THE IMPORTANCE OF CYBERSECURITY AWARENESS FOR CHILDREN

Yuliana
Universitas Udayana, Indonesia, E-mail: yuliana@unud.ac.id

Article Info	Abstract
Keywords: Awareness, Children, Cybersecurity. **DOI:** 10.25041/lajil.v4i1.2526	Online school during the COVID-19 pandemic makes the children prone to cyberattacks and malware. Therefore, cybersecurity awareness among children is critical. Online games and stories cause children to neglect their studying time. Therefore, this paper aims to describe the importance of cybersecurity awareness among children. Analyses were performed by using a literature review. Inclusion criteria are review alongside research articles. Inclusion criteria are review research articles that were read twice to reduce the bias, were then summarized and narrated descriptively. Results revealed that cybersecurity awareness could be increased by digital literacy training. Children should be taught how to avoid risky behavior online. The cybersecurity awareness program is suitable for children to avoid phishing, pornography, cyberbullying, identity theft, and privacy breaches. Children must be taught how to keep their passwords safe and private. They also need to be more cautious when playing online games. In conclusion, digital literacy and cybersecurity programs can be taught to children. These programs are suitable for raising cybersecurity among children.

A. Introduction

All users are prone to various security risks when they spend significant time online. Many different terms are used to address these risks that internet users face in their everyday lives. Some terms are used interchangeably, such as cybersecurity, online safety, and internet security. Cybersecurity is widely used because it has many perspectives. However, there needs to be a clear operational definition among scholars.[1] Cybersecurity is the collection of policies and concepts about guidelines, risk management, and technologies to protect the cyber environment and users' assets. Cybersecurity ensures the maintenance of the security properties of the organization and users. The users include children. Online school during the COVID-19

---

[1] Farzana Quayyum, Daniela S Cruzes, and Letizia Jaccheri, "Cybersecurity Awareness for Children: A Systematic Literature Review," *International Journal of Child-Computer Interaction* 30, no. 1 (2021): 1–25, https://doi.org/10.1016/j.ijcci.2021.100343.

pandemic makes children prone to cyberattacks and malware. They need to raise their awareness of cybersecurity. Online games and stories cause children to neglect their studying time.[2]

The increasing availability of the internet for children during online school raises concerns among parents and society. Children are prone to online risks. Therefore, developing a cybersecurity program awareness is essential to increase students' awareness. Some important things to be considered are cybersecurity risks for children, approaches, theories, and solutions for raising cybersecurity awareness.[3] A substantial amount of time is spent online for educational and entertainment purposes. The internet gives many opportunities. Therefore, security awareness should be taught to children. Children are difficult to discern between the opportunities and risks of digital systems. However, those online activities create threats to children's privacy and safety. The danger of the risks is not realized until it is very late. Online abuses could happen. [4]

Critical aspects that need to be evaluated and concerned about are the concern, solutions, recommendations, and approaches to raising cybersecurity among children. Therefore, this paper aims to describe the importance and the way to raise cybersecurity awareness for children. This research is a narrative literature review. Articles were taken from the Science Direct and Google Scholar databases. Inclusion criteria are review and research articles. Exclusion criteria are not peer-reviewed articles and unavailable full-text articles. Articles were read twice to reduce the bias. The selected articles were summarized and narrated descriptively.

B. Discussion
1. The Hazard Of Internet Use Among Children

The use of the internet gives much comfort to people. Online working, studying, or accessing entertainment are possible by using the internet. The use of the internet can increase the social well-being of children. However, some threats exist, such as cyberbullying, identity theft, pornography, etc. Children should be taught how to avoid risky behavior online. Cybersecurity awareness can be increased through digital literacy training. The cybersecurity awareness program should be given to children to avoid phishing, pornography, cyberbullying, identity theft, and breaking of privacy. Children must be taught how to keep their passwords safe and private. They also need to be more cautious when playing online games.[5]

2. The importance of cybersecurity awareness

Educating children about online dangers is essential. Many countries have implemented special programs to raise awareness. Children need to be educated about how to behave safely online. In African countries, there needs to be more of this program implementation. It was developed to raise awareness of a cyber-safety culture for children. [6]

A study about children from 12 to 19 years old as internet users in Malaysia revealed that this group has the highest number of internet users. They often overshare information. Everything on the internet is perceived as the truth. Children have less knowledge of protecting sensitive information. This should be a concern because personal data should be protected.

---

[2] Quayyum, Cruzes, and Jaccheri.

[3] Quayyum, Cruzes, and Jaccheri.

[4] Quayyum, Cruzes, and Jaccheri.

[5] Martina J Zucule De Barros and Horst Lazarek, "A Cyber Safety Model for Schools in Mozambique," in *Proceedings of the 4th International Conference on Information Systems Security and Privacy (ICISSP 2018)*, 2018, 251–58, https://doi.org/10.5220/0006573802510258.

