

Moderating Effect of Self-Efficacy in the Relationship Between Knowledge, Attitude and Environment Behavior of Cybersecurity Awareness

Norhafizah Che Zainal¹, Mohd Hazwan Mohd Puad¹, & Nor Fazlida Mohd Sani²

¹ Faculty of Educational Studies, Universiti Putra Malaysia, UPM Serdang, Selangor, Malaysia

² Faculty of Computer Science and Information Technology, Universiti Putra Malaysia, UPM Serdang, Selangor, Malaysia

Correspondence: Mohd Hazwan Mohd Puad, Faculty of Educational Studies, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia. Tel: 603-9769-8123. E-mail: hazwan@upm.edu.my

Received: November 20, 2021

Accepted: December 10, 2021

Online Published: December 30, 2021

doi:10.5539/ass.v18n1p55

URL: <https://doi.org/10.5539/ass.v18n1p55>

Abstract

Today, cybersecurity is a growing issue in our education society to ensure a safe teaching and learning process for teachers and students. Reports and studies demonstrated that teachers and students are moderately aware of the cybersecurity threat surrounding them that could affect the learning curve and other fatal impacts. This study aims to identify the role of self-efficacy in the relationship between knowledge, attitude, and environment behavior of cybersecurity awareness. The researchers used a correlational design with a quantitative approach by using a questionnaire instrument to collect data from teacher respondents. A total of 350 teachers took part in this survey voluntarily, distributed using social media applications in the midst of the Covid-19 pandemic. The researchers used the IBM SPSS Statistics to analyze the data descriptively and inferentially. The levels of knowledge, attitude, self-efficacy, and environment behavior of Malaysian school teachers towards cybersecurity awareness are low. Self-efficacy acts as a moderator in influencing the relationship between knowledge, attitude, and environment behavior of cybersecurity awareness. Strategies and programs need to be initiated by stakeholders to increase the self-efficacy of cybersecurity that could assist the positive change of environment behavior among teachers for teaching and learning benefit.

Keywords: self-efficacy, knowledge, attitude, environment behavior, cybersecurity awareness

1. Introduction

The cybersecurity problem is increasing in line with the increase in social media users. Statistics reported by the Malaysian Communications and Multimedia Commission (MCMC) through a survey show an increase in internet usage among young users by 155 percent from 2016 to 2020. Students are vulnerable to cybercrime. Teachers need to increase cyber security awareness among students (Zulkifli et al., 2020). The internet users with a high cybersecurity awareness can reduce cybercrime incidents (Pitchan et al., 2019). Understanding teachers' cybersecurity awareness can help the school create cybersecurity awareness among students (Ahmed et al., 2021). This study aims to identify the role of self-efficacy in the relationship between knowledge, attitudes, and behaviors of cybersecurity awareness among school teachers in Malaysia.

The knowledge factor is very closely related to cybersecurity awareness. Internet users with good knowledge of cybersecurity will identify negative or positive situations when using social media (Pitchan et al., 2019). Moreover, teachers with good knowledge of cybersecurity awareness will not be easily fooled by the threat of cybercrime. Teachers who have a good knowledge of cybersecurity can clearly convey the existing knowledge about cybersecurity to the students and convey the correct understanding of cybersecurity.

As for the attitude factor, teachers who practice good cybersecurity attitudes will set an example for students in practicing cybersecurity (Zulkifli et al., 2020). According to Ajzen and Fishbein (2000), a positive attitude should induce approximation tendencies, while negative attitudes should influence avoidance tendencies. Nowadays, many students have their social media accounts. How teachers use social media will be followed by students. The judicious use of social media will make social media a place where knowledge is contributed and knowledge is added. The students always notice the teacher's attitude. In addition, careful use of social media

can also save teachers from becoming involved in cybercrime.

According to Bandura (1991), self-efficacy does not refer to a person's abilities but rather to a person's judgment of what can be done with the abilities they have. In the context of this study, teacher self-efficacy is defined as the consideration of the teacher's ability to achieve desired outcomes in aspects of learning, as well as the involvement of students in the practice of cybersecurity awareness.

This research aims to examine the moderating effect of self-efficacy on cybersecurity awareness in relation to the relationship between attitude and knowledge with the environment behaviors of teachers in Malaysia. Based on the issues discussed above, the following questions are of interest and should be addressed in this research:

- i. What are the levels of attitude, knowledge, self-efficacy, and behavior in cybersecurity awareness?
- ii. Is there any significant relationship between attitude and knowledge with behavior in cybersecurity awareness?
- iii. To what extent does self-efficacy moderate the significant relationship between attitude and knowledge with behavior in cybersecurity awareness?

