



ISSN: 2586-7342 © 2021 KODISA & KJFHC
KJFHC website: <http://www.kjfhc.or.kr>
doi: <http://dx.doi.org/10.13106/kjfhc.2021.vol7.no7.1>.

Relationships among Nursing Students' Recognition, Perceived Usefulness, and Intention to Accept IoT

Ji-Yeon KANG¹, Ye-Won KONG², Eun-Bi KIM³, Eun-Ae KIM⁴, Sun-Joo PARK⁵, Jina PARK⁶, Ji-Yeon SEONG⁷, Chae-Eun SON⁸, Bo-Mi LEE⁹, Yunmi KIM¹⁰

1. First Author Dept. of Nursing, Eulji University, Korea, E-mail: ruathswldus@naver.com
2. Co- Author Dept. of Nursing, Eulji University, Korea, E-mail: yewonpen@naver.com
3. Co- Author Dept. of Nursing, Eulji University, Korea, E-mail: eb3257@naver.com
4. Co- Author Dept. of Nursing, Eulji University, Korea, E-mail: mouse0319@naver.com
5. Co- Author Dept. of Nursing, Eulji University, Korea, E-mail: sunjoo1018@naver.com
6. Co- Author Dept. of Nursing, Eulji University, Korea, E-mail: jeen0429@naver.com
7. Co- Author Dept. of Nursing, Eulji University, Korea, Email: tjdwldus5@naver.com
8. Co- Author Dept. of Nursing, Eulji University, Korea, E-mail: soncu43@gmail.com
9. Co- Author Dept. of Nursing, Eulji University, Korea, E-mail: hotnbomi@naver.com
10. Corresponding Author Dept. of Nursing, Eulji University, Korea, E-mail: kyunm@eulji.ac.kr

Received: February 8, 2021. Revised: February 16, 2021. Accepted: February 19, 2021.

Abstract

The purpose of this study was to investigate the degree of recognition, perceived usefulness, and intention to accept the Internet of Things (IoT) in healthcare among nursing students, as well as to determine related factors. Through this study, we wanted to develop the basic research for the education related to the IoT in healthcare. In this study, data were collected from 348 nursing students using self-report online questionnaires, Naverform, and analyzed using the independent sample t-test, one-way analysis of variance, and Pearson correlation coefficients in SPSS version 26.0. The results of the study show that recognition of the IoT was correlated with its perceived usefulness ($r=0.37$; $p<.001$) and intention to accept the IoT ($r=0.23$ ($p<.001$)). The strongest correlation was found between perceived usefulness of the IoT and intention to accept ($r=0.67$; $p<.001$). In conclusion, recognition of the IoT in healthcare affected its perceived usefulness, and a significant correlation was found between perceived usefulness of the IoT and intention to accept it. This study analyzed how much recognition, perceived usefulness, and intention to accept IoT in healthcare nursing students have. Based on these findings, we suggest that education related to the IoT in healthcare should be incorporated into the nursing curriculum.

Keywords: Students, Nursing, Internet of Things, Education

Major classifications: Health Science

1. Introduction

Due to rapid population aging, the nursing workload is increasing in clinical settings, and clinical nurses are presented with additional challenges in the workplace due to the expansion of integrated nursing and nursing services. If the existing human-centered nursing environment can be transformed into a system that utilizes the Internet of Things(IoT), it may be possible for the IoT to play a key role in improving the quality of patient care and ensuring patient safety (Minerokoski et al., 2017). In light of these changes in hospital systems, undergraduate nursing students—as prospective health professionals—need to become aware of the introduction of the IoT in healthcare, recognize its usefulness, and become ready to accept its applications. This study investigated the recognition, perceived usefulness and intention to accept the IoT in healthcare among nursing students, and analyzed related factors by calculating correlations between variables. It is hoped that the findings of this study will assist in the future development of IoT education to meet related needs in healthcare.

2. Literature review

In the 4th Industrial Revolution, the IoT is being integrated into nurse's work such as automatically monitoring vital sign, monitoring of urine output, sleeping pattern monitoring, monitoring falls, the distant medical management, management system of goods using GPS(Global Positioning System), home care, and management system of chronic diseases (Aboelmaged & Hashem, 2018). While the opportunities to use IoT are continuously increasing in hospitals studies on the recognition and intention to accept the IoT by medical staffs have been scarcely conducted. For this reason, the health care field is not fully responding to future changes (Kang, 2018). A prior study identified the relationship and direction between the level of recognition, perceived usefulness, and intention of the use.

