly, theories and information are based on behavioral references. Secondly, the reference summary is limited as it is influenced by culture. Thirdly, the results are restricted only in one culture. The next consideration is related to problems in comparisons between cultures. Finally, limitations in developing tools that are suitable for all cultures must be considered. This study introduces the concepts of cross-cultural research and adapting psychometrics and measurement instruments for cross-cultural research and provides an overview of the methodological issues and best practices for cross-cultural adaptation of psychological instruments. Although the development of cross-cultural test adaptation methodology has advanced in recent years, the discussion is often pitched at an expert level and requires an advanced knowledge of statistics, psychometrics, and scientific methodology [15]. Bias and equivalence are key concepts in the methodology of cross-cultural studies. Bias is a generic term for any challenge of the comparability of cross-cultural data. Bias leads to invalid conclusions. The demonstration of equivalence (lack of bias) is a prerequisite for any cross-cultural comparison [16].

For psychological research, quality of instruments is crucial and contributes to the validity of the research. Some of the works might establish correlation between independent and dependent variables. Moreover, the research itself also aims to apply the results to other samples without complete conclusions. Researchers need to focus on the accuracy, validity, and other factors that could affect research validity, in both internal and external aspects [17]. Good psychometrics will establish internal validity, especially for cross-cultural studies which involve comparison among different samples in various contexts [17]. The target psychometrics need to be valid and equivalent. If the topic is about communication or non-verbal interpretation, the cultural comparison will be preceded more easily than the one with linguistic components. In general, to translate one instrument into a different language is insufficient in terms of measurement [3]. To illustrate this point, cultural differences are the main factors that affect instruments in different aspects including time, cultural effects, perspectives, and types of measurement [3]. Accordingly, for cross-cultural studies, the inspection of relations among instruments in different languages is essential [3].

The instruments for cross-cultural studies are designed systematically for collecting various data in different contexts, cultures, and others research instruments. Furthermore, to create effective instruments for cross-cultural studies, there are three ways including designing a new one, using a current one, and adjusting a current one for suitability [18]. In this study, researchers designed a new instrument of self-report which can be categorized by rank order method, scale method, ratio data method, and other criteria [19]. However, to measure internal characteristics is something innate, there are different statistical scales which are applicable including the Thurstone scale, the Likert scale, the Guttman Scale, and other scales [20], [21].

The qualitative comparison among psychometrics in this cross-cultural research mainly uses driving aggression evaluative forms. The reason is that humanity sciences and cross-cultural studies in different cultures agree that aggression is a universal behavior and exists in every society. Although every culture contains similar biological components, aggression is still manageable in general. For all cultures, this factor is different due to the unique actions, motivation, and conditions [22]. Driving aggression could symbolize different interpretation of similar cultures which supports instrument comparison in cross-cultural study and validate the results of it as well. This component can control the probability of discrepancy that affects internal validity also. Consequently, the present study aimed to study quality variations of psychometrics for cross-cultural research by considering structural validity, discrimination, and reliability. Moreover, the implication of this study contributes to the development of tools and practical psychometrics for cross-cultural studies.

2. RESEARCH METHOD

The present study recruited 450 undergraduate students from three universities in three different countries including Mahasarakham University (Thailand), Indonesia University of Education (Indonesia), and Monash University (Australia). Even though the study would have been more effective if it included 1,000 participants, the results using parameters to gain the data from 100 students is still sufficient [23]. There are two aspects of sample size to consider which can cause variation. If two groups have different variations and the number of participants is too small (30 samplers in total), the critical value would be measured by using Z-statistic instead. In contrast, if the groups of samplers are large (more than 30 samples each), the process is more effective [24]. However, in this study there is factor analysis to compare structural validity in psychometrics when being used for cross-cultural study. Although the process itself is suitable for large groups of samplers, qualified participants between 100-200 people are acceptable if the factors are clear. For instance, if the factors are comprised with 0.80 loadings and 0.5 communalities, these factors would be acceptable [25].

