

Psycho-social Antecedents of Research Potentiality among Graduate Students: A SEM Approach¹

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Research training and practice at graduate levels are intended to enhance scientific and systems thinking for future work and life. In order to promote graduate success in research, antecedents of research potentiality were investigated. Data from 551 Thai graduate students in social sciences and education were analyzed through path analysis technique. Research potentiality was influenced by psychological state, which accounted for 87% of the variance. The most favorable factor in the psychological state was attitudes towards research, followed by scientific reasoning. Furthermore, psychological trait and situational factor directly affected psychological state, which accounted for 89% of the variance. The most important factor for psychological trait was consideration of future consequences, followed by academic habit. The strongest factor in the situational group was guidance and descriptive norm, followed by learning atmosphere. These findings shed light for researcher development in behavioral science and higher education.

Keywords: Psycho-social, Research potentiality, graduate level, Path analysis

Graduate education is now a necessity for more people because of the inevitability for research and innovation in this era. Thus, there must be emphasis on research training and applications. One of the important learning expectations in this level is to groom learners to be at the frontiers of knowledge via research inquiry. Therefore, research expertise is a required ability to analyze, to solve problems and to lead to innovation for a better society. Research potentiality of the graduate students is the key objective of the curriculum in higher education (Bordovskaia & Kostromina, 2013).

There was some evidence that after graduation, these formal graduate students were found to lack the necessary research skills and strong determination to carry out further research studies. These findings were found in other countries (Wadesango, Maphosa & Moyo, 2014), as well as in Thailand (Bhanthumnavin & Bhanthumnavin, 2016). Therefore, there is need for improving research potential in terms of intention, motivation, and sense of control in graduate students in order to enhance research skills and determination. Thus, it is impelling to examine their research potentiality and its antecedents for the purposes of student preparation and/or recruitment. Character or potentiality has been studied as antecedents of success (e.g., Bhanthumnavin, 2015a, Morosanova, Fomina, & Bogdanova, 2014). Studies on its antecedents among graduate students are rare especially in Thailand.

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This study aimed at investigating important psychological characteristics and situational factors affecting research potentiality among graduate students. It is a correlational-comparative study based on interactionism paradigm (Endler & Magnusson, 1976).

Research Potentiality: Definitions and Aspects

Recently, “potential” is mentioned in many fields, such as IT potential (Yaghoobi & Razmjoo, 2016), sustainable potential (Boggia, Rocchi, Paolotti, Musotti, & Greco, 2014), and learning potential (Ceroni, Carpigiani, Castanheira, & Da Silva, 2016; Steen-Utheim & Wittek, 2017). Several scholars (e.g., Bordovskaya, Kostromina, Rosum, and Moskvicheva, 2012; Lewin, 1938; Rotter, 1982) agreeably defined “potential” as the psychological features or forces of a person.

There are some suggestions about the components of research potentiality. For example, Iskra and Moskvicheva (2014) suggested that there are three components. First is motivation related to needs, goals, intention, or desires for knowledge searching. Second is cognitive includes intellect and reasoning abilities which related to moral reasoning. The third component relates to sense of control (e.g., self-control, self-regulation) to govern research process. In this study, research potentiality was assessed via three variables, namely, self-regulated research learning, research moral identity, and research behavioral intention (See details in Bhanthumnavin, 2014; 2015b).

Self-regulated learning is a cyclical process of controlling one’s thoughts and actions towards a certain goal (Bandura, 1991). It is a multi-dimensional construct (Baumeister, Gailliot, DeWall, & Oaten, 2006) with at least three factors (Zimmerman, 1990). First, metacognition involves goal setting ability and self-evaluation to accomplish sub-goals of the main goal (Mann, Ridder, & Fujita, 2013). Second, self-regulated persons usually display high motivation or high curiosity in search of information and knowledge. Third, they try to create supportive environment to ease their success. Scholars have several ways to assess self-regulation (DiBenedetto & Zimmerman, 2013) depending on which factors will be emphasized. For example, Songthaing and Jarenvongrayab (2007), based on Costa and Kallick (2004), studied self-regulation in three dimensions (self-managing, self-monitoring, and self-modifying). In the present study, self-regulated research learning from Bhanthumnavin (2014) directed by factor analysis, consisted of four dimensions, namely, self-direction, self-motivation, self-reflection, and environmental structuring.

In order to acquire high potentiality for effectiveness in conducting research, the researchers must also observe research ethics and morality. For the last decade, researchers (Blasi, 1984) suggested that moral identity has a strong effect on moral attitudes and behaviors (Reynold & Ceranic, 2007; Reed, Aquino, & Levy, 2007). Aquino and Reed (2002) proposed that moral identity has two dimensions. First, internalization refers to moral perceptions of how it is important, sense of acceptance or feeling of proud to have. Second, symbolization refers to actions or behaviors that reflect one’s own moral images. In this study, factor analysis of research moral identity from Bhanthumnavin (2014) was conducted and it was found to comprise of four dimensions, namely, 1) symbolization about dishonesty in data gathering and sampling,

2) importance of conducting high standard research, 3) symbolization about doing high standard research, and 4) feeling proud when following the research principles.