The above research questions, when examined and analyzed, could answer the following objectives:

- i. To evaluate the levels of attitude and knowledge with behavior in cybersecurity awareness.
- ii. To investigate the relationship between attitude and knowledge with behavior in cybersecurity awareness.
- iii. To examine the moderating effect of self-efficacy in the relationship between attitude and knowledge with behavior in cybersecurity awareness.

The hypotheses examined in this study are:

H₀₁: There is no significant relationship between attitude towards the environment behavior of cybersecurity awareness

H₀₂: There is no significant relationship between knowledge towards the environment behavior of cybersecurity awareness

H₀₃: Self-efficacy does not moderate the relationship between attitude and knowledge towards the environment behavior of cybersecurity awareness

This research aims to investigate the moderating effect of self-efficacy in the relationship between attitude and knowledge with environment behaviors in the cybersecurity awareness of teachers in Malaysia. Therefore, the following research framework is being prepared for the purpose of this research. As shown in Figure 1, there are two independent variables, namely attitude and knowledge. The identified moderating variable is self-efficacy, while the dependent variable is behaviors.

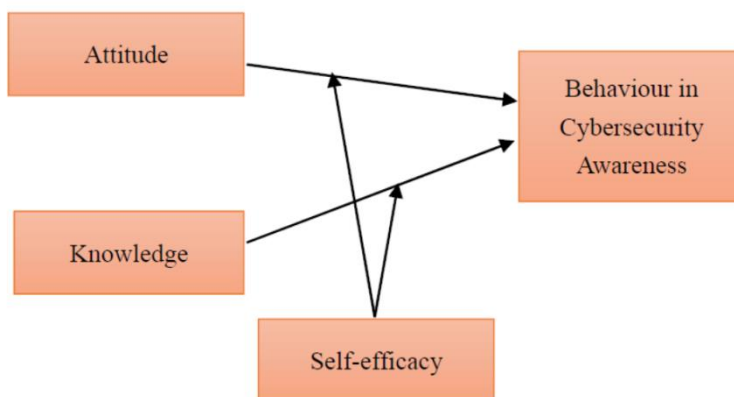


Figure 1. Research Framework for Moderating Effect of Self-efficacy in Relationship between attitude and knowledge with Behavior in Cybersecurity Awareness

2. Literature Review

2.1 Cybersecurity in Teaching and Learning

In secondary school, computer science majors learn computer cybersecurity as part of their curriculum. However, this doesn't mean that other students don't need to learn cybersecurity. All teachers and students need to learn

cybersecurity (Javidi & Sheybani, 2018). Exciting teaching and learning need to be implemented to raise awareness of cybersecurity. Javidi and Sheybani (2018) also noted that school leadership needs to equip future generations with skills and a basic understanding of cybersecurity awareness behaviors. Cybersecurity awareness behaviors should be taught indirectly through cybersecurity clubs and cybersecurity awareness programs (Rahman et al., 2020). Students should also be encouraged to participate in competitions towards cybersecurity awareness behaviors with the guidance of teachers to provide indirect exposure. Tirumala et al. (2016) concludes that creating cybersecurity awareness among students, especially in primary and secondary schools, is of great importance.

A study conducted in the United Kingdom showed that students are more knowledgeable about cybersecurity than teachers (Pencheva et al., 2020). This situation occurs because of the nature of students who want to explore something new. The teacher should guide students in cybersecurity awareness behaviors to avoid becoming involved in cybercrime. According to Pencheva (2020), this problem needs to be addressed by integrating cybersecurity into secondary school education. Ahmed et al. (2021) also believes that cybersecurity should be part of the curriculum. However, according to Rahim (2019), the challenge in implementing cybersecurity in the curriculum lacks expertise, funding, and resources.

It has been found that teachers have limited knowledge compared to the knowledge sought by students themselves (Pencheva et al., 2020). Cybersecurity workshops and programs need to be run more frequently in order to attract more attention to teachers. Teachers need to take the initiative to expand their knowledge of cybersecurity by searching for information on government-provided websites such as CyberSAFE. A study has shown that CyberSAFE is a cybersecurity awareness program that can help all groups understand cybersecurity awareness through necessary tips, advice, videos, games, quizzes and newsletters (Rahim et al., 2019). Garba (2020) found that implementing a cybersecurity program increases awareness. A cybersecurity awareness program should be carried out regularly to remind and update the potential for cybercrime (Rahim et al., 2019).