The instrument for this research is the driving aggression evaluative form (ADB-21 Inventory). Aggressive driving behaviors are considered universal and can be found in any culture. The instrument itself is focusing personal thoughts, verbal expression, emotions, and driving behaviors which intend to affect people negatively in both physical and mental states.

The instrument was the 21-item self-report on a 6-point Likert scale. Researchers apply the theory of aggressive driving behaviors into the instrument as well. There was 0.85 reliability overall. For the English version, the translation process was employed and preceded from Thai version. After that, the instrument was translated back to Thai language by experts before having final inspection in similarity. If differences were found, then adjustments were employed to validate the instrument and researchers rechecked it again for precision. This process paid attention to the standard, politeness, and cultural norms presents among the sample. For the Indonesian version, the translation process was employed and preceded from the Thai version. After that, the instrument was translated back to Thai language by experts before having final inspection in similarity. If differences were found, then adjustments were employed to validate the instrument and researchers rechecked it again for precision. This process too paid attention to the standard, politeness, and cultural norms. Apart from those, the instrument itself also contained general information such as gender, year of study, learning outcome, driving ability, driving experiences, and record of accidents.

The researchers used Initial Eigen values to measure component factors of structural validity among the instruments. This process is often used to measure structural equality in cross-cultural studies, with internal structure being one of the main techniques to check the instruments for target cultures [13], [25]. Also, the study applied the item total correlation coefficient among each question and total score, alpha coefficient for measuring discrimination of the instruments, as well as one-way analysis of variance (ANOVA) for measuring differences between discrimination in the instruments of each country [26].

3. RESULTS AND DISCUSSION

For structural validity of instruments that were used in Thailand, the translated version from Thai to English for Australian participants, and the twice translated version from Thai to English and English to Indonesian for Indonesian participants, the results are shown in Table 1. The table shows that the total components of six original instruments that are used in Thailand are located between 0.86–9.03, and the total cumulative percentage was 73.93. For the translated version from Australia, the total component is between 1.15–7.96 and the cumulative percentage was 79.95. For the twice translated version from Indonesia, the total component was between 1.22–6.80 and cumulative percentage is 68.86 in total.

Table 1. The results for structural validity

Component	Thailand			Indonesia			Australia		
	Total	% S ²	Cumulative %	Total	% S ²	Cumulative %	Total	% S ²	Cumulative %
1	9.03	43.02	43.02	6.80	32.39	32.39	7.96	37.92	37.92
2	1.79	8.54	51.56	2.22	10.58	42.96	2.51	11.93	49.85
3	1.58	7.50	59.06	1.64	7.81	50.78	2.19	10.44	60.29
4	1.22	5.79	64.85	1.33	6.32	57.09	1.69	8.05	68.34
5	1.05	4.99	69.84	1.25	5.96	63.05	1.29	6.12	74.46
6	0.86	4.09	73.93	1.22	5.81	68.86	1.15	5.49	79.95

For discrimination of instruments that were used in Thailand, the translated version from Thai to English for Australian participants, and the twice translated version from Thai to English and English to Indonesian for Indonesian participants, the results are shown in Table 2. The table shows that item total

correlation of each question and total score has 0.39–0.76 of discrimination which was 0.60 on average. For the translated version from Australia, the discrimination is between 0.21–0.80 with 0.53 on average. For the twice translated version from Indonesia, the discrimination was 0.26–0.65 with 0.49 on average.

The results from variation analysis are shown in Table 3. The table reveals that the discrimination of 21 items from three countries has no significant difference at 0.5. For reliability of instruments that are used in Thailand, the translated version from Thai to English for Australian participants, and the twice translated version from Thai to English and English to Indonesian for Indonesian participants, the results from using Cronbach's alpha is shown in Table 4. The table shows the original instrument from Thailand has the highest reliability which is 0.93. The second highest is the translated version from Australia with 0.90, and the lowest is the twice translated version from Indonesia with 0.89.