According to Fishbein and Ajzen (1975), the disposition that represents action is behavioral intention. It is the tendency that an individual will engage in an action. Thus, high potential researcher should reflect high degree of research behavioral intention. In this study, after performing factor analysis, research behavioral intention (from Bhanthumnavin, 2014) was found to consist of four dimensions, namely, 1) intention to create high standard research, 2) intention to manage time and space for research, 3) intention to do research just for meeting the minimal standard, and 4) not paying attention to prepare for research conducting.

Conceptual Framework of the Antecedents of Research Potentiality

Many studies related to the antecedents of human behaviors have been using the conceptual framework of so-called “Interactionism paradigm” (Endler & Magnusson, 1976). It is the same concept as “person-situation” (e.g., Roger, Fuller-Tyszkiewicz, Lewis, Krung, & Richardson, 2017; Villasana, Alonso-Tapia, & Ruiz, 2016) or “psycho-social” paradigms (e.g., Johnson & Ivarson, 2017; Kaye, Kowert, & Quinn, 2017; Tian, Bian, Han, Gao, & Wang, 2017) which are currently popular.

Interactionism paradigm (Endler & Magnusson, 1976) indicates that there are four group of variables affecting an individual’s behaviors. First, psychological trait group refers to a set of psychological characteristics embedded in the individual by the process of socialization. Second group is situational factors which play the roles of both push and pull for human actions. The third group is the interaction between psychological traits and situational factors which is called mechanical interaction. The fourth group consists of psychological states. They are psychological characteristics that can be changed by the effects of current situations. The examples of theory that consider psychological characteristics and situations as well as their interactions as the antecedents of behaviors or outcomes are theory of reasoned action (Fishbein & Ajzen, 1975), theory of planned behavior (Ajzen, 1991), and contingency theory of leadership effectiveness (Fiedler & Chemers, 1984).

In this study, variables in each group will be conglomerated into the latent variables, which include the latent psychological trait, latent situational factor, latent psychological state, and latent research potentiality. The formation of latent variable consisted of many observed variables can be found in some important theories or constructs, such as the psychological theory of moral and work behavior (Bhanthumnavin, 1993), core self-evaluation (Judge, Locke, and Durham, 1997), and psychological capital (Luthans, Avolio, Avey, & Norman, 2007).

Little and Lindenberger (1999) also suggested that there are a few guidelines for research to choose which variables and how many of them would be used for a latent variable (Bollen, 2002). Nevertheless, it will be more acceptable if the latent variable is based on theoretical support. However, SEM will be performed in this study. This analytical approach will reveal the details of both the construct validity of the measurement model of each latent variable, as well as the relationship among them

(Schreiber, Stage, King, Nora, & Barlow, 2006). Using latent variable model has more benefits of reducing measurement errors, and improving the strength and accuracy of the parameter estimated (Wolf, Harrington, Clark, & Miller, 2013).

Psychological Traits as Antecedents of Psychological States and Research Potentiality

Core self-evaluation has been suggested as an important psychological characteristic in the past decade. It consists of four major traits, i.e., self-esteem, generalized self-efficacy, low neuroticism, and locus of control (Judge, Erez, Bono, & Thorensen, 2003). It has been found that each trait above is related to other psychological characteristics, such as, attitudes (Judge, & Bono, 2001; Judge, Ilies, Zhang, 2012; Kong, Wang & Zhao, 2014), and self-regulation (Zacher, 2014).

Consideration of future consequences (CFC) is based on Strathman, Gleicher, Boninger and Edwards (1994). Several studies using this disposition have been recently popular abroad (e.g., Arnocky, Milfont, & Nicol, 2014; Robinns & Burleson, 2015; Toepoel, 2010), but less in Thailand. CFC is related to future and past affects, as well as many other psychological characteristics, such as, procrastination (Rebetez, Barsics, Rochat, D'Argembeau, & Van der Linden, 2016; Sirois, 2004), and reasoning (Sirirak, 2012).

Achievement motive refers to needs for success, fear of failure, and striving to do things better (Atkinson & McClelland, 1948; McClelland & Koestner, 1992). Achievement-motivated persons have high potential to produce positive outcomes, such as, academic achievement (Bipp & Van Dam, 2014), and work effectiveness (Schultheiss, Wiemers, & Wolf, 2014). Furthermore, Need for achievement is also related to less intention to leave (Moneta, 2011), and high self-regulation at work (Bartels & Magun-Jackson, 2009).

Knowledge is the basic requirement for an individual to get a job done (Campbell, 1990). There are three types of knowledge necessary for doing research, i.e., research methodology, measurement, and statistical analysis (Aiken, West, Sechrest, & Reno, 1990). There was some evidence that having knowledge on a certain thing is related to attitude towards that thing. This relationship was found in the issue of nuclear power plant (Pet-in, 2012; Panyaskulvong, 2012).

Habit is an action or behavior that is automatic (Verplanken & Orbell, 2003) or repeated regularly (Mittal, 1988) with no needs to be controlled or forced. Sometimes, it can indicate identity of an individual (Trafimow & Wyer, 1993). Previous studies showed that habit is related to intention to act. Many researchers studied habit and intention, for example, Ouellette and Wood (1998) found positive relationship between these two constructs.

