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Relationship Between Participant's Selection Attributes, Satisfaction, and Continued Participation according to SAFETY Awareness of Water Leisure Sports

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Abstract

Purpose: *The study examines the impact of Safety Awareness on the Selection Attributes, Satisfaction, and continuation of participants' participation, which not only affects the management of Water Leisure Sports facilities but also affects the image of sports events due to safety accidents. In addition, the purpose is to provide basic data necessary for promoting Safety Awareness and developing education services and establishing specific strategies to revitalize the water leisure industry in the Water Leisure Sports industry with high growth functionality.*

Method: *In this study, 250 users of the Daegu-Gyeongbuk area water leisure center were the subjects of the study, and a questionnaire was conducted using the convenience sampling method. By adopting the self-evaluation writing method, the survey respondents were asked to see the questionnaire and mark it in the corresponding section.A valid sample is a questionnaire of 223 people using data from 250 final responders who are unresponsive or missing part of the survey. For data processing, after collecting the distributed questionnaire, data that are judged to be inadequate or unreliable in response are excluded from the research subject. After inputting the data that can be analyzed individually into the computer, statistical verification was performed with the statistical package programs SPSS Program 25.0 and AMOS 18.0 according to the purpose of data analysis. The structural equation modeling was used as an empirical statistical method.*

Results: *In this study, there was a statistically significant correlation between most of the variables, and since the values of all correlation coefficients did not exceed .8, there was no multicollinearity problem. Model goodness-of-fit verification has shown to satisfy all the goodness-of-fit indices. As a result of hypothesis verification, first, it was found that safety Safety Awareness has an effect on the Selection Attributes(β=.098, t=1.532, p<.001).Second, Safety Awareness was found to have an effect on Satisfaction(β=.117, t=2.724, p<.001). Third, Safety Awareness was found to have an effect on Continued Participation(β=.136, t=3.457, p<.001). Therefore, the following activities must be undertaken such as safe driving of Water Leisure Sports users, securing of systematically trained experts, thorough safety education before activities, expansion and financial investment of safety facilities and safety equipment, qualification training of water sports safety management personnel, and supplementation of legal systems, etc. After that, it can raises participants' sense of safety and makes them feel satisfied.Finally, it will help expand the base of Water Leisure Sports and revive related industries.*

Conclusion: *Safety Awareness was found to have a positive effect on the Selection Attributes, Satisfaction, and Continued Participation. Therefore, development and implementation of educational programs for accident prevention at Water Leisure Sports facilities or workplaces, pre-training for quick action in the event of an accident, and compensation for follow-up measures and safety education are required. In addition, related agencies need to make constant efforts to protect valuable lives and popularize Water Leisure Sports by developing safety management tasks for users through strengthening the crackdown on violations of the law and revise the regulation due to active efforts and securing many experts.*

[Keywords] ***Water Leisure Sports, Safety Awareness, Selection Attributes, Satisfaction, Continued Participation***

1. Introduction

1.1. The needs and purpose of the study

The natural environment of Korea, which has many rivers and lakes, has led to a rapid increase in the population participating in Water Leisure Sports in response to the increasing desire for leisure and the improvement of the quality level of adventure sports experience[1]. Water Leisure Sports provided an opportunity to realize that humans are a part of nature by maximizing the harmony between nature and humans, overcoming nature, and providing pleasure to modern people who prefer nature-friendly sports. In addition, it is a sport that helps improve the environment, ecology, and quality of life[2][3]. Water Leisure Sports are classified as adventure sports because they have characteristics that take place in nature[4][5]. Adventure sports have features such as enjoyment and thrill, and it is true that there is an element of danger behind it[6][7]. In Korea, water sports are continuously developing due to the gradual development and rapid increase of participants, but water accidents are increasing due to a lack of water safety management personnel and safety management Awareness among operators and users of Water Leisure Sports facilities. In particular, water leisure sports use a variety of leisure equipment and most activities take place in natural spaces where it is difficult to control, such as seas, rivers, and lakes, so if safety accidents are insufficient or if safety accidents occur, life-threatening problems occur.However, most studies were conducted in relation to safety management of water leisure sports, the re-participation of water leisure sports participants, and the service quality of water leisure sports operators.

Therefore, in this study, we investigate the effects of safety awarness, which not only affects the management of Water Leisure Sports facilities, but also declines of the image of sports events due to safety accidents and the avoidance of participants, on the participant's Selection Attributes, Satisfaction, and Continued Participation. The purpose of this study is to raise Safety Awareness in the Water Leisure Sports industry with high growth capabilities, and to provide basic data necessary for the development of educational services and establishment of specific strategies for revitalizing the water leisure industry.

1.2. Theoretical background and study hypotheses

Safety Awareness is a state of mind that is aware of something and clearly knows one's actions or conditions. In this study, it is the cognition or awareness of safety that is held to prevent accidents exposed to water activities[8].

Selection Attribute refers to a relatively specific meaning representing the physical and observable properties of a product[9]. The Selection Attribute also means how attitudes toward product attributes differ from customers' preferences and purchases, and how these are distinct from other attributes[10]. In addition, attributes represent unique attributes belonging to the target, and selection attributes are influential factors in the selection process, often resulting from different choices made by respondents to the comparison, typically tangible intangible properties inherent in the product or service[11].

Satisfaction is an evaluation of whether the selected alternative is consistent with prior beliefs about the alternative[12]. In a conceptual sense, the result of the purchaser's comparison of the purchase cost and the actual compensation for the result expected by the customer as a result of purchase or experience of use. In a practical sense, it is the sum of satisfaction for various attributes of a product or service[13].

Continued Participation or re-engagement refers to an individual's expected or planned future behavior, which can be said to be the probability that beliefs and attitudes have been transferred to the

behavior. Consumers' intention to purchase means the possibility of repurchase or revisit of a product or store, or the high possibility of voluntarily recommending its use to others[12]. The intention to continue to participate in sports activities is to indicate whether or not to continue to participate in the sport in the future rather than in the past or present, and to express a continuous intention by various factors[14].

Hypothesis 1. Safety Awareness will affect the Selection Attributes.

Hypothesis 2. Safety Awareness will affect your Satisfaction.

Hypothesis 3. Safety Awareness will affect Continued Participation.

2. Research Methods

2.1. Subjects and sampling technique

In this study, 250 users of the Daegu-Gyeongbuk area water leisure center were the subjects of the study, and a questionnaire was conducted using the convenience sampling method. By adopting the self-evaluation writing method, the survey respondents were asked to see the questionnaire and mark it in the corresponding section. Of the 250 responses that were finally collected, 223 questionnaires were taken as valid samples, excluding the data for which the response was poor or part of the survey contents was omitted.

2.2. Measurement method

A questionnaire was used as a measuring tool used in this study. The questionnaire used in Noh(2016) and Bae(2020)'s research was used for Safety Awareness[15][16], and the Selection Attributes used the questionnaire used in Kim(2008)'s research[4]. The questionnaire used in Spreng, Mackenzie & Olshavsky(1996)[17], Taylor & Baker(1994)'s research was used for Satisfaction and the Continued Participationused the questionnaire used in Bitner(1992)'s research[18][19]. Note that in the preceding study, the factor analysis overall showed that the factor loadings for each factor were .05 or higher, and the Cronbach's α coefficient was .07 or higher.

