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Analysis of the Difference and Correlation by Altitude in the Species Number of Vascular Plants and Naturalized Plants in Korea

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Abstract

Purpose: *By analyzing 1,441 flora survey data of the 3rd to 5th data of the National Natural Environment Survey, the differences by region and altitude were analyzed in the species number of vascular plants and naturalized plants distributed throughout Korea, and the naturalization index. This study aimed to reveal the correlation by altitude in the species number of vascular plants, the species number of naturalized plants, and the naturalization index.*

Method: *This study utilized the flora survey data for 14 years from 2006 to 2019 in the 3rd to 5th National Natural Environment Survey. One-way ANOVA analysis was performed by region and altitude to examine the differences in the species number of vascular plants, the species number of naturalized plants, and the naturalization index. Researchers performed curvilinear estimation regression analysis to find the correlation, and SPSS Statistics 21 statistical program was used for statistical analysis.*

Results: *There were differences by region and altitude in the species number of vascular plants, the species number of naturalized plants, and the naturalization index. The species number of vascular plants had a positive correlation with an increase in the number of species as the altitude increased. The species number of naturalized plants had a negative correlation with a decrease in the number of species as the altitude increased. The naturalization index had a negative correlation that decreased up to a certain altitude, increased after that point, and then decreased again.*

Conclusion: *As for vascular plants, the higher the altitude, the greater the species number of vascular plants, and the lower the altitude, the fewer vascular plant species. Conversely, as for naturalized plants, the lower the altitude, the greater the species number of naturalized plants, and the higher the altitude, the fewer naturalized plant species. In addition, as for the naturalization index, the lower the altitude, the higher the naturalization index, and the higher the altitude, the lower the naturalization index. This study is expected to be utilized as basic data for managing naturalized plants.*

Keywords: ***Vascular Plants, Naturalized Plants, Naturalization Index, Flora, Correlation***

1. Introduction

After the 20th century, as human and material exchanges between countries became active and global changes such as climate change and desertification occurred, the inflow and outflow of species between countries began to appear rapidly[1].

Although the proliferation and settlement of non-native species are considered part of global change, non-native species introduced into new environments pose a significant threat to native ecosystems and biodiversity. Accordingly, research on non-native species is continuously being conducted[2][3][4].

Naturalized plants are generally known as precursors of disturbed environments, but in some cases, they are also known to threaten the ecological niche of native species even in stable habitats[5][6].

Research on naturalized plants started in the 1960s and has been steadily increasing since the 2000s, and the direction and scope of research are gradually expanding. In particular, naturalized plants are being studied intensively in the study of vascular plants[6][7][8]. Studies are being actively conducted to analyze the characteristics of naturalized flora in a specific region and the ecological environment of specific naturalized plants[6][9][10].

Research on the distribution of naturalized plants deals with the distribution status by region, year, and location type. Some studies are also being conducted on the distribution status by altitude, population density, and forest land ratio[11][12][13]. In studies on the distribution of naturalized plants by region, Park SH et al.(2002), Jung SY (2014), and Lee HJ(2020) analyzed the total and average species number of naturalized plants for the whole of Korea[11][14][15]. For the entire Gyeongsangbuk-do area, Lee HJ(2018) analyzed the total and average species number of naturalized plants. In a study on the distribution of naturalized plants by year, Lee HJ(2018) analyzed the species number of naturalized plants confirmed by visiting 80 places in Gyeongsangbuk-do for 8 years from 2010 to 2017[11][16][17][18]. Lee HJ(2020) analyzed the species number of naturalized plants by region, year, altitude, population density, GDP, and forest land ratio based on data from the 3rd to 4th National Natural Environment Survey, for 12 years from 2006 to 2017. Kim BW(2008), Oh CH et al.(2010), Jung SY(2014), and Lee HJ(2018) analyzed the habitat types by classifying them in consideration of the habitat environment of naturalized plants[11][19][20][21].

The researchers investigated differences by region and altitude in the species number of vascular plants, the species number of naturalized plants, and the naturalized index distributed throughout Korea. This study aimed to reveal the correlation by altitude in the species number of vascular plants, the species number of naturalized plants, and the naturalization index. The correlation results are expected to be utilized as primary data for managing naturalized species at the national level.

2. Methods

2.1. Gathering data

This study was analyzed using the flora survey data for 14 years from 2006 to 2019 in the National Natural Environment Survey[22][23][24]. <Table 1> and <Figure 1> show the number and ratio of research areas by region. Chungcheong Province had the most research areas by region, with 257 places(17.83%).

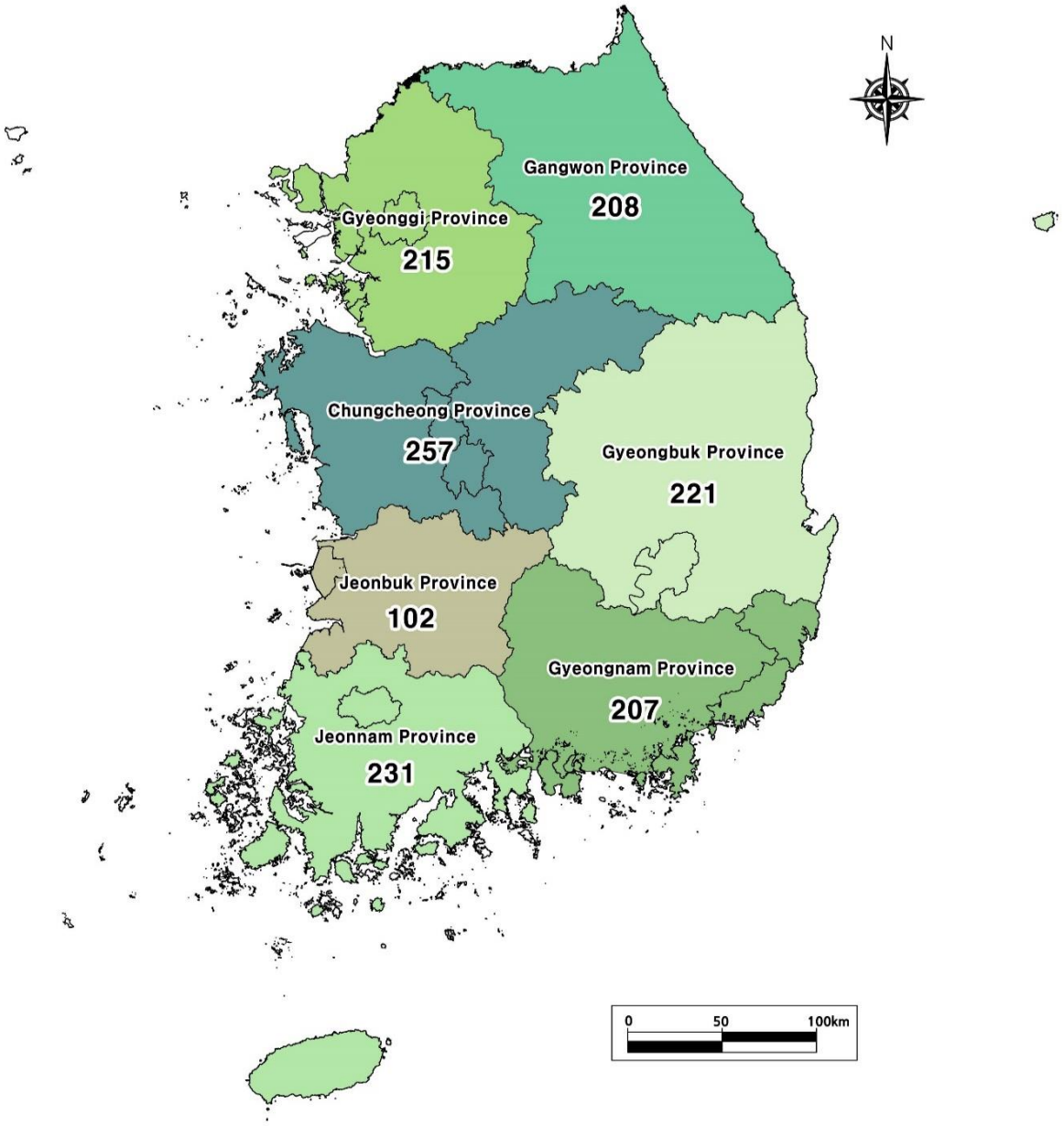
Next, Jeonnam Province had research areas with 231 places(16.03%), Gyeongbuk Province with 221 places(15.34%), Gyeonggi Province with 215 places(14.92%), Gangwon Province with 208 places(14.43%), Gyeongnam Province with 207 places(14.37%), and Jeonbuk Province with 102 places(7.08%).

Table 1. The number and ratio of research areas by region.

Region	The number of research areas	Ratio
Gyeonggi province	215	14.92
Chungcheong province	257	17.83
Gyeongnam province	207	14.37

Jeonnam province	231	16.03
Gangwon province	208	14.43
Jeonbuk province	102	7.08
Gyeongbuk province	221	15.34
Total	1441	100.00

Figure 1. The status of research areas by region.



2.2. Data analysis

This study was analyzed based on 1441 cases of flora survey data for 14 years from 2006 to 2019 in the 3rd to 5th National Natural Environment Survey. The researchers classified the country into seven regions and analyzed the differences in the species number of vascular plants,

the species number of naturalized plants, and the naturalization index. To determine the difference by altitude, researchers divided the 1~1600m elevation by 100m and analyzed them into 16 sections[25][26][27].

One-way ANOVA was performed by region and altitude to determine the differences in the species number of vascular plants, the species number of naturalized plants, and the naturalization index. A curvilinear estimation regression analysis was performed to check the correlation. Spss Statistics 21 statistical program was used to perform the above statistical analysis[28][29].

3. Analysis of the Difference in the Species Number of Vascular Plants, the Species Number of Naturalized Plants, and the Naturalization Index

3.1. Analysis of variance by region

<Table 2> and <Figure 2> show the results of one-way ANOVA analysis to examine the differences by region in the species number of vascular plants, the species number of naturalized plants, and the naturalization index. The result of confirming the significance probabilities was p=0.000. There were differences by region in the species number of vascular plants, the species number of naturalized plants, and the naturalization index[30][31].

The average species number of vascular plants was highest in Gangwon Province, with 281.4 species. Next, Gyeongnam Province had 253.0 species, Gyeongbuk Province had 249.3 species, Chungcheong Province had 242.6 species, Jeonnam Province had 239.7 species, Gyeonggi Province had 223.7 species, and Jeonbuk Province had 217.7 species. There were differences by region, but the differences were not significant.

The average species number of naturalized plants was highest in Gyeonggi Province, with 19.2 species. Next, Chungcheong Province had 18.9 species, Gyeongnam Province had 17.9 species, Jeonnam Province had 17.0 species, Gyeongbuk Province had 17.0species, Gangwon Province had 16.6 species, and Jeonbuk Province had 14.5 species. There were differences by region, but the differences were not significant.

The average naturalization index was highest in Gyeonggi Province, at 7.79. Next, Chungcheong Province was 7.35, Gyeongbuk Province was 6.67, Gyeongnam Province was 6.65, Jeonnam Province was 6.45, Jeonbuk Province was 6.27, and Gangwon Province was 5.62. There were differences by region, but the differences were not significant.

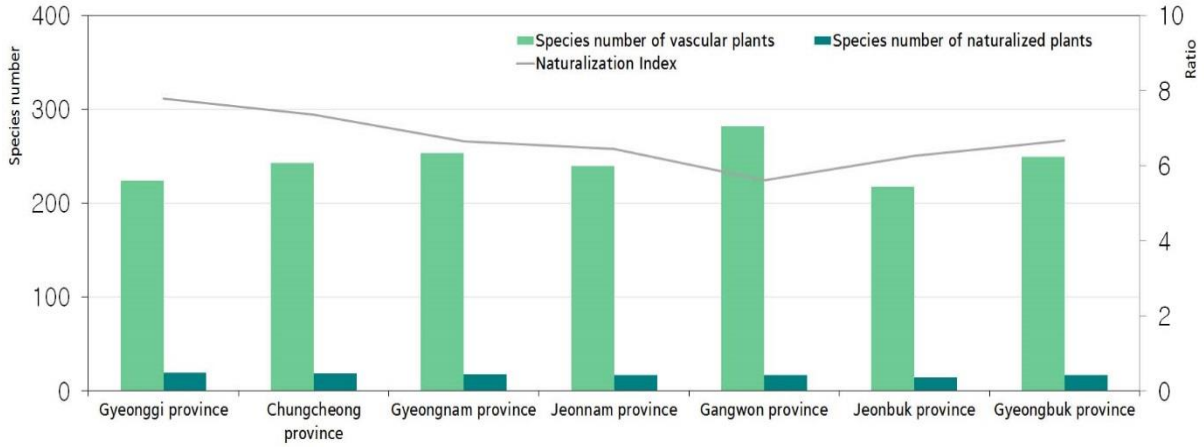
Table 2. Analysis of variance by region in the species number of vascular plants, the species number of naturalized plants, and the naturalization index.

Descriptive statistics							
Region	Number of study sites	Species number of vascular plants		Species number of naturalized plants		Naturalization index	
		Avg. number of species	Std. deviation	Avg. number of species	Std. deviation	Avg. naturalization index	Std. deviation
Gyeonggi province	215	223.7	111.19	19.2	14.13	7.79	3.90
Chungcheong province	257	242.6	112.41	18.9	13.80	7.35	3.38
Gyeongnam province	207	253.0	105.82	17.9	13.51	6.65	3.16
Jeonnam province	231	239.7	111.85	17.0	13.58	6.45	3.39
Gangwon province	208	281.4	117.18	16.6	12.03	5.62	3.22
Jeonbuk province	102	217.7	81.14	14.5	10.13	6.27	3.31

Gyeongbuk province	221	249.3	93.10	17.0	9.34	6.67	2.66
Total/average	1441	245.7	108.50	17.6	12.73	6.74	3.37

Levene's test of equality of error variance
Species number of vascular plants: F=6.876, df1=6, df2=1434, p=0.000
Species number of naturalized plants: F=2.473, df1=6, df2=1434, p=0.022
Naturalization index : F=9.753, df1=6, df2=1434, p=0.000

Figure 2. Variance analysis graph by region in the species number of vascular plants, the species number of naturalized plants, and the naturalization index.



3.2. Analysis of variance by altitude

<Table 3> and <Figure 3> show the results of one-way ANOVA analysis to examine the differences by altitude in the species number of vascular plants, the species number of naturalized plants, and the naturalization index. The result of confirming the significance probabilities was p=0.000. There were differences by altitude in the species number of vascular plants, the species number of naturalized plants, and the naturalization index.

The average species number of vascular plants was the highest at 1201-1300m with 304.4 species. There were 302.2 species at 1001-1100 m, 298.3 species at 1101-1200 m, 291.9 species at 1301-1400 m, 274.4 species at 1401-1500 m, 228.7 species at 301-400 m, 220.3 species at 201-300 m, and 187.1 species at 0-100 m. There were differences by altitude in the species number of vascular plants.