According to the literature review above, there were some evidences that these psychological traits were related to some dispositions, such as, attitudes, as well as to some potentials, such as intention to do things, and self-regulation. These five psychological traits were grouped as latent psychological trait variable.

Situational Factors as Antecedents of Psychological States and Research Potentiality

In order to successfully doing certain new things, an individual need guidance from significant others. Graduate students, even though they may take many courses relating to research practice, but they may not have a chance to do it in full. They need guidance from significant others, such as mentors, to help them go through the process. Previous studies found that the mentor or role model (referred as descriptive norm) produced positive outcomes. For example, mentors usually give social support which related to positive attitudes toward work (Roxana, 2013), less anxiety (Bradley & Cartwright, 2002), and high potentially positive outcomes (Kushnir, Ehrenfeld, & Shalish, 2008).

Perceived subjective norm refers to expectations of significant others as pressure to an individual to engage or not to engage in a behavior. It was found that subjective norm was positively related to attitudes and intention (e.g., Fornara, Pattitoni, Mura, & Strazzer, 2016; Wan, Shen, & Choi, 2017). Furthermore, a recent study of 433 children showed the relationship between norm and self-regulation (Blake, Piovesan, Montinari, Warneken, & Gino, 2015).

Learning atmosphere is one of the important factors affecting learners' understanding and comprehension of the subject. Learning atmosphere and related constructs, such as, classroom atmosphere, and learning environment, were found to be related to psychological characteristics, and potentiality, especially in terms of intention (Tzafrir, Gur, & Blumen, 2015). For example, Liaw and Huang (2013) studied 196 university students in Taiwan. Results from path analysis indicated that learning environment had direct effect on self-regulation ($\beta = 0.40, p < .01$). It also had indirect effect on self-regulation via satisfaction.

The amount of learning and training on the subject is another external factor relating to knowledge on the subject. It has long been believe that receiving greater amount of learning and training implies that you are having more knowledge and information on that matter which can enhance your readiness to proceed appropriately to get work done effectively. There were some evident that receiving certain training was positively related to readiness (Yodrabam, 2005).

According to the literature review, evidences suggested that situational factors directly affected some potential, especially intention or readiness, as well as, some psychological characteristics, especially attitudes. These four situational constructs will be grouped as latent situational factor variable.

Psychological States as Antecedents of Research Potentiality

Based on the Theory of Reasoned Action (Fishbein & Ajzen, 1975), attitudes is one of the important predictors of intention. Previous studies had revealed that attitudes were related to intention or readiness to act. Relationships between attitude and intention was also found in many behaviors, e.g., driving (Helman, Kinnear, McKenna, Allsop, & Horswill, 2013), and smoking (Carosella, Ossip-Klein, & Owen, 1999).

There is little evidence about misconception and the research potentiality. Misconception refers to misunderstanding or incorrect belief which can be a great obstacle of readiness to learn new knowledge, especially in research area (Bransford, Brown, & Cocking, 2000; Lambert & McCombs, 1998). Many scholars and researchers have paid attention to research misconceptions (e.g., Duda, 1984; Kawulich, Garner, Wagner, 2009; Kelly & Kaczynski, 2006).

Scholars and researchers have studied reasoning as a predictor, especially in elementary level (e.g. Saetier, Intarakamhang, Tansuwannond, & Chatrakamollathas, 2017; Zhou, Han, Koenig, Raplinger, Pi, Li, Xiao, Fu & Bo, 2016). However, less attention has been paid to study reasoning and research ability in higher education. Westaby (2005) proposed Behavioral reasoning theory based on the Theory of planned behavior (Ajzen, 1991). The researcher found that reason for behavior, as well as reason against behavior had both direct and indirect effects on intention via attitudes, subjective norms, and perceived control which could explain 62% of the variance of the intention.

It is inevitably for quantitative researchers to involve in statistical usage, i.e., data analysis. Many graduate students who are afraid of numbers will experience statistical anxiety (Ratanaolarn, 2016). Anxious persons feel uncomfortable, stressful, unhappy, or frustrated when they take statistic-related course. Previous studies shows that math anxiety negatively related to self-regulation (Jain & Dowson, 2009).

According to the research literature above, some psychological states, especially, attitudes, and anxiety directly affected some human potentiality, especially intention and self-regulation for certain actions. These four measures will be grouped as latent psychological state variable.

Research Hypotheses

Based on interactionism paradigm (Endler & Magnusson, 1976), three hypotheses can be generated (Figure 1).

Hypothesis 1. Research potentiality is directly affected by psychological trait, situational factor, and psychological state.

Hypothesis 2. Psychological state is directly affected by psychological trait, and situational factor.

Hypothesis 3. Research potentiality is indirectly affected by psychological trait, and situational factor.

Methodology

Samples

A total of 551 Thai graduate students from both Master and Ph.D. levels in social science and education were obtained in 2015 from universities in Bangkok, and

other provinces of Thailand. Multi-stage quota random sampling was employed. There were 173 males (31.5%), 377 females (68.5%) and 1 unidentified gender. The age ranged was 22-68 years old with the average age of 32.57 years. Most of them took more than one research related course (54.5%), and chose to do research thesis (61.10%). The total of starting parameters were 51 parameters. According to Hair, Hult, Ringle, and Sarstedt (2013), it is suggested that sample size should be 10 times per each structural path in the structural model. Thus, the sample size in this study was suitable.

