A Study of Executive Function Factor of University Students

Apichat Mookdamuang[1], Kanchit Saenubol[2],
Monthira Charupheng[2], Orn-uma Charoensuk[2]

Abstract

The purposes of this research were 1) to investigate of executive function factor of university students and 2) to validate consistency a measurement model of an executive function of university students with empirical data. The sample of study was eight hundred and eighty students in faculty of Rajabhat University in the North Eastern area. The research instrument was executive function scale with the discrimination ranges from 0.36-0.72 and the reliability coefficient of 0.97. The statistical were analyzed by exploratory factor analysis and confirmatory factor analysis. The research results were as follows 1) the executive function factor of students in university, the Eigen values were in the range 2.24-19.53. The sum of squared loading cumulative were 46.06. There were eight factors: Initial, Cognitive, Flexibility, Planning, Working Memory, Emotional Control, Self-Monitoring, Goal-Direct Persistence, and Inhibition. 2) The executive function factor of university students of measurement model was fit with empirical data. (X2=139.72

1 Ph.D. Candidate, Doctor of Research and Development on Human Potentials, Faculty of Education, Srinakharinwirot University, Thailand

2 Faculty of Education, Srinakharinwirot University, Thailand

df=119 p=.09 GFI=0.97 AGFI=0.95 CFI=1.00 RMSEA=0.01 SRMR=0.03)

Keywords: Executive function factor, university students

Introduction

Executive function refers to the concept that explains a cognitive process which involves in determining human behaviors and organizing other thoughts. Executive function is a result of high-level thinking of the brain that can connect past experiences and current experiences, self-management including cognitive ability that controls emotions, thoughts, and decision making. In addition, it also involves self-regulatory ability towards determined behaviors. Executive function can be developed from the infancy through adolescent (Anderson, 2001: 290).

Executive function can result in deficiency in everyday task performances such as studying, working, socializing and self-caring (Fleming, 2012: 329). Ones tended to struggle social interaction as he or she tends to express an aggressive behavior, unable to control his or her emotions and inappropriate gestures, and unable to follow the rules. Moreover, the studies indicated that children and adolescents who have emotional problems and personality problems are likely to short of self-manage (Diamond, 2008: 908).

University students whose ages range from 18-24 years old are on the stage of transforming roles - from late adolescence into adulthood. This period is very critical as means of turning due to significant changes in ways of living, freedom and responsibility. It is the time that most people are away from home, leaving their parents behind for attaining education and working. They have to manage their own expenses, lifestyles and family settlement. Therefore, it is important that adolescents need to develop and adapt themselves to be a perfect adult (Schulenberg, *et al.*, 2004: 513).

According to the data from The North East Network of Adolescence in 2016, it was reported that there was a dramatically increase of risks on children and adolescents from the 3 major problems including drugs, sexual risk behaviors and game addicted respectively. It was a university student who tend to encounter such a behavior that he or she has to adapt oneself to the new environment, friends, and lifestyles which are independent from parents. These behaviors can have negative impacts on the student who have low executive function. However, ways of solutions for these university students have been neglected because they are expected to take a role of an adult and capable to solve problems by themselves. It is undeniable that this is a critical period that the university students are on a verge of transforming themselves into an adult. Therefore, a provision of effective

self-development is in need to support them to succeed in both leaning activities and working in future (Togilia, 2013: 516).

Previous studies on developing executive function of university student in Thailand is limited to the teacher training students. This group of students needs to develop executive function not only for self-development but also for their future profession. According to Thailand Quality Framework of Higher Education Ministry of Education (2011: 12) for Bachelor of Education Program (five-year program), specifies the desired characteristics of students that they have to be responsible for themselves and the society, be patient, possess ability of learning management, ability to integrate knowledge from theory to create new knowledge, creativity of problem solving, ability to analyze and give a reasonable solution, ability to solve a complicated problem, ability to create appropriate and practical alternatives of solutions, ability to keep up dating the knowledge in the field, possess skills of interpersonal relation and understand others, possess positive perspectives and emotional maturity to work with students and colleagues. From the specific qualifications of the students, it is clear that there is an involvement of executive function in every aspect of qualifications. This is a key of student development. Therefore, executive function in significant for developing the quality of people including students and adults. The researchers have found the importance of studying executive function of the students that this will be beneficial for enhancing educational system in Thailand as well as to develop economics, society and environment towards sustainability of the country in the future.

