



# Development of Sexual Literacy Indicators Among Adolescents: Test of School Group Invariance

## Desarrollo de indicadores de alfabetización sexual en adolescentes: Prueba de Invarianza de Grupo Escolar

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### Contents

- 1. Introduction
- 2. Research Methodology
- 3. Result and Discussion
- 4. Discussion
- Bibliographic references

#### ABSTRACT:

The purposes of this study were to develop and test school group invariance of sexual literacy indicators among adolescents. The measurement was tested on 750 personnel from the Department of Health and Physical Education in Thailand. The data were collected using a self-report questionnaire, including personal data and the sexual literacy indicator scale. Frequency, percentage, mean and standard deviation, Cronbach's alpha coefficient, correlation analysis, and multi-group confirmatory factor analysis were used to analyze data. The results yielded that there are Five Factors in the sexual literacy indicator among adolescents: sex knowledge, understanding, sex access information, sex adversity, sex self-management, and sex adapt data information with high reliability, 0.83, 0.82, 0.84, 0.80 and 0.86 accordingly and the result of confirmatory factor analysis demonstrated that the sexual literacy indicator among adolescent model labeled a high quality of construct validity  $X^2 = 5.30$ ,  $df = 3$ ,  $p = 0.15$ ,  $X^2/df = 1.76$ ,  $RMSE = 0.02$ ,  $RMR = 0.00$ ,  $GIF = 0.99$ ,  $AGIF = 0.99$ )

**Keywords:** indicator, sexual literacy, confirmatory factor analysis, measurement invariance

#### RESUMEN:

Este propósito de este estudio es desarrollar y probar la invariabilidad grupal escolar del indicador de alfabetización sexual entre adolescentes. La medición se probó en 750 personas del Departamento de Salud y Educación Física de Tailandia. Los datos se recopilaron mediante un cuestionario de autoinforme que incluye datos personales y la escala del indicador de alfabetización sexual. La frecuencia, el porcentaje, la media y la desviación estándar, el coeficiente alfa de Cronbach, el análisis de correlación y el análisis factorial confirmatorio multigrupo se utilizaron para analizar los datos. Los resultados arrojaron que hay cinco factores en el indicador de alfabetización sexual entre los adolescentes: conocimiento sexual, comprensión, información de acceso sexual, adversidad sexual, autogestión sexual e información de datos de adaptación sexual con alta confiabilidad, 0.83, 0.82, 0.84, 0.80 0.86 en consecuencia, y el resultado del análisis factorial confirmatorio demostró que el indicador de alfabetización sexual entre los modelos de adolescentes etiquetaba una alta calidad de validez de constructo  $X^2 = 5.30$ ,  $df = 3$ ,  $p = 0.15$ ,  $X^2/df = 1.76$ ,  $RMSE = 0.02$ ,  $RMR = 0.00$ ,  $GIF = 0.99$ ,  $AGIF = 0.99$ ) y el indicador de alfabetización sexual entre adolescentes presentó una invarianza parcial estricta de género.

**Palabras clave:** indicador, alfabetización sexual, análisis factorial confirmatorio, invarianza de medición

## 1. Introduction

The social groups with which adolescents interact have changed from a family group and school friends to interacting with people of all ages and genders on social media. Adolescents are exposed to a lot of inappropriate language and behavior on TVs, phones and social media (National AIDS Prevention and Alleviation Committee, 2010), which expose them in danger of risky sexual behaviors and exploitations. UNESCO (2014) has identified major issues in sex education and sexual well-being among adolescents. Many adolescents learn about sex, contraception, and sexual health from their friends or get incorrect information from the internet.

Children are exposed to a lot of inappropriate dressing, vulgar language, and sexually explicit behavior on TV and the internet. These have led to children engaging in dangerous sexual practices, resulting in pregnancies and HIV and other sexually transmitted diseases, infections. More and more children are either the victims of sex crimes or even the perpetrators of sex crimes. Moreover, the government has to spend a lot of money (at least 300 million baht per year) to treat patients after illegal abortions

Among the males, only 52.9% used condoms when having sex for the first time, and only 50% of females had partners who used condoms. According to the Ministry of Public Health, childbirth from younger mothers aged 10 – 19 increased 16.5% of the youth population (Mahidol University Institute for Population and Social Research ,2016).