Measures

Variables in this study were mostly measured by summated rating method, with 6 point scale ranging from “absolutely true” to “absolutely not true”. Most of these questionnaires were constructed by the researcher. The questionnaires were in Thai language. There were four groups of variables as follows (see Table 1).

Research potentiality as latent variable consisted of three variables from Bhanthumnavin (2014). First, self-regulated research learning (SRL) involves self-direction in learning, observing own thoughts and actions, planning, and creating positive environment to enhance learning and doing research, with the total of 13 items. The score alpha reliability was 0.79. Secondly, research moral identity (RMI) involves internalization and symbolization related to research process (e.g., literature reviewing, hypothesis testing, data gathering), with the total of 15 items which yielded the score reliability of 0.87. The third variable was research behavioral intention (RBI), consisted of 15 items, was defined as more approach and less avoidance of research readiness and preparation, with the score reliability of 0.80.

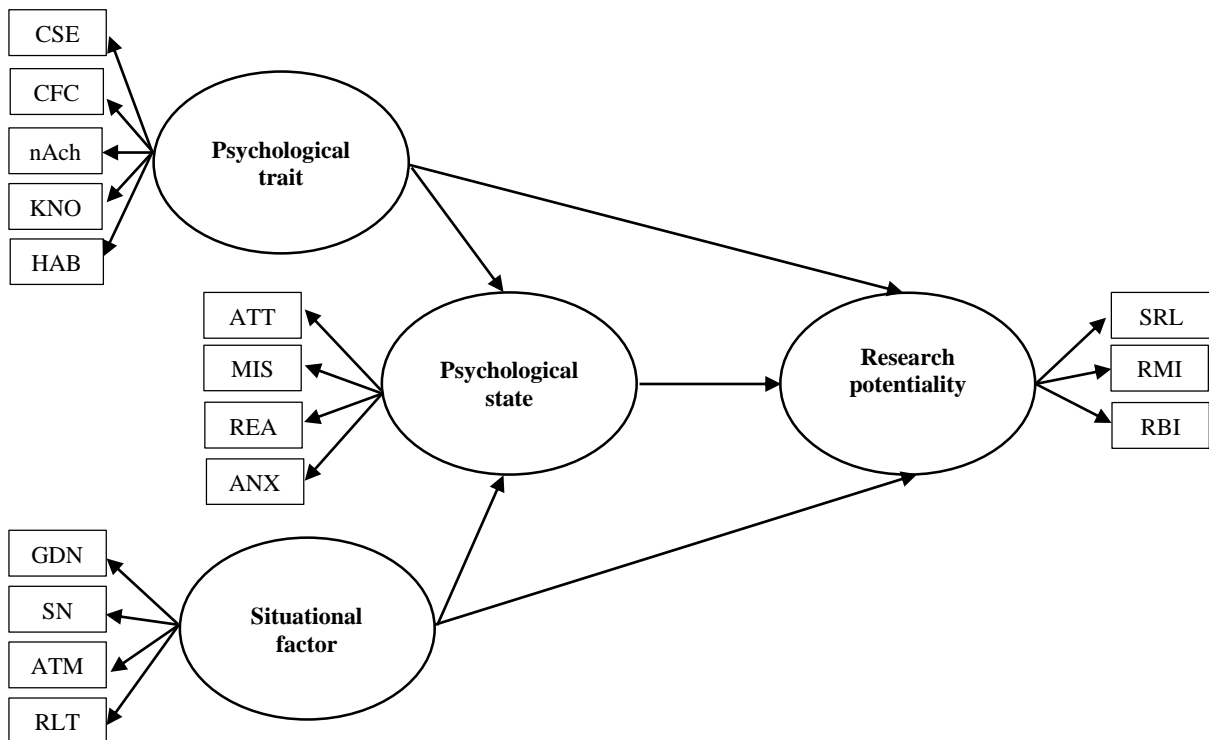


Figure 1. Hypothetical model of this study.

Latent psychological state construct consisted of four variables. Most of them were from Bhanthumnavin (2015). First, attitudes towards research (ATT) involves cognitive and affective aspects related to research process. It comprised of 12 items, with the score reliability of 0.83. Secondly, research misconception (MIS) defined as wrong ideas or misunderstanding about meaning of research, integrity of research findings, and some research procedures, with 15 items, and score reliability of 0.80. Thirdly, scientific reasoning (REA) (Meekun, 2008) assessed ability to think about causal-effect relationship, with 12 items and the score reliability of 0.77. The last variable in this group was statistical anxiety (ANX) related to feeling of frustrating, fear, bored or stress, including physical reaction (e.g., sweating, cold hands) when reacted to statistics in three aspects (knowledge, consume, produce). This concept of anxiety was based on Cruise, Cash, and Bolton (1985), and Vigil-Colet, Lorenzo-Seva, and Condon (2008). It comprised of 18 items, with the score reliability of 0.96.