3. Methods

In this study, the participants were nursing students attending E University in S City. The minimum number of samples required for the study was calculated using the G-power 3.1.9.4 program. The number of samples required was 319 when calculated as two-sided tests, correlation coefficients of 0.2, significance levels of 0.05, and power of .95, referring to a prior study (Kang, 2018) reported as 0.2 correlation between usefulness and intention to accept the IoT. In total, 348 nursing students were selected as participants, considering a 5% dropout rate. Recognition of the IoT was measured using an 11-item questionnaire related to the impact of the IoT in healthcare as a whole and on the healthcare professions from an occupational standpoint. Each question was scored on a 5-point Likert scale, with responses of "not at all" given 1 point and responses of "very much so" given 5 points. The total score ranged from 11 to 55. Higher scores indicated higher levels of recognition of the IoT. In this study, the Cronbach α of the tool for recognition of the IoT was .55. Perceived usefulness of the IoT was measured using five questions: two questions about the speed of perceived task processing and three questions about perceived productivity improvements. Each question was scored on a 10-point Likert scale, ranging from 1 point for "not at all" to 10 points for "very much so," and higher scores corresponded to higher recognition. In a prior study (Kang & Kim, 2018), the Cronbach α for this tool was .96, while in this study, it was .94. Intention to accept IoT was measured using a tool consisting of four questions: intention to perform tasks using the IoT, the need for technology use, willingness to actively use the technology, and willingness to use IoT under appropriate circumstances. Each question was scored on a 10-point Likert scale, ranging from 1 point for "not at all" to 10 points for "very much so," and higher scores corresponded to higher levels of recognition. In a prior study (Kang & Kim, 2018), the Cronbach α value for this tool was .96, while in this study, the Cronbach α was .94. Data were collected from July 8 to August 10, 2020.

The participants were students who voluntarily agreed to participate in individual surveys, and responses were gathered via a Naver form (i.e., a non-face-to-face method). The general characteristics of subjects were analyzed through frequency analysis and descriptive statistics, and the independent-sample t-test and one-way analysis of variance (ANOVA) were conducted to evaluate the significance of differences in recognition, perceived usefulness and intention to accept the IoT in healthcare. The correlations between recognition, perceived usefulness, and intention to accept the IoT were analyzed using Pearson correlation coefficients in SPSS version 26.0 (IBM Corp., Armonk, NY, USA).

4. Result

4.1. Descriptive statistics for IoT related factors

As shown in Table 1, the average score for questions about the recognition of the IoT was 3.59, the average score for the perceived usefulness of the IoT was 7.84, and the average score for intention to accept the IoT was 7.41.

Table 1: Mean scores for recognition, perceived usefulness, and intention to accept the Internet of Things

Factors	Mean ± SD
Recognition	3.59 ± 0.35
Perceived usefulness	7.84 ± 1.33
Intention to Accept	7.41 ± 1.64

4.2. Recognition, perceived usefulness, and intention to accept the IoT by personal characteristics

Table 2 presents comparisons between the average scores for the recognition, perceived usefulness, and intention to accept the IoT in healthcare based on participants' characteristics. The IoT recognition scores of female students (3.6) were significantly higher than those of male students (3.5) ($t=-2.18, p=.030$). Those who had previously encountered information about the IoT had higher recognition scores than those who had not, but the difference was not statistically significant. No significant differences were found according to whether students had experienced education related to the IoT. A non-significant difference in IoT recognition was found according to participants' answers to the item asking whether COVID-19 has affected use of the IoT in nursing ($F=2.68; p=.070$). No significant differences in the perceived usefulness and acceptance of the IoT were found according to participants' characteristics.

Table 2: Recognition, perceived usefulness, and intention to accept the IoT in healthcare according to participants' characteristics

Factors		Recognition		Perceived usefulness		Intention to accept	
		Mean±SD	t/F	Mean±SD	t/F	Mean±SD	t/F
Year	1st	3.6±0.33	0.90	7.8±1.48	0.66	7.2±1.79	0.85
	2nd	3.6±0.39		7.9±1.21		7.4±1.54	
	3rd	3.5±0.34		7.8±1.34		7.5±1.69	
	4th	3.6±0.33		7.7±1.31		7.6±1.55	
Gender	Male	3.5±3.56	-2.18**	7.9±1.40	1.19	7.3±1.78	-0.37
	Female	3.6±0.34		7.8±1.31		7.4±1.61	
Experience with the IoT	Yes	3.6±0.33	0.40	7.9±1.31	1.94*	7.5±1.64	1.37
	No	3.6±0.48		7.4±1.42		7.0±1.57	
Education on the IoT	Yes	3.6±0.35	1.47	8.1±1.31	1.91*	7.6±1.69	1.42
	No	3.6±0.35		7.8±1.33		7.3±1.61	
Influence of COVID-19 on nursing using the IoT	No	3.5±0.32	2.68*	8.0±1.26	1.61	7.5±1.63	1.73
	Moderate	3.5±0.36		7.6±1.46		7.1±1.73	
	Yes	3.6±0.35		7.9±1.29		7.5±1.60	

4.3. Correlations between recognition, perceived usefulness, and intention to accept the IoT in healthcare

The correlations between recognition, perceived usefulness, and intention to accept the IoT in healthcare are shown in Table 3. Recognition of the IoT was positively correlated with perceived usefulness ($r=.37$; $p<.001$) and with the intention to accept the IoT ($r=.23$; $p<.001$). Perceived usefulness and intention to accept the IoT were also correlated ($r=.67$; $p<.001$).