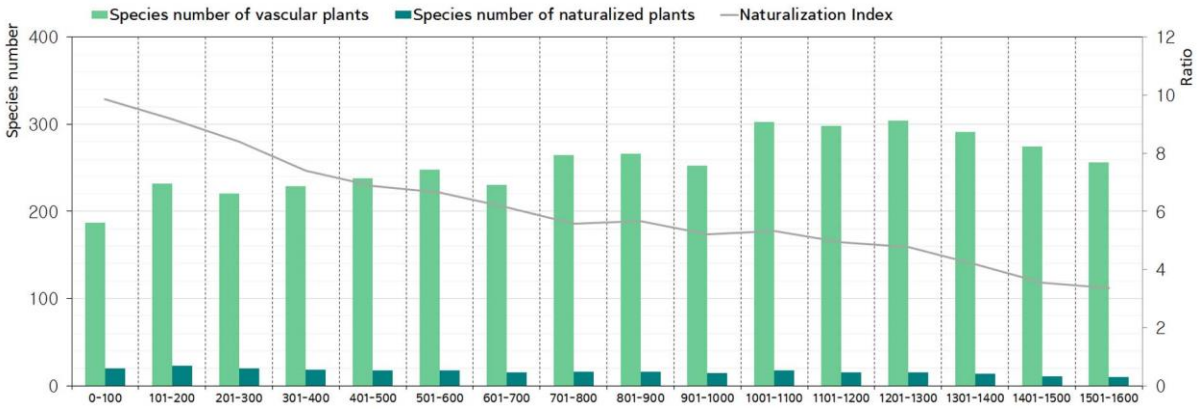
The average species number of naturalized plants was the highest at 101-200m with 22.7 species. There were 19.7 species at 0-100 m, 19.7 species at 201-300 m, 18.3 species at 301-400 m, 17.9 species at 501-600 m, 14.1 species at 1301-1400 m, 11.0 species at 1401-1500 m, and 9.8 species at 1501-1600 m. There were differences by altitude in the species number of naturalized plants.

The average naturalization index was the highest at 0-100m with 9.87. It was 9.18 at 101-200m, 8.4 at 201-300m, 7.41 at 301-400m, 6.87 at 401-500m, 4.19 at 1301-1400m, 3.55 at 1401-1500m, and 3.37 at 1501-1600m. There were also differences by altitude in the naturalization index.

Table 3. Analysis of variance by altitude in the species number of vascular plant, the species number of naturalized plants, and the naturalization index.

Descriptive statistics							
Altitude(m)	Number of study sites	Species number of vascular plants		Species number of naturalized plants		Naturalization index	
		Avg. number of species	Std. deviation	Avg. number of species	Std. deviation	Avg. naturalization index	Std. deviation
1-100	45	187.1	102.43	19.7	14.24	9.87	3.90
101-200	141	231.8	113.90	22.7	15.38	9.18	3.70
201-300	123	220.3	102.62	19.7	13.90	8.40	3.61
301-400	152	228.7	104.44	18.3	13.32	7.41	3.46
401-500	157	238.3	93.04	17.7	12.22	6.87	2.96
501-600	182	248.1	109.16	17.9	12.95	6.65	2.97
601-700	176	230.4	91.82	15.4	10.86	6.14	2.96
701-800	119	264.8	121.42	16.2	12.49	5.58	2.72
801-900	98	266.1	116.15	16.1	11.67	5.67	2.65
901-1000	77	252.3	100.85	14.4	10.41	5.21	2.63
1001-1100	47	302.2	103.02	17.3	10.04	5.33	2.10
1101-1200	56	298.3	109.86	15.4	9.49	4.94	2.24
1201-1300	38	304.4	116.05	15.5	12.52	4.77	2.55
1301-1400	18	291.0	125.10	14.1	12.26	4.19	2.79
1401-1500	8	274.4	100.64	11.0	10.66	3.55	2.71
1501-1600	4	256.3	98.50	9.8	7.97	3.37	2.49
Total/average	1441	245.7	108.50	17.6	12.73	6.74	3.37
Levene's test of equality of error variance Species number of vascular plants: F=5.471, df1=15, df2=1425, p=0.000 Species number of naturalized plants: F=3.348, df1=15, df2=1425, p=0.000 Naturalization index : F=20.257, df1=15, df2=1425, p=0.000							

Figure 3. Variance analysis graph by altitude in the species number of vascular plants, the species number of naturalized plants, and the naturalization index.



4. Correlation Analysis of the Species Number of Vascular Plants, the Species Number of Naturalized Plants, and the Naturalization Index

4.1. Correlation analysis between the species number of vascular plants and the altitude

<Table 4> shows the results of correlation analysis between the species number of vascular plants and the altitude. Both the linear regression model and the curvilinear regression model are suitable models. However, in the curvilinear regression model, the independent variable does not appear to have a significant effect on the dependent variable [32][33][34]. Therefore, the linear regression model result can be expressed as the following relational expression. When looking at the value of R2, the explanatory power was 4.1%.

y = 202.790 + 6.766 ---------- (linear model)

Where, y= species number of vascular plants, x=altitude

It can be seen that the relationship between the species number of vascular plants and the altitude has a positive correlation that the species number of vascular plants increases as the altitude increases.

Table 4. Model summary and parameter estimates for the species number of vascular plants and the altitude.

Model summary and parameter estimates									
Dependent variable : species number of vascular plants									
Model summary						Parameter estimate			
Equa-tion	R squared	F	Degree of freedom 1	Degree of freedom 2	Probability of significance	Constant term	b1	b2	B3
Linear	.041	61.184	1	1439	.000	202.790 (.000)	6.766 (.000)		
Quad-ratic	.041	30.660	2	1438	.000	206.470 (.000)	5.445 (.099)	.093 (.679)	
Cubic	.041	20.592	3	1437	.000	215.965 (.000)	-.353 (.969)	1.008 (.453)	-.041 (.490)
Independent variable = altitude									

4.2. Correlation analysis between the species number of naturalized plants and the altitude

<Table 5> shows the results of correlation analysis between the species number of naturalized plants and the altitude. Both the linear regression model and the curvilinear regression model are suitable models. However, in the curvilinear regression model, the independent variable does not appear to have a significant effect on the dependent variable. Therefore, the linear regression model result can be expressed as the following relational expression. When looking at the value of R2, the explanatory power was 2.4%.

y = 21.406 - 0.608 ---------- (linear model)

where, y=species number of naturalized plants, x=altitude

It can be seen that the relationship between the species number of naturalized plants and the altitude has a negative correlation that the species number of naturalized plants decreases as the altitude increases.

Table 5. Model summary and parameter estimates for the species number of naturalized plants and the altitude.

Model summary and parameter estimates									
Dependent variable : species number of naturalized plants									
Model summary						Parameter estimate			
Equation	R squared	F	Degree of freedom1	Degree of freedom2	Probability of significance	Constant term	b1	b2	B3
Linear	.024	35.275	1	1439	.000	21.406 (.000)	-.608 (.000)		
Quad-ratic	.026	19.554	2	1438	.000	23.444 (.000)	-1.339 (.001)	.051 (.052)	
Cubic	.027	13.327	3	1437	.000	24.964 (.000)	-2.268 (.034)	.198 (.213)	-.007 (.350)
Independent variable = altitude									

4.3. Correlation analysis between the naturalization index and the altitude

<Table 6> shows the results of correlation analysis between the naturalization index of naturalized plants and the altitude. Both the linear regression model and the curvilinear regression model are suitable models, and the independent variable has a significant effect on the dependent variable. Therefore, the linear regression model result and the curvilinear regression model result can be expressed as the following relational expressions. When looking at the value of R2, the explanatory power of the cubic model was 17.4%.

y = 9.375 - 0.416 ---------- (linear model)

y = 10.549 - 0.837x^1 + 0.030x^2 ----------(quadratic model)

y = 11.350 – 1.326x^1 + 0.107x^2 - 0.003x^3 ---------- (cubic model)

where, y=naturalization rate, x=altitude

It can be seen that the relationship between the naturalization index and the altitude has a negative correlation that decreases up to a certain level in the curvilinear regression model(cubic model), increases after that point, and then decreases again.

Table 6. Model summary and parameter estimates for the naturalization Index and the altitude.

Model summary and parameter estimates									
Dependent variable : Naturalization Index									
Model summary						Parameter estimate			
Equation	R Squared	F	Degree of freedom 1	Degree of freedom 2	Probability of significance	Constant term	b1	b2	B3
Linear	.160	273.295	1	1439	.000	9.375 (.000)	-.416 (.000)		
Quad-ratic	.172	149.032	2	1438	.000	10.549 (.000)	-.837 (.000)	.030 (.000)	

Cubic	.174	100.930	3	1437	.000	11.350 (.000)	-1.326 (.000)	.107 (.006)	-.003 (.043)

Independent variable = altitude

5. Conclusion

This study analyzed differences and correlations by region and altitude in the species number of vascular plants, the species number of naturalized plants, and the naturalization index, using the flora survey data of the 3rd to 5th National Natural Environment Survey. The results are summarized as follows.

First, there were differences by region and altitude in the species number of vascular plants, the species number of naturalized plants, and the naturalization index. As for the average species number of vascular plants, Gangwon Province had the highest number with 281.4 species, and Jeonbuk Province had the smallest with 217.7 species. The average species number of naturalized plants was the largest in Gyeonggi Province with 19.2 species, and the smallest in Jeonbuk Province with 14.5 species.

The average naturalization index was also highest in Gyeonggi Province at 7.79 and the lowest in Gangwon Province at 5.62.

The average species number of vascular plants was the highest at 1201-1300 m with 304.4 species and the smallest at 0-100 m with 187.1 species. The average species number of naturalized plants was the highest at 101-200 m with 22.7 species and the smallest at 1501-1600 m with 9.8 species. The average naturalization index was the highest at 0-100 m with 9.87 and the lowest at 1501-1600 m with 3.37. In the case of vascular plants, the higher the altitude, the greater the number of species, and the lower the altitude, the fewer the species.

Conversely, in the case of naturalized plants, the lower the altitude, the greater the number of species, and the higher the altitude, the fewer the species. The naturalization index was also higher at lower altitudes and lowers at higher altitudes.

Second, in the correlation analysis result, the relationship between the species number of vascular plants and the altitude had a positive correlation with the increase in the species number of vascular plants as the altitude increases. The relationship between the species number of naturalized plants and the altitude had a negative correlation that the species number of naturalized plants decreases as the altitude increases. The naturalization index had a negative correlation that decreases up to a certain altitude, increases after that point, and decreases again.

The results of this study are expected to be utilized as primary data for the management of naturalized plants.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Lead Author	HL	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑
Corresponding Author*	CK	-Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Co-Author	WL	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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Effect of Caffeine Education on Caffeine Awareness: For College Students

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Abstract

Purpose: *This is a single group related ex ante and ex post design study intended to examine and understand the effect of caffeine education on the cognitive improvement of college students.*

Method: *From November 1, 2019 to November 29, 2019, a preliminary questionnaire survey was conducted with 103 junior year students from 2 health related departments at a university located in J city, Jeollabuk-do, once a week for 3 weeks, after which a total of 3 education sessions were conducted. The collected data were analyzed by using the frequency analysis and the paired sample t-test using the SPSS Win 18.0 program.*

Results: *The mean for intake before education was 1.47±.40, and the mean for intake after education was 1.77± .47. The pre-educational knowledge was 0.58± .23 and the post-educational knowledge was 0.89± .10. When the intake and knowledge levels were compared with those before the education, the mean score increased after the education. Through which, it is evident that the level of caffeine knowledge increased after the education.*

Conclusion: *The caffeine education program reduced the frequency of the caffeine intake, and after the education, the rate of correct response for knowledge questions increased, thereby confirming the fact that the caffeine knowledge level was improved. Furthermore, after checking the caffeine content in the recognition and behavior, it was confirmed that there was an improvement in the positive direction of selecting beverages and selecting alternative foods. However, in order to generalize university students and expand and interpret the effects of the education, it is considered that a wide range of subjects and long-term education will be needed.*

Keywords: ***Caffeine, Education, Recognition, Knowledge, College Student***

1. Introduction

1.2. Need for the study

In the case of modern people, the intake of beverages including coffee, tea, and coca cola containing various caffeines along with smart games[1] has increased in order to enjoy a leisurely life according to a busy lifestyle[2]. Moreover, the caffeine consumption is increasing among all age groups due to the facilitation of convenience stores, etc[3]. In particular, the consumption of caffeinated beverages is increasing steeply due to the improvement of concentration among young people and the effect of reducing fatigue due to a lot of work and tests, etc[4]. According to a report by the Ministry of Food and Drug Safety in 2020, the average daily intake of caffeine by age is 78.0 mg for adults(19 years and older), 16.2 mg for adolescents(13-18 years old), 5.4 mg for children(7-12 years old), and preschool children(aged 1 to 6 years), while the average daily intake of caffeine per capita in Korea turned out to be 65.7 mg between 2015 and 2017 at 1.6 mg, respectively[5].

Furthermore, the caffeine intake of Koreans is increasing every year to 61.1% in 2015, 64.0% in 2016, and 71.8% in 2017, and it is said that the caffeine intake related evaluation should be continuously conducted along with publicity to reduce the excessive caffeine intake[5]. According to the Korea Consumer Agency, in the case of adolescents, energy drinks often used for the purposes of suppressing drowsiness during testing, etc., contain excessive caffeine, and the average caffeine content was 67.9 mg, which is more than half of the daily intake limit of 125 mg for the adolescents[6][7].

Caffeine stimulates the central sense of the cerebral cortex to yield a buzz effect to recover from fatigue and change mood, thereby causing a diuretic effect to help the blood circulation by facilitating the heart movement and a diuretic effect to help excretion by expanding the kidney blood vessels. However, by stimulating the adrenal medulla, the muscle of the heart is stimulated, thereby resulting in the increased contractility and cardiovascular disease which effectively increases the blood pressure given the increased cardiac output, as well as the mineral deficiency and hair loss[8][9]. Furthermore, the excessive secretion of gastric acid causes gastric ulcer and esophagitis, and in the case of poisoning, various physical and psychological symptoms such as irritability, anxiety, insomnia, and headache are accompanied. Such symptoms are known to last as short as 2 days and as long as 9 days[10].

As a result of a study conducted to survey the side effects of caffeine intake, 72.7% of the subjects experienced insomnia, and 60.5% of students responded that it was difficult to get up in the morning regarding the side effects of caffeine, while 46.3% of them complained about constant fatigue[11]. After consuming an energy drink containing a large amount of caffeine, they complained about sudden rough behaviors, headaches, and palpitations[12], and also responded that problematic behaviors such as drug use, sexual risk behavior, and fighting were evident[13]. Furthermore, they responded that withdrawal symptoms such as graduation, fatigue, and headache occur when the caffeine intake is suddenly discontinued[14].

Whereas, while recognizing the harmful effects of caffeine, 43.8% responded that they would continue to drink it in the future[11]. As such, while the negative effects of caffeine on the human body are excessively operative, they drink habitually or to improve concentration and reduce fatigue without realizing the seriousness of caffeine.

Examining the previous studies on caffeine, the period of first consumption of high caffeine was the most among the college students[15], and among those in their 30s, 40s, and 50s, those who responded that they “began drinking coffee for the first time in their 20s”[16]. In the case of the youngest group, which are those in their 20s, they started drinking coffee from their teens. It was reported that most of those in their 20s begin drinking coffee for the first time because of the environment where coffee can be easily accessed at cheap prices such as coffee mixes, vending machines, convenience stores, and take-outs at coffee shops in the modern society[11].