Latent situational construct consisted of four variables. First, research guidance and descriptive norm (GDN) was the degree to which the student has significant others who can be a good advisor or role model in doing research. It comprised of 15 items with the score reliability of 0.83. Secondly, perceived subjective norm (SN) focused on the degree of perceived expectation from significant others in doing research with high effectiveness and high morality. A total of 10 items yielded the score reliability of 0.87. Thirdly, research learning atmosphere (ATM) involved the emotional and academic support from instructors and peers in the university. It comprised of 16 items, with the score reliability of 0.89. The final variable in this group was the amount of research learning and training (RLT) related the report from the graduate students that they were taught or involved in quantitative research studies in the courses. A total of 15 items yielded the score reliability of 0.82.

Latent psychological trait construct consisted of five variables. First, core self-evaluation (CSE) was based on Judge, Erez, Bono and Thoresen (2003). There were four aspects of this construct, namely, self-esteem, generalized self-efficacy, neuroticism, and locus of control. Twelve items were translated into Thai language, which yielded the reliability of 0.78. Secondly, consideration of future consequences (CFC) was based on Strathman, Gleicher, Boninger and Edwards (1994) involved the perceptions of the future outcomes from their present actions. A total of 12 items were translated into Thai language, which yielded the score reliability of 0.70. Thirdly, need for achievement (nAch) from Bhanthumnavin (2015) refers to the desire of individual to accomplish a high standard task or assignment by thinking before hands of what will be the enhancers or obstructers in completing this work. Total of 15 items were accepted, with the score reliability of 0.77. Fourthly, research knowledge (KNO) was assessed by 25 items with 4 multiple choices related to understanding about quantitative research process. The reliability of this measure was 0.63. The last variable in this group was academic habit (HAB) referred to previous academic behaviors or actions. A total of 15 items yielded the score reliability of 0.86.

Analyses

Correlational matrix from each pair of variables in the study was computed to examine and compare the magnitudes of the relationships. Path analysis was performed to test a model of the psycho-social antecedents on research potentiality. The following criteria were used to identify the model fit, they are, the chi-square (χ^2) test of model fit which should not be significant (Joreskog & Sorbom, 1989), the Tucker-Lewis Index

Table 1
Item and measurement quality of each variable in this study

Variables	Initial no. of items	Items used	Range of t-ratio (item discriminant)	Range of item-total correlation	Reliability (α)	Confirmatory Factor Analysis						
						χ^2	df	P value	RMSEA (≤ 0.06)	CFI (≥ 0.90)	TLI (≥ 0.90)	SRMR/WRMR (≤ 0.08)
1. Self-regulated research learning*	13	13	3.75 to 11.15	0.26 to 0.60	0.79	65.98	52	0.09	0.04	0.98	0.98	0.06
2. Research moral identity*	15	15	4.61 to 12.80	0.25 to 0.72	0.87	101.49	81	0.06	0.04	0.98	0.97	0.06
3. Research behavioral intention*	15	15	4.71 to 9.73	0.21 to 0.55	0.80	100.78	81	0.07	0.04	0.98	0.97	0.07
4. Attitudes towards research**	16	12	4.18 to 13.14	0.24 to 0.70	0.83	52.98	38	0.05	0.05	0.98	0.97	0.06
5. Research misconception**	25	15	3.23 to 9.21	0.16 to 0.58	0.80	104.36	84	0.06	0.04	0.96	0.95	0.06
6. Scientific reasoning***	12	9	4.72 to 8.24	0.25 to 0.53	0.77	33.41	23	0.07	0.05	0.98	0.96	0.04
7. Statistical anxiety**	24	18	6.21 to 19.84	0.51 to 0.86	0.96	127.88	104	0.06	0.04	0.99	0.99	0.03
8. Research guidance and descriptive norm**	28	15	5.03 to 8.38	0.25 to 0.51	0.83	96.86	77	0.06	0.04	0.97	0.97	0.06
9. Perceived subjective norm**	15	10	3.15 to 17.55	0.32 to 0.77	0.87	22.18	21	0.39	0.02	1.00	1.00	0.03
10. Research learning atmosphere**	25	16	7.04 to 10.32	0.49 to 0.67	0.89	108.25	88	0.07	0.04	0.99	0.98	0.04
11. Amount of research learning and training**	21	15	4.14 to 11.08	0.19 to 0.60	0.82	99.44	80	0.07	0.04	0.98	0.97	0.05
12. Core self-evaluation***	12	12	5.41 to 11.76	0.30 to 0.58	0.78	51.55	38	0.07	0.98	0.96	0.05	0.06
13. Need for achievement**	15	15	4.34 to 8.96	0.27 to 0.60	0.77	94.98	75	0.06	0.04	0.97	0.96	0.06
14. Academic habit**	20	15	4.77 to 10.73	0.25 to 0.62	0.86	82.69	65	0.07	0.04	0.98	0.97	0.05
15. Research knowledge**	25	11	0.13 to 0.47	0.18 to 0.42	0.63	63.94	44	0.03	0.05	0.90	0.88	0.91
16. Consideration of future consequences***	12	10	3.02 to 8.74	0.06 to 0.46	0.70	37.87	27	0.08	0.05	0.97	0.95	0.06

Note: * constructed by Bhanthumnavin (2014), ** constructed by Bhanthumnavin (2015), *** standardized measure

(TLI) (Tucker & Lewis, 1973) moving toward 1.00, the Comparative Fit Index (CFI) (Bentler, 1990) which should more than 0.95, the Root Mean Square Error of Approximation (RMSEA) (Browne & Cudeck, 1993) which should less than 0.50, and the Standardized Root Mean Square Residual (SRMR) (Hu & Bentler, 1999) which should less than 0.50.