2.3. Validity and reliability of the questionnaire

For the questionnaires used in this study, the prior study showed that the factor loadings of each factor were .05 or higher, and the reliability test showed that the Cronbach's α coefficient was .07 or higher, verifying its validity. In this study, the confirmatory factor analysis results for each study variable were found that Safety Awareness were TLI .934 CFI .948, RMSEA .072, and the Selection Attributes were TLI .915 CFI .933, RMSEA. 077, Satisfaction was TLI .973 CFI .966 RMSEA .070, Continued Participation was TLI .928 CFI .941, RMSEA .076. CFI, TLI, GFI was .9 or more, and RMSEA was .08 or less. It was confirmed that the model satisfies the goodness-of-fit criterion[20]. In addition, since both conceptual reliability and variance extraction index values exceed both .7 and .5, concentration validity is judged to have no problem[21][22]. In addition, as a result of verifying Cronbach's α coefficient for reliability analysis, it was confirmed that there is no problem as a measurement tool, all of which are above .7.

2.4. Analysis of data

The data processing in this study excluded poorly responding or unreliable data from the study. After inputting the data that can be analyzed into a computer, statistical verification was performed using the statistical package programs SPSS Program 25.0 and AMOS 18.0 according to the purpose of data analysis as follows.Frequency analysis and reliability analysis and correlation analysis of study variables used SPSS Program 25.0 to find out the general characteris-

tics of the subject. Using AMOS 18.0, a structural equation model was conducted to verify the relationship between the Safety Awareness factor, the Selection Attribute factor, the Satisfaction factor, and the participation persistence factor, and to verify the relationship between the Safety Awareness factor, Selection Attribute factor, Satisfaction factor, and Continued Participationfactor.

3. Results

3.1. Correlation

Table 1. Correlation.

	1	2	3	4
Safety awareness	1			
Selection attribute	.267**	1		
Satisfaction	.252**	.385***	1	
Continued participation	.243**	.364***	.392***	1

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

<Table 1> shows that there is a statistically significant correlation between most of the variables as a result of correlation analysis, and since the values of all correlation coefficients did not exceed .8, there was no multicollinearity problem.

3.2. Verification of the fitness of the measurement model

Table 2. Goodness of fit index of the measurement model.

	$x2$	df	CFI	TLI	RMSEA
Model fit index	109.349	63	.974	.956	.065

<Table 2> shows the results of verifying model suitability as TLI=.956, CFI=.974, and RMSEA=.065, indicating that all the fit indices were satisfied.

3.3. The results of hypothesis test

Table 3. Results of structural equaling modeling analysis.

	Path	Estimate	S.E.	t-value	
H1	Safety awareness→ Selection attribute	.098	.128	1.532***	Accept
H2	Safety awareness→ Satisfaction	.117	.135	2.724***	Accept
H3	Safety awareness→ Continued participation	.136	.074	3.457***	Accept

Note: ***p<.001.

<Table 3> validates the hypothesis, and the analysis of the structural equation modeling for Hypothesis 1 shows that first, Safety Awareness has a positive effect on selection properties(β=.098, t=1.532, p<).001). Second, as a result of the structural equation modeling analysis for Hypothesis 2, it was found that Safety Awareness had a positive effect on Satisfaction(β=.117, t=2.724, p<.001). As a result of the structural equation modeling analysis for Hypothesis 3, third, Safety Awareness was found to have a positive effect on the Continued Participa-

tion(β=.136, t=3.457, p<.001). Therefore, it can be confirmed that all hypotheses in this study were adopted.

4. Discussion

Safety Awareness, Selection Attributes, Satisfaction, and Continued Participation are shown to be related. In the case of water sports, it is an adventure sport with a high incidence of safety accidents due to athletic injuries or operational equipment. Many studies have shown that risk perception or safety perception affects participants' immersion or participation, and differences in risk perception or safety perception affect satisfaction through positive or negative emotional responses, which may again affect continuous participation. In other words, the degree of perception of risk in water leisure sports activities can affect participation itself and post participation behavior.

Therefore, safety management and prevention of safety accidents in marine and Water Leisure Sports sites should be preceded by reinforcing safety education for consumers, and cultivating the expertise of professionals who conduct safety education, rather than simply institutionalizing operators and institutions[23]. Emergency measures in case of an accident are also important, but the most important is accident prevention, so wearing correct safety equipment, prohibiting excessive operation, and sufficient warm-up exercise can be said to be the preventive measures for injuries[24].

Before participating in Water Leisure Sports, participants must first grasp the safety status and then participate in the actual exercise, inform the relevant participants of their physical and psychological status, and be aware of the possibility of safety issues, and always have a posture of deciding whether to participate[25][26].

In addition, the safety cognition or awareness of water and marine sports participants play a decisive role in preventing safety accidents, and since safety attitudes have a great positive effect on safety participation, it is judged that water and marine leisure sports participation will be more active and lead to many developments. Moreover, since safety accidents are also undergoing changes in the sports situation or in the times, evaluation models for safety management must also evolve and change based on safety-related programs operated in sports facilities including various sports events for safety management[25][27]. It is desirable to encourage people to participate in these activities while eliminating or minimizing risks or risk factors that may occur in Water Leisure Sports[3]. Plus, digital technology has been widely introduced and developed in the sports industry[29], and since the combination of network, digital technology, and sports industry will improve in the future, it can be a good way to provide education using digital for safety and risk related areas.Risk and safety in water leisure sports activities are the basic areas inherent. The danger is the potential to lose something valuable, and it is a critical factor that causes challenges and competition in water leisure sports. However, it is more likely that risk perception or safety awareness itself will perform other actions prior to performance rather than directly affecting the behavior after participation. It is significant that water leisure sports participants can experience sufficient satisfaction only when individual and physical risk factors are removed rather than specialized courses. In other words, water leisure sports venues need to be equipped with an environment that can induce safe participation and eliminate risk factors that may arise from the skill acquisition process and environmental factors. In addition, in order to enhance the expertise of the participants, the procedure of performing step-by-step tasks must be faithfully implemented to induce service satisfaction[30].

The provision of safety services at water leisure sports facilities, customer satisfaction, and intention to repurchase are factors that influence important interrelationships. Safety service quality at water leisure sports facilities is a factor that should be secured first from the operator's point of view. It is a factor that influences customer behavior. Accordingly, the water leisure sports facility operator should continuously research ways to improve safety service qual-

ity and ensure the safety of customers, thereby removing the element of resistance to purchase. In addition, it is necessary to manage the quality of safety services and develop programs to improve the customer satisfaction and recurrence intention and to make full efforts to improve the quality of service when the water leisure sports facility operates.

Finally, the following activities must be undertaken such as safe driving of Water Leisure Sports users, securing of systematically trained experts, thorough safety education before activities, expansion and financial investment of safety facilities and safety equipment, qualification training of water sports safety management personnel, and supplementation of legal systems, etc. After that, participants' cognition and awareness of safety increases.This will not only become a major factor in choosing a Water Leisure Sports facility, but also lead to Satisfaction and Continued Participation in the overall operation of the facility, ultimately helping to expand the base of Water Leisure Sports and revitalize related industries.

5. Conclusion

In this study, I looked at the Safety Awareness of Water Leisure Sports participants and the relationship between Selection Attributes, Satisfaction, and Continued Participation. Also, the purpose of this study is to raise awareness of safety in the Water Leisure Sports industry with high growth functionality, and to provide basic data necessary for the development of educational services and establishment of specific strategies for revitalization of the water leisure industry.

For this, In this study, 250 users of the Daegu-Gyeongbuk area water leisure center were the subjects of the study, and a questionnaire was conducted using the convenience sampling method. By adopting the self-evaluation writing method, the survey respondents were asked to see the questionnaire and mark it in the corresponding section. Of the 250 responses that were finally collected, 223 questionnaires were taken as valid samples, excluding the data for which the response was poor or part of the survey contents was omitted.