For this reason, the researcher interests to investigate and analyze factors of executive function of university students from Rajabhat Universities in the North Eastern region of Thailand. The aim of the study is to elucidate ways to provide a support or management in the Thai context and set up an appropriate executive function guidance for the universities in Thailand.

Objectives

1. To investigate factors of executive function of university students.

2. To validate consistency a measurement model of the executive function of university student with empirical data.

Hypothesis

The executive function factors model of the students proposed by the researchers is consistent with the empirical data.

Methodology

Population

The population of the current study were first year university students on academic 2018 of Faculty of Education from 11 Rajabhat Univerities, Northeastern of Thailand. The universities included Buriram Rajabhat University, Chaiyaphum Rajabhat University, Nakon Ratchasima Rajabhat University, Loei Rajabhat University, Roi-et Rajabhat University, Sakon Nakorn Rajabhat University, Rajabhat Maha sarakham University, Sisaket Rajabhat University, Surindra Rajabhat University, Ubon Ratchathani Rajabhat University and Udon Thani Rajabhat University. The total number of population was 5,780.

Sample

The samples of this study were first year students of Faculty of Education from Rajabhat Universities in the Northeastern region. The samples were derived by applying stratified random sampling for drawing slots. The universities were divided into two groups as follow:

Group 1: These samples were for exploratory factor analysis. The samples of this group included students from Buriram Rajabhat University, Nakon Ratchasima Rajabhat University, Loei Rajabhat University, Sakon Nakorn Rajabhat University, and Udon Thani Rajabhat University. There were 400 students in this group.

Group 2: These samples were for confirmatory factor analysis including students from Chaiyaphum Rajabhat University, Roi-et Rajabhat University, Rajabhat Maha sarakham University, Sisaket Rajabhat University, Surindra Rajabhat University, and Ubon Ratchathani Rajabhat University. There were 480 students in this group.

Instruments

The instruments used in this study was an executive factor questionnaire consisting of 68 items with the 5-point Likert scale generated by the researchers. Content validity and reliability of the items were ascertained by 5 experts. The questionnaire was piloted with students before calculating the correlation of coefficient by applying Alpha Coefficient of Cronbach. The value of r that shows the correlation of each questionnaire item and its definition between 0.06-1.00. The discrimination ranges from 0.36-0.72 and reliability coefficient was 0.97.

Statistical analysis

1. Exploratory Factor Analysis was for a common factor analysis by applying the Principal Component Analysis. The orthogonal rotation was achieved by varimax method.

2. Confirmatory Factor Analysis was calculated by the approximation of the parameter. Maximum Likelihood (ML) was obtained from chi-square value (X^2), value of Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA) and Standard Root Mean Square Residual (SRMR).

Results

1.The executive function level of 480 students is shown in Table 1 as follow. The result showed that students had high level of executive function, but the initial executive function factors sceen to be medium level. Even though other factors are at high level.