Results

The findings from this study can be summarized that the psychological trait and the situational factor directly affect the research potentiality via the psychological state. The details are as follows.

Intercorrelations among the Variables

Intercorrelation matrix from Table 2, among the psychological traits, indicated that the highest relationship in this group was between core self-evaluation and need for achievement ($r = 0.524, p < .01$). The rest of the correlations in this group ranged from 0.125 ($p < .01$) to 0.484 ($p < .01$). As for the relationships between psychological traits and the dependent variables, the highest relationship was found between consideration of future consequences and research moral identity ($r = 0.572, p < .01$). The rest of magnitudes ranged from 0.196 ($p < .01$) to 0.475 ($p < .01$).

The highest magnitude of the relationship among situational factors (Table 2) was between “research guidance and descriptive norm” and “the amount of research learning and training” ($r = 0.630, p < .01$). The rest of the correlations in this group ranged from 0.251 ($p < .01$) to 0.614 ($p < .01$). As for the relationship between situational factors and the dependent variables, the highest relationship was found between the “research guidance and descriptive norm” and research behavioral intention ($r = 0.553, p < .01$). The rest of magnitudes ranged from 0.178 ($p < .01$) to 0.533 ($p < .01$).

The correlation matrix among psychological states in Table 2 displayed that the relationship between attitude towards research and statistical anxiety showed the highest magnitude ($r = 0.549, p < .01$). The rest of magnitudes in this group ranged from 0.129 ($p < .01$) to 0.428 ($p < .01$). As for the relationship between psychological states and the dependent variables, the highest relationship was found between the attitudes towards research and research moral identity ($r = 0.587, p < .01$). The rest of magnitudes ranged from 0.130 ($p < .01$) to 0.571 ($p < .01$).

SEM for the Psycho-social Antecedents of Research Potentiality

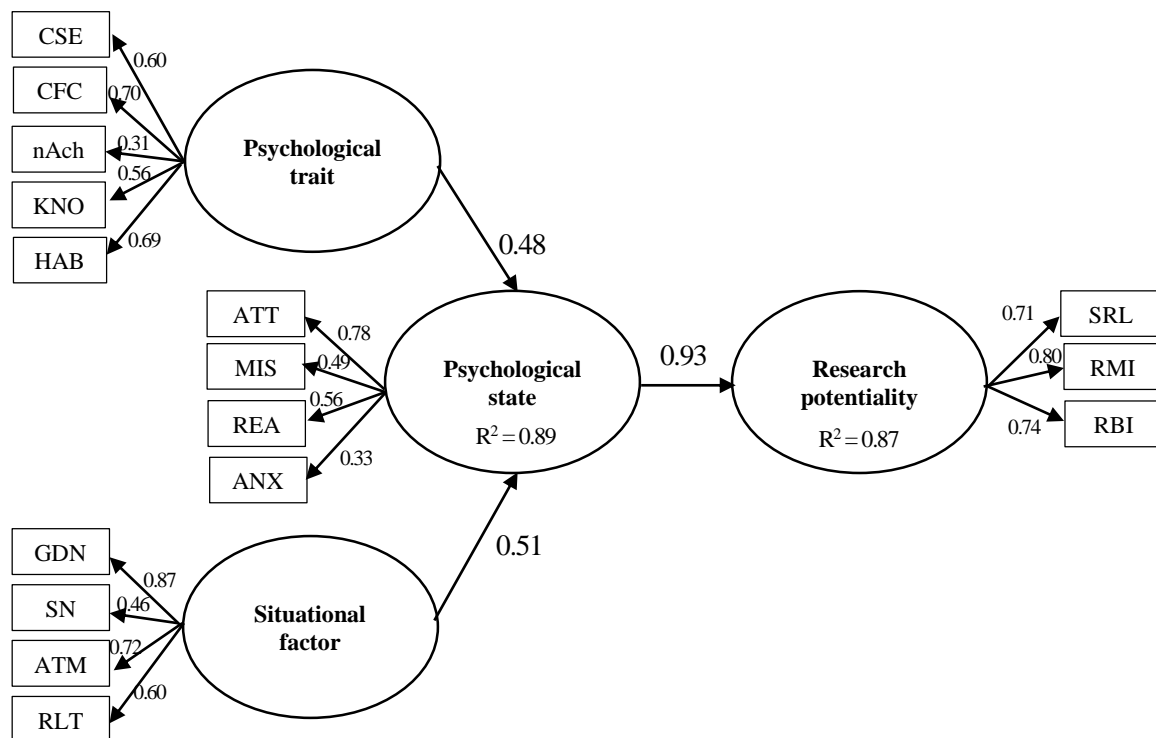
Path analysis was performed to examine the influence of psychological characteristics and situational factors on research potentiality of the graduate students. The hypothetical model presented in Figure 2 was not consistent with the empirical data. In details, the direct effect from latent psychological trait as well as latent situational factor to latent research potentiality were not significant. Thus, these two paths were removed. The revised model was introduced in Figure 2. The model was a good fit (the Chi-square test = 74.646, $df = 57$, p -value = 0.0584; RMSEA = 0.024; CFI = 0.995; TLI = 0.990; SRMR = 0.025).

