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Path Model of Teacher's Normative Communication and Attitudes toward Nuclear Power Plant among Thai Youth

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This study aimed to investigate the relationships among teacher's perceived normative communication, media exposure, and knowledge on the three components of attitudes toward nuclear power plant (NPP) in 638 high school students. The findings indicated that teacher's normative communication was the most important factor, as compared to the other two factors, namely NPP knowledge and media exposure. Results from Structural Equation Modeling (SEM) indicated that the direct effect of teacher's normative communication was found toward trust in the government, and all three aspects of NPP attitude, namely, cognitive aspect, affective aspect, and intention aspect. Moreover, affective aspect, cognitive aspect, and teacher's normative communication could explain 74.0% of the variance of the NPP intention aspect. Applications for teachers in schools to increase the acceptance of NPP among young generation, and suggestions for future study were discussed.

Keywords: communication, nuclear, components of attitudes, high school students, Thai teacher

Energy crisis together with global warming due to excess emission and increasing amount of CO_2 in the atmosphere are now major concerns for many countries. One promising mean to reduce the CO_2 content in the atmosphere is to abate the use of fossil fuels (e.g., coal, oil, natural gas), and looking for alternative or renewable energies for substitution or use in terms of energy mixed scheme (European Commission, 2007; Orhan, Dincer, Rosen, & Kanoglu, 2012). Nuclear energy via nuclear power plant (NPP) is one of the available alternative energy sources with strong potential to meet the based-load electrical demand from industrial development. It is a common fact that any introduction of the use of new technology usually meet with resistance to change. This is due to many factors which are mainly fear and ignorance of the new technology. Communicating knowledge about technology to the potential consumers is vital for the successful application of particular energy project. That is public acceptance with long lasting effect can be prompted by proper education for the young generation (International Atomic Energy Agency [IAEA], 2013). These obstacles can be reduced by enhancing the knowledge about utilization of nuclear energy. Young generation, such as high school and university students could play a vital role of leading decision makers in the future.

School is an important social institution, and directly influences the students' beliefs and actions. Teachers are the significant persons in the lives of their students. The students can permanently assimilate the teachers' thoughts and beliefs by communications and interactions. This study is a correlational study to examine influence of perceived teacher's normative communication and other important factors on the three aspects of attitudes toward nuclear power plant (i.e., cognitive, affective, and behavioral intention) using structural equation modeling (SEM) for data analysis.

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Attitudes toward Nuclear Power Plant

The key of successfully deploying a nuclear power plant project is to increase public acceptance which involves attitudes of the people. It is commonly known that based on the theory of attitude (Eagly & Chaiken, 1993). There are three aspects or components of attitude, namely, cognitive, affective, and behavioral intention (Figure 1). Many researchers all around the world have been trying to understand the attitudes toward NPP. Recently, Bhanthumnavin and Bhanthumnavin (2014) developed three measures to assess these three aspects of attitude. By employing factor analysis technique both exploratory and confirmatory, the researchers found three-factor model of cognitive aspect of attitude toward NPP, namely, perceived potential harm and low necessity, economic progress and well-being, and readiness together with dependency. They also found a three-factor model of affective aspect of attitudes toward NPP, namely, not being afraid of NPP, feelings related to bombs, war, and sickness, and bad impressions. A two-factor model of behavioral intention of attitudes toward NPP, namely, readiness to support and readiness to resist, was found Each of these measures consisted of 15 items with 6-point Likert type scales. These three measures were used in this study. Furthermore, it was also found that these three aspects were rather highly correlated among each other. Previous studies (Pet-in, 2012; Termkunanon, 2010) indicated that cognitive and affective aspects were important predictors of behavioral intention aspect.