The Sexual Information and Education Council of the United States (SIECUS)

claims that the focus of sex education should not only be on sexual intercourse, but also sexual behaviors, sexual health, social and cultural rights. Sex education

should be spoken more openly and not only in the classroom. Nowadays, most children have mobile phones and constant access to the internet. Therefore, they are exposed to social media pressures, attitudes, and inappropriate influences.

Comprehensive sex education among adolescents will result in positive health behaviors. It showed in the result of a survey carried out in the United States between 1999 and 2004. During this period, the average number of babies born to unwed mothers had fallen from 62 to 41 per 1,000 births. 75% of teenagers are using birth control. There has been a 25 percent reduction in the number of cases of sexually transmitted diseases (Advocates for youth. 2006: 1). In another survey, the data were collected from three teenage groups in Europe and North America who were spending more time on social media, found out that the group which had the best information on sex and sexual behavior had the best results with less underage sex, pregnancies, and lower rates of sexually transmitted disease. (Meganello, J.A., 2008: 840).

For the reasons mentioned above, the researcher has developed a sexual literacy indicator for adolescents by studying the research of Nutbeam, D. (2009), Thiyaporn Kantathanawat, (2014), Chitraporn Boonthanom, (2014), Apicha Nomsira, (2015) and Jakkapong Prongprommarat & Krissana Kiddee (2018). The results yielded that there are five factors in the sexual literacy indicator among adolescents: 1) sex knowledge, 2) understanding, 3) sex access information, 4) sex adversity and sex self-management, and 5) sex adapt data information.

The testing of the invariance of sexual literacy indicators among three groups with different contexts can add information in estimating the error in measurement the developed indicators. This will be beneficial for the promotion of sexual intelligence of teenagers to have appropriate sexual behavior and teachers are able to manage the teaching of sex education for students effectively

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## **2. Research Methodology**

### **2.1. Population and sample**

Population is heads of the group of health education and physical education teaching at the high school level in Thailand year of 2017. The total number is 4,839 peoples. (Office of the Basic Education Commission. Online: 2017). The researchers determined the size of the sample using the criteria of Hair (Hair, et al., 2010 :102) wherein the size of the sample and the number of observable variables in Confirmatory Factor Analysis (CFA) which should be in the ratio of 10 – 20 per variable. In this research, 36 independent variables were observed. Therefore, the sample size must be used for at least 360 people, for the purpose of the model is strong in hypothesis testing

and are consistent with empirical data. In this study, the author defined the size of the sample equal to 750 people and sampling by multistage random sampling as follows:

Step 1. Random 10 Provinces by using the drawing from different regions are North, Northeast, Central Region, Southern, Bangkok Metropolitan Region.

Step 2. Random Heads of Health Education and Physical Education, each affiliated with 5 students in each school from each province by using drawing, the sample in the research of each affiliation was 250, the total number of 750 peoples

## 2.2. Research tool

The tools used in this research were questionnaires, containing personal information such as sex, education, work experience, and affiliation. A 5 level rating scale used to determine the appropriateness of indicators of sexual literacy, consists of 5 elements: 1) Knowledge about sex 2) Access to information about sex 3) Coping ability about sex 4) self-management ability about sex and 5) Application of knowledge and information about sex (Nutbeam, D. 2009; Thiyaporn Kantathanawat, 2014; Chitraporn Boonthanom, 2014; Apicha Nomsira, 2015 and Jakkapong Prongprommarat & Krissana Kiddee, 2018). The research tools were evaluated for content validity by five (5) experts on sex, psychology and measurement and assessment. The Index of consistency is between 0.8– 1.00, Discrimination is between 0.243 - 0.844 and Confidence is 0.93 (Table 1). Then, the researcher test the construct validity of 5 observed variables. The calculation is done by the calculation of construct reliability (CR) of latent variables and average variance extracted (AVE) (Table 2), and testing with confirmatory factor analysis by LISREL 9.10 and Goodness of Fit Index (Table 1)

**Table 1**  
Internal consistency reliability ( $\alpha$ ) of the questionnaire according to variables

Latent variables	$\alpha$	Observed variables	bsc	SE	T	R2	AVE	CR
sexual literacy	0.83	1. sex knowledge, understanding	0.65**	<-->	<-->	0.42	0.49	0.81
	0.82	2. sex access information	0.74**	0.05	18.87	0.55		
	0.84	3. sex adversity	0.70**	0.06	17.48	0.49		
	0.80	4. sex self-management	0.66**	0.05	16.91	0.44		
	0.86	5. sex adapt data information	0.67**	0.06	16.17	0.45		

Notation : \*\*p<.01, bsc means standard factor loading, <--> means Mandatory parameters which don't report SE and t

## 2.3. Data collection

The author used the questionnaire to collect the data from the Department of Health and Physical Education in Thailand year of 2018; the research team coordinated by the network of each university, which is the sample. The data collection period is May – July 2018. The data were collected from 750 schools, 750 Health and Physical Education teaching. In the beginning, only 658 questionnaires or 88% were sent back and completed. Therefore, the author chose samples randomly and assigned the research team to collect the data from students in 92 schools again in August 2018. As a result, the completed 750 sets of questionnaire were available.