Table 2

Intercorrelation matrix and descriptive statistics of each variable in the study (N = 551)

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Core self-evaluation	51.93	7.17	1															
2. Need for achievement	68.32	8.22	.52**	1														
3. Research knowledge	7.17	2.10	.13**	.18**	1													
4. Academic habit	58.02	10.71	.345**	.41**	.15**	1												
5. Consideration of future consequences	43.60	5.50	.30**	.48**	.25**	.36**	1											
6. Research guidance and descriptive norm	66.70	9.64	.45**	.44**	.19**	.37**	.38**	1										
7. Perceived subjective norm	122.11	23.95	.23**	.31**	.13**	.14**	.30**	.38**	1									
8. The amount of research learning and training	66.24	9.83	.37**	.38**	.29**	.31**	.39**	.63**	.25**	1								
9. Research learning atmosphere	73.92	10.12	.31**	.42**	0.08	.22**	.33**	.61**	.43**	.44**	1							
10. Attitude towards research	52.92	7.81	.45**	.50**	.24**	.43**	.39**	.61**	.29**	.49**	.40**	1						
11. Research misconceptions	63.01	8.36	.13**	.32**	.30**	.21**	.42**	.30**	.26**	.344**	.23**	.37**	1					
12. Scientific reasoning	43.91	5.58	.27**	.38**	.26**	.120**	.39**	.38**	.36**	.39**	.31**	.41**	.43**	1				
13. Statistical anxiety	66.39	16.52	.30**	.26**	.19**	.29**	.20**	.32**	0.08	.34**	.14**	.55**	.15**	.13**	1			
14. Self-regulated research learning	55.78	7.82	.41**	.37**	.15**	.40**	.25**	.53**	.18**	.40**	.36**	.56**	.13**	.24**	.25**	1		
15. Research moral identity	69.33	10.27	.368**	.47**	.27**	.35**	.57**	.51**	.42**	.52**	.34**	.59**	.56**	.57**	.27**	.33**	1	
16. Research behavioral intention	69.37	8.79	.35**	.53**	.20**	.47**	.50**	.55**	.34**	.46**	.41**	.56**	.45**	.40**	.23**	.50**	.61**	1
95% CI for lower bound of mean	51.33	67.63	7.00	57.12	43.14	65.89	120.11	65.42	73.07	52.27	62.31	43.44	65.01	55.13	68.47	68.64	70.10	
95% CI for upper bound of mean	52.53	69.01	7.34	58.92	44.06	67.51	124.11	67.06	74.77	53.57	63.71	44.38	67.77	56.43	70.19	70.10		
Skewness	.062	.081	-.432	-.088	.127	-.358	-.296	-.122	-.296	-.190	-.169	-.760	-.132	-.054	-.425	-.029		
Kurtosis	-.081	-.245	-.234	.040	.145	.291	.074	-.275	.506	-.265	.341	1.090	-.423	.130	.093	-.457		

Note: * p<.05, ** p<.01



Note. All parameter estimates are standardized with $p < .05$.

Figure 2. Psycho-social model of research potentiality of Thai graduate students.

Measurement Models

Latent situational construct consisted of four variables, i.e., research guidance and descriptive norm, perceived subjective norm, research learning atmosphere, and the amount of research learning and training. It was found that research guidance and descriptive norm was the most important variable in this group (loading = 0.87), followed by research learning atmosphere (loading = 0.72). The least important variable in this group was perceived subjective norm (loading = 0.46).

Latent psychological trait construct consisted of five variables, i.e., core self-evaluation, consideration of future consequences, need for achievement, research knowledge and academic habit. The most important variable in this group was consideration of future consequences with the loading of 0.70, followed by academic habit with the loading of 0.69. The least important variable in this group was need for achievement with the loading of 0.31.

Latent psychological state construct consisted of four variables, i.e., attitudes towards research, research misconception, scientific reasoning, and statistical anxiety. Favorable attitudes towards research was found to be the most important variable in this group with the loading of 0.78, followed by scientific reasoning with the loading of 0.56. The least important variable in this group was statistical anxiety with the loading of 0.33.

Latent research potential construct consisted of three variables, i.e., self-regulated research learning, research moral identity, and research behavioral intention. The most important variable in this group was research moral identity with the loading of 0.80,

followed by research behavioral intention (loading = 0.74), and self-regulated research learning (loading = 0.71).

Path Model

The final model (Figure 2) revealed that latent research potentiality construct was directly affected by latent psychological state construct which accounted for 87% of the variance of the latent research potentiality construct. The latent research potentiality construct was also indirectly affected by latent psychological trait construct and latent situational construct which partially supported hypothesis 1, but fully supported hypothesis 3.

Latent psychological state construct was directly affected by latent psychological trait construct and latent situational factor construct which was accounted for 89% of the variance. Thus, hypothesis 2 was fully supported.