For data processing, after collecting the distributed questionnaire, data that are judged to be inadequate or unreliable in response are excluded from the research subject. After inputting the data that can be analyzed individually into the computer, statistical verification was performed with the statistical package programs SPSS Program 25.0 and AMOS 18.0 according to the purpose of data analysis. Using the structural equation model as an empirical statistical method, the following conclusions are obtained:

First, Safety Awareness had a positive effect on the Selection Attributes.

Second, Safety Awareness was found to have a positive effect on Satisfaction.

Third, Safety Awareness was found to have a positive effect on Continued Participation.

Therefore, development and implementation of educational programs for accident prevention at Water Leisure Sports facilities or workplaces, pre-training for quick action in the event of an accident, and compensation for follow-up measures and safety education are required. In addition, related agencies need to make constant efforts to protect valuable lives and popularize Water Leisure Sports by developing safety management tasks for users through strengthening the crackdown on violations of the law and revise the regulation due to active efforts and securing many experts.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Lead Author	HC	-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*	CP	-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 the Lower Limb Muscles' Function for the Prevention of KNEE JOINT INJURIES of the Intramural Baseball Pitchers of Colleges and Universities

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Abstract

Purpose: *The purpose of this analysis is to provide the basic data for the prevention of knee joint damages by analyzing differences in the isokinetic muscular function of knee joints as per the pitching speed of 21 intramural baseball players of colleges and universities.*

Method: *The subjects of this study were 21 intramural baseball players of colleges and universities, whose length of experiences were 2 to 7 years. By measuring the pitching speed, they were classified as S1 group whose maximum ball speed was 110km/h or greater, S2 group whose maximum ball speed was less than 110km/h to 100km/h or greater, and S3 group whose maximum ball speed was less than 100km/h, respectively. The isokinetic muscular strength of knee joints was measured for all of the 3 groups, and the strength of the left and right flexors and extensors were measured at 60°, 180°, and 240°, respectively. The data processing for this study was performed by using the SPSS 18.0 statistical program to calculate the mean and standard deviation for each of the items, and the one-way ANOVA was performed to compare the differences for each item by group, while using the Tukey method as an ex post analysis between the groups. Furthermore, the multiple linear regression was performed to identify the influence of the isokinetic muscular function of knee joints according to the angular speed on the pitching speed. The statistical significance level was set to $p<.05$, respectively.*

Results: *The results of measuring the isokinetic muscular strength of knee joints are as follows. As for the PT and WPR measured at an angular speed of 60°, the S1 group turned out to be significantly higher($p<.05$) in the left flexors and extensors than S3 group. As for the PT and WPR measured at an angular speed of 180°, the S1 and S2 groups turned out to be significantly higher($p<.05$) in the left extensors than the S3 group. As for the PT measured at an angular speed of 240°, S1 and S2 groups in the left extensor turned out to be significantly higher($p<.05$) than S3 group. As for the WPR, S1 group turned out to be significantly($p<.05$) higher than S3 group. The results of performing the multiple linear regression are as follows with a view to discover the effect of isokinetic muscular strength of knee joints on the pitching speed. At the angular speeds of 180° and 240°, the regression segments of the left knee joint extensors for both the PT and WPR turned out to have a significant effect at the 5% level. R2, which is the explanatory power of the regression model which explains changes in the pitching speed for the left knee joint extensors, turned out to have an explanatory power in the range of 37.9-55.5%, respectively.*

Conclusion: *Gathering the results above, it turned out that the higher the pitching speed for the group, the superior the muscular function, and in particular, the extensors on the left side demonstrated such remarkably pronounced characteristics. Such results suggest that the extensor muscles could influence the pitching speed for the stretching motion(acceleration) of the left legs during the pitching. Furthermore, in order to prevent injuries, attention ought to be paid to strengthening the counter muscular of the muscles which are primarily used.*

[Keywords] ***Knee Joint, Isokinetic Muscular Strength, Muscular Function, Intramural Baseball Pitchers of Colleges and Universities, Pitching Speed***

1. Introduction

In the baseball games, pitchers use the muscles of the upper limbs, lower limbs, and the trunk of their body, while pitching balls via rotation, flection, and extension exercises focused on the joints. If the pitching motion would be described in 6 steps, they may be classified into wind-up, early cocking, late cocking, acceleration, deceleration, and follow-through[1].

In particular, since the lower limbs are adjoined to the ground while the ball is pitched, they influence the stability and balance of the movements, and as the feet begin to naturally land on the ground in the early cocking of the pitching movement, the ball speed begins to gather the power which determines the speed. Towards the end of the accelerator after the late cocking, the ball is released from the hand, while the leg of axis is stretched. Thereafter, pitching comes to completion with the deceleration and follow-through. In such pitching movement, the role of the lower limbs operates as a lever and influences the speed and the control of ball[2]. Furthermore, as for such a phenomenon, when the ball is released, a large load is applied due to the flection of knee joints, and if the ratio of the extension and flection muscles is not congruent, the risk of injuries might rise[3].

Examining the previous studies in Korea, Shin and Kim(2018), who reported damages of youth baseball players, understood the fact that the shoulder and elbow injuries are the movements connecting the lower limbs, trunk, and the upper limbs as one, and claimed that there was a possibility of phased-in movements causing injuries to other areas[4]. Kim and Gong(2019), reported that, as for the shoulder and elbow injuries, baseball players demonstrated weakened muscular joint functions of the lower limbs[5].

Furthermore, the studies of the range of motion include, a study on the difference between hip joints, muscular strength of knee joint, and ROM according to the length of the functional lower limbs of baseball pitchers[6], effect of shoulder stabilization exercises for the increased range of motion and the correction of shoulder imbalances for the adolescent baseball players[7], and the effects of a combination of the movement and joint mobilization on the range of motion, extent of pains, and functional performance of adolescent baseball players struggling with the internal collision syndrome for shoulder joints[8], while reporting that the better the range of motion, the better the muscular function, with the increased ball speed. As for the studies related to the evaluation of the isokinetic muscular strength of the lower limbs, there was a study stressing the need for establishing a standard value for the muscular strength evaluation[9], while there were many papers pertaining to the movement analysis of the baseball players.

The recent representative papers include a kinematic analysis of the batting motion of elite college baseball players and unskilled students[10], analysis of the joint moments of the left and right legs during the pitching motion of baseball pitchers[11], and the kinematic comparison of the batting movements of professional baseball players[12], among others. In addition, other research papers such as muscle activity and plantar pressure analysis have been reported or in progress.

As for the previous studies overseas, there were many studies related to the shoulders and elbows related to the pitcher, and the most recent representative studies include a study of pelvic control and lower limb injuries of professional baseball pitchers[13] and a study related to the induction of shoulder and elbow injuries of high school baseball pitchers[14]. As for the research related to the pitchers and knee joints, a study related to the knee angle and stride according to the ball speed of youth baseball pitchers[15] and a study of the knee pain's relevance to back pains[16] have been reported.

As examined, as for the baseball pitchers, research has been mainly focused on optimizing the conditions for the movements of upper limbs, trunk, and lower limbs to speed up the ball speed. In particular, there are many kinematic studies on the upper limbs for the pitchers, yet the studies on the role of lower limbs, whose importance has been emphasized for the pitching movements, are still inadequate.

Therefore, the purpose of this study is to provide the basic data on the prevention of injuries by analyzing the differences between the isokinetic muscular function of knee joints according to the ball speed with a view to prevent knee joint injuries for the intramural baseball pitchers of colleges and universities.