Malaysia does not have a formal curriculum for a teacher to teach cybersecurity awareness behaviors to all students. However, to ensure the well-being of students, digital citizenship should be prepared to help students understand not only the dos and don'ts of things but also develop healthy attitudes and behaviors while surfing the Internet (Soon et al., 2019). With the help of various parties, teaching and learning about cybersecurity awareness can be an important habit for the students. In Malaysia, every school has counselling teachers ready to help students practice cybersecurity awareness behaviors (Soon et al., 2019). Parents and teachers need to take an important role in teaching these students to use the Internet (Zahri et al., 2017).

2.2 Role of Attitude-Social Influence- Self-Efficacy (ASE) Model to Cybersecurity Awareness

The Attitude-Social Influence- Self Efficacy model was derived from the Theory of Reasoned Action (TRA) and the Social Cognitive Theory (Bandura, 1998). This model is designed to predict the outcome of volitional behaviors. Based on this theory, three factors influence intention and behaviors. The factors influenced by this theory are attitude, social influence, and self-efficacy. Intentions determine behaviors based on attitude, social influence, and self-efficacy. A person's attitude indicates to what extent a person assesses their behaviors positively or negatively (Ajzen, 1991). Social influence is a process in which people directly or indirectly influence their thoughts, feelings, and actions (Twinomujuni et al., 2015). Self-efficacy refers to a person's expectation of their ability to achieve (desired) behaviors (De Vries et al., 1988). Figure 2 shows the ASE model, adapted from Vries, Dijkstra and Kuhlman (1988).

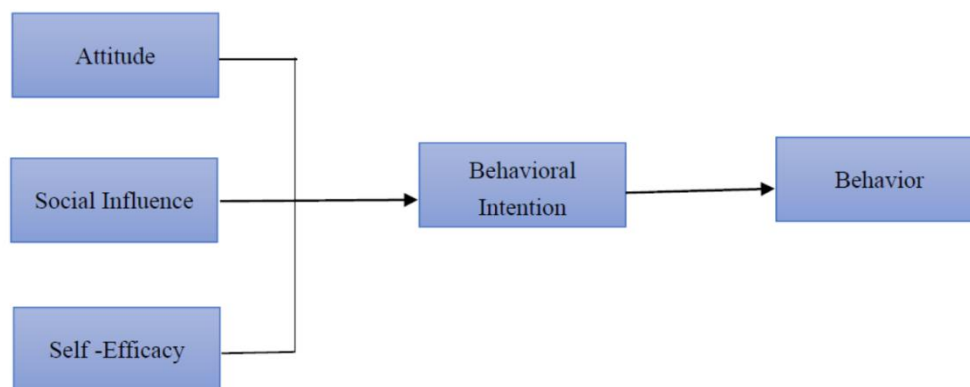


Figure 2. ASE Model

The ASE model was used to study possible determinants of participation in a fitness program for employees (Lechner & Vries, 1995). Attitudes, social influences, and self-efficacy towards an employee fitness program were measured using the ASE model. In this study, the correlations between the various components of the ASE model show that self-efficacy was most strongly correlated with phases of behavior change followed by attitude and social influence.

In addition, there is also a study using the ASE model to examine student awareness of safe and nutritious foods (Khaing et al., 2019). The result of this study shows that students know unhealthy foods but still choose to eat them because they have access to the school canteen. The researcher proposes enacting school canteen guidelines and regulations to avoid prohibited foods and regularly monitor the school canteen. These school canteen guidelines and regulations will help reduce students' unhealthy food consumption in the school canteen.

3. Methodology

This study uses a quantitative approach with a descriptive and correlative survey design to test three objectives. The main aim of this study was to examine the effect of self-efficacy moderators on the relationship between attitudes and knowledge of environment behaviors of cybersecurity awareness.

The independent variables in this study consisted of the institution (primary school or secondary school), gender, age, teaching experience, cybersecurity attitudes, and cybersecurity knowledge. Self-efficacy was the moderator for this study. On the other hand, the dependent variable is the environment behaviors of cybersecurity awareness. This study was carried out on the Malaysian peninsula. Respondents of 350 public school teachers in Malaysia who have social media accounts were analyzed. Random sampling was used in this study. Various social media accounts were used to obtain feedback on the questionnaire. Facebook, Telegram, WhatsApp, and email were attached along with the Google form link to distribute the survey questions.