Discussion and Implications

This correlational-comparative study aimed at investigating the psycho-social antecedents of research potentiality in Thai graduate students. Results from SEM in terms of measurement model for research potentiality indicated that research moral identity was the strongest factor in this group. It implies that in order to be a potential researcher, “good researcher” (moral) comes first before “readiness” (academic) which was the second strongest factor in this group.

As for latent psychological state construct, attitudes towards research was the most important factor for this group. Recent study on the topic of research readiness in undergraduate level (Bhanthumnavin, 2015c) also found that for measurement model of latent psychological state construct, attitudes towards research was also the strongest factor. However, it was the second strongest factor in measurement model of latent psychological state construct in research scholars (Bhanthumnavin, 2015a). Furthermore, this finding suggested that attitudes towards research was the most important factor directly affecting latent research potentiality construct. Several previous studies also confirmed that attitudes including satisfaction towards subject or behavior usually played important role in predicting the attitudinal objects (e.g., Wan, Shen, & Choi, 2017; Limpasirisuwan & Donkwa, 2017).

Research guidance and descriptive norm together was found in this present study to be the most important factor in the latent situational factor construct affecting latent psychological state construct. This is because the graduate students who mostly have little experience in doing research, feel afraid, and helpless. Even though, they might take some research methodology courses, but most of these courses emphasize the principles rather than practice. Thai graduate students usually do not have a chance to be trained as research assistants. So, when it comes to thesis or dissertation, the graduate students do not know what to begin, and what to do next. Good role models and supportive mentors are the keys to help them go through this frustrated process. Previous studies revealed the importance of mentor, supervisor, or advisor on students’ personal growth, academic achievement and professional success (Chan, 2016).

The most important factor in latent psychological trait construct was consideration of future consequences. Despite of being a rather less well known construct, but its root relates to a long-time important construct as future orientation (Zimbardo & Boyd, 1999). Persons with high degree of consideration of future consequences are more likely to think ahead about future outcomes of their present actions. This kind of thinking is related to scientific thinking which is about causal-effect relationships. This ability will help the graduate students to be ready for enhancing supportive elements and reducing the barriers in research conducting process.

According to the findings from path analysis, latent psychological trait construct and latent situational trait construct directly affected only latent psychological state construct, but not to latent research potentiality construct. Thus hypothesis 1 was partially supported, but hypothesis 3 was supported. Bhanthumnavin (2015d) also reported that latent psychological trait construct and latent situational trait construct had indirect effects on latent mindful risk-taking behavior construct via latent psychological state construct and latent success in life construct. Furthermore, recent study (Bhanthumnavin & Bhanthumnavin 2016) found that latent perceived situational construct played mediating role between latent psychological trait construct and latent psychological state construct. However, both latent psychological and situation constructs did not directly affect the latent dependent construct as well. In addition, similar to the findings in this study, it seems that latent situational construct had a little bit more influence than latent psychological trait construct.

It can be suggested that the graduate students should be urgently heightened attitude towards research. This can be administered in many ways. One of these ways is by creating good role model, mentor or advisor (e.g., Bliska, 2016; Praditbathuka, 2013; Tocher, 1961). Mentor or advisor who are dedicated to groom the students will help them release fear and anxiety in doing research, and make things easier and enjoyable, which will enhance favorable attitude towards research. Furthermore, these supervisor can help the students solve research process problems, which in turn, prevent the student from misconducts and research moral disengagement (Bhanthumnavin, 2015a). Moreover, research learning atmosphere also plays an important role. In this study, its emphasis was on quantitative approach. Instructors teaching this course should be a good role model, showing enjoyment, and satisfy in carrying out and solving problems during his or her own research process, supportive and helpful.

Based on the findings from this study, the important take home messages are as follows. First, it is believed that the more one has knowledge, the more is predicted effectiveness. However, the findings from this study did not support this claim. It was found that research knowledge, and the amount of research learning and training were less important to research intention and research potentiality than other predictors. More importantly, future orientation, and scientific reasoning should be promoted in the graduate students from a younger age. Secondly, the findings in this study did not only reveal the importance of favorable attitudes towards research affecting research potentiality, but also indicated the important antecedents of attitudes towards research. The results revealed both psychological characteristics, especially consideration of future consequences, as well as academic habit, and also situational factors, especially, social support and norm from significant others were important predictors of attitudes toward research. Finally, research potentiality is highly related to research moral identity which corresponds with the statement of Rosenthal (1993) that doing research rigorously is equivalent to do research with high standard of morality.

There are some limitations in this study. First, it is a correlational comparative study that consumers should not claim for causal-effect. Secondly, results from SEM approach could be subjective (MacCallum & Austin, 2000) due to the effects of sampling, measures, and occasions (Nesselroade, 1991). Thus, a consumer should be more aware of the limitations of single studies.

For future study, academic habit seems to be shining bright among the antecedents. Many researchers also suggested this construct as a major predictor of intention and behavior (e.g. Ang, 2016; Neal, Wood, Labrecque, & Lally, 2012). Subsequent studies should include research habit strength as predictor of research effectiveness. Furthermore, psycho-social antecedents of academic habit strength should be investigated. Interactionism model should be used in future studies in order to cover more important dimensions of possible antecedents of behaviors. Competing models based on interactionism model is highly encouraged.

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