2. Methodology

2.1. Subject of study

This study was performed against 21 pitchers in their 20s who have had no prior history of diseases and illnesses during the past year as intramural baseball players of colleges and universities with 2 to 7 years of experiences in city D. By measuring their pitching speed, 7 people were assigned to each of the 3 groups S1, S2, and S3, respectively <Table 1>.

Table 1. Physical characteristics of the subjects.

Group	Age (yr)	Height (cm)	Weight (kg)	Experiences (yr)
S1(n=7)	24.57±1.99	178.29±3.77	80.00±19.22	4.43±1.99
S2(n=7)	23.14±1.77	177.86±4.56	80.86±16.09	3.14±0.90
S3(n=7)	22.57±2.70	176.00±4.32	67.00±7.28	3.57±1.81

Note: Values: mean ± SD. S1 = Fast speed group(100/km/hor more), S2 = Middle speed group(less than 110km/h and 100km/hor more), S3 = Slow speed group(less than 100km/h).

2.2. Measured items

Table 2. Measured items.

Classification	Measured item	Tool
Measurement of isokinetic muscular strength	Knee joint; left, right, extensor, flection	Measuring instrument of isokinetic muscular strength

2.3. How to measure the pitching speed

Using a speed gun(Jugs Pro-Sports Digital Radar Gun, USA), the pitching speed was measured from the official pitcher's mound at a distance of 18.44m to the home plate, and a warm-up for 20 minutes was performed before pitching and 20 catch balls per individual were performed, with the shoulders adequately relaxed and 10 practice pitches were carried out. The maximum ball speed and the average ball speed of the full strength pitching and ball controlling pitching were calculated by measuring only 10 full strength pitches and 10 ball controlling pitches for a total of 20 initial velocity.

2.4. How to measure the isokinetic muscular function

As for the isokinetic muscular function test, Humac Norm(CSMI, US A) was used, and the peak torque(PT) and the work per repetition(WPR) of left and right knee joint extensors and flections at the angular speeds of 60°, 180°, and 240° were measured, while the unit was recorded as Nm.

2.5. Experimental procedures

As for the knee joints' flection and extensor test, the subjects were seated on the examination table, then their upper bodies were fixed for a correct posture. For the adaptation to the testing equipment, 3 exercises were performed before testing, and as for the number of measurements taken for each speed, 5 measurements were taken for the angular speed of 60°/sec, 5 measurements were taken for the angular speed of 180°/sec, and 25 measurements were taken for the angular speed of 240°/sec. The break time between the measured items was 30 minutes or more, which was carried out for both legs alternately.

2.6. Statistical processing

The data processing of this study was performed by using the SPSS 18.0 statistical program, and the mean and standard deviation for each measurement item were calculated. The one-way ANOVA was implemented to compare the difference of each measurement item according to the group, and the Tukey method was used for the ex post analysis between the groups. Furthermore, the multiple linear regression(MLR) was performed to investigate the effect of the isokinetic muscular strength of knee joints according to the angular speed on the pitching speed. The statistical significance level was set to $p<.05$, respectively.

The results of analyzing the isokinetic muscular function of knee joints according to the pitching speed for each speed for the intramural baseball players of colleges and universities are as follows.

3. Results

3.1. Analysis of the PT for the isokinetic muscular strength of knee joints for the angular speed

3.1.1. Analysis of the PT for the isokinetic muscular strength of knee joints for the angular speed of 60°

As for the results of the peak torque for the isokinetic muscular strength of knee joints for each group measured at an angular speed of 60°, as illustrated in <Table 3>, the extensors and flexors of the left knee joints turned out to be significantly higher for S1 group than for S3 group($p<.05$), respectively.

Table 3. Comparison of the groups of the peak torque measured at an angular speed of 60°.

Group	Knee(RE)	F	Knee(LE)	F	Knee(RF)	F	Knee(LF)	F
S1	213.80±64.92	.999	232.00±34.20	6.022**	126.00±59.09	.505	127.40±20.51	4.138*
S2	205.17±36.19		192.33±32.87		125.00±21.14		117.83±19.90	
S3	176.50±37.14		169.50±22.11		106.33±26.50		96.50±14.76	
			3 < 1				3 < 1	

Note: Values : mean ± SD, *p<.05, **p<.01.

RE=Right extention, RF=Right flection, LE=Left extention, LF=Left flection.

3.1.2. Analysis of the PT of the isokinetic muscular strength of knee joints at an angular speed of 180°

The results of the peak torque for the isokinetic muscular strength of knee joints of the players among the groups measured at an angular speed of 180° turned out to be significantly higher($p<.05$) for S1 group than for S2 and S3 groups in the extensors of the left knee joints as illustrated in <Table 4>.

Table 4. Comparison of the groups of the peak torque measured at an angular speed of 180°.

Group	Knee(RE)	F	Knee(LE)	F	Knee(RF)	F	Knee(LF)	F
S1	151.80±39.99		164.60±19.53		94.80±35.02		96.00±19.58	
S2	139.50±24.09	1.065	131.00±19.49	8.733**	97.33±17.80	.557	92.17±14.47	1.236
S3	126.67±20.36		122.50±12.66		83.50±17.74		82.67±9.22	
			2, 3 < 1					

Note: Values : mean ± SD, *p<.05, **p<.01.

3.1.3. Analysis of the PT of the isokinetic muscular strength of knee joints at an angular speed of 240°

The results of the peak torque for the knee joint muscular strength of the players among the groups measured at an angular speed of 240° turned out to be significantly higher(p<.05) for S1 group than for S2 and S3 groups in the extensors of the left knee joints as illustrated in <Table 5>.

Table 5. Comparison of the groups of the peak torque measured at an angular speed of 240°.

Group	Knee(RE)	F	Knee(LE)	F	Knee(RF)	F	Knee(LF)	F
S1	140.80±35.53		154.80±14.34		88.40±21.00		90.40±20.97	
S2	125.83±22.32	1.181	123.33±21.91	8.508**	92.50±15.14	1.064	89.67±14.90	1.130
S3	116.17±21.56		112.83±13.88		78.50±15.19		77.67±12.64	
			2, 3 < 1					

Note: Values : mean ± SD, *p<.05, **p<.01.

3.2. The impact of the left flexors and extensors of the isokinetic muscular strength of knee joints by angular speed on the pitching speed

The multiple linear regression(MLR) was performed to investigate the impact of the flexors and extensors of the isokinetic muscular strength of knee joints on the pitching speed by angular speed. The results of analyzing the impact of each factor on the pitching speed are as follows.

3.2.1. The multiple linear regression(MLR) analysis of the PT of the left knee joint for an angular speed of 60°

<Table 6> is a result of analyzing the impact of the PT of the left knee joint measured at an angular speed of 60° on the pitching speed, and it turned out that the PT of the left knee joint measured at an angular speed of 60° did not significantly impact the pitching speed.

Table 6. The MLR analysis of the left knee' joint's peak torque at an angular speed of 60°.

Dependent / Independent	Maximum speed			
	b	SE	β	t
(Constant)	62.701	10.800		5.806
Knee_LE	.097	.090	.352	1.079
Knee_LF	.192	.158	.397	1.217
R2	.511			
F	7.312**			

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

3.2.2. The multiple linear regression(MLR) analysis of the PT of the left knee joint at an angular speed of 180°.

<Table 7> is a result of analyzing the impact of the peak torque of the left knee joint measured at an angular speed of 180° on the pitching speed. The regression segment of the left knee joint's extensors(β=.704) turned out to have a significant impact at a level of 5%, which also turned out to have an explanatory power of 50% with R2=.500, which is an explanatory power of the regression model explaining the changes in the pitching speed according to the left knee joint's extensors.