The research instrument is in the form of a questionnaire. The rationale of the questionnaire is that it is the simplest and time-saving method to obtain information quantitatively from a large number of respondents. The research questionnaire consists of two parts, namely Part A and Part B. Part A is a questionnaire to collect background information from the respondents, namely the teachers. The information required is the institution category (secondary or primary school), gender, age, and teaching experience. Part B is a questionnaire to obtain information on attitudes, knowledge, self-efficacy, and environment behaviors of cybersecurity awareness. In this study, self-efficacy is used as a moderator to assess the moderating effect of self-efficacy between attitude and knowledge towards the environment behaviors of cybersecurity school teachers in Malaysia.

The questionnaire instrument was adapted from previous studies. Questionnaires for testing attitudes, knowledge, and environment behaviors towards cybersecurity were adopted from the questionnaire by Saizan and Singh (2018). The self-efficacy questionnaire aims to examine the level of self-efficacy of teachers in implementing cybersecurity behaviors. The Teacher Sense of Efficacy Scale (TSES) instrument developed by Tschannen-Moran and Wookfolk Hoy (2001) was used for this questionnaire. The researchers chose the TSES questionnaire because this questionnaire is certified in terms of validity and reliability and used by many researchers local and abroad.

Table 1 below shows the instrument of cybersecurity awareness factors. Cronbach alpha above 0.7 means that the instruments are reliable in the research (Taber, 2018). The experts in the field of computer science and educational technology have verified the validity of the survey to confirm the items measure what is supposed to be measured, which is cybersecurity awareness among Malaysian school teachers.

Table 1. Reliability of Instruments

Cybersecurity Awareness Factor	Number of items	Cronbach Alpha
Attitude	19	0.805
Knowledge	14	0.848
Environment	6	0.854
Self-efficacy	12	0.938

The collected data were analyzed with the IBM SPSS Statistics software. A descriptive analysis of respondents' demographics was performed to determine the number of respondents tested related to gender, age, category of the institution (primary or secondary schools), and teaching experience. Means and standard deviations were used to analyze questions about attitudes, knowledge, self-efficacy, and environment behaviors. Regression

moderator analysis was used to test the effect of moderator self-efficacy in the relationship of attitudes and knowledge toward environment behavior of cybersecurity awareness

4. Result and Discussion

Table 2 below shows the frequency distribution and percentage of respondents involved in this study regarding gender, age, institution, and teaching experience.

Table 2. Demography of respondents (N=350)

Demography	Frequency	Percentage (%)
Gender		
Male	80	24.2
Female	250	75.8
Age		
21 to 30 years old	35	10.6
31 to 40 years old	94	28.5
41 to 50 years old	136	41.2
51 to 60 years old	65	19.7
Institution		
Primary school	137	41.5
Secondary school	193	58.5
Teaching Experience		
Less than 5 years	33	10.0
6 to 10 years	37	11.2
11 to 15 years	91	27.6
16 to 25 years	97	29.4
More than 25 years	72	21.8

A total of 212 respondents are secondary school teachers, 60.6 percent and 138 respondents are primary school teachers, corresponding to 39.4 percent. The majority of the teachers involved, with 258 respondents, that is 73.7 percent are female. The proportion of male teachers involved is 26.3 percent, 92 respondents. Teachers between the ages of 41 and 50 are the majority who took part in this study, that is 40.9 percent, which corresponds to 143 people, and only 10.6 percent of the teachers, that is only 37 people between the ages of 21 and 30 years. Based on Table 2 above, teachers with 16 to 25 years of learning experience had the most respondents, 104 respondents, which is 29.7 percent. Meanwhile, very few respondents are teachers with less than five years of teaching experience, which is 10 percent of 35 teachers.

Table 3 shows the level of knowledge, attitude, self-efficacy, and environment behavior of cybersecurity awareness. The level of attitude, knowledge, and environment behavior of cybersecurity awareness is determined based on the mean score value. The interpretations of the levels were categorized into low, medium, and high. The low mean is in the range between 1.00 and 2.33. The scale for the medium-level mean is between 2.34 and 3.66. The interpretation for the high-level mean is between 3.67 and 5.00.