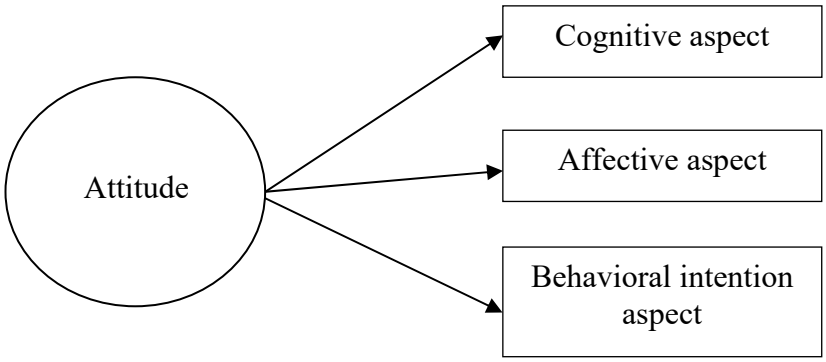

Figure 1. Three aspects of attitudes (Kretch, Crutchfield, & Ballachey, 1962).

Influence of Teacher on Students' Attitudes toward Nuclear Power Plant

A teacher is one of the most important significant other in a student's life, and usually has strong influence on students' beliefs, trust, and actions (Bar-Tal & Harel, 2002; Bhanthumnavin, 2015; Butler & Shibaz, 2014; Van Uden, Ritzen, & Pieters, 2014). Previous studies revealed that perceived NPP norm from teacher was positively related to the student's trust in people (Termkunanon, 2010), as well as trust in the government (Pet-in, 2012). Individual's trust was found to be related to acceptance of new technology, especially nuclear power plant (Bhanthumnavin & Bhanthumnavin, 2011).

Recently, it has been demonstrated that normative influence from significant others had increasingly more powerful role in student acceptance of new technology at school, such as computer usage (Gibson et al., 2014; Hopp & Gangaadharbatla, 2016). Moreover previous studies revealed influence of teachers on the students' attitudes toward desirable behaviors, such as, attitudes toward responsible behavior (Numniem, 2003), and especially attitudes toward NPP (Pet-in, 2012) in terms of cognitive and affective aspects (Termkunanon, 2010).

Other Factors Relating to Attitudes toward Nuclear Power Plant

At present, news and information from mass media can easily reach everyone. There are some evidences that amount of media exposure is related to attitudes, but there is still no clear conclusion. Termkunanon (2010) studied 205 high school students, and found some direct effect of media exposure to attitudes toward NPP, as well as, intention to support NPP. However, the direction of relationship between the media exposure was positive with attitudes, but negative with intention. A study using 612 undergraduate students (Pet-in, 2012) found positive relationship between media exposure and intention to support NPP, but did not find a significant relationship between media exposure and attitudes toward NPP. However, another study found the relationship in opposite directions on both attitudes and intention in undergraduate students (Panyasakulvong, 2012).

Mass media in Thailand is now playing an important role in directing people's beliefs and actions (Yoelao, Junprasert, Tuntivivat, & Chaiakkarakan, 2015). Exposure to media to get some information could also increase trust. Studies in Thailand indicated that students who exposure to information about nuclear energy were the ones who reported higher trust in other people (Termkunanon, 2010) and trust in the government (Panyasakulvong, 2012).

Another important factor was general knowledge about NPP which involved the understanding about NPP. Previous studies suggested students who possessed more accurate knowledge on hygiene and health, were the ones who got higher score on attitudes toward health behavior (Promlukkano, 2006). Similar results were also found in nuclear subject (Bhanthumnavin & Bhanthumnavin, 2011).

Nowadays, people rely more on technology and machines to facilitate their living. However, some people are still afraid and reluctant to used technology. This is because they have fear of an unknown, and misunderstand technology. It was found that knowledge on technology is related to trust in the organization about who controls and operates that technology (Bhanthumnavin & Bhanthumnavin, 2011). Moreover, it was found that knowledge sharing has positive influence on the acceptance of the new introduced technology (Esmaeilzaden, Sambasivan, Kumar, & Nezakati, 2013).

Research Hypotheses

The conceptual framework of this study is displayed in Figure 2. There were two hypotheses.