Table 1. Executive function level of students (n=480)

Executive function factors	k	$\bar{X}$	SD	SK	KU	Level
Initial (CRE)	3	3.30	0.96	-0.29	-0.53	medium
Self-initiative tasks **(**CRE**1)**	3	3.30	0.96	-0.29	-0.53	medium
Cognitive Flexibility (COF)	7	3.57	0.56	0.10	-0.16	high
Flexible Solutions (COF1)	2	3.76	0.69	-0.19	0.14	high
Creative problem solving **(**COF2**)**	3	3.60	0.65	0.08	-0.27	high
Solve Immediate problems(COF2)	2	3.35	0.69	0.12	-0.07	medium
Planning (PLA)	**7**	3.65	0.60	-0.09	-0.27	high
Targeting (PLA1)	3	3.68	0.66	-0.08	-0.13	high
Organizing Tasks **(**PLA2**)**	3	3.65	0.67	-0.03	-0.14	high
Time Management (PLA3)	1	3.60	0.86	-0.19	-0.20	high
Working memory (WOM)	8	3.54	0.51	0.14	0.42	high
Memorize Information (WOM1)	2	3.36	0.61	0.28	0.09	medium
Concentration (WOM2)	2	3.58	0.69	-0.15	-0.17	high
Information Processing **(**WOM3**)**	4	3.68	0.62	-0.04	0.13	high

Executive function factors	k	$\bar{X}$	SD	SK	KU	Level
Emotional control (EMO)	4	3.81	0.66	-0.33	-0.16	high
Emotional Management (EMO1)	3	3.71	0.73	-0.20	-0.21	high
Relaxation (EMO2)	1	3.91	0.89	-0.49	-0.14	high
Self-Monitoring (SEM)	4	3.92	0.58	-0.37	-0.04	high
Self regulation (SEM1)	2	3.93	0.69	-0.40	-0.26	high
Self Assessment (SEM2)	2	3.90	0.66	-0.33	-0.09	high
Goal-Direct Persistence (GDP)	4	3.92	0.60	-0.21	-0.28	high
Goal Awareness (GDP1)	2	4.16	0.68	-0.62	0.60	high
Being persistent (GDP2)	2	3.68	0.76	-0.01	-0.84	high
Inhibition (INH)	3	3.88	0.59	-0.33	-0.06	high
Inhibit Thought (INH1)	1	3.58	0.86	-0.36	0.00	high
Ability to say no (INH2)	1	3.95	0.80	-0.48	-0.05	high
Decision making (INH3)	1	4.11	0.87	-1.05	1.36	high
Executive Function	40	3.70	0.40	-0.40	0.28	high

2. The investigation of executive function of university students shows the Eigen value of 2.24-19.53 which explained a cumulative percentage of variance accounting for 8 factors was 46.06. The explanation of the 8 factors are as follows.

Factor 1: Initial, there were 3 questionnaire items. The value of a loading factor is between 0.63-0.69 which is an indicator of self-initiative task execution.

Factor 2: Cognitive Flexibility, there were 7 questionnaire items with a loading factor of 0.49-0.70. This indicates ability to solve various problems with flexibility, knowledge of problem solving improvement, and adjustability in working.

Factor 3: Planning, there were 7 questionnaire items, this factor has a loading factor between 0.40-0.71. It indicates ability of task planning and execution, capability to see the big picture rather than details, task organization and ability to prioritize tasks.

Factor 4: Working memory, this factor comprised of 5 questionnaire items with a loading factor of 0.52-0.66. This indicates ability to memorize and retain information for working, concentration and ability of information processing and using schemata.

Factor 5: Emotional control, this factor comprised of 5 questionnaire items with a factor loading between 0.35-0.77. It is an indicator of ability to control

emotions, and to relax oneself and to know how to express negative emotion appropriately.

Factor 6: Self-monitoring, this factor comprised of 5 questionnaire items with a loading factor of 0.49-0.75. This factor indicates ability to self-monitor of appropriate behaviors, not trouble others, ability to self-asses and self-evaluate after task completion in order that provision of better solutions or improvement can be prepared for the future.

Factor 7: Goal-directed, there were 4 questionnaire items of this factor came with a loading factor of 0.51-0.62. This factor indicates ability to pursue goal determination and being persistent.

Factor 8: Inhibition. Consisting of 3 questionnaire items, this factor has a loading factor between 0.41-0.45. The factor indicates ability to inhibit automatic tendency of behaviors from situations, ability to say no, self-control from incentives and decision making based on rightness and appropriateness.

