

Development of Intelligence Information Security Core Principles Educational Contents for Elementary Students through Ancient Chinese Hero Myths and Korean Narrative Literature

Sunghee Kim

PhD student of Chinese language and
literature, Jeju National University,
South Korea.

Eunsun Choi

PhD student of major in Computer
Education, Faculty of Science
Education, Graduate School, Jeju
National University, South Korea.

Yeong Ho Lee

Professor,
Department of Chinese language and
literature in College of Humanities, Jeju
National University, Korea.
(Co-corresponding author:

Namje Park

Professor,
Department of Computer Education in
Teachers College,
Jeju National University
(corresponding author:

ABSTRACT

These days, the Internet and IT devices have become essential requirements for living, with many things to be done non-face-to-face due to an unexpected disease epidemic in 2019. However, the lack of sufficient education on information security compared to the explosive increase in IT devices has made many children become a cyber crime target easily. Therefore, we feature contents that can provide information security education by using storytelling techniques to inspire children's interest.

This paper compiles the stories of Chinese myths and Korean folktales and presents contents that can be used to educate students on information security by utilizing creative storytelling techniques. Developed educational content applies an educational model consisting of motivation, introduction of learning objectives, creative storytelling activities, presentation, sharing, and evaluation.

Besides, a pre- and post-education survey was conducted on students to analyze the developed educational contents' effectiveness.

Classes were conducted on a trial basis for Korean elementary school students to see the effects of educational content proposed in this paper. Before and after the training, surveys examined the students' satisfaction with education and their perception of information security, resulting in improved awareness of the concept, importance, and necessity of information security ($p < 0.001$). The students also expressed their satisfaction with education by strongly expressing their willingness to participate in information security education in the future. Moreover, in the preliminary survey, more and more students did not want to choose a career path related to information security, but they wanted to choose a direction after the training.

In this paper, Chiyoo Myth of China and Cheoyong folktale of Korea are linked to a modern blocking intrusion system to understand the concept of blocking intrusion of information security easily. Information security education will be provided to elementary school students by utilizing the developed contents. The content developed in this paper consists of two stories, but we will discover more historical stories and develop ways to educate students creatively (CISCO, 2014, p. 60; Lee J, Kim J, 2010).

Keywords: Information security education, Creative-storytelling, Ancient Chinese hero myths, Information technology humanities, information

INTRODUCTION

Since the advent of the 4th industrial revolution, IT technology has been more and more advanced, and accordingly, the age of using electronic devices such as computers and mobile phones is gradually getting younger. With the widespread online classes in early 2020, due to the sudden incident of COVID-19, millions of people, from children to seniors, collect and use the information on the internet. However, lots of people were not prepared, and cyber crimes are increasing day by day.

According to 'COVID-19 Financial Cyber Threats Report' published by the Korea Financial Security Agency in May 2020, the 'Financial Security Agency's Financial Security Control Center' detected about 73,000 malicious e-mails, including the COVID-19 keyword, from mid-March to April. In particular, criminal damages against young children are also increasing rapidly, and a fraudulent method of stealing money has emerged, saying that it is possible to borrow money in the name of parents using minors. The criminals made a scam targeting minors, saying, "If you bring a sim card, mobile phone and ID card in the name of your parents, you can borrow at least millions of won to billions of won." The intelligence crime investigation unit of the Seoul Metropolitan Police Agency recently sent an indictment to the prosecution on fraud charges to a group of people who stole money and valuables worth 750 million won from 22 people through this trick.

Cybercrime has existed in the past, but the threat is growing with the desperate situation and increasingly advanced criminal methods. It is essential to sign agreements for convenience of investigation with various countries and cooperate with global platform companies in order to prevent cybercrime from overseas. Despite the rapid growth of mobile and cloud technologies in recent years, cybercrime damage is believed to have increased sharply due to the lack of a corresponding specialized security system. In particular, there is a shortage of more than a million cyber security professionals worldwide, which could potentially expose them to various threats ranging from simple phishing attacks to large-scale cyber attacks directly targeting specific targets. As the field of information security continues to diversify and grow in scale, the demand for information security professionals to perform related tasks continues to increase.

Information security is one of the key factors that successfully lead the business environment to secure information systems' reliability and utilize information. In the cyber security industry, there is an opinion that it is time to invest in people rather than one-time security technologies and solutions to counter more advanced threats.