## 2.4. Data collection

1. Analysis of descriptive statistics include frequency, percentage, average, standard deviation and Correlation Coefficient

2. To examine the relationship of Verification Parameter, the researchers used KMO (Kaiser-Meyer-Olkin) and Bartlett's test of sphericity to check the suitability of the information and the relationship of a variant which was analyzed.
3. To examine the concordance of the model of sexual literacy for high school students which was developed with empirical information by LISREL 9.10 which was considered Chi-square, GFI (Goodness of Fit), AGFI (Adjust Goodness of Fit Index) and RMSEA (Root Mean Square Error of Approximation)
4. To examine the model, Concordance (C-Statistic) was used to measure the Goodness of Fit. The researchers used conscript in examining as follow:

**Table 2**  
Criteria and Theory of the Values  
of Goodness-of-Fit Appraisal.

Criteria Index	Criteria	Values	Results	Supporting theory
Chi-square: $X^2$	$p \geq 0.05$	0.14	passed	Rasch, 1980
Relative Chi-square: $X^2/df$	$\leq 2.00$	1.32	passed	Byrne et al., 1989
RMSEA	$\leq 0.05$	0.03	passed	Hu & Bentler, 1999.
GFI	$\geq 0.90$	0.99	passed	Jöreskog et al., 2016.
AGFI	$\geq 0.90$	0.95	passed	Hooper et al., 2008
RMR	$\leq 0.05$	0.02	passed	Hu & Bentler, 1999
SRMR	$\leq 0.05$	0.02	passed	Hu & Bentler, 1999
NFI	$\geq 0.90$	0.99	passed	Schumacker & Lomax, 2010
CFI	$\geq 0.90$	1.00	passed	Schumacker & Lomax, 2010
Cronbach's Alpha	$\geq 0.70$	0.61-0.85	passed	Tavakol & Dennick, 2011.

5. To analyze the Cross-validation, the model of indicators of sexual literacy of adolescents was analyzed with the invariance of measurement between school group with confirmatory factor analysis of multi-group (Multi-group CFA: MGCFA) with LISREL program which has the level of invariance 4 levels by descending order of concentration (Schmitt and Kuljanin; 2008) as follows:

5.1 Model of Configural invariance means that the Office of the Basic Education Commission, Local Administrative Organization, and private organization have the same model of measurement.

5.2 Weak invariance model means that the Office of the Basic Education Commission, Local Administrative Organization, and private organization, which has the same measurement model and factor loading of each indicator is equal. In case of having different factor loading between school groups, the researchers will conduct an estimate of factor loading and make partial weak invariance.

5.3 Strong invariance model means that the Office of the Basic Education Commission, Local Administrative Organization and private organization which have the same measurement model of factor loading and intercept of each indicator is equal, and the in case of factor loading or intercept is not equal shows as partial strong invariance model.

5.4 Strict invariance model means that the Office of the Basic Education Commission, Local Administrative Organization and private organization have same measurement model of factor loading, intercept, and error measurement of each indicator is equal. In case of factor loading, intercept and error measurement is not equal between school groups, some value shows as partial strict invariance model.

To evaluate the four invariance level, the researchers compared the different three types of index which are Chi-square ( $c^2$ ), Degree of Freedom (df) and Comparative fit index (CFI) between

hierarchical model (stage 1 compare with stage 2, stage 2 compare with stage 3). To be considered invariance, the statistical significance must be less than 0.01 of difference of Chi-square ( $\tilde{N}c2$ ) with Degree of Freedom ( $\tilde{N}df$ ) and different of Comparative fit index ( $\tilde{N}CFI$ ).