Table 3. Knowledge, attitude, self-efficacy, and environment behavior of cybersecurity awareness (N=350)

Variable	Mean (M)	Standard Deviation (SD)
Knowledge	3.60	0.54
Attitude	3.67	0.49
Self-efficacy	3.88	0.52
Environment	3.43	0.68

Based on respondents' feedback, attitudes towards cybersecurity awareness are high among school teachers in Malaysia. These results show that the mean is 3.67 and the standard deviation is 0.49. The level of self-efficacy toward cybersecurity also showed a high mean of 3.88 and a standard deviation of 0.52. The level of knowledge toward cybersecurity awareness is medium, with a mean value of 3.60 and a standard deviation of 0.54. The level of environment behaviors toward cybersecurity awareness also showed a medium mean of 3.43 and a standard deviation of 0.67.

Multiple regression analysis with the method entered was used to determine the factors that best predict environment behaviors of cybersecurity awareness among school teachers in Malaysia. The regression model was evaluated to ensure that the overall model was significant. The purpose of the regression analysis was to determine the magnitude and direction of the influence of each of the independent variables on the dependent variable.

Table 4 below shows the summary of the ANOVA table for the knowledge, attitude, and environment behaviors of cybersecurity awareness. The results show that the test statistic is significant ($F_{2,347} = 90.93, p < 0.05$). These results show that knowledge and attitude are significant predictors influencing the environment behaviors of cybersecurity awareness among school teachers in Malaysia.

Table 4. ANOVA table for the model of knowledge, attitude, and environment behavior (N=350)

Model	Sum of Square	df	Mean Square	F	p-value
Regression	54.77	2	27.39	90.93	0.01
Residual	104.51	347	0.30		
Total	159.28	349			

As illustrated in Table 5, the regression model results indicate that attitude and knowledge influence the environment behavior of cybersecurity awareness. The attitude variable has no significant influence on the regression model. The relative order of preference of behavioral predictors among school teachers in Malaysia based on beta values (β) can be summarized as knowledge ($\beta=0.70$). This factor is statistically significant at a 95 percent level as the p-value is less than 0.05. Below is the regression equation:

$$\text{Environment behavior} = 0.48 + (0.11 \text{ Attitude}) + (0.7 \text{ Knowledge})$$

The coefficient determination is 34.4 percent, which explains the variation in the dependent variable due to independent variables

Table 5. Coefficient table for the model of knowledge, attitude, and environment behavior (N=350).

Model	Unstandardized Coefficient		t	p-value
	β	Standard Error		
Constant	0.48	0.27	1.81	0.07
Attitude	0.11	0.06	1.88	0.06
Knowledge	0.70	0.06	12.52	0.01

Dependent variable: Environment Behavior ($R^2 = 34.4\%$)

Figure 3 shows the coefficient value and significance level for the model of knowledge, attitude, and environment behavior of cybersecurity awareness. The beta value of knowledge was 0.70, with a significant p-value equal to 0.01. The relationship indicates that the knowledge enhanced the environment behavior of cybersecurity awareness by 70 percent. This shows that most of the respondents are knowledgeable about cybersecurity awareness. The second component attitude appeared to be insignificant, with a beta value of 0.11 and a significant p-value equal to 0.06. This indicates that the respondent does not have a positive attitude towards environment behaviors of cybersecurity awareness.

The first hypothesis assumes that there is no significant relationship between attitudes towards environment behavior of cybersecurity awareness. The attitudes of teachers were predicted not to affect the environment behavior of cybersecurity awareness. The result supports the first hypothesis.

H_{01} : There is no significant relationship between attitude towards the environment behavior of cybersecurity awareness

The second hypothesis assumes no significant relationship between knowledge towards the environment

behavior of cybersecurity awareness. However, the finding shows there is a significant relationship between knowledge toward environment behavior. The result rejects the second hypothesis.

H₀₂: There is no significant relationship between knowledge towards the environment behavior of cybersecurity awareness