Furthermore, when examining the studies on the reasons for consuming caffeine, there were test anxiety relief[17], fatigue relief[18][19], learning immersion[20], stress relief[20], and sleeping habits[17][21].

Hence, it is very important to take appropriate interventions for the caffeine intake in a situation where the consumption of caffeinated beverages is continuously increasing in Korea. In particular, in the case of health related departments, since there is not enough time for many important tests and exams, they consume a lot of high caffeine energy drinks for the purposes of improving concentration and alleviating fatigue[22], and hence, it is easy to consume excessively caffeinated drinks[23].

Hence, this study attempted to verify the changes in perception before and after education by examining and understanding the actual consumption of caffeinated beverages and providing the education appropriate for the level of the subjects.

2. Purpose of Research

The purpose of this study is to examine and understand the effect of caffeine education on the improvement of perception for the health related departments' college students in their junior year. The specific objectives are as follows.

1) Examine and understand the caffeine intake of college students.

2) Examine and understand the caffeine knowledge level of college students.

3) Determine as to whether the caffeine education of college students has a significant change in the difference in their knowledge of caffeine drinks.

3. Research Method

3.1. Research design

This study is a single group related ex ante and ex post-design study to examine and understand the changes in their perception and behavior before and after the caffeine education program conducted for college students.

3.2. Subjects of the study

The subjects of this study were randomly sampled as the subjects who understood the purpose of the study, voluntarily decided to participate in the study, and who consented in writing. The sample size was calculated by using the G-power 3.0 program with an effect size of .25, a significance level of .05, and a power of 0.8. As a result, the minimum sample size was 103, and the data were collected from 113 people considering the dropout rate of 10%. Among which, 10 copies of the questionnaire with insincere responses were excluded, and the final 103 copies were used for the analysis.

3.3. Research tools

In this study, referring to the previous studies[24][25] on the consumption of caffeinated beverages, a questionnaire was prepared on the effect of the caffeine education program on the perception of college students and modified according to the characteristics of this study, then after supplementation, 2 nursing professors were consulted and a preliminary survey was conducted.

As a result of testing the validity and reliability of the preliminary survey, the extraction value in commonality was more than 0.7, indicating validity, and reliability was confirmed as the Cronbach's alpha value was 0.8 or higher. The contents of the questionnaire were consisted of a total of 22 items, including 2 questions for the subjects' general characteristics, 6 questions for the health status, 3 questions for the intake status, 2 questions for the caffeine's side effects, 4 questions for the caffeine related knowledge level, and 5 questions for the education evaluation.

4. Method of Data Collection

This study was conducted from November 1, 2019 through November 29, 2019, targeting junior year students of 2 health related departments at a university located in J city. After conducting a preliminary survey with a structured questionnaire, a total of 3 educational sessions were conducted for 30 minutes once a week for 3 weeks, and every time they were visited, gifts were presented. After explaining the purpose and method of the study, protection of personal information when participating in the study, and the time required for the survey, the questionnaire was distributed after voluntary participation and written consent were secured. It was explained that the collected questionnaire was anonymous, and that if they do not want to participate in the study, they can withdraw it, and there is no disadvantage whatsoever. It was explained that the research data will not be used for any other purposes, and that all of the questionnaires will be discarded after the submission is made for the journal. The time required for the questionnaire was approximately 10 minutes.

5. Method of Data Analysis

The collected data were analyzed by using the SPSS/WIN 18.0 program as follows.

1) Standard deviation, variance, and mean were used through the frequency analysis to examine and understand the general characteristics and health status.
2) Mean and standard deviation were used to determine the subject's caffeine intake, side effects, and knowledge level.
3) The corresponding sample t-test was used in order to examine and understand the change in perception through the ex ante and ex post education.

6. Results

6.1. General characteristics of the study subjects

The subjects of this study were 103 people, of which 14(13.6%) were male and 89(86.41%) were female. The mean age of the subjects was 21.98 years. It turned out to be 72.7% for 20-year-olds, 20.9% for those over 24, 3.5% for 22-year-olds, 1.7% for 21-year-olds, and 1.2% for 23-year-olds, respectively.

6.2. Health status of the study subjects

Their current health status was 'normal' 50.5%, 'good' 42.7%, and 'bad' 6.8%. The level of interest in health was 'normal' 53.4%, 47.6% had their average sleep time per day for '5-6 hours', 53.4% for the subjects' exercise habit who responded that they 'exercise but not regularly', 39.8% said 'not at all', and 6.8% responded that they 'do it regularly', respectively. The cause of stress was academics(60.2%) and interpersonal relationships(14.6%). The extent of stress turned out to be ‘moderate’ at 41.7% and ‘normal’ at 33.0% <Table 1>.

Table 1. Health status of the study subjects.

Health status	Classification	n(%)
Own health status	Good	44(42.7)
	Normal	52(50.5)
	Not good	7(6.8)
Interest in health	High	36(35.0)
	Normal	55(53.4)
	Low	12(11.7)

Average sleep time	Less than 5 hours	11(10.7)
	5-6 hours	49(47.6)
	6-7 hours	32(31.1)
	Over 7 hours	11(10.7)
Exercise	Regularly	7(6.8)
	Not regularly	55(53.4)
	Not at all	41(39.8)
Cause of stress	Interpersonal relationship	15(14.6)
	Family problems	1(1.0)
	Academic work	62(60.2)
	Health and disease	3(2.9)
	Others	22(21.4)
Stress level	Don't have it	17(16.5)
	Normal	34(33.0)
	A little	43(41.7)
	Very much	9(8.7)

Note: N=103.

6.3. Intake of the study subjects

It turned out that as for whether the caffeine intake is practiced, 85.5% responded they do, and as for their reason, 43.7% responded that they liked the scent and taste, and 58.3% responded that their intake takes place before lunch and dinner, and 52.4% responded that their intake takes place at coffee shops and convenience stores <Table 2>.

Table 2. Intake status of the study subjects.

Health status	Classification	n(%)
Own health status	Good	44(42.7)
	Normal	52(50.5)
	Not good	7(6.8)
Interest in health	High	36(35.0)
	Normal	55(53.4)
	Low	12(11.7)
Average sleep time	Less than 5 hours	11(10.7)
	5-6 hours	49(47.6)
	6-7 hours	32(31.1)
	Over 7 hours	11(10.7)
Exercise	Regularly	7(6.8)
	Not regularly	55(53.4)
	Not at all	41(39.8)
Cause of stress	Interpersonal relationship	15(14.6)
	Family problems	1(1.0)
	Academic work	62(60.2)
	Health and disease	3(2.9)
	Others	22(21.4)
Stress level	Don't have it	17(16.5)
	Normal	34(33.0)
	A little	43(41.7)
	Very much	9(8.7)

Note: N=103.

6.4. Caffeine's side effects for the study subjects

<Table 3> illustrates the results of a study on the side effects which the study subjects experienced after consuming beverages among 94 people who responded that they consumed the beverages containing caffeine. Regarding the side effects of the subjects, 'heart palpitation' is moderate were claimed by 20 people(21.3), true by 23(24.5), very much by 8(8.5) 'fatigue' is moderate by 23(24.5), true by 12(12.8), very much by 1(1.1), ' caffeine dependence' was moderate by 18(19.1), true by 8(8.5), very much by 1(1.1). As a result of adding up the responses equivalent to or above 'normal', it turned out that 'heart palpitation' was 54.3%, 'fatigue' 38.4%, and 'caffeine dependence' 28.7%, respectively <Table 3>.

Table 3. Side effects of caffeine.

Side effects	Classification	n(%)
Difficulty waking up in the morning	Not true at all	36(38.3)
	Not true	34(36.2)
	Normal	13(13.8)
	TRUE	11(11.7)
	Very true	0(0)
Sleep disorder	Not true at all	36(38.3)
	Not true	21(22.3)
	Normal	20(21.3)
	TRUE	13(13.8)
	Very true	4(4.3)
Fatigue	Not true at all	30(31.9)
	Not true	28(29.8)
	Normal	23(24.5)
	TRUE	12(12.8)
	Very true	1(1.1)
Fatigue recovered	Not true at all	23(24.5)
	Not true	20(21.3)
	Normal	37(39.4)
	TRUE	13(13.8)
	Very true	1(1.1)
Anxiety, worry, and tension	Not true at all	32(34.0)
	Not true	35(37.2)
	Normal	17(18.1)
	TRUE	9(9.6)
	Very true	1(1.1)
Nausea and vomiting	Not true at all	53(56.4)
	Not true	22(23.4)
	Normal	10(10.6)
	TRUE	8(8.5)
	Very true	1(1.1)
Dizziness	Not true at all	44(46.8)
	Not true	22(23.4)
	Normal	17(18.1)
	TRUE	9(9.6)
	Very true	2(2.1)

Heart palpitations	Not true at all	33(35.1)
	Not true	10(10.6)
	Normal	20(21.3)
	TRUE	23(24.5)
	Very true	8(8.5)
Cold sweat	Not true at all	53(56.4)
	Not true	28(29.8)
	Normal	9(9.6)
	TRUE	4(4.3)
Improved concentration	Not true at all	27(28.7)
	Not true	19(20.2)
	Normal	36(38.3)
	TRUE	11(11.7)
	Very true	1(1.1)
Emotional disorder	Not true at all	59(62.8)
	Not true	22(23.4)
	Normal	11(11.7)
	TRUE	2(2.1)
Extreme excitement	Not true at all	61(64.9)
	Not true	20(21.3)
	Normal	10(10.6)
	TRUE	3(3.2)
Caffeine dependence	Not true at all	38(40.4)
	Not true	29(30.9)
	Normal	18(19.1)
	TRUE	8(8.5)
	Very true	1(1.1)

Note: N=94.

6.5. Caffeine intake after the caffeine education

<Table 4> illustrates the difference between the intake and knowledge levels after the caffeine education. While the number of respondents who consumed caffeinated beverages increased on an ex post basis rather than the ex ante basis, the frequency of not drinking coffee at all increased from 27.8% to 31.1%, yet those who drank more than 6 times decreased from 6.8% to 1.0%, respectively. Through which, it may be interpreted that the study subjects recognize and consume coffee. As a result of surveying the knowledge that the subjects had misunderstood in the response to the preliminary caffeine effect knowledge level, it turned out that more than 80% of the subjects responded appropriately for all the questions <Table 4>.

Table 4. Ex ante and ex post intake status of caffeine.

Classification		Coffee	Cocoa	Black tea	Green tea
Don't drink at all	Before	28(27.8%)	90(87.4%)	94(91.3%)	75(72.8%)
	After	32(31.1%)	81(78.6%)	94(91.3%)	74(71.9%)
Once or twice	Before	38(36.9%)	8(7.8%)	5(4.9%)	21(20.4%)
	After	48(46.6%)	13(12.6%)	7(6.8%)	21(20.4%)

3-4 times	Before	22(21.4%)	4(3.9%)	4(3.9%)	6(5.8%)
	After	18(17.5%)	6(5.8%)	2(1.9%)	7(6.8%)
5-6 times	Before	8(7.8%)	0(0%)	0(0%)	1(1.0%)
	After	4(3.9%)	1(1.0%)	0(0%)	1(1.0%)
6 times or more	Before	7(6.8%)	1(1.0%)	0(0%)	0(0%)
	After	1(1.0%)	2(1.9%)	0(0%)	0(0%)

Note: N=103.

6.6. Extent of knowledge about the caffeine effects before and after the caffeine education

In the pre-educational survey conducted, the results of the survey on whether the subjects were aware of caffeine demonstrated that 36 people(34.0%) were 'well aware of it', 62(60.2%) 'heard of it', and 5(4.8%) responded 'don't know.' In this study, it is evident that the subjects had heard of caffeine, but did not know about it in detail.

<Table 5> illustrates the level of knowledge about the effects of caffeine before and after the caffeine education. As a result of the survey conducted on the knowledge that the subjects had misunderstood in response to the preliminary caffeine effect knowledge level, more than 80% of the total 6 questions indicated the correct answers <Table 5>.

Table 5. Ex ante and ex post knowledge level of the caffeine effect.

Knowledge	Classification	Before	After
Buzz effect	* True	*80(77.7)	*97(88.2)
	Not true	8(7.8)	1(7.3)
	Don't know	15(14.6.0)	5(4.5)
Increased concentration	* True	*70(68.0)	*88(85.4)
	Not true	15(14.6)	9(8.7)
	Don't know	18(17.5)	6(5.8)
Frequent discharge of urine	* True	*73(70.9)	*88(85.4)
	Not true	13(12.6)	6(5.8)
	Don't know	17(16.5)	9(8.7)
Same impact on human body	TRUE	51(49.5)	15(14.6)
	*Not true	*9(8.7)	*82(79.6)
	Don't know	43(41.7)	6(5.8)
Contained in medicines	* True	*12(11.6)	*93(90.3)
	Not true	52(50.5)	0(0.0)
	Don't know	39(37.9)	10(9.7)
Less than 400 mg of caffeine recommended per day	* True	*25(24.3)	*95(92.2)
	Not true	5(4.9)	3(2.9)
	Don't know	73(70.8)	5(4.9)

Note: N=103.

6.7. Extent of knowledge about the caffeinated beverages before and after the caffeine education

<Table 6> illustrates the level of knowledge about caffeinated beverages before and after the caffeine education.

Before the education, coffee and coca cola were properly recognized as containing caffeine, yet 54.4% of them responded 'I don't know' to the question of whether cider contains caffeine. However, after the education, 84.5% responded ‘not included’ appropriately. Furthermore, 63.1% of the respondents responded that they did not know whether cocoa contains caffeine, yet 77.7% responded that it did after the education <Table 6>.

Table 6. Ex ante and ex post knowledge level of the caffeine drink.

Knowledge	Classification	n(%)	
		Before	After
Coffee	It isn’t contained	4(3.9)	0(0)
	It is contained	98(95.1)	103(100.0)
	Don’t know	1(1.0	0(0)
Coca cola	It isn’t contained	24(23.3)	11(10.7)
	It is contained	54(52.4)	91(88.3)
	Don’t know	25(24.3)	1(1.0)
Cider	It isn’t contained	33(32.0)	87(84.5)
	It is contained	14(13.6)	15(14.5)
	Don’t know	56(54.4)	1(1.0)
Coffee milk /Chocolate milk	It isn’t contained	12(11.6)	3(2.9)
	It is contained	81(78.6)	99(96.1)
	Don’t know	10(9.7)	1(1.0)
Cocoa	It isn’t contained	29(28.2)	15(14.6)
	It is contained	9(8.8)	80(77.7)
	Don’t know	65(63.1)	8(7.7)
Black tea	It isn’t contained	33(32.0)	0(0.0)
	It is contained	67(60.9)	103(100.0)
	Don’t know	13(11.8)	0(0.0)
Fruit juice	It isn’t contained	69(70.0)	85(82.5)
	It is contained	7(6.8)	12(11.7)
	Don’t know	27(26.2)	6(5.9)
Green tea	It isn’t contained	23(22.3)	8(7.8)
	It is contained	72(69.9)	93(90.3)
	Don’t know	8(7.8)	2(1.9)
Bacchus	It isn’t contained	10(9.7)	2(1.9)
	It is contained	85(82.5)	100(97.1)
	Don’t know	8(7.8)	1(1.0)
Vita 500	It isn’t contained	16(15.5)	5(4.9)
	It is contained	74(71.8)	95(92.2)
	Don’t know	13(12.6)	3(2.9)

Note: N=103.