2. The executive function factor of students in university of measurement model was fit with empirical data. (X^2=139.72 df=119 p=.09 GFI=0.97 AGFI=0.95 CFI=1.00 RMSEA=0.01 SRMR=0.03). This shows that executive function of students consists of 8 components which are Initial, Cognitive Flexibility, Planning, Working Memory, Emotional Control, Self-monitoring, Goal-directed persistence, and Inhibition as shown in the Table 2.

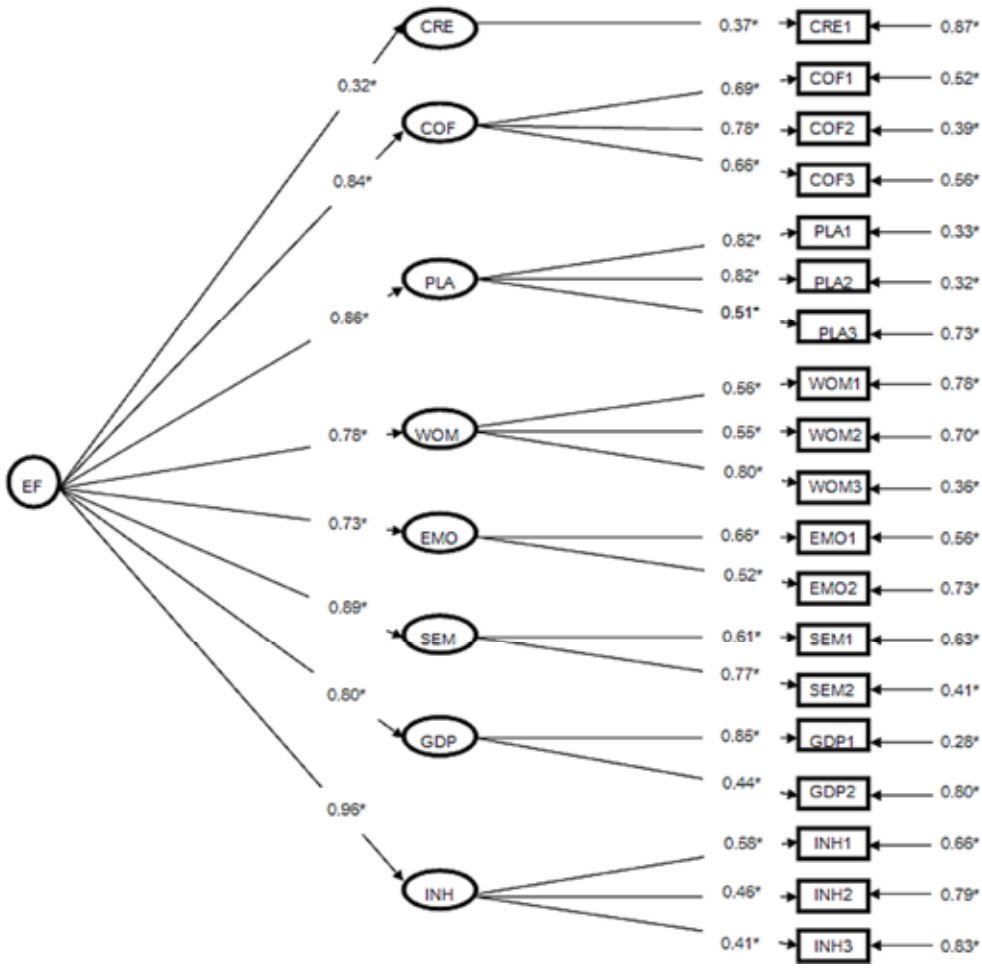
Table 2. Confirmatory Factor Analysis of students' executive function model (n=480)