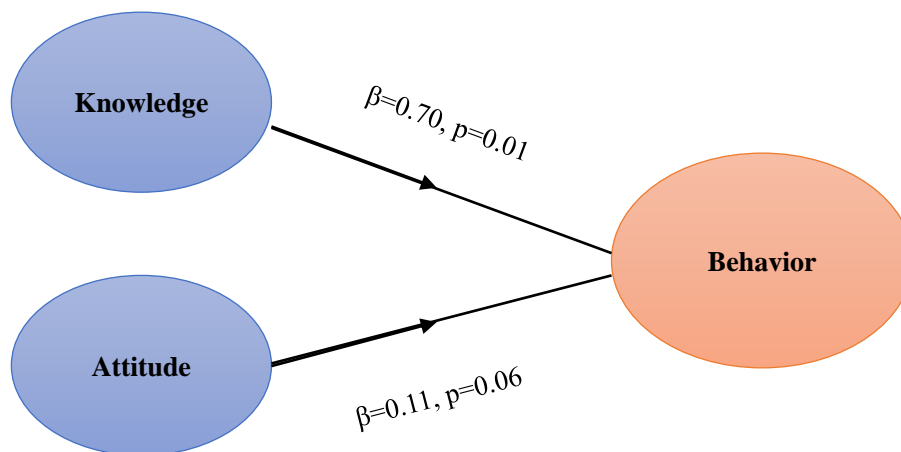


Figure 3. Model of knowledge, attitude, and behavior of cybersecurity awareness.

Table 6 summarizes the ANOVA table for the model of knowledge, attitude, self-efficacy (moderator), and environment behaviors of cybersecurity. The results show that the test statistic is significant ($F_{4,345} = 53.62, p < 0.05$). These findings show that all of the predictors listed could significantly influence environment behaviors of cybersecurity awareness among school teachers in Malaysia.

Table 6. ANOVA table for the model of knowledge, attitude, self-efficacy (moderator), and environment behavior of cybersecurity awareness (N=350).

Model	Sum of Square	df	Mean Square	F	p-value
Regression	61.06	4	15.27	53.62	0.01
Residual	98.22	345	0.29		
Total	159.28	349			

As shown in Table 7, the results of the regression model show that attitude, knowledge, self-efficacy, and moderation effect influence environment behaviors of cybersecurity awareness. All tested variables have a significant influence on the regression model. The relative order of preference of the behaviors predictors of teachers in Malaysia based on beta values (β) can be expressed as attitude ($\beta=0.47$), knowledge ($\beta=0.99$), attitude ($\beta=0.61$), and moderation effect ($\beta=0.03$). In summary, these factors are statistically significant at a 5 percent level since the p-values corresponding to this factor are less than 0.05. It's indicated that attitude contributed to behaviors when self-efficacy appeared.

Table 7. Coefficient table for the model of knowledge, self-efficacy (moderator), and behavior of cybersecurity awareness (N=350).

Model	Unstandardized Coefficient		t	p-value
	β	Standard Error		
Constant	-2.78	1.23	-2.25	0.03
Attitude	0.47	0.18	2.62	0.01
Knowledge	0.99	0.18	5.40	0.01
Self-Efficacy	0.61	0.16	3.75	0.01
Moderation Effect	-0.03	0.01	-2.35	0.02

Dependent variable: Behavior ($R^2 = 38.3\%$)

Figure 4 shows the coefficient value and significance level for the cybersecurity awareness model of self-efficacy as a moderator with knowledge, self-efficacy (moderator), and environment behavior of cybersecurity awareness. The beta value of knowledge was increased to 0.99 when self-efficacy appeared as the moderator of the model, with a significant p-value of 0.01. The second component is an attitude with a beta value of 0.47 and a significant p-value equal to 0.01. The attitude appears to be significant when self-efficacy as a moderator. The beta value for attitude also increased compared to the model without self-efficacy as a moderator.

The third hypothesis predicts self-efficacy does not moderate the relationship between attitude and knowledge towards the environment behavior of cybersecurity awareness. However, the finding shows that self-efficacy moderates the relationship between attitude and knowledge towards environment behavior.

H₀₃: Self-efficacy does not moderate the relationship between attitude and knowledge towards the environment behavior of cybersecurity awareness

Hence, hypothesis 3, which is self-efficacy does not moderate the relationship between attitude and knowledge towards the environment behavior of cybersecurity awareness, was rejected. Thus, the regression model equation is as below:

$$\text{Behavior} = -2.78 + (0.47 \text{ Attitude}) + (0.99 \text{ Knowledge}) + (0.61 \text{ Self-efficacy}) - (0.03 \text{ Moderation Effect})$$