Table 7. The MLR analysis of the left knee joint's peak torque at an angular speed of 180°.

Dependent / Independent	Maximum speed			
	b	SE	β	t
(Constant)	61.286	12.801		4.788
Knee_LE	.303	.113	.704	2.678*
Knee_LF	.003	.186	.004	.016
R2	.500			
F	9.989**			

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

3.2.3. The multiple linear regression(MLR) analysis of the PT of the left knee joint at an angular speed of 240°

<Table 8> is a result of analyzing the impact of the left knee joint peak's torque measured at an angular speed of 240° on the pitching speed. The regression segment of the left knee joint extensors(β=.628) turned out to have a significant impact at a level of 5%, which also turned out to have an explanatory power of 49.8% with R2=.498, which is an explanatory power of the regression model explaining the changes in the pitching speed according to the left knee joint's extensors.

Table 8. The MLR analysis of the left knee joint's peak torque at an angular speed 240°.

Dependent / Independent	Maximum speed			
	b	SE	β	t
(Constant)	61.539	11.941		5.154
Knee_LE	.274	.103	.628	2.657*
Knee_LF	.076	.152	.118	.501
R2	.498			
F	6.942**			

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

4. Discussion

In this study, with a view to discover the impact of the isokinetic muscular strength of knee joints on the pitching speed, the isokinetic muscular strength of the left and right extensors and flections according to the pitching speed for each speed was measured and compared. Moreover, to understand the impact of the extensors and flections of the left lower limbs' muscular strength, a multi linear regression analysis was performed. The discussion based on the result is as follows.

4.1. Isokinetic muscular strength of knee joints

4.1.1. The isokinetic muscular strength of knee joints: at an angular speed of 60°

At an angular speed of 60°, the peak torque and work per repetition of <Table 9> for the knee joint of the lower limbs turned out such that, the groups having a high ball speed had a significantly high muscular strength in both the extensors and flections on the left side. However, the right knee joint did not yield any significant results. Such results suggest that the groups having a high ball

speed in terms of the lower limbs' muscular strength have a high muscular strength for the left extensors and flections. In particular, in baseball games, it is apparent that the muscular strength of the left side of the lower limbs is used far much more than that of the right side for the pitcher's pitching movement. As a similar study, as a result of measuring the isokinetic muscular strength of the pitcher's shoulder joint, it was reported that the muscular strength was significantly higher in the left and right extensors[17][18]. The interpretation is that, as for the pitcher's pitching movement, it is primarily caused by throwing the ball with the trunk, with the possibility of the difference between the arms and legs used and the tilt causing the impact. As such an imbalance of the muscular strength brings the risk of injuries if excessively used, strengthening the weakened muscles will likely help reduce the load on the joints[19][20].

Table 9. Comparison of the groups of work per repetition measured at an angular speed of 60°. [Unit: Nm]

Group	Knee(RE)	F	Knee(LE)	F	Knee(RF)	F	Knee(LF)	F
S1	214.00±49.76		228.50±34.38		141.67±44.84		134.00±21.86	
S2	219.80±68.53	1.167	209.00±44.45	4.648*	137.40±40.28	1.528	134.80±29.56	5.588*
S3	176.50±37.14		169.50±22.11		106.33±26.50		96.50±14.76	
			3 < 1				3 < 1, 2	

Note: Values : mean ± SD, *p<.05, **p<.01.

4.1.2. The isokinetic muscular strength of knee joints: at the angular speeds of 180° and 240°

At the angular speeds of 180° and 240°, the peak torque and work per repetition of the knee joints of the lower limbs of <Table 10> and <Table 11> turned out such that, the groups having a high ball speed had a significantly high muscular strength in the extensors on the left side. However, there were no significant results in the flections and extensors of the left knee joint's flections and the right knee joint's flections. Such results suggest that the groups having a high ball speed have a high muscular strength for the extensors on the left side. In particular, in baseball games, it suggests that the propulsion of a ball can be improved in the movement of spreading the legs while the pitcher is pitching. For the pitching mechanism, to transmit the momentum from the lower body to the throwing arm, the ground must be pushed even stronger, and to transmit the momentum while pitching, an appropriate sequence of the pelvic and trunk movements is required, with the force beginning from the extensor muscles of the lower limbs[21][22].

Table 10. Comparison of the groups of work per repetition measured at an angular speed of 180°. [Unit: Nm]

Group	Knee(RE)	F	Knee(LE)	F	Knee(RF)	F	Knee(LF)	F
S1	80.20±47.33		200.00±21.84		113.60±32.91		121.00±25.53	
S2	163.50±33.17	1.041	158.67±26.23	8.916**	114.33±20.79	.488	111.50±17.82	2.029
S3	148.33±28.88		144.67±17.82		101.00±24.25		97.33±15.68	
			2, 3 < 1					

Note: Values : mean ± SD, *p<.05, **p<.01.

Table 11. Comparison of the groups of work per repetition measured at an angular speed of 240°. [Unit: Nm]

Group	Knee(RE)	F	Knee(LE)	F	Knee(RF)	F	Knee(LF)	F
S1	121.20±14.60		132.20±15.25		71.40±11.01		72.40±19.57	
S2	105.33±16.07	2.165	112.50±24.91	4.216*	73.67±14.98	.261	73.83±14.36	.426
S3	101.33±18.18		98.50±14.98		67.67±16.38		66.00±12.84	
			3 < 1					

Note: Values : mean ± SD, *p<.05, **p<.01.

4.2. The isokinetic muscular strength of knee joints and ball speed by angular speed

At an angular speed of 60°, the PT and WPR of the left knee joint turned out to have no significant impact on the pitching speed. However, in the case of the angular speed of 180° <Table 12>, the peak torque and work per repetition of the left knee joint turned out to have a significant impact on the pitching speed, which also turned out to have an explanatory power of 50-55.5%, which is an explanatory power of the regression model explaining the changes in the pitching speed according to the left knee joint's extensors. As for the angular speed of 240° <Table 13>, the peak torque and work per repetition of the left knee joint turned out to have a significant impact on the pitching speed, which also turned out to have an explanatory power of 37.9-49.8%, which is an explanatory power of the regression model explaining the changes in the pitching speed according to the left knee joint's extensors. Such results suggest that, as for the pitcher's pitching movement in baseball, the force begins from the phase of stepping on the ground to the early cocking to acceleration of pushing away the ground, determining its size[23][24]. Furthermore, the force which began from the ground leads to the pelvis, core, upper body, and the throwing arm[25].

Table 12. The MLR analysis of the left knee joint's work per repetition at an angular speed of 180°.

Dependent / Independent	Maximum speed			
	b	SE	β	t
(Constant)	64.140	10.486		6.117
Knee_LE	.294	.103	.880	2.865*
Knee_LF	-.088	.154	-.175	-.570
R2	.555			
F	8.719**			

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

Table 13. The MLR analysis of the left knee joint's work per repetition at an angular speed of 240°.