[6] Barros and Lazarek.

Some challenges in increasing security awareness are understanding and awareness. When the messages are understood, they are more likely to be accepted. [7]

Cybersecurity awareness is related to the methodology to educate users about cyber threats and data stealing. The degree of users' understanding is related to the importance of information security. Cybersecurity awareness has two primary purposes: alerting and understanding the risks. Human-related vulnerability can happen at personal and organizational levels. [8]

3. Solution for increasing awareness of security program in education program

The popularity of tablets and smartphones makes children rapidly shift to Game-Based Learning (GBL). This shift is caused by mobility and a built-in sensor. Therefore, blended and mobile learning is ubiquitous. There are six critical dimensional frameworks of this learning as follows: [9]

   a. Spatio-temporal
   b. Collaboration/Social
   c. Pedagogy
   d. Personalization
   e. Data security & privacy
   f. Session

The educational program is developed based on the solutions. Both technological aspects and pedagogical qualities should be maintained during online learning.[10]

Cybersecurity awareness has been studied in recent years. Children are included in the subject of the study. According to the World Health Organization definition, children are anyone under 18 years old. Password practices are the concerns of cybersecurity in children. A simple password is easy to be hacked. [11]

Children are essential to the community because they have a bright and long future. The main concern is the safety of the children. Using smartphones and computers has some risks for children. However, we cannot limit the children's in accessing the material online, but we can supervise them on how to surf online safely. Therefore, the Ministry of Education of the Union of Arab Emirates implemented a cybersecurity awareness program. This program was given to students from 8 to 10 years old. It was revealed that this program effectively reduces online risks for children. The students learn how to behave online safely.[12]

The Ministry of Education in the Union of Arab Emirates focused on training and education programs for students in internet best practices. The goal is to increase cybersecurity and cyber awareness. The grade 4 students (8-10 years old) were given the internet safety topic as the primary subject of the Design and Technology program. It was considered a compulsory module. This program was done for three months. The materials comprised internet usage,

---

[7] Noor Hayani Abd Rahim, "Assessment of Cybersecurity Awareness Program on Personal Data Protection among Youngster in Malaysia" (2017).

[8] Filippos Giannakas et al., "Security Education and Awareness for K-6 Going Mobile," *International Journal of Interactive Mobile Technology* 10, no. 2 (2016): 41–48.

[9] Filippos Giannakas, Georgios Kambourakis, and Andreas Papasalouros, "A Critical Review of 13 Years of Mobile Game-Based Learning," *Educational Technology Research and Development* 2, no. 1 (2017): 1–20, https://doi.org/10.1007/s11423-017-9552-z.

[10] Giannakas et al., "Security Education and Awareness for K-6 Going Mobile."

[11] Suzanne Prior and Karen Renaud, "Age-Appropriate Password 'Best Practice' Ontologies for Early Educators and Parents," *International Journal of Child-Computer Interaction*, 2020, 100169, https://doi.org/10.1016/j.ijcci.2020.100169.

[12] Arwa A Al Shamsi, "Effectiveness of Cyber Security Awareness Program for Young Children : A Case Study in UAE," *International Journal of Information Technology and Language Studies (IJITLS)* 3, no. 2 (2019): 8–29, https://doi.org/10.13140/RG.2.2.28488.14083.

online dangers, the ways to protect themselves online, and solutions to respond to online risks appropriately. At the end of the program, children should be able to answer the following questions, as depicted in Figure 1 below. The unique program that needs to be concerned, including the theme and constructs, is shown in Figures 2 and 3.[13]

Research main question	Interview sub-question	Purpose of interview question
1. What online risks children may expose to?	1.1 What online risks you learn about?	To discover the ability of the child to identify different online risks.
	1.2 What online risks you may expose to?	To investigate the ability of children to identify online risks they may expose to.
2. How cyber security awareness training influences student's online behavior?	2.1 Can you give an example to show how the awareness program influenced your online behavior?	To investigate how the cyber security awareness program influenced children's behavior online.
3. How effective is the Cyber Security Awareness program adopted by the Ministry of Education in UAE in educating students aged 8 to 10 about the safe use of the internet?	3.1 Do you think that this awareness program is effective? To what extent?	To find out the children opinion about the benefits of the cyber security awareness program.

Figure 1. The questions for children's assessment after finishing the cybersecurity awareness program[14]

---

[13] Shamsi.

[14] Shamsi.