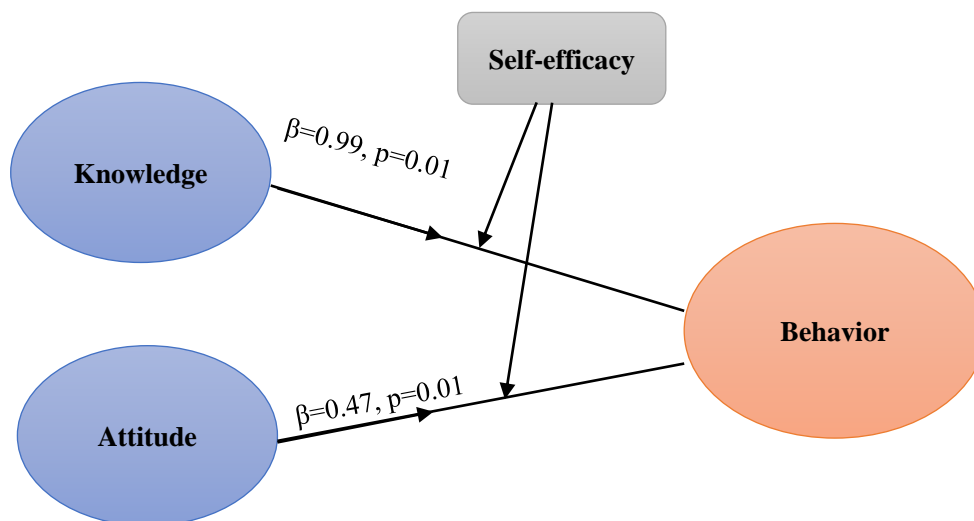


Figure 4. Model of self-efficacy as a moderator with knowledge, self-efficacy (moderator), and behavior of cybersecurity awareness.

The coefficient determination is increased to 38.8 percent. Therefore, it could be concluded that self-efficacy would significantly moderate the relationship between attitude and knowledge towards the environment behaviors of cybersecurity awareness. The moderating effect of self-efficacy is also consistent with the study by Yang (2012). According to Yang (2012), the level of self-efficacy in mobile shopping will positively affect the relationship between perceived enjoyment and attitude toward mobile shopping.

5. Conclusion and Recommendation

Studies of environment behavior of cybersecurity awareness among school teachers in Malaysia are limited. However, environment behaviors of cybersecurity awareness have become a significant problem for research in another work area (Alshaikh, 2020). Since self-efficacy is often different in the behavior field, it has become an exciting topic to study in the role of self-efficacy on environment behavioral cybersecurity awareness among school teachers in Malaysia.

Hence, it is important to include self-efficacy as a moderator when studying the relationship between cybersecurity awareness attitude, cybersecurity awareness knowledge, and environment behavior of cybersecurity awareness among school teachers in Malaysia for a better result.

The results of this study will have some implications for various parties, such as researchers in the field and

educators. When self-efficacy is included as a moderator, the strength of the relationship also increases. Therefore, the result would have implications for researchers, particularly in the area of cybersecurity behaviors. The researcher should include self-efficacy in explaining relationship attitudes and knowledge of cybersecurity behaviors, as this could affect the strength of a teacher's performance behaviors.

In addition, since self-efficacy has been shown to moderate the relationship between attitudes and knowledge toward environment behaviors of cybersecurity awareness, educators should focus on increasing self-efficacy to increase attitudes and knowledge levels of cybersecurity awareness.

There are several recommendations for future research to overcome the limitations encountered in this study. First, a future study, particularly in Malaysia, should include private school teachers or international school teachers to identify the differences between public and private school teachers. Second, future research should also examine more factors that may contribute to the environment behaviors of cybersecurity awareness of school teachers.