Dependent / Independent	Maximum speed			
	b	SE	β	t
(Constant)	68.538	12.789		5.359
Knee_LE	.256	.109	.554	2.352*
Knee_LF	.082	.165	.117	.497
R2	.379			
F	4.277*			

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

5. Conclusion

As a result of analyzing the isokinetic muscular function of knee joints according to the pitching speed of the intramural baseball pitchers of colleges and universities, the following conclusions were reached. The faster the pitching speed, the superior the muscular function. In particular, the extensor on the left turned out to be even more apparent as a matter of characteristic. Such results suggest that the extensor muscles might impact the pitching speed in the spreading movement(acceleration) of the left leg while pitching. Furthermore, to prevent injuries, care and attention ought to be given to strengthening the counter muscles of the muscles which are primarily used.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Author	WC	-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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A Study on Military Makeup Design With Camouflage Characteristics during CRISIS

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Abstract

Purpose: *Since the beginning of times, humans have had to deal with food, clothing, and shelter. As they evolved and progressed, they did not have any medium of protection when dangers emerged from the environment, like animals. The origins of the army, was as a group of humans who had to protect themselves. Camouflage started when humans had to protect themselves from other humans, rather than animals or external factors, so they needed an additional protection apart from weapons.*

Method: *This study concluded that military camouflage pattern characteristics were concealment, display, and distortion, respectively. Based on these features, camouflage makeup patterns were conceived. Concealment is hiding in order to permeate terrain in a war; showiness is a means of showing one's rank or situation by means of a military uniform; and distortion is similar showing a distorted appearance by concealing it.*

Results: *Based on Camouflage Art, which shows us as if we're one in our surroundings. Using the camouflage characteristics of the military look, three works were made with makeup, symbolic colors were added to make each characteristic visible, and objects were used to express them.*

Conclusion: *This work is a research on makeup patterns that use protective media such as camouflage in crisis. It is believed that this study can have a good influence not only in the industrial application of beauty but also in the military and fashion circles.*

[Keywords] ***Military Look, Camouflage, Concealment, Showiness, Distortion***

1. Introduction

1.1. Study purpose

Since the beginning of times, humans have used agriculture and hunting to solve food, clothing, and shelter. In addition to hunting tools, they made tools for survival, but they had no medium to protect themselves. Humans faced increasing danger and pursued a desire for survival[1]. As they progressed in the survival battle, they began to create groups that could protect them from their opponents that were humans instead of only animals. This became the beginning of the military and created clothing and techniques that were advantageous for war. As a result, it can be said that military look has been developing and progressing. In war, not only skills were necessary, but also hiding was required, and this was the beginning of camouflage.Among the wide range of crisis types, various academia are studying to develop a national system for crisis management that encompasses human and natural disasters. However, the importance of military crisis management in charge of the national security crisis, which is a key area of comprehensive crisis management, has fallen a little behind.The reason is that the overall tendency of the military is being injected into the wartime management organization[2].

The purpose of this study is to reinterpret camouflage characteristics as a work by citing concealment, showiness, and distortion derived from the research of Choi JH(2013) and Hwang EJ(2010) among the comprehensive concepts of military look.

The purpose is to study a new pattern plan for camouflage that adapts to the terrain(for camouflage) of military uniforms, and to reinterpret them as makeup suitable for military style and transform them into works.

In the study of these works, it is meaningful that the camouflage characteristics express beauty in harmony with the military look. In addition, it is meaningful to devise new camouflage patterns derived from camouflage features and based on makeup reinterpretation. These works will contribute to the development of the beauty industry, create public value for military culture innovation, and be used in various industries other than the beauty industry[3].

This work was conducted in the following order.

First, we examine the definition and history of military look, organize the concept of camouflageaccordingly, and define makeup.

Second, we derive the characteristics of the camouflage pattern shown in the military look and uses it to create a draft.

Third, we produced, explained, and defined our work.

2. Theoretical Background

2.1. Military

Military Look is an active clothing worn by soldiers participating in the war and is said to be a special outfit worn for the purpose of protecting one's body[4]. The symbolic meaning of this, that is, the function of keeping the command and order in the army, the function of communion that makes you feel comradeship, the function of class indication, the function of protecting the body, the function of indicating that you are a member of the group you belong to, etc. have persisted over time[5]. n addition, military look transcends times in a broader sense and refers to all kinds of outfits that apply designs to clothes worn during warfare. It refers to clothes that emphasize elements of the military look[6]. This has a characteristic effect on the clothing of ordinary people as well as in war. In the stage of entering into combat posture, the functionality for enhancing combat power is important, but display and dignity are important in the process of preparing and executing peace or battle, and decoration is required as a means for hierarchy and order[7].

Military uniforms are classified according to the characteristics of each group, such as army look, marine look, air force look, and the pilot look worn by air force captains, and for officers and It is classified as private. Combat uniforms should require practical and comfortable performance regardless of wartime or peace, but formal and ceremonial clothes, rather than practicality, need a symbolic meaning according to the system rather than practicality. Thus, the decorative elements of military uniforms express symbolic meaning through clothing[8]. Starting with military uniforms, the military look has been reborn as fashion[9], and in the current fashion market, representative decorations of military look such as camouflage patterns, emblems, metal buttons, pockets, and buckles are often used. The most widely used colors are representative colors of military look, khaki or brown[8]. Identifying and analyzing colors and colors that have been used in military look design at the end of the century is thought to be an important clue in color planning for fashion companies and effectively expressing military look design as a product[10].

2.2. Camouflage

Camouflage is a word derived from the French camoufler(disguise) and is said to have been used by hunters to protect themselves from predators before being used in war[11]. In addition to the

teeth and claws of animals, hunters discovered that they can use animal fur colors as protection. Taking different colors and patterns of animals, for example, weak animals have a protective color that harmonizes with the surrounding environment, but mainly the strong and fast-moving beasts disperse from distant places with dark stripes or spots. Each had a unique camouflage pattern to make it look like[12]. In the case of animal camouflage, shape as well as color are one of the main factors[13].

As such, the most basic technique of camouflage is to merge with the surrounding environment, and to conceal the movement of people, weapons, equipment, and facilities from the other party by inserting leaves, grass, ears, etc. As a method of disproportionately coloring colors[14], it was found that the shape was hidden or eliminated by mixing the main boundary lines into other shapes[15]. Along with colors and patterns, there is a form as a visual element of camouflage[14]. At the end of World War I in France, as camouflage became popular after the war as it included civilian meaning, camouflage went beyond social deception and naturally entered the category of military[16]. As the characteristics of the product emerged, it had a great influence on popular culture[17]. The war began with the painting of tanks, ships and planes in environmental-like colors for reconnaissance in case of a crisis[18], and by World War II countries had actively used camouflage camouflage to avoid exposure to enemies[19]. The Egyptians, who have the oldest makeup history used makeup to protect their bodies[20]. Camouflage art is an art that reflects the surrounding colors, environments, and patterns of the surrounding environment as they are in order to take pictures there[21], set the beginning of this, and even today, works of art with the meaning of camouflage are diversifying. The purpose of this study is to derive concealment, display, and distortion from camouflage characteristics among the comprehensive concepts of military look and reinterpret it as a work. Therefore, it is meaningful to express the beauty that the camouflage characteristics will give in this work. This is an example of it <Figure 1>.

Figure 1. Camouflage[1].

2.3. Make-up

Make-up is a means of beautifying the face by applying or rubbing cosmetics[22]. In the dictionary meaning, it has the meanings of 'to produce' and 'to complement'. Cosmetics is a word derived from the Greek word *cosmetic*, which means ‘to organize and wrap well.’ In other words, Cosmetics are tools that keep humans organized and harmoniously decorated[23]. The utility of makeup has protective and psychological functions in addition to aesthetic functions[24]. Make-up is the original expression of human aesthetic instincts. Furthermore, it has developed as a symbolic means for expressing and understanding the person's thoughts and actions[25].