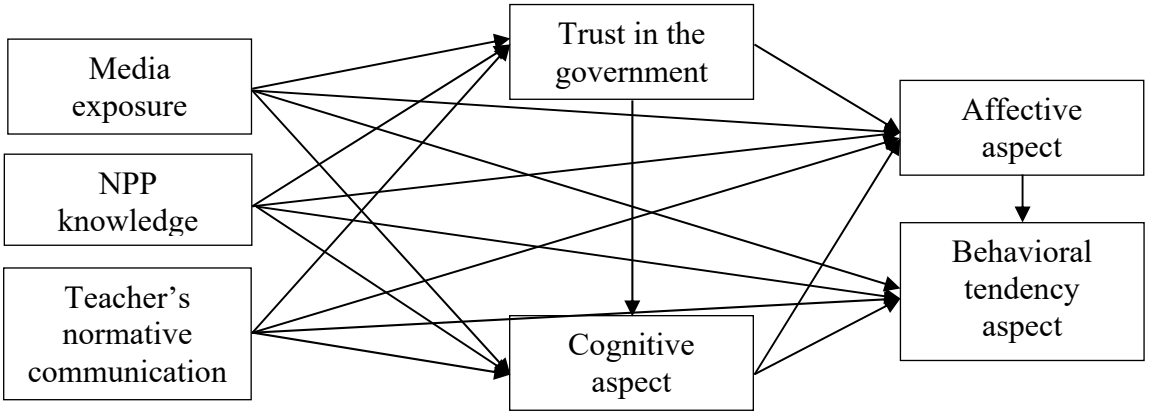

Figure 2. The conceptual framework of the study.

Hypothesis 1: Media exposure, teacher norm, or general NPP knowledge is positively and significantly related to cognitive aspect, affective aspect, or behavioral intention aspect.

Hypothesis 2: Media exposure, teacher norm, or general NPP knowledge is directly and indirectly related to behavioral intention aspect via trust in the government.

Methodology

Samples

Samples in this study were high school students in Bangkok and vicinity obtained by multistage quota random sampling method in the year of 2014. There were four stages: 1) three secondary schools were included 2) in each school, the 11th grade students were chosen 3) at least four classes of the 11th grade participated, and 4) in each class, the average number of the students was approximately 50 students. It was expected to collect data from at least 600 students. The students returned 640 questionnaires. Two questionnaires were excluded. Thus, the total of 638 students' data was employed in this study. They consisted of 248 males (38.90%) and 390 females (61.10%) with the average GPA of 2.82 (*SD*=0.60), and the average age of 16 years old.

Measures

At least seven measures in this study were in the form of summated rating scale (except General NPP knowledge). Each item was attached with 6 point Likert-type scale ranging from "absolutely true" to "absolutely not true". All of these measures were constructed and factor analyzed.

Three communication relating variables were as follows. Media exposure was the amount of information received on the Fukushima Daiichi accident from the mass media (e.g., television, newspaper) as well as from significant others (e.g., family, friends) (e.g., I used to search for information about Fukushima Daiichi from internet). The Cronbach's alpha reliability of the scores on the 15 items test was 0.68. Perceived teacher's normative communication involves perception or belief of preferences and actions relating to NPP from significant teacher (e.g., My teacher think that it would be too risky to have NPP in Thailand). The Cronbach's alpha reliability of the scores from these 15 items was 0.77. General NPP knowledge was the degrees of student's understanding of NPP establishment and operations (e.g., If the NPP explodes, the effects will be severely like atomic bomb). Two dimensions of rating scale were attached with each item: direction of the answer (right or wrong), and the confidence of the answer (low, moderate, high). The total of 15 items in this measure yielded a Cronbach's alpha reliability of 0.45.

Trust in the government refers to one's beliefs and emotional disposition that the government will do its best, less corruption, and display more integrity on NPP construction operation and investment. The measure consisted of 15 items (e.g., I am afraid that there will be corruption in some megaprojects related to the government) with reliability (α) of 0.85.