In this paper, we propose contents to teach information security concepts and principles at the elementary school level to respond to future security threats. In particular, this educational content was developed to use creative storytelling techniques to educate students about the intrusion prevention system in a more familiar way through Chinese myth and Korean folktale. First, we introduce the story by selecting the folktale that can motivate and present the learning goal that is related to the story. Then, we do creative storytelling activities with the students. The final step is to organize and evaluate the presentation and sharing of each group. In order to check the suitability and educational effect of the developed content, it was applied to elementary school students on a pilot basis, and through analysis of the results, we find out that the educational content proposed in this paper is meaningful.

RELATED RESEARCH

Creative storytelling

Creativity seems to be a word that was initially created as an attempt to integrate and deal with various concepts in 19th-century art and science. In general, when most people think of the word creativity, several concepts come to mind at once, which can usually be seen as the ability to create new things. But it also means that whatever is produced should be different from what is unexpected or that others may have produced.

The story was told as a way to convey tradition, heritage, and history to future generations. Storytelling is the process of personalizing what students have learned and organizing their meaning and knowledge in stories they hear and speak. The power of storytelling as an educational tool has been continuously used since the beginning of humanity, but it has been widely used for online learning in recent years. Storytelling is generally known as a powerful educational and academic approach that can be used to improve the learning outcomes of general, scientific, and technical education (Gervás, Pablo., 2009; Dreon O, Kerper R, Landis J. Digital Storytelling, 2011; Sharda N., 2007).

Information Security Education

As personal information security education becomes necessary, a wide range of education is being conducted for students and the general public in overseas countries. The US National Initiative for Cybersecurity Education (NICE) defined cybersecurity personnel and knowledge systems based on the Workforce framework. NICE's Workplace Framework is an information security knowledge system that categorizes tasks and expertise related to cybersecurity by category and analyzes individuals' capabilities for each particular task. It is to deal with the cultivation of the cybersecurity workforce in the scope of the overall cyber domain. For each job category by job category, the main job content and necessary knowledge are detailed, and companies and organizations identify the currently needed talent to secure additional human resources and cybersecurity. It was created for a wide range of applications, including educational program plans. This Workforce Framework categorizes 31 specialized areas into 7 areas: management, operation and maintenance, supervision, defense, analysis, collection, and investigation. The NICE cybersecurity training classification system is structured from an attack and defense perspective, but it is characterized by dealing with the knowledge system of most defense perspectives.

The EU has been making continuous efforts and investments in raising awareness of information security and has recently been actively researching information protection awareness and developing guidelines. Such efforts to raise awareness of information protection are supported by the Information Society and Media Directorate-General (INFSODG) and European union agency for cybersecurity (ENISA) informatization/information protection policies. INFSO DG's related policies include "eEurope," "Strategies for a Safe Information Society," "Media Literacy," and "Safe Internet Plus Program." ENISA is actively promoting awareness of information security through ENISA's role and vision "and various guidelines (Paulsen C, McDuffie E, Newhouse W, Toth P., 2012; Paulsen C, McDuffie E, Newhouse W, Toth P., 2010)

Information security educational contents for elementary school through ancient Chinese hero myths and Korean narrative literature

In order to enhance the understanding of information security and to give elementary school students a sense of familiarity, we intend to conduct education using the information security elements contained in the story of myths.

The story of information security in the Chinese Chiyou myth

In the period of ancient legends in China, there was a tribe of Yandi and Huangdi. There was a war between the two tribes, and the Huangdi tribe defeated the Yandi tribe.

Chiyou is the grandson of Yandi, who was defeated in the war against Huangdi. He has a head made of copper, a forehead made of iron, and a body of an animal, and his appearance look freakish and valiant. Chiyou was not only bizarre in shape but also unusual in eating. He ate sand, stones, and iron as rice every day. He also had the skill of making various weapons. Pointed and sharp spears, large axes and sturdy shields, and light and fast-flying bows and arrows, he can make all by hand.

Huangdi, who became the chief, gathered all the demons of the world in Seotaesan. Chiyou also attended, but when Chiyou observed Huangdi, it did not look much better than Chiyou himself. So, Chiyou decides to attack Huangdi together by persuading his tribes, the southern myo tribes, and many ghosts to stand on his side.