Table 3: Correlations between recognition, perceived usefulness, and intention to accept the IoT in healthcare

Factors		Recognition	Perceived usefulness	Intention to Accept
Recognition	r	-	.37***	.23***
Perceived usefulness	r	-	-	.67***

5. Discussion

Female students had significantly higher average scores than male students for recognition of the IoT in healthcare. These results disagree with those of Chang and Jung (2019), who stated that male students had higher recognition scores than female students. An explanation of this difference is that most of their participants were male students, and their study focused on the general recognition of the Fourth Industrial Revolution, which is outside of the scope of this study. The undergraduate nursing students in this study showed higher scores for perceived usefulness and intention to accept the IoT (7.36 and 7.41 points, respectively), than those reported for employees in nursing, medical technology, and administrative positions (7.19 and 7.26 points, respectively) in previous research using the same tool (Kang & Kim, 2018). The finding that undergraduate nursing students in their 20s were more willing to use the IoT than employees in nursing, medical technology, and administrative jobs, and that undergraduate nursing students accepted this technology faster than the older generation in healthcare is consistent with prior research results (Kim & Kim, 2019). In this study, the correlation between recognition and perceived usefulness of the IoT in healthcare was medium ($r=.37$; $p<.001$), the correlation between recognition and acceptance was weak ($r=.23$; $p<.001$), and the correlation between perceived usefulness and acceptance was strong ($r=.67$; $p<.001$). In this study, it was difficult to determine the directionality of the relationships between variables because no regression or path analysis was conducted. However, a prior study identified the directionality of the relationships between the level of recognition, perceived usefulness, and intention of use. Based on those findings, recognition of IoT can be interpreted as positively affecting perceived usefulness, while recognition and perceived usefulness positively affect intention to accept the IoT. In order to increase intention to accept the IoT, targeted education is needed for undergraduate nursing students who will work in hospitals where patients are being monitored more precisely than before due to COVID-19 and as a result of the expansion of integrated nursing and nursing services.

6. Conclusion

In the rapidly changing healthcare environment of the Fourth Industrial Revolution, healthcare workers need to acquire new capabilities and skills (Kim, Jang, Jung & Park, 2018). In order to obtain basic information that will help improve the curriculum related to IoT in healthcare for nursing students, the present study investigated the recognition, perceived usefulness and intention to accept the IoT in healthcare among nursing students, as well as correlations among those variables. Of particular note, the recognition score for the IoT showed significant positive correlations with perceived usefulness and intention to accept the IoT. Therefore, in order to promote the use of the IoT at nursing sites, it is necessary to revise the nursing curriculum to include information on the IoT.

References

- Aboelimged, M., & Hashem, G. (2018). RFID application in patient and medical asset operations management: A technology, organizational and environmental (TOE) perspective into key enablers and impediments. *International journal of medical*

- informatics*, 118, 58-64.
- Balaguera, H. U., Wise, D., Ng, C. Y., Tso, H. W., Chiang, W. L., Hutchinson, A. M., Galvin, T., Hilborne, L., Hoffman, C., Huang, C. C., & Wang, C. J. (2017). Using a medical Intranet of Things system to prevent bed falls in an acute care hospital: a pilot study. *Journal of medical Internet research*, 19(5), e150.
- Chang, M. O., & Jung, M. Y. (2019). The Study of Awareness and Preparation of College Students for the Era of 4Th Industrial Revolution. *The Journal of the Korea Contents Association*, 19(6), 47-57.
- Kang, H. S., & Kim, Y. H. (2018). The Effects of Technology Readiness Index of Artificial Intelligence and Internet of Things on the Recognition of Substitute Employment of Medical Personnel. *Korea Journal of Hospital Management*, 23(2), 54-66.
- Kim, K. J., Jang, B. Y., Jung, J. Y., & Park, O. W. (2018). The coming of the 4th Industrial Revolution and the HRD issues for nurses: Prospects and challenges. *Korean Journal of Resources Development*, 21(3), 137-159.
- Kim, M. R., & Kim, S.Y. (2019). Comparative Study on the Perception of Artificial Intelligence Telemedicine in the Fourth Industrial Age-Between Nursing Students, Nurses and General Public. *Journal of Digital Contents Society*, 20(7), 1461-1471.
- Mieronkoski, R., Azimi, I., Rahmani, A. M., Aantaa, R., Terävä, V., Liljeberg, P., & Salanterä, S. (2017). The Internet of Things for basic-nursing care—a scoping review. *International Journal of Nursing Studies*, 69, 78–90.