6.8. Extent of knowledge about the caffeinated beverages before and after the caffeine education

The mean for intake before the education was 1.47±.40, and the mean for intake after the education was 1.77± .47. The pre-educational knowledge was 0.58± .23 and the post-educational knowledge was 0.89± .10. When the intake and knowledge levels were compared with those before the education, the mean score increased after the education. Through which, it is evident that the level of caffeine knowledge increased after the education. The intake increased on an ex post basis, yet the intake frequency decreased, indicating that the caffeinated beverages were recognized and consumed as an effect of the education <Table 7>.

Table 7. Statistics of the corresponding sample.

		Level of intake	Level of knowledge
Before education	M±SD	1.47± .40	0.58± .23
After education	M±SD	1.77± .47	0.89± .10
t		-5.16	-12.38
p		.000	.000

Note: N=103.

7. Discussion

The purpose of this study was to examine and understand the caffeine intake and knowledge levels for the junior students at a university located in J city, and provide the accurate information on caffeine to educate them to consume caffeine with a correct perception, and it was carried out to confirm the changes in their perception through the education.

In this study, the caffeine intake of college students was approximately once or twice a week, and in Kim SH[26], 86.0% of the low intake group of 1-2 cups/day was similar to once or twice a week, yet the high intake of 3 cups/day was similar. It turned out that 82.0% of the intake group were insignificant relative to those who consumed up to twice a day or more. It is considered that the caffeine intake to strengthen concentration for learning and reduce sleep time during the test period is considered to be different, and hence, a study comparing caffeine intake between the test period and non-test period would need to be conducted.

In the study of Jung ES[20], the reasons for the students drinking caffeinated beverages were before and after studying and when they fell asleep. The reason of Lee SH[27] for the caffeine intake related to academics. The reasons for the caffeine intake in this study were the presence or absence of caffeine intake(91.3%), 43.7% said for good scent and taste, to stay alert against sleep(21.4%), and to relieve fatigue(10.7%), and examining in connection with the previous studies, there was no agreement between 'better scent and taste'. It is considered that the students consume caffeine as a favorite food(dessert). Furthermore, Jho YH[28] stated that the intake tended to increase during the test period due to the effect of caffeine. This is very consistent with the 'to stay alert against sleep' and 'to relieve fatigue' of this study, and if the intake period of students is included in a later study, it is considered that the change during the test period will be known, and it would be consumed for buzz and recovery from fatigue among the effects of caffeine.

The subjects responded that they mainly consume it after lunch through before dinner(58.3%), and the place of intake turned out to be coffee shop and convenience store(52.4%), and school(16.5%). It is evident that the college students mainly consume caffeine in various forms at the places where caffeine can be easily accessed inside and outside of school to stay alert against sleep by taking a break after lunch(21.4%) and to relieve fatigue(10.7).

In Oh YJ[29], 121 out of 245 people experienced the caffeine's side effects, which was more than half, but in this study, it was a relatively small number, around 20 out of 103 people. However, Lee & Kang[27] interpreted that the subjects did not experience any side effects after consuming high caffeine drinks, which was similar to the results of this study. The subjects of this study responded that the side effects were in the order of 'I have felt my heart pounding', 'I have trouble sleeping', and 'I'm always tired'. However, the sensitivity to caffeine may vary depending on the individuals, such as genetic factors, gender, age, and physical conditions[26]. As such, caffeine can have various side effects on the human body, and as it is contained in various foods other than coffee, the subject can consume more than the perceived amount, and hence, caution is required for the caffeine intake.

Regarding the extent of caffeine knowledge before the start of education, and as a result of examining as to whether the subjects had a knowledge of caffeine in a pre-educational survey about caffeine, 'I know well' were responded by 36 people(34.0%), 'I have heard of it' by 62(60.2%), and 'I don't know' by 5(4.8%), respectively. In this study, it can be interpreted that the subjects had heard of caffeine but did not know about it in detail. In this study, the side effects such as difficulty in waking up in the morning, sleep disturbance, fatigue, anxiety, worry, tension, nausea and vomiting, and heart palpitations were observed, and they continue to experience consumption even while being aware of the physical or mental problems related to caffeine[30]. Hence, the continuous attention and education are required because it means that there is a high intention to continue taking caffeine even if there are side effects.

In general, the level of knowledge related to caffeine was high in terms of the level of knowledge about the caffeine's buzz effect, concentration improvement, and tolerance. Among the caffeine containing foods, coffee, green tea, and black tea, they demonstrated a high rate of correct answer, and Kim HG[31] also confirmed a significant result with green tea and black tea having a high rate of correct answer. Whereas, as for the caffeine's side effects and the caffeine containing foods, in particular, cider, cocoa, and pharmaceuticals, they did not accurately recognize whether the foods contain caffeine, thereby resulting in a rather low level of knowledge. A previous study demonstrated a similar result by showing a low percentage of correct answers in the presence or absence of caffeine in cider[5][10][24][26]. More than half of all students did not know about the recommended daily caffeine intake for the adults as suggested by the Food and Drug Administration, and most of the students responded inappropriately to the question 'The effect of caffeine on the human body is the same for all'[5][10][11][15].

After the caffeine education, the percentage of correct answers on the knowledge related questions improved to a high level, and some opinions about selecting alternative foods and checking the caffeine content before consumption showed that the behavior of respondents has improved. Gathering which, it was confirmed that the caffeine education related program improved the caffeine knowledge and awareness of the college students.

8. Conclusion and Recommendations

8.1. Conclusion of the study

Through the preliminary questionnaire survey, the knowledge level of caffeine among the

college students was examine and understood, and the level of knowledge turned out to be rather low. Hence, an education program was conducted to improve the level of caffeine recognition.

In this study, most of the subjects consumed caffeine, and among them, the coffee consumption was small, which was less than once or twice a week. In this study, a small number of respondents responded that they experienced side effects, and the frequency of caffeine intake and the extent of side effects were low, thereby indicating that the subjects' caffeine addiction was not severe. Among the subjects who experienced side effects, the frequency was highest in the order of 'I have felt heart palpitations', 'I have trouble sleeping', and 'I'm always tired'. In this connection, compared to the results of studies demonstrating the fact that there were many cases of side effects in the other previous studies, there were not many subjects who experienced side effects in this study, yet caution is required for the caffeine intake to prevent any side effects.

The reason that the students drink caffeinated beverages is 'because it smells good and tastes good', and the intake time is mainly 'before lunch and dinner' and it is also considered that subjects can easily consume the foods containing caffeine as desserts, and before the education, the subjects responded that they had heard of caffeine, but did not know about its specifics. In general, the level of knowledge about caffeine was high, but the level of knowledge about the caffeine's side effects and the presence or absence of caffeine in the food was rather low, thereby indicating that overall education on beverages containing caffeine is necessary.

The number of subjects who consumed a relatively large amount of coffee before the education decreased after the education, and the respondents who said 'I do not drink at all' also increased, and gathering which, it is evident that the subjects' caffeine intake decreased through the education. The number of respondents who responded 'I don't know' for all caffeine related knowledge questions decreased, and it was confirmed that the level of knowledge improved as the percentage of correct answers increased after education. Furthermore, it was confirmed that the majority of all students knew about the appropriate daily caffeine intake after education. In the education evaluation questionnaire, in the column describing the changes in one's lifestyle through the curriculum, 'I chose a beverage/alternative food that does not contain caffeine', 'I had to think twice before consuming caffeine(for appropriate amount, concentration, and amount)' and 'I learned about the caffeine.' Hence, the caffeine education improved the caffeine knowledge related level of the college students, and it was confirmed that the caffeine perception and behavior were improved in the right direction.

8.2. Recommendations of the study

Based on the results of this study, recommendations are presented as follows.

First, in this study, it is difficult to generalize the results for the college students since the sample was biased towards women as the subjects were selected as the junior students of the health related departments at a university located in J city. Hence, it is necessary to conduct studies by selecting a wider range of subjects. Second, in this study, research and education for an appropriate alternative to the caffeine intake among the caffeine related educational programs are inadequate, and hence, relevant studies are required. Third, while education was conducted for 3 weeks in this study, but in order to confirm a more accurate educational effect, it is suggested to conduct a follow-up survey after a certain period of time after caffeine education.

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10. Appendix

10.1. Authors contribution

	Initial name	Contribution
Lead Author	SH	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Corresponding Author*	ML	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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Analysis of Prior Research Trends on the Financial Safety for Components of Public Spending and Economic Growth

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Abstract

Purpose: *The primary purpose of this study is to analyze the main content of discussions on the relationship between the size of government spending and economic growth. Furthermore, the secondary purpose of this study is to analyze the main discussion content of the papers that studied the relationship between different items of government expenditure and economic growth. In this way, this study can contribute to exploring the research flow and direction between government spending and economic growth.*

Method: *This study systematically collected and investigated quantitative and qualitative studies that analyzed the relationship between the size of government spending and economic growth and the relationship between government spending items and economic growth. In addition, policy reports and related data on economic data and impact analysis between government spending and economic growth were additionally utilized in addition to the analysis of previous studies.*

Results: *Most of the research so far has focused on the relationship between the size of government spending and economic growth. In other words, it was confirmed that there were not many studies that recognized the differences between government expenditure items and analyzed the different quantitative relationships between different expenditure items and economic growth.*

Conclusion: *In future research, it is necessary to analyze the different impact relationships between government spending items and economic growth, and follow-up studies that can suggest more specific and practical policy implications according to the results. It is also needed to analyze the quantitative relationship between different expenditure items and economic growth at the local government level and to draw implications for the different influence relationships between government spending and economic growth at different levels of government.*

Keywords: ***Financial Safety, Public Spending, Economic Growth, Government Expenditure, Components of Public Spending***

1. Introduction

The scope and content of studies analyzed by setting economic growth(performance) variables as independent or dependent factors are vast(e.g.,[1][2][3][4][5]). Also, extensive studies have been conducted theoretically and empirically to explain the variation in economic growth as well as the effect of government size(i.e., public spending) on growth for decades. Those studies can be categorized into four groups of theoretical camps based on its findings and arguments as follows.

First group of studies has found a positive effect of government size on economic development(e.g.,[6][7][8][9][10][11][12][13]). However, second camp has argued that an increase in government spending is negatively associated with economic growth(e.g., [14][15][16][17][18][19][20][21]). Third group of studies has found no statistically significant correlations between government size and economic growth(e.g.,[22][23][24][25]). Finally, the last group of research has discussed about the relatively different effects of each of the components of government expenditures on economic growth(e.g.,[16][26][27][28][29][30][31][32][33]).

The primary purpose of this study is to analyze the main content of discussions on the relationship between the size of government spending and economic growth. Furthermore, the secondary purpose of this study is to analyze the main discussion content of the papers that studied the relationship between different items of government expenditure and economic growth. In this way, this study can contribute to exploring the research flow and direction between government spending and economic growth.

2. Research Method and Scope

In order to achieve the above-mentioned research purpose, this study systematically collected and investigated quantitative and qualitative studies that analyzed the relationship between the size of government spending and economic growth and the relationship between government spending items and economic growth. In addition, policy reports and related data on economic data and impact analysis between government spending and economic growth were additionally utilized in addition to the analysis of previous studies. It is revealed that the temporal and spatial scope of this study was not limited in particular, and only the content scope was limited to discussing the relationship between the size of government spending and economic growth.

3. Studies on the Size of Public Spending and Economic Growth

The link between government size(i.e., public spending or government expenditures) and economic growth(i.e., gross domestic product or gross state product) has been extensively discussed. The empirical findings and theoretical arguments regarding the associations are mixed, because studies have used different groups of countries and time periods as well as different measures of government size and economic growth[18][34]. However, based on the discussion and findings from the studies previously published, in general, an increase in government size is associated with an increase in economic growth among developing countries, whereas the reverse is true for developed ones.

First, with regard to supporting arguments on the positive linkage of government size with economic growth(i.e., a big government), some discuss several positive functions of a government in economic development as follows: 1)“protecting individuals and their property”, 2)“operating a court system to resolve disputes”, and 3)“making a stable monetary regime”[6][7]. In a similar vein, another research finds that an increase in public spending plays a significant role in reducing social costs resulting from various types of conflicts, increasing public investment for nations’ constructive and stable operations, as well as maintaining their independence from other countries[8].

In addition, a big government is more likely to invest in redistributive policies like social welfare programs, compared to a small government. Although a high level of government expenditures for unproductive activities has a detrimental effect on economic growth to some degree, it points out that an intensive level of redistributive programs plays a critical role in addressing income inequality, maintaining the social order, as well as improving economic

growth in the long run[9].

On the contrary, an increase in government size(i.e., a high level of government expenditures) is likely to constrain economic improvement by reducing motives or incentives to work resulting from an increased level of unproductive public spending(e.g., social welfare programs and other types of redistribution programs)[14] and strict regulations that have detrimental effects on private investment and positive economic activities[12][15]. Another research finds that a big government is likely to impose a heavy tax burden in order to expand its budget and financial activities. A high level of tax burden is more likely to have detrimental effects on private investment and labor supply as well as retard economic growth in the long run[16].

In a similar vein, it notes that rent-seeking activities and government regulations, which are relevant to an increase in public spending, have also negative influences on economic growth by allocating financial resources inefficiently from productive to unproductive government expenditures[9]. Another research also generally supports the negative relationship between the size of government and economic growth. The study finds that the negative effect of public spending leads to lower level of economic development by increasing a government's fiscal policies and regulations, which are more likely to hamper the market economy, crowd out more efficient provision from private sectors, as well as increase tax burden[13].

Another research also confirms the negative correlation between the size of government expenditures and economic growth based on empirical results from 29 rich countries in two periods(1970-1995 and 1970-2005). Additionally, the research confirms that a large government tries to utilize positively "economic openness" and "sound economic policies"(p. 195) in an effort to reduce and compensate for the negative effects of an increase in public spending on economic growth[18].

With regard to arguments from those two theoretically competing camps, it finds that a developing country is more likely to have positive effects of its public spending on economic performance since a larger portion of government expenditures in developing countries tend to be implemented for building social overhead capital(SOC) facilities. On the other hand, a developed country is more likely to invest its government expenditures to implement redistributive programs and social welfare assistances, which are unproductive spending as well as not directly relevant with economic growth[35].

According to[26], the link between government size and economic growth is a complicated and nonlinear relationship. An increase in government expenditures leads to a higher level of economic performance by some point of public spending, but the positive association tends to become negative after a particular point of government size. Another research mentions that the effects of government size on economic growth are relatively different depending on the size of government. Specifically, he argues that the negative linkages of an increase in tax burden with incentives to work and economic growth are generally confirmed among large governments, while an increase in government expenditures tends to lead to marginal productivity of capital and economic growth among small governments[36].

The different research examines the empirical linkage between government size(i.e., total government expenditures) on economic growth(i.e., gross domestic product per capita) in 32 developed and 51 developing countries over the period of 1996 to 2006. His study tries to address the empirical gaps of the previous studies on the relationship between government size and economic growth, which have identified the positive correlations in developing countries and negative linkages in developed ones by analyzing the two groups of countries separately. In other words, the primary contribution of his study to the growth and government spending literature is that the research demonstrates the magnitude of effects of government expenditures on economic growth between two groups of countries are relatively different. The study also finds that the effects of public spending on economic development are five times

higher in developing countries than in developed groups. From the results, the study points out that national-level of government policies and decisions on financial policies are more likely to influence economic development in developing countries rather than in developed groups[34].