With the attack of Chiyou, who had formed a strong coalition in the beginning, the war generally went unfavorable to Huangdi. Huangdi, who ruled the world with "humanity" could not stop violent Chiyou's attacks. When Huangdi, whose heart was frustrated, looked up at the sky and lamented, the sky gave him a magical talisman. With this talisman, Huangdi overpowered Chiyou. However, when Chiyou, who had ruled the world by showing off his power, died, the world became cluttered again, and Huangdi stabilized the world by drawing the image of Chiyou. This custom was passed on to the later generations, and the figure of Chiyou played a role in expelling demons and evil energy (Encyclopedia Britannica. 2020).

The story of information security in the Korean Cheoyong in Korean narrative literature

In the era of King Heon-gang in Silla, there was a servant named Cheoyong who helped the royal affairs of the king. Cheoyong's wife was so beautiful that Yeokshin admired his wife. So at night, he turned into a person and came to Cheoyong's house to sleep secretly.

One day, when Cheoyong came home from outside, he saw two people sleeping, but they did not get rid of them with anger. Instead, Cheoyong sang, "I played all night in the bright moon of Gyeongju, and when I came back and looked at the seats, I had four legs, two of them are mine, but whose two are. Originally it was mine, but what should I do with what was already taken away?" Singing and dancing, he stepped back.

At this time, Yeokshin revealed his shape and knelt in front of Cheoyong and said, praying for forgiveness. And he said, "I swear, from today onwards, I will never enter that door just by looking at the picture of your image." When Yeokshin asks for forgiveness, Cheoyong forgives. For this reason, people put the shape of Cheoyong on the door to defeat the evil, when the auspicious event had happened (Chung S., 2014).

Information security in ancient Chinese hero myths and Korean narrative literature

The common role of the figure of Chiyou in Chinese mythology and that of Cheoyong in Korean mythology is to prevent access to harmful beings. It is seen as a principle similar to the intrusion prevention system that controls the intrusion into the internal network through the external network from the Internet today. Among intrusion prevention systems, we can think of firewalls in particular. The principle of preventing enemy intrusion by showing Cheoyong's figure and blocking the invasion of evil spirits into the house by attaching a picture of Cheoyong is to limit the access installed at the gateway to protect against illegal intrusion into the network connected by IP. It is a

principle similar to the firewalls. Therefore, through myths, difficult concepts for elementary school students can be explained in an easy and fun way.

Learning plan using storytelling

The creative storytelling model used for learning is shown in figure 1.



Figure 1. The creative storytelling model

In the first stage of motivation, students create an atmosphere in which they can concentrate on the class and organize a group so that students can communicate creatively. In the story introduction stage, before telling the story, pictures were presented so that they could guess the content, and even in the middle of the story, students were asked to predict the development to induce participation. Figure 2 is the sample of instruction plan for the introduction stage.

Stage	Activity	Evaluating	Time	Note
Introduction	Look at the pictures.   Use your Creativity and make your own information security story	Observe and evaluate whether learners are faithfully involved in what they are going to learn.	10 min.	Prepare pictures to suit the class objective.

Figure 2. Instruction plan using pictures in the introduction stage

In the second stage, the presentation of learning goals, the concept of information security that students must learn is briefly explained, and functions similar to information security are found in the myth story.

In the third stage, the storytelling activity stage, the characters, background, and events of the myth story were identified, and the story was created. Next, a task to be performed was presented to find the elements of information security in the myth. Based on this, discussions were made for each group to produce a storytelling presentation using various methods autonomously. The following figure 3 is an example of a creative storytelling presentation task.