### 3. Result and Discussion

**Table 3**  
Number and Percentage of the individual characteristic variable (n = 750)

individual characteristic	Teacher (number)	Percentage (%)
Gender		
Male	403	53.73
Female	374	46.27
Education		
Bachelor Degrees	576	76.80
Master Degrees	162	21.60
Doctor Degrees	12	1.60
Work Experience (years)		
5-10	234	31.20
11-15	195	26.00
16-20	208	27.73
More 21	113	15.07

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**Table 4**  
Skewness and Kurtosis of latent and observed variables

Observed variables	Mean	SD.	Skew	Kurt
1. sex knowledge, understanding	3.58	0.50	0.29	.08
2. sex access information	3.67	0.58	0.21	-.43
3. sex adversity	3.66	0.62	0.16	-.26
4. sex self-management	3.60	0.62	0.12	-.21
5. sex adapt data information	3.59	0.55	0.22	-.09

\*Skewness < |1| (Hair, & et al. 2010) \*\* Kurtosis < |7| (Curran, & et al. 1996)

When considering every latent variable, every observed variable of latent variables has the characteristic of normal distribution when the range of skewness is |0.12| to |0.29| and the range of kurtosis is |0.08| to |0.21|.

**Table 5**  
The relationship of observed variable in the model of the indicators of sexual literacy

Variable	Correlation				
	Know	Access	Adversity	S Manage	Adapt
Know	1.00				
Access	.55**	1.00			
Adversity	.51**	.72**	1.00		
S Manage	.51**	.60**	.66**	1.00	
Adapt	.53**	.65**	.70**	.74**	1.00

KMO : Measure of Sampling Adequacy = .862  
Bartlett's Test of Sphericity : Chi-Square= 2163.46, df = 10, p = .00

Notation : \*\*p<.01

The result of invariance of the model of indicators of sexual literacy between school groups found that model 1 which is model of indicators of sexual literacy has Configure Invariance by  $\chi^2 = 25.12$ , Degree of Freedom = 16. It has no statistical significance at a Comparative fit index = 0.98. The second stage which was tested was Model 2.1. It is Weak invariance, when compared with model 1 with a difference of  $\chi^2$  and Degree of freedom ( $\tilde{N}df$ ) is equal 13.13 and 6. In order to find the statistical significance of the model of indicators of sexual literacy by different factors between school groups, the researchers found out that Factor five (5) was not equal so the researchers estimated and tested again which made Model 2.2. It has Partial weak invariance, and when compared with model 1 it was found out that the difference of  $\chi^2$  and Degree of Freedom ( $\tilde{N}df$ ) are equal 7.86. There is no statistical significance by the difference of Comparative fit Index ( $\tilde{N}CFI$ ) which is equal to 0.009. It confirmed that the model of indicators of sexual literacy has partial weak invariance. The next step is the Model 3 which is partial strong invariance, which assigned constant equality between the sexes has increased when compared with Model 2.2. It was found that the difference of  $\chi^2$  and Degree of Freedom ( $\tilde{N}df$ ) are equal to 4.29 and 4 in order and has no statistical significance by the different of Comparative fit Index ( $\tilde{N}CFI$ ) which is equal to 0.001. It is and concluded that the model of indicators of sexual literacy has Partial strong invariance. Model 4 was the last test to conduct the Partial strict invariance which assigned error measurement between school groups. When compared with Model 3 found that the difference of  $\chi^2$  and Degree of Freedom ( $\tilde{N}df$ ) are equal to 9.79 and 8 in order and has no statistical significance with the difference of Comparative fit Index ( $\tilde{N}CFI$ ) equal to 0.00. It confirmed that that the model of indicators of sexual literacy has Partial strict invariance, with the difference in factor of element Five (5) between school groups.

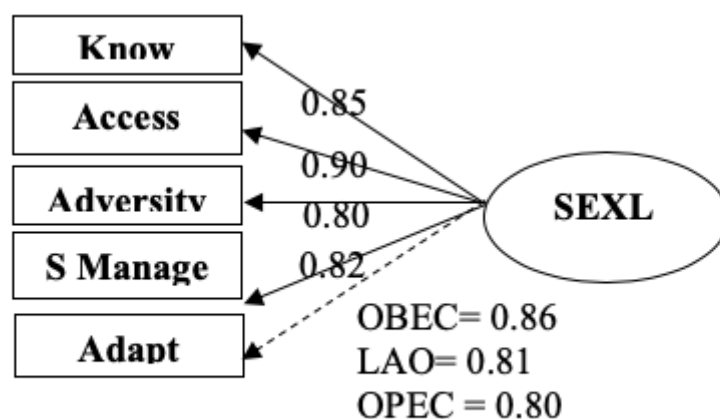
**Table 6**  
Comparison of the invariance of the model of indicators of sexual literacy