4. Studies on the Effects of the Components of Government Expenditure and Economic Growth

Beyond discussion on the general relationship between government size and economic growth, several studies(e.g.,[27][28][32][34]) mention that future research needs to explore the relatively different effects of government expenditure on economic growth depend on purposes and types of expenditures in order to contribute to the development of the literature on economic growth and public spending. However, few studies have tried to investigate the structure of government expenditure and its empirical correlations with economic growth to date.

For instance, the above <Table 1> identifies what types of expenditures are included in each of the seven categories constructing the state expenditures.

Table 1. Construction and measures of the state expenditures.

Expenditures	Components
Elementary and secondary education	Expenditures for the state's Department of Education, transportation of school children, adult literacy programs, handicapped education programs, programs for other special populations(i.e., gifted and talented programs), anti-drug programs, and vocational education.
Higher education	Expenditures for capital construction, community colleges, vocational education, law, medical, veterinary, nursing and technical schools, and assistance to private colleges and universities, as well as tuition, fees and student loan programs.
Public assistance	Expenditures for cash assistance under the Temporary Assistance for Needy Families(TANF) program and other cash assistance(i.e., state supplements to the Supplemental Security Income program, general or emergency assistance).
Medicaid	Expenditures from state funds, federal matching funds and other funds and revenue sources used as a Medicaid match such as provider taxes, fees, assessments, donations, and local funds.
Corrections	Expenditures for capital construction, aid to local governments for jails, parole programs, prison industries, and community corrections, as well as expenditures made for juvenile correction programs.
Transportations	Expenditures for highways, mass transit, and airports. States were also asked to include expenditures for road assistance to local governments, the administration of the Department of Transportation, truck and train/ railroad programs, motor vehicle licensing, and gas tax and fee collection.
All others	Expenditures for all remaining programs not captured in the functional categories, including the Children's Health Insurance Program and any debt service for other state programs(i.e., environmental projects, housing).

Note: State Expenditure Report: Examining Fiscal 2009-2011 State Spending by the National Association of State Budget Officers.

The study points out that future studies need to pay more attention to the structure of public spending and taxation as well as explore the causal relationship of economic growth with unproductive and productive government expenditures separately[16]. In addition, Another research investigates the different effects of public spending on economic growth depending on the types of public goods that a government provides. Specifically, the study finds that public spending on provision of "core expenditure categories" such as "public order and safety, national defense, education, transportation and communication"(p.9) is positively associated with economic improvement, while an increase in government expenditures on other services and goods have negative effects on economic growth[26].

Another research mentions that it is important to distinguish between productive and unproductive government expenditures since some types of productive government spending(e.g., communications, transportations, and other social infrastructures) are more likely to improve economic activities and growth. On the contrary, some components of unproductive government expenditures(e.g., social welfare and security programs) tend to retard economic development[27]. However, inconsistent with the above argument, some research support the positive effects of unproductive government spending on economic growth due to its potential to reduce economic inequality as well as preserve the order of society[9][37].

These findings are partially supported by [28]'s study that examines the crowding-out and crowding-in effects of different elements of government expenditures for 39 developing and developed countries over the period of 1975 to 1984. Based on the results, it confirms the negative relationship between unproductive government expenditure and economic growth in both developing and developed countries. They also find that some components of productive government spending(e.g., communication and transportation) have crowding-in effects on private investment as well as positively influence economic growth only in developing countries[28].

Categorize government expenditures(productive and unproductive spending) and tax structures(distortionary and non-distortionary taxation) in their models, examining different relationships of those four components with economic growth[29][30]. Consistent with theoretical arguments, these models support the positive link between productive government spending and economic development. Specifically, it demonstrates that the effect of government education expenditures on economic growth is greater than other types of productive expenditures. In addition, they point out that the biased effect of government size on economic growth can be mitigated by including both sides of the government expenditure and tax structure[29].

The other research finds that each component of government expenditures correlates differently with economic growth in both developed and developing countries. For instance, public spending on education shows a positive link with economic growth in developed countries, whereas government expenditures on defense, health, and social security and welfare have negative links with economic growth in developing countries[31]. Another research finds that the effect of public spending or investment for human capital is likely to be statistically insignificant since the relationship between those two variables is almost non-linear and quadratic[38]. In addition, it supports the positive effects of government expenditures and investment for transportation and communication on economic development in developing countries[39]. Similarly, another research finds positive relationships of public spending on education and infrastructure with economic growth, while government expenditures for national defense have negative effects on economic improvement[33].

5. Conclusion

The main purpose of this study is twofold. First, the main trend of previous studies on the relationship between government spending and economic growth is analyzed. Second, it analyzes the discussion of the relationship between the different expenditure items constituting government spending and economic growth. As pointed out earlier, most of the research so far has focused on the relationship between the size of government spending and economic growth. In other words, it was confirmed that there were not many studies that recognized the differences between government expenditure items and analyzed the different quantitative relationships between different expenditure items and economic growth. Therefore, in future research, it is necessary to analyze the different impact relationships between government

spending items and economic growth, and follow-up studies that can suggest more specific and practical policy implications according to the results.

In addition, most of the previous studies that discussed the relationship between government spending and economic growth are studies that analyzed data at the national level. In other words, there are very few studies analyzing the relationship between government spending and economic growth at the level of the state or local governments, which are lower economic actors. Therefore, it is suggested that a follow-up study is needed to analyze the quantitative relationship between different expenditure items and economic growth at the local government level and to draw implications for the different influence relationships between government spending and economic growth at different levels of government.

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7. Appendix

7.1. Author contribution

	Initial name	Contribution
Author	YS	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑ -Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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The Key to Sustainable Growth of Airlines: The Safety Orientation of Cabin Crew

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Abstract

Purpose: *The cabin crew's in-flight work consists of safety and security-related tasks and requires specialized knowledge. With the popularization of air travel, the importance of safety-related work for cabin crew is becoming more and more important. Therefore, it is time to consider the work of cabin crew from a safety-oriented point of view and study to clarify the duties of cabin crew. The purpose of this study is to examine the effect of cabin crew knowledge pursuance on work self-efficacy and safety orientation, and the effect of cabin crew job regulation on work self-efficacy and safety orientation. The mediating effect of work self-efficacy is also verified.*

Method: *The questionnaire, targeting Korean staff working as flight attendant in domestic and overseas airline companies, has been carried out for this study, and on-line questionnaire has been processed as to maximize their participation. In this study, the hypothesis was verified through a structural equation model using 22 observational variables and 4 latent variables whose reliability and validity were confirmed through the evaluation of the measurement.*

Results: *First, both knowledge pursuance and job regulation have a significant effect on the work self-efficacy of airline cabin crew. Second, knowledge pursuance had a significant effect on safety orientation, but job regulation had no significant effect on safety orientation. Third, work self-efficacy has a significant effect on safety orientation. Fourth, work self-efficacy is partially mediated in the relationship between knowledge pursuance and safety-orientation of airline cabin crew. Fifth, work self-efficacy is completely mediated in the relationship between job regulation and safety orientation of airline cabin crew, and the mediating effect is statistically significant.*

Conclusion: *Cabin crew's efforts to continuously acquire and maintain professional knowledge on the overall safety of aircraft and safety for each aircraft type are important factors that enable the professionalism of the cabin crew. Safety knowledge and safety motivation play an important role as antecedent variables for carrying out safety behaviors consisting of safety compliance and safety participation. Proposals for various programs that allow indirect experience of safety-related situations include in-house safety seminars, easy-to-use VR-based safety accident and incident case, and constructive individual feedback. This training method will provide an opportunity for cabin crew to gain confidence in their ability to respond well to a variety of safety-related accidents and accidents based on their aviation-related safety knowledge.*

Keywords: ***Safety Orientation, Knowledge Pursuance, Job Regulation, Work Self-Efficacy, Cabin Crew***

1. Introduction

Air travel has the characteristics of a public good as a means of public transportation and a catalyst for social and cultural exchange[1]. The safe operation of aircraft is not only the key to the sustainable growth of aviation management, but also very important to the well-being of the people at the national level. Accordingly, the ministry of land, Infrastructure and transport(MLIT) conducts an intensive

inspection of the safety systems of airports and airlines. At the same time, the MLIT strives to ensure comfortable travel for air travelers by suppressing the possibility of aircraft accidents in advance and raising the safety awareness of aviation workers. However, despite the efforts of government departments, large and small aviation accidents have been occurring steadily. As international flights resumed after nearly two years of suspension due to COVID-19, cabin crew are doing their best to ensure safe flight through recurrent training. Therefore, it is necessary to focus on the human factor as an effort to prevent aviation accidents at this point when international flights are in full swing.

The causes of aviation accidents can be divided into hardware and software factors, and as revealed in the recurrence inspection of aviation accidents, human factors, which are software factors, account for a large portion[2]. The International Civil Aviation Organization(ICAO) and the airline business manual specify that a cabin crew member is “a person who boards an aircraft and evacuates passengers quickly and safely in case of an emergency, who normally performs in-flight safety and service tasks”[3]. describe the in-flight duties of cabin crew by dividing them into safety, security, and passenger service. As such, safety is the most important and top priority among cabin crew's duties.

As the COVID-19 situation subsides and consumer sentiment for air travel rises, some domestic low-cost airlines are expanding and diversifying the mid- to long-distance route market by introducing mid- to large-sized aircraft. The main task of cabin crew is safety, and safety-related certificates and experience are preferred. Practical uniforms and sneakers that focus on cabin crew safety mean that the airline defines the role of cabin crew members as fulfilling their safety obligations. Although the need for research on cabin crew safety work is sufficient, existing cabin crew related research is focused on service-related fields. Therefore, this study focused on the antecedent variables for cabin crew to recognize the importance of safety and safely perform flight tasks for every flight. Based on previous studies[4][5][6][7], knowledge pursuance and job regulation were selected as antecedent variables that could affect the safety orientation of cabin crew. Knowledge pursuance refers to the attitude that cabin crew strives to continuously improve their knowledge and skills on safety in order to maintain their knowledge of aviation safety. Job regulation means that airline maintains cabin crew positions in compliance with the provisions set out in aviation law and international civil aviation regulations.

Recently, research on self-efficacy, a sub-concept of psychological capital based on positive psychological status, has been actively conducted. Previous studies on the effect of self-efficacy on service orientation and customer satisfaction are results related to cabin crew's work, but empirical studies on the effect on the safety-oriented job attitude of cabin crew have not been well conducted[8][9]. Therefore, in this study, the effects of important knowledge pursuance variables from the viewpoint of cabin crew's individual attitude and important job regulation variables from the structural perspective of cabin crew duties were examined on safety orientation. In addition, the effect of the work self-efficacy and safety orientation of cabin crew and the mediating effect of work self-efficacy are investigated. The purpose of this study is to derive human utilization measures for safe operation of aircraft, which are essential for sustainable growth of airlines.

2. Theoretical Background

2.1. Cabin crew’s knowledge pursuance, job regulation and work self-efficiency

Cabin crew are employees who perform safety tasks and in-flight services at the point of contact with passengers, and play a role in helping passengers arrive at their destination safely and comfortably. The position and safety duties assigned to each cabin crew are finally decided through a pre-flight briefing according to the aircraft type, route, and number of crew members. Cabin crews acquire knowledge through manuals produced in accordance with the aviation law and ICAO, and maintain an attitude to pursue aviation-related knowledge in order to maintain a safe cabin environment. The cabin crew can increase their work self-efficiency through the qualifications they have completed through regular training, which increases the confidence that they can do safety-related tasks well for every flight[10][11][12][13].

H1: Knowledge Pursuance of cabin crew will have a significant positive(+) effect on work self-efficacy.
H2: Job regulation of cabin crew will have a significant positive(+) effect on work self-efficacy.

2.2. Cabin crew's knowledge pursuance, job regulations and safety orientation

Cabin crews are responsible for the safety of tens of thousands of passengers each year, and the safety orientation of cabin crew is paramount to both airlines and passengers[14][15][16][17]. Cabin crew must continuously maintain their knowledge of safety work to take responsibility for the safety of passengers, and can only perform their duties by taking and passing safety-related tests. Since this process will have a significant impact on the maintenance of safety orientation of cabin crew, hypotheses are established as follows.

H3: Knowledge pursuance of cabin crew will have a significant positive(+) effect on safety orientation.
H4: The job regulation of cabin crew will have a significant positive(+) effect on safety orientation.

2.3. Work self-efficacy and safety orientation of cabin crew

As competition in the aviation industry intensifies, airlines are making efforts to devise service-oriented practical measures through intensive safety education and briefings for cabin crew before and after flight in order to maintain safe flight[14]. However, the cabin crew's safety-oriented job attitude for passengers may be in conflict with service-oriented behavior for passengers. Therefore, in order to fully understand the two concepts of safety and service, it is important for cabin crew to have the confidence to do well in safety-related tasks. Therefore, it can be inferred that the individual variable of self-efficacy is a very important intrinsic motivating factor for cabin crew who have to perform various and detailed cabin crew duties. Based on previous studies[18][19][20][21], it can be inferred that self-efficacy affects performance variables when cabin crew is in charge of safety tasks.

H5: The work self-efficacy of cabin crew will have a significant positive(+) effect on safety orientation.

2.4. Mediating effect of work self-efficacy

As previous studies revealed[10][12][22][23][24], Self-efficacy is a cause variable that affects the organization's positive performance. According to a study on safety accidents among domestic adolescents, groups with low safety efficacy did not take measures to prevent recurrence after safety accidents than high groups, and groups with high safety efficacy tended to be careful and cautious[25]. Accordingly, the self-efficacy of the cabin crew's job plays a mediating role in the relationship that the attitude level knowledge seeking variable for the pursuit of safety knowledge and skills and the variable securing qualifications by completing regular safety education will affect the safety orientation.

H6: The work self-efficacy of cabin crew will have a mediating effect in the relationship between knowledge pursuance and safety orientation.
H7: The work self-efficacy of cabin crew will have a mediating effect on the relationship between job regulation and safety orientation.

3. Survey Design and Survey Composition

3.1. Survey design

The population of this study was defined as Korean cabin crew working as cabin crew for domestic and foreign airlines. An online survey was conducted by combining the snowball sampling method and the judgment sampling method. 252 out of 384 initial samples were used for statistical analysis, excluding 132 responses from insincere respondents and non-regular flight attendants under two years.

3.2. Survey composition

The cabin crew's pursuit of knowledge was based on research by[4][6][7], and four questionnaires

were drawn to measure efforts to continuously pursue knowledge and skills in the job. The detailed measurement questions measured the importance and scope of airline cabin crew knowledge and skills, active learning attitudes, and the degree of steady effort to identify passenger propensity by country and route. It consists of a total of 4 questions, and a 5-point Likert scale was applied as the measurement standard.

Airline cabin crew work is carried out in accordance with ICAO regulations, and only those who have completed cabin crew training are eligible for judgment. Five items of belief in job regulation(Identifying the ability to perform in-flight tasks among colleagues, identifying the actual work of colleagues, performing in-flight tasks, peer evaluation opportunities and peer performance assessment)were derived based on previous studies and a five-point Likert scale was applied to the measurement[4][6][7].