Main constructs	Main Dimensions
Online risks	O1: Cyber Bullying O2: Pornography O3: Identity theft O4: Online Phishing O5: Break to privacy
Content of awareness program	C1: Internet Safety C2: Cyber Bullying C3: Identity theft C4: Online Phishing C5: Privacy C6: Password C7: securing private information C8: Internet Strangers
Effectiveness of cyber security awareness program	E1: Positively affects children's behavior online E2: effective in raising cyber security awareness level among students E3: efficient in helping students to protect themselves online
Effects on students	EF1: protect their personal information EF2: use strong passwords EF3: respond properly to different incidents online EF4: more cautious while playing online games EF5: keep their parents aware if they feel uncomfortable online EF6: aware of phishing emails and messages. EF7: Transfer the knowledge their family members
Limitations	L1: narrative L2: little awareness videos, more should be included L3: little hands-on activities, more should be included
Suggestions	S1: society engagement S2: cyber security training for parents

Figure 2. The primary construct and theme of the cybersecurity awareness program[15]
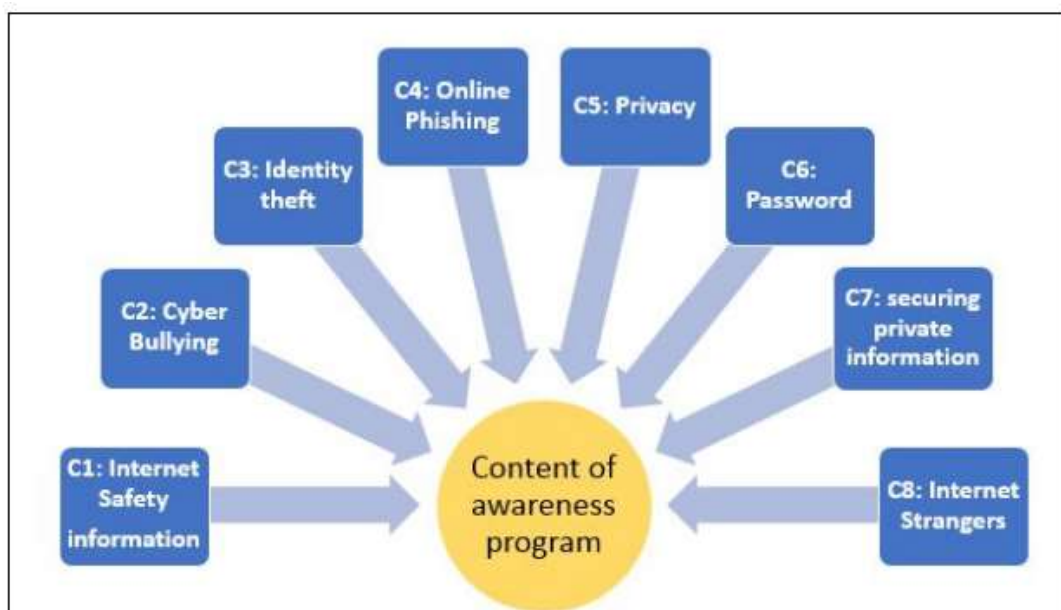

Figure 3. The content of the cybersecurity awareness program[16]

Smartphone usage has been widely used across countries, including South African society. However, there is no particular curriculum regarding cyber security in schools. The university teaches some cyber security principles. However, it is only applied to students who are taking computing-related courses. The students taking the computing courses are only small parts of

---

[15] Shamsi.
[16] Shamsi.

the community. Therefore, cybersecurity should be taught to children. There is an essential principle in giving the requisite skills in cyber security. This principle should be started as early as possible, especially in primary school. It can be embedded into the national curriculum. Gender imbalance must be stopped in the cyber security awareness programs. Cybersecurity awareness should be seen as important as reading, writing, and arithmetic, especially in the technology era. [17]

Unique curricula for an early age are implemented in the United Kingdom. The program includes Information and Communications Technology as a foundational skill for early-age students. This is essential to ensure the children understand online safety behavior, including how to evaluate fake news or hoaxes. There are two essential elements of cyber security education. Those elements are awareness and special steps in taking precautions. [18] The essential steps of maintaining cybersecurity are shown in Figure 4. Exceptional infrastructure security and data protection should be provided.[19]
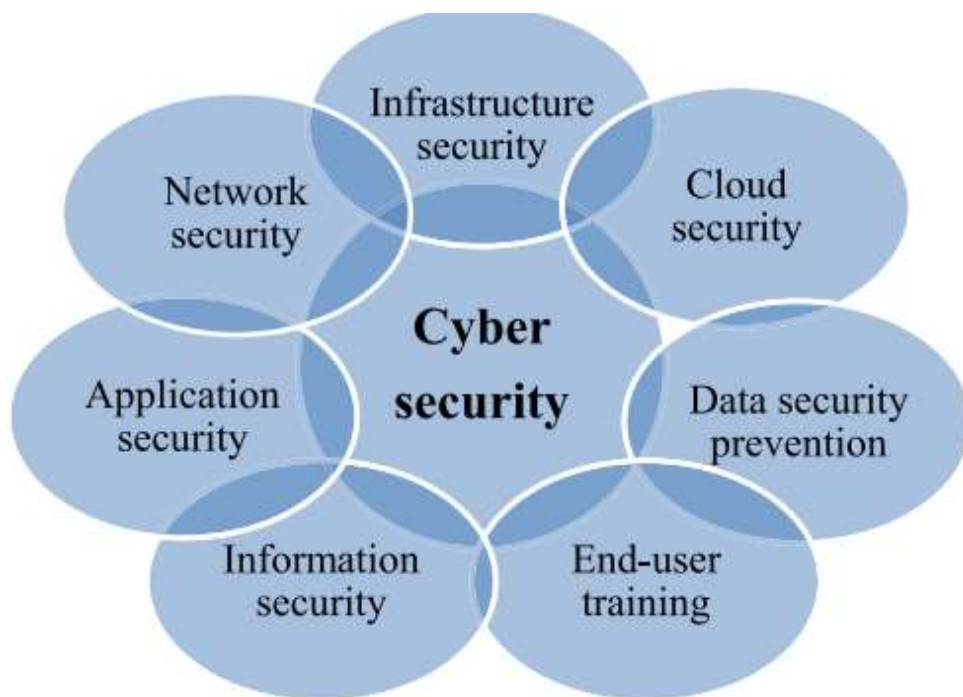