References

- Ahmed, O. S., Nasef, S. A., Zuhir, A., Rawashdeh, A., & Elmagzoub, M. (2021). Teacher's awareness to develop student cyber security: A Case Study. *Turkish Journal of Computer and Mathematics Education*, 12(May), 5148-5156.
- Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Ajzen, I., & Fishbein, M. (2000). Attitudes and the Attitude-Behavior Relation: Reasoned and Automatic Processes. *European Review of Social Psychology*, 11(1), 1-33. <https://doi.org/10.1080/14792779943000116>
- Alshaikh, M. (2020). Developing cybersecurity culture to influence employee behavior: A practice perspective. *Computers and Security*, 98. <https://doi.org/10.1016/j.cose.2020.102003>
- Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational Behavior and Human Decision Processes*, 50(2), 248-287. [https://doi.org/10.1016/0749-5978\(91\)90022-L](https://doi.org/10.1016/0749-5978(91)90022-L)
- Bandura, A. (1998). Exercise of Agency in Personal and Social Change. *Behavior and Cognitive Therapy Today*, 1-29. <https://doi.org/10.1016/b978-008043437-7/50002-8>
- De Vries, H., Dijkstra, M., & Kuhlman, P. (1988). Self-efficacy: The third factor besides attitude and subjective norm as a predictor of behavioural intentions. *Health Education Research*, 3(3), 273-282. <https://doi.org/10.1093/her/3.3.273>
- Garba, A., Musa, M. A., & Othman, S. H. (2020). *A Study on Cybersecurity Awareness Among Students in Yobe : A Quantitative*. July.
- Javidi, G., & Sheybani, E. (2018). K-12 Cybersecurity Education, Research, and Outreach. *2018 IEEE Frontiers in Education Conference (FIE)*. <https://doi.org/10.1109/FIE.2018.8659021>
- Khaing, A. M., Ameen, A., & Isaac, O. (2019). Analysis of Consumption Habit on Safety and Healthy Foods at School' Canteens of Basic Education Schools : A Qualitative Study on Factors that Influence Students' Food Choice. *International Journal of Management and Human Science (IJMHS)*, 3(August), 12-25. Retrieved from <http://www.ijmhs.org>
- Lechner, L., & Vries, H. De. (1995). Starting Participation in an Employee Fitness Program: Attitude, Social Influence, and Self-Efficacy. *Preventive Medicine*, 24, 627-633.
- Pencheva, D., Hallett, J., & Rashid, A. (2020). Bringing cyber to school: Integrating cybersecurity into secondary school education. *IEEE Security and Privacy*, 18(2), 68-74. <https://doi.org/10.1109/MSEC.2020.2969409>
- Pitchan, M. A., Omar, S. Z., & Ghazali, A. H. A. (2019). Cyber security practice among internet users towards cyberbullying, pornography, phishing email and online shopping. *Jurnal Komunikasi: Malaysian Journal of Communication*, 35(3), 212-227. <https://doi.org/10.17576/JKMJC-2019-3503-13>
- Rahim, N. H. A., Hamid, S., & Kiah, M. L. M. (2019). Enhancement of Cybersecurity Awareness Program on Personal Data. *Malaysian Journal of Computer Science*, 32(3), 221-245.
- Rahman, N. A., Sairi, I. H., M.Zizi, N. A., & Khalid, F. (2020). The Importance of Cybersecurity Education in School. *International Journal of Information and Educational Technology*, 10(5), 378-382.

<https://doi.org/10.18178/ijiet.2020.10.5.1393>

- Saizan, Z., & Sigh, D. (2018). Cyber Security Awareness Among Social Media Users: Case Study In German-Malaysian Institute (GMI). *Jurnal Teknologi Maklumat Dan Multimedia Asia-Pasifik*, 7(2), 111-127.
- Soon, S. T., Kaur, K., & Philip, L. (2019). Cybersafety in Education For The 21st Century: A Comparative Study of Malaysia and Thailand. *ICE 2019 Conference Proceedings, April*, 28.
- Tirumala, S. S., Sarrafzadeh, A., & Pang, P. (2016). A survey on internet usage and cybersecurity awareness in students. *2016 14th Annual Conference on Privacy, Security and Trust, PST 2016*. <https://doi.org/10.1109/PST.2016.7906931>
- Tschannen-Moran, M., & Hoy, A. W. (2001). Teachers' Sense of Efficacy Scale Instrument. *Teaching and Teacher Education*, 17(1), 783-805.
- Twinomujuni, C., Nuwaha, F., & Babirye, J. N. (2015). Understanding the low level of Cervical cancer screening in Masaka Uganda using the ASE model: A community-based survey. *PLoS ONE*, 10(6). <https://doi.org/10.1371/journal.pone.0128498>
- Yang, K. (2012). Consumer technology traits in determining mobile shopping adoption: An application of the extended theory of planned behavior. *Journal of Retailing and Consumer Services*, 19(5), 484-491. <https://doi.org/10.1016/j.jretconser.2012.06.003>
- Zahri, Y., Susanty, A. H. R., & Mustaffa, A. (2017). Cyber Security Situational Awareness among Students: A Case Study in Malaysia. *International Journal of Educational and Pedagogical Sciences*, 11(7), 1704-1710. Retrieved from <https://waset.org/publications/10007340/cyber-security-situational-awareness-among-students-a-case-study-in-malaysia>
- Zulkifli, Z., Molok, N. N. A., Abd Rahim, N. H., & Talib, S. (2020). Cyber Security Awareness Among Secondary School Students in Malaysia. *Journal of Information Systems and Digital Technologies*, 2(2), 28-41. Retrieved from <https://journals.iium.edu.my/kict/index.php/jisdt/article/view/151>

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).