Work self-efficiency is defined as 'personal belief and confidence in job performance ability as a flight attendant'. New general self-efficacy measurement question was applied[26]. A total of 8 questionnaire items(‘Possess sufficient ability to perform the job.’ ‘No difficulties in performing the job’, Sufficient qualifications to perform the job‘, Possess sufficient expertise’, ‘confidence in one's own superior abilities’, ‘Strong confidence in success through experience and performance’, ‘Able to handle more challenging tasks’, ‘Fits my expectations in my job’.) were modified and supplemented to suit this study, and were measured on a Likert 5-point scale.

Safety orientation refers to the overall safety-oriented attitudes and actions taken by cabin crew for the safe operation of aircraft[27]. There are 7 detailed measurement items: 'Safety check before every flight, actions taken by co-workers when safety checks are not performed, attention to abnormal situations, questions related to potential safety factors, confidence in one's ability to evaluate safety-related tasks, thoroughly carry out safety work, and caution during critical flight stages.

3.3. Analysis method

This study used IBM SPSS 22.0 and AMOS 22.0 versions. The detailed analysis procedure is as follows. First, frequency analysis was performed to analyze the distribution of demographic characteristics and job-related characteristics. Second, reliability analysis was performed to confirm the reliability of the scale, and when the Cronbach's coefficient exceeded 0.7, the reliability of the scale was evaluated as acceptable. Third, the measurement model was evaluated before constructing and analyzing the structural equation model. In the evaluation of the measurement model, the bias of the same method was confirmed by comparing the measurement model of the four constituent factors and the single factor model. A confirmatory factor analysis was performed to review the normality and evaluate the construct validity of the scale. Construct validity was calculated by calculating the Mean Variance Extraction(AVE) index and Synthetic Construct Reliability(CCR) proposed by[28]. If the AVE is 0.5 or more or the CCR is 0.7 or more, the concentrated validity is satisfied. And discriminant validity was evaluated when there was no correlation coefficient exceeding the square root of AVE in the correlation matrix between latent variables. Fourth, a structural equation model was built using a scale with reliability and validity, and the hypothesis was verified by evaluating the significance of the path coefficients set between each latent variable through maximum likelihood estimation. Fifth, the resampling method proposed by was implemented to analyze the mediating effect of job efficacy[29]. The statistical significance of the mediating effect on job efficacy was evaluated by calculating the standard error based on 1,000 resamples generated through bootstrap and bias correction at a 95% confidence interval.

4. Empirical Analysis

4.1. Demographic characteristics of the sample

A frequency analysis was conducted on the demographic and job-related characteristics of cabin crew members of airlines participating in this study. Among the 252 people who participated in this study, most airline cabin attendants were women(94.4%), and the age of the cabin crew was the most

in their 30s(61.1%). As for marital status, more than half were single(69.4%), and those with a bachelor's degree(71.8%) had the most education.

The proportion of cabin crew members participating in this study were domestic airlines(49.2%) and foreign airlines(50.8%), and most of them were full-time employees(85.7%). More than half of the positions are economy class cabin crew(52.4%), and those with less than 5 years of aviation experience(53.6%) are the most frequent.

4.2. Measurement model evaluation

Confirmatory factor analysis was performed by designating a measurement model consisting of the first 25 observed variables and 4 latent variables. However, since one observational variable of job regulation(JR4) and work self-efficacy(SE2) inhibited one-dimensionality, these two items were removed and the measurement model was reconstructed. A measurement model consisting of 23 observed variables and 4 latent variables was used for all subsequent analyses.

To evaluate normality, the absolute values of skewness and kurtosis of the observed variables were checked. The absolute values of skewness ranged from a minimum of .006 to a maximum of .851, and in the case of kurtosis, a minimum of .033 and a maximum of 1.244. This was found to be much closer to the normal distribution than the level(skewness <3, kurtosis <10) suggested by[30].

In a cross-sectional study situation, the same method bias may occur when measuring by the self-report method using a measurement tool such as a questionnaire. In this study, the same method bias was diagnosed by comparing the theoretically constructed four-factor measurement model with the single-factor model that includes all observed variables in one latent variable. As a result, in the case of the 4-factor measurement model, all but the χ^2-statistic were found to be at a suitable level [χ^2(203)=371.111(p<.001), Normed-χ^2=1.828, RMR=.027, TLI=.910, CFI=.921, RMSEA=.057(LO90=.048/HI90= .067)], whereas the fitness indices of the measurement model consisting of a single factor mostly showed an unacceptable level[χ^2 (209)=884.661(p<.001), Normed- χ^2 =4.233, RMR=.050, TLI=.649, CFI=.682, RMSEA=.113(LO90=.106/HI90= .121)]. Therefore, it was judged that the bias of the same method was unlikely to distort the results of this study. Table 1 shows the results of analyzing the reliability and concentration validity of the scale for the 4-factor measurement model. As a result of the reliability analysis, high internal consistency was secured in knowledge pursuance(=.761), job regulation(=.754), work self-efficacy(=.895), and safety orientation(=.816).

As a result of the concentrated validity analysis, the standardized factor loads for the 22 observation variables used in this study ranged from a minimum of .572 to a maximum of .812, and all were statistically significant. In addition, knowledge pursuance(AVE=.703, CCR= .904), job regulation(AVE=.583, CCR=.848), work self-efficacy(AVE=.740, CCR=.952), safety orientation(AVE=. 563, CCR = .899) met the Fornell and Larcker criteria(AVE>0.5, CCR>.07)[28]. Therefore, it is judged that the 22 observation variables used in this study have sufficient convergent validity.

Table 1. Reliability and convergent validity test.

LVs	OVs	SFLs	AVEs	CCRs	α
Knowledge pursuance	KP1	.572***	.703	.904	.761
	KP2	.728***			
	KP3	.701***			
	KP4	.658***			
Job regulation	JR1	.606***	.583	.848	.754
	JR2	.630***			
	JR3	.686***			
	JR5	.722***			
Work self-efficacy	SE1	.764***	.740	.952	.895
	SE3	.812***			

	SE4	.734***			
	SE5	.774***			
	SE6	.681***			
	SE7	.692***			
	SE8	.733***			
Safety orientation	SF1	.599***	.563	.899	.816
	SF2	.573***			
	SF3	.609***			
	SF4	.585***			
	SF5	.741***			
	SF6	.691***			
	SF7	.596***			

Note: * p<.05, ** p<.01, *** p<.001.

Model fit: χ^2 (203)=371.111(p<.001), Normed-χ^2 =1.828, RMR=.027, TLI=.910, CFI=.921, RMSEA=.057(LO90=.048, HI90=.067).

Abbreviations. LV(latent variable), OV(observed variables), SFL(standardized factor loading) AVE(average variance extracted), CCR(composite construct relbility), α(Cronbach's alpha coefficient).

<Table 2> shows the results of comparing the difference between the AVE square root and each correlation coefficient to check discriminant validity. All correlation coefficients were lower than the corresponding AVE square root, confirming that the discriminant validity of the scale used in this study was sufficient. Therefore, it was confirmed that the concentration validity and discriminant validity were sufficient, and the construct validity of the scale used in this study was established.

Table 2. Discriminant validity test.

	KP	JR	WS	SO
KP	**.838**			
JR	.386***	**.764**		
WS	.584***	.466***	**.860**	
SO	.594***	.253**	.600***	**.750**

Notes: * p<.05, ** p<.01, *** p<.001.

KP, JR, WS and SO respectively represent knowledge pursuance, job regulation, work self-efficacy and safety orientation. Bold figures on the diagonal represent the root squared value of each construct's AVE.

4.3. Structural equation model and hypothesis verification

The hypothesis was verified through a structural equation model using 22 observational variables and 4 latent variables whose reliability and validity were confirmed through the evaluation of the measurement. The hypothesis test results are shown in <Figure 1>. According to the goodness-of-fit index of the structural equation model, which is equivalent to the measurement model, the covariance matrix was evaluated as a suitable level for estimating the structural equation model in this study[(203)=371.111(p<.001), Normed-=1.828, RMR=.027, TLI=.910, CFI=.921, RMSEA=.057(LO90=.048/HI90=.067)].

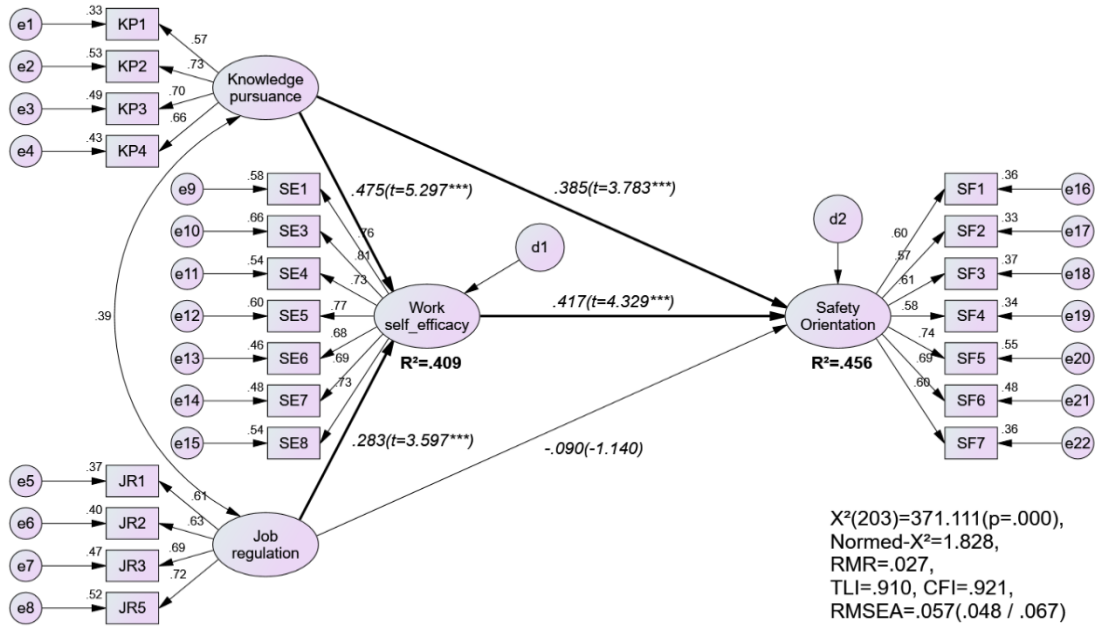
As a result of hypothesis verification, the positive effect of knowledge pursuance on work self-efficacy(=.475) is statistically significant(t=5.297, p<.001). Hypothesis 1 was adopted. In addition, the positive effect of job regulation on work self-efficacy(=.283) was also found to be statistically significant. Hypothesis 2 was therefore also adopted. In addition, among the total variance of work self-efficacy, knowledge pursuance and job regulation explanatory power were 40.6%.

The effect on work self-efficacy was 0.192 higher in knowledge pursuance than job regulation. As a result of performing the χ^2test on the difference between the two path coefficients, it was found that

$\Delta\chi^2$= 4.442. This exceeds the rejection range of 3.84 when the degree of freedom is 1 at the 5% significance level, and the effect on work self-efficacy is statistically higher in knowledge pursuance than job regulation.

As a result of hypothesis testing on the antecedent factors of safety orientation, the positive effect of knowledge pursuance on safety orientation directly(γ_3=.385) was statistically significant(t=3.783, p<.001). So hypothesis 3 was accepted. However, the positive effect of job regulation directly on safety orientation(γ_3=-.090) did not reach a statistically significant level(t=-1.140, p>.05), so hypothesis 4 was rejected. The positive effect of work self-efficacy on safety orientation(β_5=.417) was found to be statistically significant(t=4.329, p<.001), so hypothesis 5 was accepted. Knowledge pursurance, job regulation, and work self-efficacy were found to explain 45.6% of the total variables of safety orientation.

Figure 1. Results of structural equation modeling.



Notes: * p<.05; ** p<.01; *** p<.001.

Standardized coefficients and those t-values are shown for the results of hypothesis test. Significant paths are displayed with the bold lines, and an insignificant path is shown with a thin line.

For mediation and moderated mediation tests, 1,000 of bootstrapping sub-samples were generated and then the biases were corrected in a 95% confidence interval.

<Figure 1> shows the results of analyzing the significance of the mediating effect of work self-efficacy in the relationship between knowledge pursuance and safety-orientation, job regulation and safety-orientation. Work self-efficacy plays a partial mediating role in the relationship between knowledge pursuance and safety orientation, and the mediating effect of work self-efficacy(.198) in this relationship is statistically significant(p<.01). The mediating effect of work self-efficacy in the relationship between knowledge pursuance and safety orientation did not include “0” in the 95% confidence interval. Therefore, hypothesis 6 was accepted.

Work self-efficacy plays a complete mediating role in the relationship between job regulation and safety orientation, and the mediating effect of work self-efficacy is at a statistically significant level(p<.01). The mediating effect of work self-efficacy in the relationship between job regulation and safety orientation did not include “0” in the 95% confidence interval. Therefore, hypothesis 7 was accepted.

Table 3. Mediation effects by work self-efficacy.

Paths	Mediation effects	LO95	HI95	p-Values
KP → SO	.198	.110	.250	.001
JR → SO	.118	.048	.326	.001

Note: 1,000 of sub-samples were generated by bootstrapping, and then the biases were corrected in a 95% confidence interval.

5. Conclusion and Implications

Knowledge pursuance and job regulation variables were calculated as antecedent variables for airline cabin crew's safety orientation, and the relationship was investigated. Also, the mediating effect of work self-efficacy was verified.

The hypothesis test results are summarized as follows. First, as a result of examining the effects of knowledge pursuance and job regulation on the work self-efficacy of airline cabin crew, both variables have significant effects. Second, as a result of examining the effects of knowledge pursuance and job regulation of airline cabin crew on safety orientation, knowledge pursuance had a significant effect on safety orientation, but job regulation had no significant effect on safety orientation. Third, as a result of examining the effect of airline cabin crew's work self-efficacy on safety orientation, work self-efficacy has a significant effect on safety orientation. Fourth, work self-efficacy is partially mediated in the relationship between knowledge pursuance and safety-orientation of airline cabin crew. Fifth, work self-efficacy is completely mediated in the relationship between job regulation and safety orientation of airline cabin crew, and the mediating effect is statistically significant.

As a result of this study, it was derived that the cabin crew's efforts to continuously acquire and maintain professional knowledge on the overall safety of aircraft and safety for each aircraft type are important factors that enable the specialization of the cabin crew[4][31]. Also, derived that safety knowledge and safety motivation play an important role as antecedent variables for carrying out safety behaviors consisting of safety compliance and safety participation[32]. This study revealed that safety-related performance, as in the results of previous studies by[33][34]. Can indicate safety behavior only when training is accompanied by knowledge of safety[13][35]. In particular, it is important for cabin crew to be fully aware of safety tasks for each stage of flight(Briefing-> Pre-flight check-> Passenger boarding -> Door Closing and arming ->aircraft push back -> Taxing -> Take-off-> Cruise -> Descent -> Approach -> Landing -> Disarming and Door Opening -> Passenger disembark). When an abnormal situation occurs, it is important to prepare and handle it in advance so that the situation does not become an emergency situation(law, IATA). Cabin crew members must continuously maintain their knowledge of safety under job regulation for safety-related tasks. In particular, new safety-related regulations are introduced during a period of outbreak of diseases such as COVID-19, and these new regulations must be actively learned and applied immediately to in-flight situations.