Three aspects of attitude towards nuclear power plant were assessed by Bhanthumnavin and Bhanthumnavin's measures (2014), each with 12 items. The test for cognitive aspect involved the evaluative beliefs and judgments on the advantages and disadvantages of NPPs (e.g., Nuclear power plants are not worthy of investment in the

country). The test for affective aspect assessed the favorable and unfavorable feelings of the university students towards NPPs (e.g., When I think of nuclear power plants, I think of cancer). The test for behavioral intention aspect related to the readiness to support or to oppose the implementation of NPPs (e.g., I agree with constructing a nuclear power plant in the country). The Cronbach's alpha reliability of the three aspects of attitude towards nuclear power plant measures were 0.84, 0.87, and 0.91 respectively.

Results

Correlations among the Variables

From Table 1, media exposure did not relate to the three aspects of NPP attitude. On the other hands, teacher's normative communication was positively and significantly related to the three aspects of NPP attitude (r=0.34, 0.36, and 0.39, respectively). Similar results were found on the correlations between general NPP knowledge and the three aspects of NPP attitudes (r=0.33, 0.37, and 0.38, respectively). These results supported hypothesis 1.

Table 1

Intercorrelations and Descriptive Statistics of Variables in the Study

Variables	Mean	*SD*	1	2	3	4	5	6
1 Behavioral intention aspect	42.55	11.32	1					
2 Affective aspect	39.09	10.47	.85**	1				
3 Cognitive aspect	36.91	8.78	.76**	.83**	1			
4 Trust in the government	37.69	9.76	.18**	.14**	.17**	1		
5 Teacher norm	43.07	7.31	.39**	.36**	.34**	.18**	1	
6 General NPP knowledge	52.94	8.15	.38**	.37**	.33**	0.00	.41**	1
7 Media exposure	45.59	8.01	-0.01	-0.02	-0.02	-0.06	0.02	.14**

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

Direct and Indirect Paths of the Three Aspects of NPP Attitude

Structural equation modeling method in terms of the observed model indicated a significant chi-square value of 20.69 (df=6, p value=0.01). However, with a large sample size in this study, the chi-square divided by degree of freedom ratio was less than 3.0 displayed an "acceptable" model fit (Bollen, 1989). Other fit indices also supported a model of good fit (*RMSEA*=0.05, *CFI*=0.99, *TLI*=0.97, *SMRS*=0.03).

From Figure 3, the perceived teacher's normative communication was the only communication relating factor that not only directly related to all three aspects of NPP attitude, namely, cognitive aspect (path coefficient=0.21), affective aspect (path

coefficient=0.06) behavioral tendency aspect (path coefficient = 0.10), but also had indirectly influence. Teacher's normative communication also directly affected trust in the government (path coefficient=0.16) which directly affected cognitive aspect (path coefficient=0.13). Thus, hypothesis 2 was partially supported.

Discussion and Conclusion

From the correlational results, the variable of "teacher's normative communication" as perceived by the students could better explain the variance of behavioral intention than affective and cognitive components of attitudes toward NPP (r=0.39 or 15.21%, r=0.35 or 12.25%, and r=0.34 or 11.56%, respectively). Similarly, the NPP knowledge could better explain the variance behavioral intention than affective and cognitive components of attitudes toward NPP (r=0.38 or 14.44%, r=0.37 or 13.69%, and r=0.33 or 10.89%, respectively).