This is an important element in expressing the facial image, which emphasizes the good image on the individual's face and complements the weak image with makeup. Make-up can be said to be an

[1]https://www.pinterest.co.kr/ (2021).

important clue in determining the overall impression of a person[26]. It is an act of expressing directly on the face what represents an external image. Accordingly, as an element that helps the presentation of various facial images, it helps in the expression of individual images differentiated from others and plays an important role in image improvement[27]. In modern society, the value of art has been enhanced by using pattern design among elements of camouflage[28].

3. Study Method

Studies on the camouflage characteristics of military look are being conducted in various forms and appear different from researcher to researcher.

Choi JH(2013) studied the characteristics of the camouflage pattern in visual expression, including the hidden and imitation in the military field.

Hwang EJ(2010) classified the camouflage pattern into concealment, distortion, deception, and display in order to interpret it in fashion design.

Kim JY(1997) argues that the characteristics classified in a study on military fashion have dignity and functionality.

Based on previous studies, this researcher concealed the camouflage characteristics of military look, like showiness and concealment derived from distortion.

4. Study Results

4.1. Concealment

Concealment means 'to hide or hide'[29] in its dictionary definition. This is the most common camouflage technique and is used not only for attack but also for defense. Animals in nature have evolved to assimilate and merge into their surroundings as a survival strategy. Predators needed this strategy to avoid predators, and predators to sneak up on their prey[22]. The fact that the camouflage pattern can be used to hide the body in the ground is a characteristic closely related to the military look.

In the works in this study, unlike World War I and II, in a future WWIII, which will occur in the future, we have determined there is a high possibility that it will take place in cities rather than in nature such as forests and jungles. In terms of concealment, the researcher designated black, gray, and blue, which are the most common colors of city centers and buildings, and devised and produced a camouflage pattern for them. Lip makeup and gold accessories are used as objects to give connection with military look with color gold, often used for decoration and points of military look such as emblems and epaulets. Concealed camouflage patterns were devised by different front and side patterns, breaking the frame of a certain pattern.

Table 1. Concealment.

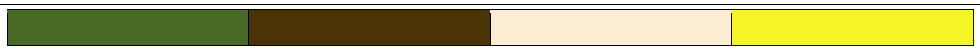
Artwork	Work result	
		
Color suggestion		
		

4.2. Showiness

In the late 1960s, Vietnamese veterans wore military uniforms to convey their political message, crying out against the war. At the same time, as military uniforms with camouflage patterns were widely spread around the world, camouflage costumes became available to the general public. Since then, in popular culture, camouflage has been mostly used for revealing and showing[22].

The colors mainly used for the camouflage pattern were based on basic colors such as khaki, green, brown, and black, and were produced in a color and pattern appropriate to the environment of the battle area[13]. Among the representative colors, khaki, gold, and black, the military look and camouflage characteristics were expressed appropriately by using brown. In addition, it is not a costume using objects, but a uniform that expresses the decorativeness of the military look. Decoration is usually one of the most symbolic parts of military look. Among the many decorations, the epaulette, which can be seen on the robe, was chosen as a decorative expression. The object was selected and produced in gold because it is a makeup pattern centered on formal clothes that gold color cannot be omitted from among the military look discussed earlier. 'Wearing a formal dress.' Ham is the act of being celebrated in vacancies or doing so after hard training and war and military secrecy work.

Table 2. Showiness.

Artwork	Work result	
		
Color suggestion		
		

4.3. Distortion

Distortion is defined in the dictionary as making something be interpreted differently or in a wrong way[30].

Deception(distortion), which is one of the camouflage elements, must distort the distinction between the surrounding terrain and the hidden object in a different perspective of the camouflage, and this point could be used to express the curvature of the body[13]. Among these characteristics, the deconstructed beauty and the neutral beauty were cited and expressed as distortion and reinterpretation as a work. Among the military elements, black and gold, which are colors that go into dignity and decoration, were used to devise a different camouflage pattern with a deconstructive feel. They express the feeling of a sharp right angle and the natural and beautiful curvature of the body at the same time.

Table 3. Distortion.

Artwork	Work result	
		
Color suggestion		
		

5. Conclusion

Today's camouflage transcends environmental camouflage and is recognized as an important part representing the ROK military's identity, and each country is striving to develop its own national pattern.

In this study, the camouflage characteristics of military look were expressed as concealment, display, and distortion. Using this, three works were made with makeup, symbolic colors were added to make each characteristic visible, and objects were used to express them. In addition, the use of the emblem as a military look and gold accessories, one of the representative colors of the military look, naturally blended the sense of moderation and dignity into the work. Concealment sets the basic colors of black, gray, and blue tones in accordance with the colors of modern landmarks, and finishes with gold lip and gold accessories. The finish is done using the colors green, gold, and brown.

The type of color that distorts the outline of an object and assimilates it with the surrounding environment to defend it is called the segmentation color[31]. These assimilation phenomena can also be classified as distortion.

This work is a research on makeup patterns that use protective media such as camouflage in crisis. This study is considered as a comprehensive[32] study for public safety that can have a good influence not only in the industrial cooperation of beauty, but also in the military and fashion circles. Based on this, we would like to make the following suggestions. The works were produced by deriving three characteristics of camouflage included in the military look and limited to the environment or specific clothing. However, in order to take this study into account, a new pattern was devised using camouflage in nature to go beyond the interpretation of the military look. It is thought that it is necessary to carry out a follow-up study suggesting development based on this study.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Lead Author	SP	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑
Correspond-ing Author*	JC	-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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A Study on the Necessity of Regulations on Event SAFETY Fence

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Abstract

Purpose: *Safety Accidents have caused many victims and injuries around the world at various Events held by crowds. The importance of safety did not start yesterday, it will be even more important in Event venues crowded with the multitude.*

Method: *Therefore, in this study, Event-related accidents occurred in Korea were examined, and Safety Fences, which play an important role of safety facilities at Events, were examined to prevent recurrence of similar accidents.*

Results: *Safety Accidents have occurred due to various Events due to the development of local self-government and the Performance culture industry. There is a need to establish standards for Safety Fences in preparation for Safety Accidents at Events.*

Conclusion: *When it is necessary to establish the standards for Safety Fences in consideration of the behavioral characteristics of the audience according to the characteristics of the Event, and it is necessary to establish a standard for proper use of products capable of bearing weights of load strength.*

[Keywords] ***Events, Safety Fences, Performances, Local Festivals, Safety Accidents***

1. Introduction

The importance of safety in various Events held in a crowd gathered did not start yesterday, and related incidents have caused many victims and injuries worldwide. As a result, the importance of safety has emerged at Events where many people gather, and accordingly, private guards have been put into safety work together with the police, who have the representative of public security, and take charge of the safety of the Event and bring about a lot of development.

Kim YH(2011) Successful hosting of large-scale civic participation events is closely related to how safely the event can be carried out, so the role of private expenses is most important[1].

NamJS(2020) Recently, the issue of safety has spread and shared not only in Korea but also around the world[2].

Nevertheless, various problems still exist, and among these problems, it may be the fact that there are no regulations on Safety Fences, which are safety equipment as important as safety personnel in Event safety.

The Safety Fence not only serves as a framework for securing the movement line for the safety of the Event, but also the role of separating the Event area and the role of a guide notifying that entry is not allowed. In addition, It plays an important role in preventing accidents such as crushing deaths caused by the concentration of the audience, which is the most dangerous part of the Event. Moreover, when an accident occurs, the stage and the auditorium are spatially separated to delay the occurrence of additional accidents.