As a result of examining the parameters of work self-efficacy in the relationship between knowledge pursuance and safety orientation of cabin crew, work self-efficacy was partially mediated. On the other hand, job efficacy was completely mediated in the relationship between the cabin crew's job regulation and safety orientation. It can be inferred that job training and evaluation should not be determined simply by written tests and oral tests when conducting essential safety education prescribed by the law for the safety-oriented attitude of cabin crew.

The following are ways to indirectly experience various situations related to aviation safety in order to pursue knowledge of cabin crew duties and increase work self-efficacy. This is to expand the existing one-sided regular safety training method to provide a forum for presentation and discussion in the form of in-house safety seminars. Through this, cabin crew can acquire safety-related knowledge on their own, thereby increasing their sense of self-efficacy for safety jobs and pursuing safety orientation. In addition, if cabin crew members can easily access VR-based aircraft safety accidents and incidents

at any time and receive constructive feedback on safety-related tasks, cabin crew members are expected to increase self-efficacy and safety orientation. Such education will give cabin crew confidence that they can respond well to various safety accidents and incidents based on aviation-related safety knowledge. This seminar on safety-related tasks(research, presentation, discussion), easy-to-use VR-based safety accident and incident experience and constructive feedback will help airlines manage sustainably by establishing an organizational culture in which airlines value safety tasks. As in the results of previous study that self-efficacy has a significant positive(+) effect on attitude, it can be inferred that these institutional measures will help to maintain a safety-oriented attitude by increasing the work self-efficacy of cabin crew[36].

The academic significance of this study is that it attempted to apply a new variable called safety orientation, a safety-oriented job attitude of cabin crew, which has rarely been dealt with in the existing airline cabin crew human management research. However, it is still in its early stages as a study on the safety orientation of cabin crew. Therefore, it is necessary to develop clear theoretical concepts and measurement indicators for the safety orientation of cabin crew based on this study. Since job regulation affects safety orientation through work self-efficacy, it is necessary to expand research on the self-efficacy of cabin crew based on the results of this study. This study is meaningful in that it is an early study to secure aviation safety and has laid the foundation for active research on it.

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7. Appendix

7.1. Author's contribution

	Initial name	Contribution
Lead Author	HL	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Corresponding Author*	SL	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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The Influence of the Knowledge of Cardiopulmonary Resuscitation and Educational Experience on the Confidence of Nursing Students

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Abstract

Purpose: *This study is a descriptive research study intended to investigate the effect of the nursing students' knowledge and educational experience of cardiopulmonary resuscitation on their confidence.*

Method: *The subjects of this study were 183 nursing students attending University V located in City J of Province J, and the study period ran from November 18 to November 29, 2019. As for the research tool, the cardiopulmonary resuscitation related knowledge and confidence were used. As for the data analysis, confidence according to the cardiopulmonary resuscitation related knowledge and educational experience of the nursing students was analyzed using the t-test, and knowledge was analyzed using the chi-square test. The relationship between knowledge and educational experience and confidence of the nursing students was analyzed with the Pearson's correlation coefficient.*

Results: *The cardiopulmonary resuscitation related knowledge score was 9.6 points for 1st and 2nd years and 13.2 for 3rd and 4th years out of a total of 17 points, where the cardiopulmonary resuscitation related knowledge was measured higher among the 3rd and 4th years. The confidence in the cardiopulmonary resuscitation of 3rd and 4th years with the experience in the cardiopulmonary resuscitation practice and clinical practice was 6.72 points, which was higher than 3.84 points for the 1st and 2nd years, and there was a statistically significant difference($p<0.05$).*

Conclusion: *Hence, in order to facilitate the cardiopulmonary resuscitation education, the educational support should be provided to develop an educational program that includes knowledge and build confidence in the cardiopulmonary resuscitation.*

Keywords: ***Nursing Student, Cardiopulmonary Resuscitation, Knowledge, Educational Experience, Confidence***

1. Introduction

1.1. Need for the study

According to the data of the recent e-Nara Index[1], the mortality rate from the circulatory system disease was 121.1 per 100,000 people, with heart disease at 63.0, cerebrovascular disease at 42.6, and hypertension at 11.9, each respectively. Furthermore, the mortality rate from the ischemic heart disease increased by 0.7(2.6%) from 26.7 per 100,000 in 2010 to 27.4 in 2020, which was 10 years later. However, the survival rate of cardiac arrest patients is 4.9%, which is low compared to 7-12% in other advanced medical countries[1][2].

Cardiopulmonary arrest can occur suddenly without notice, and many of the patients occur at home, at school, and at work[3][4], with fatal consequences within minutes of occurrence. Accordingly, whether resuscitation is performed is an important factor in determining the survival rate and prognosis[5]. The ability to respond promptly and accurately in the early stages

of emergency situations is secured through the systematic and repetitive learning and training, and it is the basic cardiopulmonary resuscitation education that provides such learning and training opportunities[6].

Cardiopulmonary resuscitation and application of defibrillation are, as a matter of principle, part of the medical practices that should be performed for the patients based on medical expertise. If there is no intentional or gross negligence for death and death, the perpetrator shall not be liable civilly, neither shall one be held liable for injury, nor shall criminal liability for death be reduced or exempted as provided by the exemption clause of Article 5-2 of the Emergency Medical Service Act, where the cardiopulmonary resuscitation and the use of defibrillation are recommended thereunder[7]. In response to such changes in the environment, it is very important that the nursing students as pre-medical practitioners are educated on cardiopulmonary resuscitation and prepared to respond promptly to the cardiac arrest[8].

Examining the cardiopulmonary resuscitation education of the nursing students, 3.2% of the 1st years received it, 38.7% of the 2nd years, 71.0% of the 3rd years, and 58.1% of the 4th years primarily received the basic cardiopulmonary resuscitation education in the 3rd and 4th years, and only 6 schools(10%) were found to offer the re-education[9]. At the College of Nursing, the basic cardiopulmonary resuscitation is studied as a core nursing skill, and the basic cardiopulmonary resuscitation(Basic Life Support; BLS) course conducted by the Korea Association of Cardiopulmonary Resuscitation as a qualification course is in progress. As such, the basic cardiopulmonary resuscitation education is conducted in regular and non-regular courses, yet each university has insufficient regulations on the mandatory completion of basic cardiopulmonary resuscitation education, and it is conducted according to the circumstances of the university. Furthermore, it is left to the discretion of each university as to the minimum retraining period and method to maintain the educational effectiveness of the nursing students[10].

Recently, the basic cardiopulmonary resuscitation has been included in the core basic nursing skills evaluation questions of the Korean Accreditation Board of Nursing Education[11], placing emphasis on the competence of the nursing students in emergency situations, and as the cardiopulmonary resuscitation education targeting the nursing students who will become future nurses would have an impact on increasing the survival rate of the cardiac arrest patients, the systematic and repeated education from the university education is necessary[12].

Examining the studies related to the CPR conducted in Korea, the studies on knowledge, attitude, and performance of the medical personnel[13][14][15], and the general public have conducted [16][17][18].

Many studies on the knowledge[11][19][20][21], attitude[11][19][21], performance confidence[19][20][21][22], self-efficacy[11][22], lasting effect[3][11][23], and patient safety[24] for the nursing students on the cardiopulmonary resuscitation have been conducted. However, in most cases, the Korea Association of Cardiopulmonary Resuscitation has conducted the studies with a focus on the basic cardiopulmonary resuscitation education, and hence, it is necessary to investigate the knowledge and confidence in the basic cardiopulmonary resuscitation which should be included in the curriculum at the nursing college.

Accordingly, this study aimed at the nursing students who did not receive the basic cardiopulmonary resuscitation related education conducted by the Korea Association of Cardiopulmonary Resuscitation at V University located in City of J of Province J, and identified the level of confidence according to their knowledge and educational experience about cardiopulmonary resuscitation. The purpose of this study is to provide the basic data necessary for the cardiopulmonary resuscitation course operation and program development.

2. Purpose of Research

The purpose of this study is to provide the basic data for developing the cardiopulmonary resus-citation education program for the college students by identifying the prior experience and knowledge level of cardiopulmonary resuscitation for the nursing students. The specific purposes are as follows.

1) Verify the educational experience of cardiopulmonary resuscitation of the nursing students;
2) Verify the clinical practice experience of the nursing students; and
3) Verify the extent of knowledge of cardiopulmonary resuscitation according to the general characteristics of the nursing students.

3. Research Method

3.1. Research design

This study is a descriptive research study conducted to determine the extent of influence of cardiopulmonary resuscitation related educational experience on the nursing students' knowledge and confidence in the cardiopulmonary resuscitation.

3.2. Subjects of the study

The subject of this study was a convenience sampling of the students attending University V located in City J of Province J, and 183 nursing students from a university who understood the purpose of this study and allowed to participate in the study.

For this study, the sample size was determined according to the statistical test method of the two-way ANOVA using the G*Power 3.1 program. When using two independent variables and calculated with a significance level of 0.05, an effect size of .25, and an impact power of 0.8, the appropriate sample size for this study was 180 people. Considering the dropout rate of 10%, 198 copies were distributed, of which 190 copies were recovered. Of which, 7 copies of the questionnaire were excluded, and 180 copies of the criteria required for analysis were satisfied, and hence, a total of 183 copies were used for this study.

3.3. Research tools

The knowledge on cardiopulmonary resuscitation is related to the cardiopulmonary resuscitation based on the theoretical knowledge required to accurately perform the steps from confirmation of patient response to termination, and with the help of two nursing professors, 20 questions of the basic cardiopulmonary resuscitation knowledge measurement tool used by Jeonghwa Lee[25] were used to evaluate content validity using 17 questions of the tool of Hyejin Kang[12]. The basic cardiopulmonary resuscitation related knowledge questions are 1 question on the definition of cardiopulmonary resuscitation, 2 question son the consciousness check, 1 question on airway maintenance, 1 question on breathing check, 3 questions on the CPR, 5 questions on chest compression, 3 questions on how to use the defibrillator, and 1 question on the defibrillator operation sequence, for a total of 17 questions, while the score for each question is 1 point if correct and 0 point if incorrect, and hence, the higher the score, the higher the basic cardiopulmonary resuscitation related knowledge.

The attitude towards the cardiopulmonary resuscitation is the psychological readiness to perform the cardiopulmonary resuscitation, and this tool, which measured the performance confidence in emergency nursing of cardiac arrest patients, is based on the e-book of BLS for Healthcare Provider[26] and Advanced Cardiovascular Life Support[27] and a 10-question questionnaire modified and supplemented by Minjeong Chae[23] was used for the tools of Seongoh Hwang and Kyeongsoo Lim[28]. The contents of this tool are consisted of patient identification,

help request, oxygen supply, electrocardiogram check, cardiopulmonary resuscitation, endotracheal intubation, defibrillation, administration, report, and record. In Minjeong Chae's study[29], the Content Validity Index(CVI) was 0.8 or higher. Confidence in performance was indicated on the numbers marked as not at all(1 point) and very much(10 points), and the higher the score, the higher the confidence. In the study of Minjeong Chae[29], the reliability of the tool was Cronbach'α = .85, and in this study, Cronbach'α = .95.

4. Method of Data Collection

Data collection was conducted from November 18 to November 29, 2019 with the subjects who understood the purpose of the study and voluntarily agreed to participate in the study.

5. Method of Data Analysis

The collected data were analyzed as follows by using the IBM SPSS WIN 21.0 program.

1) Frequency, percentage, mean, and standard deviation were calculated to understand the general characteristics of the nursing students.
2) The nursing students' knowledge and confidence related to the cardiopulmonary resuscitation were analyzed using the mean and standard deviation.
3) Confidence according to the cardiopulmonary resuscitation related knowledge and educational experience of the nursing students was analyzed using the t-test, and knowledge was analyzed using the chi-square test.
4) The relationship between knowledge and educational experience and confidence of the nursing students was analyzed with the Pearson's correlation coefficient.

6. Results

6.1. General characteristics of the study subjects

The general characteristics of the subjects are demonstrated in <Table 1>. Of the 183 subjects, 88 students were in their 1st and 2nd year, and 95 were in their 3rd and 4th years, respectively. As for the age of 1st and 2nd years, 47 people(53.4%) were aged 21 or younger, 24(27.3%) aged 22, and 17 were aged 23 or older(19.3%). As for the ages of 3rd and 4th years, 42 were(44.2%) aged 21 or younger, 25(26.3%) aged 22, and 28(29.5%) were aged 23 or older. The gender of 1st and 2nd years was 74 females(84.1%) and 14 males(19.3%), and the 3rd and 4th years were 70 females(73.7%) and 25 males(29.5%), respectively. As for the years, 43 people were 1st years(48.9%), 45 were 2nd years(51.16%), 44 were 3rd years(24.0%), and 51 were 4th years(27.0%). As for their religion, 25 people were Christians(28.4%), 14 were Buddhists(15.9%), 24 were Catholics(27.3%), and 25 were others(28.4%) among the 1st and 2nd years, and as for the 3rd and 4th years, 32 people were Christians(33.7%), 12 were Buddhists(12.6%), 15 were Catholic(15.8%), and 36 were others(37.9%). As for the clinical practice experiences, 88 people(100%) had none for the 1st and 2nd years, and 95 people(100%) were 3rd and 4th years.

Table 1. General characteristics of the study subjects.

Variable	Questions	1st and 2nd years		3rd and 4th years	
		Frequency(n)	Percentage(%)	Frequency(n)	Percentage(%)
Age	21 years old or younger	47	53.4	42	44.2
	22 years old	24	27.3	25	26.3
	23 years old or older	17	19.3	28	29.5
Gender	Women	74	84.1	70	73.7
	Men	14	15.9	25	26.3
Grade year	1st year/ 3rd year	43	48.9	44	46.3
	2nd year/ 4th year	45	51.1	51	53.7
Religion	Christianity	25	28.4	32	33.7
	Buddhism	14	15.9	12	12.6
	Catholicism	24	27.3	15	15.8
	Others	25	28.4	36	37.9
Clinical practice experience	Yes	0	0	95	100
	None	88	100	0	0

Note: N=183.

6.2. Cardiopulmonary resuscitation related knowledge

<Table 2> illustrates the cardiopulmonary resuscitation related knowledge of the subjects of this study. It turned out that the nursing students' cardiopulmonary resuscitation related knowledge was 9.6 out of 17 points for 1st and 2nd years and 13.2 out of 17 points for 3rd and 4th years, thereby indicating that there was a knowledge gap between the two groups.

Examining the correct answer rate for each question of the cardiopulmonary resuscitation related knowledge, first, the 1st and 2nd years demonstrated the highest correct rate with 82 people(93.2%) who answered the 4th question of 'What is the best way to open the airway?' 'What is cardiopulmonary resuscitation?' as answered by 79 people(89.3%), and as for the 7th question of 'When should chest compressions be started immediately?', 79.5%(70 people) answered correctly. 68 people(77.3%) answered the 3rd question of 'What should I do next if I found out that one was unconscious?', 68 people(77.3%) answered correctly.

The 11th question, which had many incorrect answers, was ‘What should I do next if I found out that one was unconscious?’ and one person(1.1%) answered correctly, and for the 14th question of ‘A defibrillator electric shock pad(PED) was correctly attached to the chest. What should I do next?', 29 people(33%) answered correctly, and for the 6th question of 'What is the most appropriate general order to turn on the AED?', 30 people(34.1%) answered correctly, respectively.