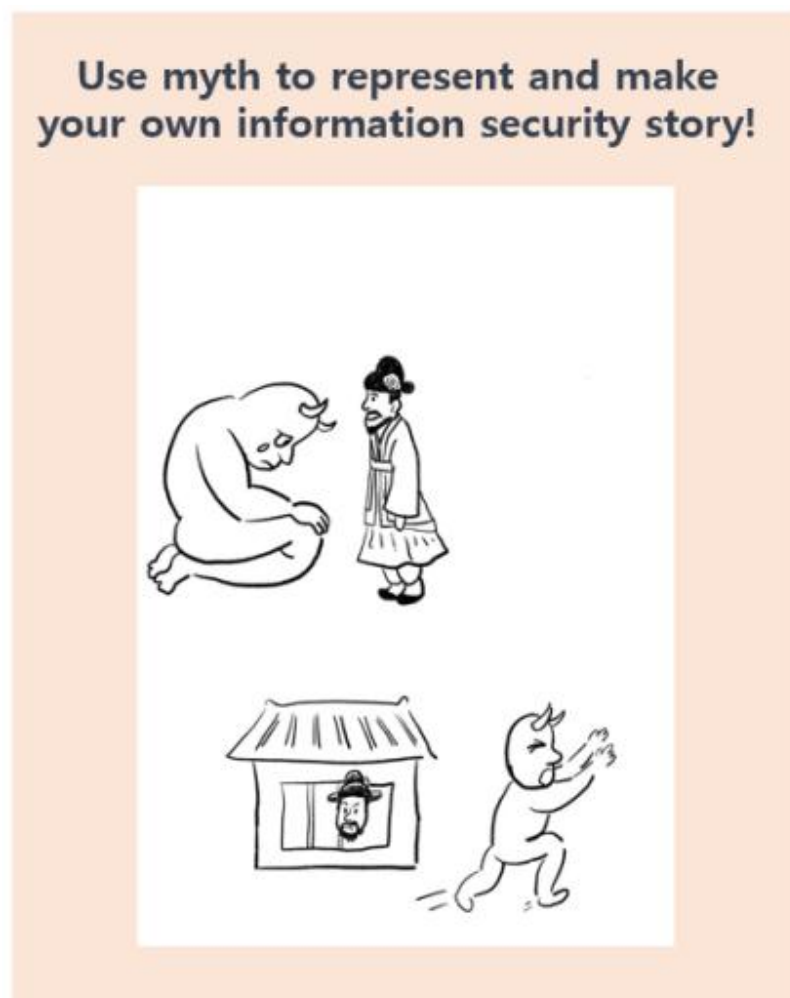


Figure 3. Example of creative storytelling presentation tasks

In the fourth stage, students presented and shared activities for each group.

In the fifth stage, organizing and evaluating, students were asked to express their feelings about their presentations, let them evaluate their friends' presentations, and finally, the teacher evaluates students' achievements (Korea.net. 2014).

RESULTS

In order to test-apply information security education contents developed in this study, classes were conducted to elementary school students in Korea by utilizing the contents. For verifying the effectiveness, the recognition survey related to information security before class was conducted to divide the groups with high and low levels of awareness. The survey conducted with the same question after training analyzed the difference in information security education effectiveness according to level.

As a result of a survey before and after education using educational contents suggested in this study, it was found that there was a significant educational effect as scores in all areas increased. The most notable point is that in the part of the intention to participate in information security education in the future, the score was set the highest, indicating that the educational contents led to students' satisfaction ($p < 0.001$). Besides, the number of learners who have become aware of the importance of information security has increased significantly, and in real life, learners can become more serious about information security when learning online or using smartphones ($p < 0.001$). As for the concept of information security, it was difficult for learners to recognize all the concepts of information security because the educational content taught only some concepts of information security.

Table 1: Analysis of pre & post perception of educational contents($n=59$)

Subfactor	Pre M(SD)	Post M(SD)	$t(p)$
Understanding of concept	2.12(0.93)	3.37(0.61)	-8.65(0.000)***
Significance recognition	1.80(0.74)	3.93(0.74)	-15.70(0.000)***
Convenience recognition	2.24(1.06)	3.49(0.92)	-6.89(0.000)***
Willingness to participate in future education	1.98(0.96)	4.03(0.91)	-11.95(0.000)***
Willingness to choose related professions	1.90(0.88)	3.39(0.91)	-9.03(0.000)***

* $p < 0.5$, ** $p < 0.05$, *** $p < 0.005$

Table 2 shows the change in the perception of students in the upper group after education in the pre-test results. Students in this group also showed a significant effect in all areas after information security education using educational content. In particular, awareness of information security convenience has shown a deep interest in future jobs related to information security. The students also strongly expressed their desire to participate in future education ($p < 0.001$).