Executive function	Factor loading					CR
	b	SE	t	FS	SC	
Initial (CRE)	0.32	0.13	2.39*	-	0.32	0.10
Self-initiative tasks **(**CRE1)	0.37	-	-	0.53	0.37	0.13
Cognitive Flexibility (COF)	0.58	0.04	13.43*	-	0.84	0.70
Flexible Solutions (COF1)	1.00	-	-	0.12	0.69	0.48
Creative problem solving **(**COF2**)**	1.13	0.07	16.28*	0.25	0.78	0.61
Solve Immediate problems(COF2)	0.96	0.08	12.72*	0.14	0.66	0.44
Planning (PLA)	0.71	0.04	16.88*	-	0.86	0.74
Targeting (PLA1)	1.00	-	-	0.28	0.82	0.68
Organizing Tasks **(**PLA2**)**	1.00	0.05	18.49*	0.29	0.82	0.68
Time Management (PLA3)	0.63	0.06	11.01*	0.08	0.51	0.27

Executive function	Factor loading					CR
	b	SE	t	FS	SC	
Working memory (WOM)	0.44	0.04	10.39*	-	0.78	0.61
Memorize Information (WOM1)	1.00	-	-	0.07	0.56	0.32
Concentration (WOM2)	0.98	0.10	10.13*	0.06	0.55	0.30
Information Processing (WOM3)	1.42	0.13	11.30*	0.21	0.80	0.64
Emotional control (EMO)	0.49	0.05	10.42*	-	0.73	0.54
Emotional Management (EMO1)	1.00	-	-	0.26	0.66	0.44
Relaxation (EMO2)	0.79	0.10	7.66*	0.17	0.52	0.27
Self-Monitoring (SEM)	0.54	0.05	11.93*	-	0.89	0.78
Self warning (SEM1)	1.00	-	-	0.11	0.61	0.37
Self Assessment (SEM2)	1.27	0.11	11.55*	0.24	0.77	0.59
Goal-Direct Persistence (GDP)	0.68	0.04	15.52*	-	0.80	0.65
Goal Awareness (GDP1)	1.00	-	-	0.54	0.85	0.72
Being persistent (GDP2)	0.53	0.07	7.52*	0.15	0.44	0.20
Inhibition (INH)	0.56	0.05	11.95*	-	0.96	0.92
Inhibit Thought (INH1)	1.00	-	-	0.13	0.58	0.34
Ability to say no (INH2)	0.80	0.10	8.22*	0.03	0.46	0.21
Decision making (INH3)	0.71	0.09	7.53*	0.03	0.41	0.17

X^2=139.72 df=119 p=.09 GFI=0.97 AGFI=0.95 CFI=1.00 RMSEA=0.01 SRMR=0.03
*p<.05

As shown in the Table 2, executive functions have a factor loading. Every factor has a significant value of 0.5. Among these factors, inhibition has the highest factor loading at 0.96. This factor positively correlates to the high level of executive function (92%). Self-monitoring, Planning and Cognitive Flexibility with factor loading of 0.89, 0.68 and 0.84 have positively correlated to high levels of executive function too (78%, 74% and 70% respectively). The factor Goal-direct persistence, Working Memory and Emotional Control which the factor loading at 0.80, 0.78 and 0.73, have found to be moderately correlated to executive function (65%, 61% and 54% respectively). Initial has the least factor loading at 0.32 which has a lowest covariant to the executive function (10%) and it can be described in Figure 1.



X^2=139.72 df=119 p=.09GFI=0.97AGFI=0.95 CFI=1.00 RMSEA=0.01 SRMR=0.03

Figure 1: The factors of executive function model of university students

Discussion

In the current study examines factors of executive function of university students. After exploratory factor analysis had been done, the researchers found that executive function consisted of 8 factors: Initial, Cognitive Flexibility, Planning, Working Memory, Emotional Control, Self-monitoring, Goal-directed persistence, and Inhibition. Next, confirmatory factor analysis have been done in order to examine the correlation of the model measurement of the factors of university students' executive function and the empirical data by analyzing the Second Order. It was found that the model measurement of executive function of the university students did not correlated with the empirical data. The

researchers then adjusted the model by rotating the relationship between the errors of the factor until the model was correlated empirically. Thus, the best fitting model of the executive function can be tested on the construct validity.