Table 2. Item total correlation of each question and total score

Items	Corrected item-Total correlation		
	Thailand	Indonesia	Australia
1	.54	.31	0.32
2	.48	.52	0.67
3	.39	.31	0.28
4	.66	.51	0.45
5	.61	.35	0.64
6	.49	.55	0.21
7	.58	.52	0.43
8	.68	.61	0.46
9	.76	.46	0.50
10	.68	.47	0.70
11	.56	.41	0.40
12	.50	.59	0.72
13	.68	.66	0.44
14	.72	.42	0.73
15	.48	.52	0.45
16	.66	.58	0.67
17	.72	.26	0.75
18	.43	.46	0.56
19	.62	.60	0.54
20	.72	.62	0.68
21	.69	.65	0.80
Mean	.60	.49	.53
S.D. (S.E. of correlation)	.10	.12	.18

Table 3. The results from variation analysis for comparing discrimination of three countries

	Sum of Squares	df	Mean Square	F	Sig.
Between groups	.12	2	.06	3.14	.051
Within groups	1.20	60	.02		
Total	1.33	62			

Table 4. Cronbach's alpha analysis for measuring reliability of participants from three countries

Cronbach's Alpha Coefficient		
Thailand	Indonesia	Australia
.93	.89	.90

He and Vijver [16] found that researchers needed to provide strategies to minimize bias and achieve equivalence that apply either to the design, implementation, or statistical analysis phase of a study. The need to integrate these strategies in cross-cultural studies is emphasized to increase the validity of conclusions regarding cross-cultural similarities and differences and rule out alternative explanations of cross-cultural differences. Similarly, Borsa, Damásio, and Bandeira [27] also found that the adaptation of psychological instruments is a complex process that requires a high methodological rigor. Because there is no consensus in the literature about its steps, some considerations regarding the validation of the adapted psychological instruments are also presented. In this stage, the researcher discusses some aspects regarding the factorial structure of the instrument, which might be evaluated through statistical procedures, such as exploratory and confirmatory factor analysis. The results are in accordance with the finding from Sousa and Rojjanasrirat [28] presenting that translation, adaptation, and validation of instruments or scales for cross-cultural research is very time-consuming and requires careful planning and the adoption of rigorous methodological approaches to derive a reliable and valid measure of the concept of interest in the target population.

It is essential that researchers who aim to conduct cross-cultural studies create equality among the instruments. For that reason, language inspection and proofreading are necessary [3]. In many countries, there are many researchers concerned with this issue such as the study of Dao-Tran *et al.* [29] which is about life quality and wellness of elderly women from Vietnam and Australia. Apart from that, there is a study by Özkan *et al.* [30] which is about driving habits. In this cross-cultural research, Özkan compared six countries in the scope of application, recognition, ability, safety, and driving speed. The study included participants from England, Natherland, Finland, Greece, Iran, and Turkey. There is also the study by Frambach *et al.* [31] on the topic of globalization in the context of problem-based learning. The study tends to explore the contribution toward self-directed learning. In this case, it is obvious that learning contexts are different in every culture. The data was collected from three different medical schools in Southeast Asia, the Middle East, and Europe, respectively. The result showed that problem-based learning is applicable in different cultural contexts. According to this result, it means that instruments need to have the same quality to be able to compare data from each culture effectively.

4. CONCLUSION

The study confirmed the structural validity of instruments (Thai and translated versions) that were used to collect data from Thai, Australian, and Indonesian participants have total component and cumulative percentage in a related value. The discrimination and item total correlation between each question and total score reach the criteria and has no difference among the three countries. The reliability from Cronbach's alpha reaches a high level in every instrument. Although the number is decreased as result of multiple translations, these three versions of psychometrics still have validity, discrimination, and reliability in a standard level of psychology. The cause of this beneficial outcome is about translation. Researchers obtained help from experts in translation as well as the back translation to inspect the quality of the language and correlation. If differences were found, an adjustment was made before re-translating it again. The process is always concerned about quality, politeness, appropriateness, and norms of that culture.

Additionally, the important suggestions for researchers to conduct cross-cultural research: i) The total component of factor have a total weight value reduced when there are many translations; ii) If there are many translations, discrimination value of psychometrics is not different; and iii) Reliability of the psychometrics will decrease when there are many translations even though it is still within the standard.

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