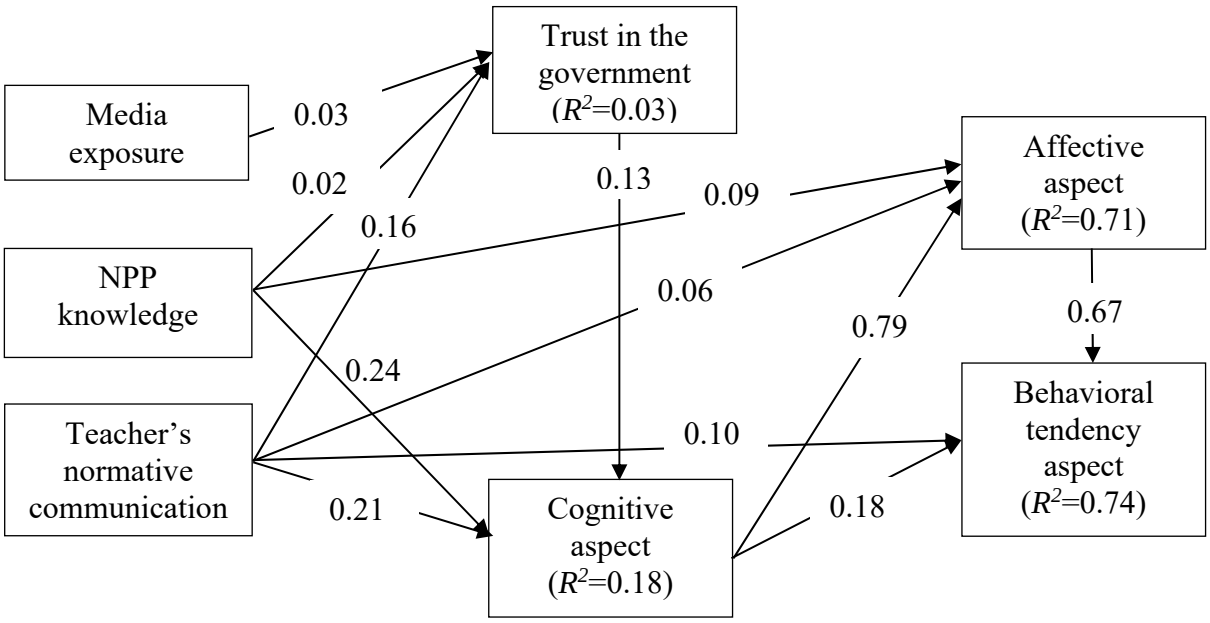

Figure 3. Antecedent model of behavioral intention aspect of attitudes toward NPP.

On the other hand, media exposure had no relationship with any of the three aspects of attitudes toward NPP. The minimal influence of media exposure was evident again in the results from path analysis (see Figure 3). This could be because at this age, high school students may choose to pay attention to other contents in the mass media, such as, entertainment, and sports, rather than news on scientific knowledge and international events. However, they may learn or hear about the intellectual news, including NPP information from significant others, especially teachers. Thus, it can be concluded that channels of communication for increasing new technology acceptance in high school students would be affective through significant others, especially teacher, rather than from mass media.

Based on the findings from this study, it is suggested that the future study should be focused on teachers in high school as the agents for increasing the NPP acceptance of young generation. The similar suggestion in terms of improving teacher's effectiveness would be directly beneficial to the students is also found in many foreign studies (Bar-Tal & Harel, 2002; Van Uden, Ritzen, & Pieters, 2014).

Path analytic results showed that teacher's normative communication and general NPP knowledge both had indirect effects on behavioral intention aspect of attitudes toward NPP of these adolescent students. Cognitive aspect of attitudes toward NPP also received direct effect from teacher's normative communication and general NPP knowledge. The affective aspect of attitudes toward NPP was a strong mediator between the other two aspects (cognitive and behavioral intention).

The relationships among the three aspects of attitudes toward NPP found in this path analytic model supported the theory of the three attitudes components (Kretch, Crutchfield, & Ballachey, 1962), and with many research studies afterwards. For example, 11 studies were found in a review article on pain knowledge and attitudes which led to practice and care in nurses (Chow & Chan, 2015).

Trust in the government was found to be an acceptable mediator of teacher's normative communication and behavioral intention, while the NPP knowledge and behavioral intention were not. This result has enhanced the important contribution of perceived teacher's normative communication in this study. Other technology acceptance studies also lend support to the socialization phenomenon in this area (Lai, 2015).

Therefore, teachers of secondary schools can be good candidates as change agents. Their scientific roles for NPP knowledge sharing should be enhanced. By supplying the teachers with more and up-to-date knowledge of NPP's advantages may lead to their favorable feeling and supportive intentions (Eagly & Chaiken, 1993). This approach of making secondary school teachers as promotors of a new national endeavor can be a successful model in Thailand as well as in other ASEAN countries.

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