The result of the Second Order for the confirmatory factor analysis of model measurement of the executive function of the university students shows that the qui-squire (X^2) has a value of 139.72. The degree of freedom (df) is 119. It has significant value (p) of 0.9. It can be seen that the X^2 is not statistically significant which means the model of the researchers correlates with the empirical data. The result supports Hair, *et al.,* (2010: 145) who suggested that the closer to zero the X^2, the more correlated the model to the empirical data. The results also show that the model measurement has a value of the Goodness of Fit Index (GFI) is 0.97, the value of the Adjusted Goodness of Fit Index (AGFI) is 095 and the value of the Comparative Fit Index (CFI) is 1.00. The interpretation of the GFI, AGFI and CFI of more than 0.95 it means the model of measurement created correlates with the empirical data (Schumacker and Lomax, 2010). In addition, the results indicated the value of Root mean square error of approximation (RMSEA) at 0.01 and the value of Standardized root mean square residual (SRMR) of 0.03. These two values were less than 0.05, it ascertain the correlation of the model and the empirical data. This evidence supports Hair, *et al.,* (2010: 145) statement that if the value of each RMSEA and SRMR is less than 0.05, the model correlate empirically. To summarize, the model measurement of the executive function of the university students has a correlation with its empirical data. The model consists of 8 factors including 1) initial 2) cognitive flexibility 3) planning 4) working memory 5) emotional control 6) self-monitoring 7) goal-directed persistence and 8) inhibition. These factors are in line with those from the study of Isquith (2006, as cited in Goldstein, 2014: 301-304, 524) comprising of 1) inhibition 2) shift 3) emotional control 4) self-monitoring 5) initiation 6) working memory 7) planning 8) organization of materials and 9) task monitor.

Moreover, examining the model measurement of executive functions by its aspects, inhibition was found to have the highest value of the factor loading at 0.96. This may be due to university students are at the period of maximum intelligence development as similar as adults. This may result in the students' thoughts when making consideration and logical decision based on their perspectives of rightness. On the other hand, if the students lack inhibition, they are not able to control themselves from inducement and this possibly lead to mistakes or failure in lives.

This is in accordance with Luria (1966, as cited in Goldstein, 2014: 10) that the executive function is like a controller of selective attention which is the core job of the frontal lobes. These organ responses to selecting inhibition from an environment as well as responding perceptions in order to connect

information to other lobes. Together, this process causes behavioral expressions through regulating, controlling, and assessing behaviors so that there will be strategic planning and self- monitoring to control any aggressive behaviors.

Last, the current study supports Black and Mullan (2014: 113) who had studied the relationship between alcohol drinking behaviors and inhibition and planning of tertiary students. The study found that adolescents with low inhibitive ability resulted with the aftermath of inappropriate behavior and had a tendency for alcohol addiction. According to Brett (2003: 23), a study of relationship between executive functions and university students revealed that the students who had not a good planning and self-monitoring tended to become game addicted and could result in low learning proficiency, struggling in everyday life performance, and avoiding socializing witch can last in long terms. In addition, Huizing and Dolan, (2006: 2010) explain that the development of executive function in adolescence into adulthood is essential for effective problem solving as a result of the development of every executive function factors. They also have a courage to accept and deny things and this can result in adaptive actions to transform them into good man in the future.

Recommendations for applications

The results from this study can be applied in the fields. The followings are some benefits.

1. The measurement model can be used to measure the factors of executive functions. The results can be used for designing the executive function development for university students in Thailand to serve its advantages to students, teachers and staff in the field of the student development.

2. Supports and development of all factors of executive function should be done as they have a direct relation to each other.

Recommendations for futere research

1. There should be a study of model of executive function of student's in accordance to different ages.

2. Models of counseling should be developed in order to support students' executive function according to the factors found in this study.

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