Figure 4. Security triangle of cybersecurity[20]

---

[17] Isabella M Venter et al., "Cyber Security Education Is as Essential as 'the Three R's,'" *Heliyon* 5, no. August (2019): 1–7, https://doi.org/10.1016/j.heliyon.2019.e02855.

[18] Venter et al.

[19] Yuchong Li and Qinghui Liu, "A Comprehensive Review Study of Cyber-Attacks and Cyber Security ; Emerging Trends and Recent Developments," *Energy Reports*, no. Article in Press (2021), https://doi.org/10.1016/j.egyr.2021.08.126.

[20] Li and Liu.

C. Conclusion

In conclusion, digital literacy and cybersecurity programs can be taught to children. These programs are suitable for raising cybersecurity among children. Cybersecurity awareness is related to the methodology to educate users to be aware of cyber threats and data stealing. The degree of users' understanding is related to the importance of information security. Cybersecurity awareness has two primary purposes: alerting and understanding the risks. Human-related vulnerability can happen at personal and organizational levels. Future research should include how to train children to behave online based on the age categories because every stage of children's development has specific critical things.

REFERENCES

Barros, Martina J Zucule De, and Horst Lazarek. "A Cyber Safety Model for Schools in Mozambique." In *Proceedings of the 4th International Conference on Information Systems Security and Privacy (ICISSP 2018)*, 251–58, 2018. https://doi.org/10.5220/0006573802510258.

Giannakas, Filippos, Georgios Kambourakis, and Andreas Papasalouros. "A Critical Review of 13 Years of Mobile Game-Based Learning." *Educational Technology Research and Developmentt* 2, no. 1 (2017): 1–20. https://doi.org/10.1007/s11423-017-9552-z.

Giannakas, Filippos, Georgios Kambourakis, Andreas Papasalouros, and Stefanos Gritzalis. "Security Education and Awareness for K-6 Going Mobile." *International Journal of Interactive Mobile Technology* 10, no. 2 (2016): 41–48.

Li, Yuchong, and Qinghui Liu. "A Comprehensive Review Study of Cyber-Attacks and Cyber Security ; Emerging Trends and Recent Developments." *Energy Reports*, no. Article in Press (2021). https://doi.org/10.1016/j.egyr.2021.08.126.

Prior, Suzanne and Karen Renaud. "Age-Appropriate Password 'Best Practice' Ontologies for Early Educators and Parents." *International Journal of Child-Computer Interaction*, 2020, 100169. https://doi.org/10.1016/j.ijcci.2020.100169.

Quayyum, Farzana, Daniela S Cruzes, and Letizia Jaccheri. "Cybersecurity Awareness for Children: A Systematic Literature Review." *International Journal of Child-Computer Interaction* 30, no. 1 (2021): 1–25. https://doi.org/10.1016/j.ijcci.2021.100343.

Rahim, Noor Hayani Abd. "Assessment of Cybersecurity Awareness Program on Personal Data Protection among Youngster in Malaysia," 2017.

Shamsi, Arwa A Al. "Effectiveness of Cyber Security Awareness Program for Young Children : A Case Study in UAE." *International Journal of Information Technology and Language Studies (IJITLS)* 3, no. 2 (2019): 8–29. https://doi.org/10.13140/RG.2.2.28488.14083.

Venter, Isabella M, J Blignaut, Karen Renaud, and M Anja Venter. "Cyber Security Education Is as Essential as 'the Three R's.'" *Heliyon* 5, no. August (2019): 1–7. https://doi.org/10.1016/j.heliyon.2019.e02855.