Next, examining the correct answer rate for each question of cardiopulmonary resuscitation related knowledge for 3rd and 4th years, the correct answer to the question 1 of 'What is cardiopulmonary resuscitation?' 92 people(96.8%) answered correctly, thereby indicating the highest percentage of correct answers, and the answer for the question 2 of 'What is the best way to check consciousness', 91 people(95.8%) answered correctly, and for the question 4 of “What

is the best way to open the airway?", 90 people(94.7%) answered correctly, and for the question 9 of 'What is the proper ratio between chest compressions and artificial respiration?', 86 people(90.5%) answered correctly.

Question 11, which had many incorrect answers, was "What should I do next if I found out that one is unconscious?" 25 people(26.3%) provided the correct answer, and for the question 8 of "I am performing chest compressions. Where should the hand be placed?', it correctly answered by 47 people(49.5%), and for the question 16 of 'Which is the most appropriate general order to turn on the AED?', 59 people(62.1%) answered correctly. The sub-question that demonstrated the lowest knowledge for all grade years was the question 11 of 'How many seconds does one inhale for 2 breaths each time?', the 1st and 2nd years had 1 person answer correctly(1.1%), the 3rd and 4th years demonstrated the lowest percentage of correct answers with 25 people(26.3%), followed by the answer to the question 16 of 'Which is the most appropriate general order to turn on the AED?', and the 1st and 2nd years had 30 people(34.1%) answer correctly, and the 3rd and 4th years had 59 people answer correctly(62.1%).

Table 2. Cardiopulmonary resuscitation related knowledge.

Questions	Contents	1st and 2nd years		3rd and 4th years	
		Frequency(n)	Percentage (%)	Frequency(n)	Percentage (%)
1	What is cardiopulmonary resuscitation?	79	89.8	92	96.8
2	What is the best way to check consciousness?	62	70.5	91	95.8
3	If I found one to eb unconscious, what should I do next?	68	77.3	78	82.1
4	What is the best way to open airway?	82	93.2	90	94.7
5	Within how many seconds should breathing be checked?	45	51.1	69	72.6
6	What is correct for CPR?	62	70.5	85	89.5
7	When should chest compressions be started immediately?	70	79.5	85	89.5
8	I am performing chest compressions. Where should the hands be placed?	32	36.4	47	49.5
9	What is an appropriate ratio for chest compressions and CPR?	57	64.8	86	90.5
10	How many chest compressions do adults need?	31	35.2	76	80.0
11	For how many seconds should CPR be performed for each of the 2 sessions?	1	1.1	25	26.3
12	I am performing chest compressions. What is not a good way?	64	72.7	81	85.3
13	You performed 30 chest compressions, and your colleague performed 2 CPRs 5 times repeatedly for about 2 minutes. What is next?	47	53.4	80	84.2
14	I have accurately placed a defibrillator electric shock pad(PED) on the chest. What is next?	29	33.0	66	69.5

15	I have performed defibrillation shock once. What is next?	33	37.5	65	68.4
16	What is the most appropriate and general order to power on the AED?	30	34.1	59	62.1
17	While defibrillation shock is carried out with the AED, what happens if I came into contact with a patient in cardiac arrest?	55	62.5	79	83.2

Note: N=183.

6.3. Confidence in the cardiopulmonary resuscitation

<Table 3> illustrates the confidence level of cardiopulmonary resuscitation of the subjects of this study. As a result of conducting the t-test to analyze the average difference in confidence in the cardiopulmonary resuscitation of the nursing students, 1st and 2nd years scored an average of 3.84 out of 10 points per question, and the 3rd and 4th years scored an average of 6.72 points, where a difference was found in the level of confidence between the two groups($p<0.05$).

Examining the score for each question between the two groups of cardiopulmonary resuscitation confidence, the 1st and 2nd years(88 students) responded with an average of 5.32 points for the first question, 'I can con-firm the patient's consciousness and check the abnormal respiration and cardiac arrest respiration.' and the 3rd and 4th years(95 students) responded with an average of 7.85 points. The 1st and 2nd years(88 people) responded with an average of 7,19 points for question 2, 'I can determine emergency situations of cardiac arrest and ask for help from people around', and the 3rd and 4th years(95 people) answered with an average of 8.54 points. The 1st and 2nd years(88 students) responded with an average of 4.90 points for the 3rd question, 'I can perform pulse check and cardiopulmonary resuscitation.' The 1st and 2nd years(88 people) responded with an average of 3.14 points for the 4th question, 'I can manage breathing using a bag valve mask(BVM)', and the 3rd and 4th years(95 people) answered an average of 6.47 points.

The 1st and 2nd years(88 students) responded with an average of 2.76 points for the question 5, 'I can distinguish between normal, ventricular fibrillation, and asystole ECGs.' And the 3rd and 4th years responded with 5.57 points on average. For the question 6, 'Endotracheal tube may be performed', the 1st and 2nd years(88 students) responded with an average of 1.89 points, and the 3rd and 4th years(95 students) responded with an average of 4.16 points. The 1st and 2nd years(88 students) responded with an average of 3.66 points for the 7th question, 'I can use a defibrillator', and the 3rd and 4th years(95 students) responded with an average of 7.87 points. The 1st and 2nd years(88 students) responded with an average of 2.31 points for the question 8, 'I can administer emergency medications safely in an accurate way'. The 1st and 2nd years(88 students) responded with an average of 3.92 points for the question 9, 'I can determine and accurately report the emergency situation of cardiac arrest patients.' The 1st and 2nd years(88 people) responded with an average of 3.27 points to the 10th question, 'I can appropriately record changes in the status of cardiac arrest patients due to nursing performed,' and the 3rd and 4th years responded with an average of 6.67 points.

Table 3. Confidence in the cardiopulmonary resuscitation.

Questions	Contents	Grade year	M±SD	t	*p*
1	I can check the patient's consciousness and check for abnormal breathing and cardiac arrest breathing.	1,2	5.32±2.25	-7.86	<.001
		3,4	7.85±2.11		
2	I can determine the emergency situation and ask for help from those around.	1,2	7.19±2.07	-4.84	<.001
		3,4	8.54±1.68		
3	I can perform pulse check and cardiopulmonary resuscitation	1,2	4.90±2.41	-8.00	<.001
		3,4	7.71±2.31		
4	I can manage breathing using a bag valve mask(BVM).	1,2	3.14±2.29	-8.44	<.001
		3,4	6.47±3.04		
5	I can distinguish normal, ventricular fibrillation, and asystole.	1,2	2.76±2.25	-6.50	<.001
		3,4	5.57±3.274		
6	I can perform endotracheal tube.	1,2	1.89±2.44	-4.95	<.001
		3,4	4.16±3.69		
7	I can use a defibrillator.	1,2	3.66±2.87	-10.75	<.001
		3,4	7.87±2.43		
8	I can administer emergency medications safely in an accurate way.	1,2	2.31±2.62	-6.27	<.001
		3,4	5.18±3.54		
9	It can determine and accurately report on the emergency situation of cardiac arrest patients.	1,2	3.92±2.58	-8.48	<.001
		3,4	7.18±2.61		
10	I can appropriately record changes in the status of cardiac arrest patients regarding the nursing performed.	1,2	3.27±2.73	-8.09	<.001
		3,4	6.67±2.94		

Note: N=183.

6.4. Relationship between the cardiopulmonary resuscitation related educational experience and the cardiopulmonary resuscitation confidence

<Table 4> illustrates the relationship between the cardiopulmonary resuscitation related educational experience and cardiopulmonary resuscitation confidence. There was a positive correlation between the cardiopulmonary resuscitation related educational experience and the cardiopulmonary resuscitation confidence. That is, it may be seen that the higher the cardiopulmonary resuscitation related educational experience, the higher the confidence in the cardiopulmonary resuscitation.

Table 4. Relationship between the cardiopulmonary resuscitation related educational experience and the cardiopulmonary resuscitation confidence.

Variable		CPR related educational experience	
		r	*p*
Confidence 1.	I can check the patient's consciousness and check for abnormal breathing and cardiac arrest breathing.	0.32	0.000
Confidence 2.	I can determine the emergency of cardiac arrest and ask for help from people around.	0.37	0.000
Confidence 3.	I can perform pulse check and cardiopulmonary resuscitation.	0.36	0.000

Confidence 4.	I can manage breathing using a bag valve mask(BVM).	0.25	0.001
Confidence 5.	I can distinguish normal, ventricular fibrillation, and asystole.	0.20	0.007
Confidence 6.	I can perform endotracheal tube.	0.24	0.001
Confidence 7.	I can use a defibrillator.	0.34	0.000
Confidence 8.	I can administer emergency medications safely in an accurate way.	0.19	0.011
Confidence 9.	It can determine and accurately report on the emergency situation of cardiac arrest patients.	0.30	0.000
Confidence 10.	I can appropriately record changes in the status of cardiac arrest patients regarding the nursing performed.	0.29	0.000

Note: N=183.

7. Discussion

Cardiopulmonary resuscitation is a series of processes that prevents the progression of clinical death to biological death and restores the circulation in the cardiac arrest, and the key to cardiopulmonary resuscitation is how promptly and accurately cardiopulmonary resuscitation is performed to determine the patient's survival rate[30]. This study is an attempt to provide the basic data for effective cardiopulmonary resuscitation course operation and program development by identifying the level of confidence in the nursing students based on their knowledge and educational experience about cardiopulmonary resuscitation.

Among the general characteristics, the knowledge, educational experience, and confidence scores for the cardiopulmonary resuscitation were significantly higher among the students with clinical practice experience and as the years increased, such results are considered to be a natural result, since the clinical practice is conducted in the 3rd and 4th year, and hence, as the year increased, the clinical practice experience increases and the education contents on the cardiopulmonary resuscitation are frequently encountered in major subjects.

In this study, it turned out that the knowledge level of cardiopulmonary resuscitation was 9.63 out of 17 points for the 1st and 2nd years and 13.2 out of 17 points for the 3rd and 4th years, thereby indicating that there was a knowledge gap between the two groups. In a study of Sookhee Oh, Jeongjoo Seon, and Sanghee Kim[19] using the same tool for the nursing students, the extent of cardiopulmonary resuscitation related knowledge was 12.58±1.84 out of a total of 17 points(74.0 points of percentile), and the knowledge score was found similarly in this study, which was partially supportive of the results of this study, and in the study of Hyejin Kang[12], the knowledge score after 6 weeks of training demonstrated 13.00±1.70 points(76.47 points of percentile) in the instructor centric training and 13.00± in simulation training. At 1.80 points(76.47 points of percentile) and 13.63±1.67 points(80.17 points of percentile) in the debriefing simulation education, the knowledge score was similar to or slightly higher than that of this study, which partially supportive of the results of this study. This is determined to be the result of the study of Hyejin Kang[12] because all of the subjects were studied after 6 weeks of education, whereas 21.9% of subjects in this study were within 3 months and 78.1% within 3 months to 2 years.

Among the basic competencies required to perform the cardiopulmonary resuscitation, the level of knowledge may be increased through cardiopulmonary resuscitation education, and

since the increase in knowledge leads to an increase in performance confidence, it will be possible to maintain a high level of cardiopulmonary resuscitation performance[19][30]. Hence, it is necessary to increase knowledge through the development of standardized knowledge measurement tools and continuous repeated education[3][11][23], and it seems that the continuous research is needed to recall knowledge that is forgotten according to the difference in knowledge by grade year or the passage of time.

Since the emergency situations such as cardiac arrest occur suddenly, it is considered that repeated education is important to ensure that anyone can respond with composure. Currently, the education on basic cardiopulmonary resuscitation for the nursing students is divided into the in-school practical training of core nursing skills suggested by the Korean Accreditation Board of Nursing Education and non-educational courses conducted as qualification courses by the Korea Cardiopulmonary Resuscitation Association. While there are differences between the universities, the basic cardiopulmonary resuscitation process, which consists of in-school practical education of core nursing skills, is carried out in the second year of basic nursing practice, and basic cardiopulmonary resuscitation is carried out in clinical practice education during the 3rd and 4th years, including the community nursing practice, which is evaluated as a core nursing skill, and hence, the repeated and continuous education is carried out.

The educational content on the basic cardiopulmonary resuscitation is consisted of the on-site safety and patient response check, pulse and respiration measurement, chest compressions, respiration, and AED. However, the nurses working at hospitals should know not only the basic cardiopulmonary resuscitation, but also how to use a manual defibrillator, inject drugs, and use a bag valve mask, etc.

Accordingly, it is considered that it is necessary to check the systematic educational contents for the basic cardiopulmonary resuscitation in the curriculum. Hence, it seems necessary to operate the cardiopulmonary resuscitation curriculum and develop the program for the nursing students by focusing on the characteristics related to the needs of the current medical environment and taking into account the knowledge and confidence revealed in this study.

This study targeted the nursing students enrolled at University V located in City J of Province J, and it is difficult to generalize to represent all nursing students given the regional bias.

8. Conclusion and Recommendations

8.1. Conclusion of the study

This study was conducted as a descriptive correlation study to identify the effects of the nursing students' knowledge and educational experience of cardiopulmonary resuscitation on their confidence and explore the relationship between them. From September 23rd to October 1st, 2019, 183 nursing students enrolled at V University located in City J of Province J province were targeted. The general characteristics and the extent of knowledge and educational experience of cardiopulmonary resuscitation were examined, and their correlations were analyzed. As for the data analysis, the chi-square test, t-test, and the Pearson's correlation analysis were used.

The results of this study may be summarized as follows.

1. Out of a total of 17 cardiopulmonary resuscitation related knowledge points, the 1st and 2nd years had a total score of 9.63 points, and the 3rd and 4th years had a total score of 13.2 points, and it was verified that the knowledge level of cardiopulmonary resuscitation was measured higher among the 3rd and 4th grade groups.
3. It was confirmed that there was a significant difference in the cardiopulmonary resuscitation confidence between the 1st, 2nd and 3rd years.

8.2. Recommendations of the study

Based on the results of this study, the following may be recommended.

First, since this study is a convenient extraction of the nursing students from a university located in City J of Province J, there may be limitations in generalizing the results of this study, and hence, in the future, the repeated studies based on the regional expansion of subjects are needed.

Second, the measurement of cardiopulmonary resuscitation performance in this study is not a direct measurement that measures the entire performance, yet a self-reported indirect measurement, reflecting the subject's subjectivity, is made, and there is a concern that the effect of education may not be measured objectively. Hence, further studies using the direct measurement tools for cardiopulmonary resuscitation performance are needed.

Third, the current cardiopulmonary resuscitation education of the nursing college is often limited to a one off education for the nursing education certification evaluation and certification acquisition. The cardiopulmonary resuscitation evaluation is required within 3 to 6 months after joining in order to understand the effectiveness of nursing education certification evaluation and the practical competency of new nurses for the cardiopulmonary resuscitation.

Fourth, in order to facilitate the cardiopulmonary resuscitation education, it is recommended that a proactive educational support be offered, which can prepare the conditions for such education in addition to the systematic education programs.

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10. Appendix

10.1. Authors contribution

	Initial name	Contribution
Lead Author	SH	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Corresponding Author*	ML	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