Table 2: Analysis of pre & post perception of educational contents(high recognition group)(n=10)

Subfactor	Pre M(SD)	Post M(SD)	t(p)
Understanding of concept	2.12(0.93)	3.37(0.61)	-8.65(0.000)***
Significance recognition	1.80(0.74)	3.93(0.74)	-15.70(0.000)***
Convenience recognition	2.24(1.06)	3.49(0.92)	-6.89(0.000)***
Willingness to participate in future education	1.98(0.96)	4.03(0.91)	-11.95(0.000)***
Willingness to choose related professions	1.90(0.88)	3.39(0.91)	-9.03(0.000)***

*p < 0.5, ** p < 0.05, ***p < 0.005

Table 3 shows changes in post-education perceptions among students who lack awareness of information security during pre-examination results. Students in the group also reveal that the education has been effectively applied in all areas. These students also learned the concept partly due to the educational content in the part where the concept of information security was insufficient and became aware of the importance (p<0.001).

Table 3: Analysis of pre & post perception of educational contents(low recognition group)(n=10)

Subfactor	Pre M(SD)	Post M(SD)	t(p)
Understanding of concept	1.00(0)	2.70(0.48)	-11.13(0.000)***
Significance recognition	1.00(0)	2.40(0.52)	-8.57(0.000)***
Convenience recognition	1.00(0)	2.10(0.32)	-11.00(0.000)***
Willingness to participate in future education	1.00(0)	2.50(0.52)	-9.00(0.000)***
Willingness to choose related professions	1.00(0)	2.00(0.47)	-6.70(0.000)***

*p < 0.5, ** p < 0.05, ***p < 0.005

CONCLUSION

As modern society moves toward a high-tech information society, the convergence of knowledge is becoming an essential element. This study examined the changes in interest and understanding of elementary school students by combining the humanities of mythology in information security education. Overall, the survey on information security awareness after training received high marks. The most noticeable part of the survey results is the high score in the area of wanting to participate again if information education classes are opened in the future. This showed that the students were satisfied with the education.

Myth is a story that contains the archetypes of human universality and makes students friendly and consensus. In addition, storytelling activities increase interest and improve imagination and creativity by allowing students to connect fantasy and reality. The survey results proved the effectiveness of education through storytelling activities by utilizing mythological stories to understand the difficult and unfamiliar concept of information security.

The difference between the fourth industrial revolution and the third industrial revolution is that it turns into a "human-centered" society. In a world surrounded by machines, the competitiveness that humans can have is humanity.

Going back to the story of Chinese mythology, we can see that 'humanity' was the way Huangdi ruled the world in mythology. As such, education that combines myths containing ancient life and modern information security will be one of the best ways to learn humans and machines together in the 4th industrial era. We hope that many cases will be used in the classroom and have more positive effects in the future. Furthermore, it is necessary to conduct advanced humanities information security education through the operation of humanities-based information education classes and further analysis of satisfaction and effectiveness of teacher training.

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AUTHOR’S BIOGRAPHY

SUNGHEE KIM is PhD student of Chinese language and literature, Jeju National University in South Korea. She is now growing her research interests in the Creative convergence education for elementary and Secondary school student thought Intelligent information technology.

EUNSUN CHOI is PhD student of major in Computer Education, Faculty of Science Education, Graduate School, Jeju National University in South Korea. She is a senior researcher of Cybersecurity Human Resource Institute. Her research interests include various field: creative education, educational contents, elementary education, and digital humanities.

YEONG HO LEE is Professor of Department of Chinese language and literature in College of Humanities at Jeju National University, Korea since 1996. He received Ph.D. degrees in Chinese language and literature from Sungkyunkwan University in 1995. His publications touch upon various fields: Chinese Grammar, Classical Chinese, Chinese learning, Literature Education, Chinese Education, Classical Education, Etc (Co-corresponding author: skk123@jejunu.ac.kr).

NAMJE PARK received the BSc degree in information industry from Dongguk University, Korea in 2000, and received his M.E., and Ph.D. degrees in Information Engineering from Sungkyunkwan University in 2003, and 2008 respectively. He is a

Professor of Department of Computer Education in Teachers College at Jeju National University since 2010. He has been serving as a Research Scientist of Arizona State University since 2010. Prior to joining the researcher at ASU, he had worked as a post-doc at University of California, Los Angeles for 1 year. And he had an appointment as the senior engineer of the information security research division of the Electronics and Telecommunication Research Institute for 6 years (corresponding author: namjepark@jejunu.ac.kr).