Measurement of invariance model	$\chi^2$ ( $\tilde{N}\chi^2$ )	Df ( $\tilde{N}df$ )	P ( $\tilde{N}p$ )	CFI ( $\tilde{N}CFI$ )
1. Configural	25.12	16	0.07	0.982
2.1 Weak	(13.13)	(6)	(0.04)*	(0.009)

2.2 Partial Weak	(7.86)	(5)	(0.16)	(0.004)
3. Partial strong	(4.29)	(4)	(0.37)	(0.001)
4 Partial strict	(9.79)	(8)	(0.28)	(0.000)

The result of analysis invariance of Partial strict invariance model, by Confirmatory Factor Analysis Multi-group, found that consistent with empirical information which  $\chi^2 = 47.06$ , Degree of Freedom = 33 and no statistical significance ( $p=0.053$ ), goodness of fit index (GFI) = 0.93 and Comparative Fit Index (CFI)= 0.97.

**Figure 1**  
The model of sexual literacy indicator in adolescents



Chi-Square= 47.06 ,df = 33 ,p = 0.05,  $\chi^2/df = 1.42$ , RMSER = 0.01

Access to information about sex, knowledge about sex, self-management ability about sex and Coping ability about sex has standard factor loading equal to 0.90, 0.85, 0.82 and 0.80 in order, while application of knowledge and information about sex has factor loading in Office of the Basic Education Commission equal 0.86, but it has 0.81 and 0.80 in Local Administrative Organization and private organization in order which shows that the element can measure student in Office of the Basic Education Commission better than Local Administrative Organization and private organization.

## 4. Discussion

The research found that the model of indicators of sexual literacy validated the theory of indicators of sexual literacy which have been accepted internationally. In the context of teenagers as the Index of consistency (IOC) which is more than 0.80. It is considered that the content is consistent with the accepted theory. The result of the structure of the model of indicators of sexual literacy has five elements which are: 1) knowledge about sex 2) access to information about sex 3) coping ability about sex 4) self-management ability about sex and 5) application of knowledge and information about sex which is consistent with knowledge about health (Nutbeam, D. 2009 ; Thiyaporn Kantathanawat, 2014 ; Chitraporn Boonthanom, 2014; Apicha Nomsira, 2015 and Jakkapong Prongprommarat & Krissana Kiddee, 2018). Considering the confidence value to knowledge of sex was 0.93. It means that each side has a confidence value equal to 0.82, 0.83, 0.86 0.80 and 0.84 in respectively, while the acceptable confidence value should be 0.70 or higher. This showed that the model of indicators of sexual literacy was developed. It can be measured in the context of Thai teenagers as well and compared with the previous study have shown higher accuracy. (Gustems-Carnicer, J., Calderón, C. and Santacana, M.F. .2017 : .Efuni, E., DuHamel, K.N., Winkel, G., Starr, T. and Jandorf, L. .2015)

A Confirmatory Factor Analysis showed that the model of indicators of sexual literacy for adolescents that the structure of measurement and factor loading are consistent as follows : At level .01, by maximum standard factor loading is access to information about sex (bsc = 0.70), application of knowledge and information about sex (bsc = 0.67), self-management ability about sex (bsc =0.66) and Knowledge about sex (bsc = 0.65) in order, while Reliability coefficient of observed variable which measures from R2 that refer to covariance of observed variable with sexual literacy which is a moderate level. These findings confirm the quality of research tools were

well structured. This is also consistent with the research of (Chitraporn Boonthanom, (2014), Apicha Nomsira, (2015) and Jakkapong Prongprommarat & Krissana Kiddee, (2018))

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## 5. Conclusion

Summarizing the above, The study of invariance of indicators of sexual literacy found that the model of indicators of sexual literacy has partial strict invariance between school groups which means the model of indicators of sexual literacy for teenagers was developed which have measurement model, factors, indicators of constant and error are different except factor loading five (5) which was higher at the Office of the Basic Education Commission than the Local Administrative Organization and private organization. Although the quality of measurement of factor five (5) in the Office of the Basic Education Commission was better than the Local Administrative Organization and private organization, it confirmed that the model of indicators of sexual literacy for adolescents have equality between the school groups. The performance measurement among the three groups is confirmed with the standard factor loading higher than 0.50. Hence, further research is recommended to improve the elements in making the model of indicators of sexual literacy to achieve equality.

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[Index]

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