Bae DY& Lee KW(2017) It is difficult, however, to quantify safety culture as it has intangible and qualitative characteristics. Although it can be managed and improved with qualita-tive data, it can be managed and improved even more effectively when quantitative data are added[3].

Park YJ& Yun WS(2016) Outdoor multi-operating companies are more open than indoor events and are more likely to have unexpected situations, so safety-related risks exist[4].

Therefore, this study examines the legislation related to safety at Event venues and discusses Event safety by analyzing Safety Accidents at Local Festivals and Performance halls.

2. Legislation Related to Event Safety

Kim TM & Jo SG(2011) A large-scale event hall is a special facility subject to security in which many citizens participate.If the province's expertise and overall and integrated safety management measures are not prepared, huge human disasters can occur[5].

For the safety of Events, the occurrence of Safety Accidents can be minimized when various social factors perform their respective roles and common roles well. There are many laws and regulations related to the safety of Events, but among them, the Misfortune and safety supervision basic law and the Public Performance Act are representative of them, and the Security Services Industry Act has been enacted in relation to the security guard who plays a key role as a safety manager.

2.1. Framework act on the management of disasters and safety

Park SH & Cho YH & Jeong SH(2016) Countries in the world are in fierce competition with each other, all in a bid to increase their own national competitiveness. Public safety in particular is an important index[6].

The Framework Act on the Management of Disasters and Safety is embodied in order to preserve the national territory from various disasters and protect the lives, bodies, and property of the people by establishing the disaster and safety management system of the state and local governments.

In Article 66-11 of the Framework Act on the Management of Disasters and Safety, there are regulations related to safety management measures when Local Festivals are held. In order to hold a regional festival, the head of the central administrative agency or the head of a local government must establish a safety management plan for the regional festival so that the relevant regional festival can proceed safely, and take necessary measures for safety management. In addition, if a person other than the head of the central administrative agency or the head of a local government intends to hold a Local Festival, a safety management plan for the Local Festival is established so that the relevant Local Festival can proceed safely and notified in advance to the head of the competent mayor/gun/gu. Outside safety management, necessary measures must be taken. The same applies to the change of the Local Festival safety management plan[7].

According to the article 73-9 of the ENFORCEMENT DECREE OF THE FRAMEWORK ACT ON THE MANAGEMENT OF DISASTERS AND SAFETY about measures for safety management when holding regional festivals, in the case of Regional Festivals where the maximum number of visitors is expected to be at least 1,000 persons during the festival period, held in the mountains or on the surface of the water, using explosive materials, such as fire, firecrackers, petroleum, or inflammable gas, the opinions of institutions related to safety management shall be heard in advance, a safety management plan shall be formulated, and submitted to the head of the competent Si/Gun/Gu no later than three weeks before the date of the festival. In such cases, where a safety management plan for a Local Festival is to be modified, the details of the revised plan shall be submitted by not later than seven days before the date of the festival.

2.2. Security services industry act

Ha JH(2021) For 45 years after the Security Industry Act was enacted in 1976, the security industry has made changes and developments in line with the demands of the times [8].

Article 2 of the Security Services Industry Act defines a definition related to security business, and (f)of Clause 5 defines a place for an international, cultural, artistic or sports Event where at least 100 persons gather is defined as a collective petition site, and various regulations are implemented accordingly.

Ha KW & Jeon KS(2018) The collective civil complaint site is required to place a security guard and to ap-point a security instructor where a pother or strife is anticipated after obtaining a per-mit in advance[9].

According to Article 30 of ENFORCEMENT DECREE OF THE SECURITY SERVICES INDUSTRY ACT, in case that security services provided by security guards are deemed necessary to prevent the occurrence of dangers caused by disorder, etc. in any Event site, any establishment or any place where a large number of people gather. The commissioner of a district police agency may ask the sponsor of any Event to seek the security services of security guards prior to the day on which such Event commences and if the sponsor is unable to do so for unavoidable reasons, the commissioner may ask the sponsor to notify him/her of the fact 24 hours prior to the commencement of the Event.

Kim DW(2017) it has now become increase-ingly difficult to envisage circumstances with-out the private security presence being en-gaged in safeguarding arrangements, whether for 'safeguarding of mega sporting Events and mass gatherings' [10].

2.3. Public performance act

Article 11 of the PUBLIC PERFORMANCE ACT, which was enacted to promote sound Performance activities, stipulates disaster prevention measures. A Performance hall manager shall formulate a disaster management plan specifying the duties, placement, etc. of employees of the relevant Performance hall in order to prevent fire and other disasters and shall report it to the Metropolitan Autonomous City Mayor, the Special Self-Governing Province Governor, or the head of a Si/Gun/Gu each year

Shin SS(2008) In order to smoothly carry out expenses for performances and events, it is necessary to prepare for safety accidents at performances and events through appropriate division of duties with related agencies[11].

ArArticle 9 of the Enforcement Decree of the Performance Act requires a report, etc. of a disaster response plan to be reported by at least 1,000 people in facilities or places other than the Performance hall by 14 days before the commencement of the Performance. In addition, where it is intended to be modified, the details thereof shall be reported by not later than seven days.

In addition, in Article 9-2(2) of the Enforcement Decree of the Public Performance Act, safety management expenses shall be calculated and used only for the purposes determined and publicly notified by the Minister of Culture, Sports and Tourism, such as Labor costs and allowances of safety management personnel, installation, maintenance, and repair of Performance halls and facilities for the safety management of Performances, or safety education on the purchase of protective equipment and other safety education and training, and matters necessary for the safety diagnosis of stage facilities, other safety inspections, safety-related insurance, and other safety management of concert halls and Performances

Choi KS(2018) In order to improve the weak safety communication system and culture, active responsibilities of performers, general safety managers, and safety management managers are needed[12].

Article 10 of the Enforcement Decree of the Performance Act stipulates safety diagnosis of stage facilities, but this is a situation that only investigates and inspects the safety of stage facilities and their installation conditions.

3. Event-Related Safety Accident Cases

Lee SC & Kim TM(2006) needs to prepare safety management measures to prevent accidents that may occur at the venue and analyze the overall problems of the venue security so that people can participate and enjoy the Event safely[13].

Jang SS(2019) The issue of safety at the event site is highly likely to be blamed for the fact that small accidents lead to large-scale casualties due to complex actions such as the idle mindset of performers, lack of field management capability, and lack of management of visitors[14].

<Table 1> summarizes the concert hall accidents that occurred in Korea.

Table 1. Cases of safety accidents at performance halls.

Performance name	Date	Location and incident content	Damage status
New kids on the block performance	1992.02.18.	Olympic park gymnastics stadium, songpa-gu, seoul	1 dead, about 60 people injured
The ppippi of youth 012 concert	1995.10.28.	Daegu civic stadium	8 injured
On a starry night	1996.12.16.	Apocalypse incident while entering daegu MBC's public broadcast.	2 dead
Concert to help a child head of houshold	1998.12.04.	Suncheon-si, jeollanam-do	2 passed out, about 10 people injured
Chuseok hyo concert	2002.09.22.	Duryu park in daegu	4 injured
Music performance to commemorate the opening of a school	2004.06.04.	Cheongju sports complex, chungbuk	13 injured
Cable broadcast recording	2005.07.11.	Accident while recording cable broadcast at seongnam girls' high school in gyeonggi-do	About 10 people injured
Bicycle festival in sangju	2005.10.03.	MBC music concert apsa accident in sangju, gyeongsangbuk-do	11 dead, 162 injured.
Seoul international fireworks festival	2013.10. 5.	Accidents caused by a million people.	14 injured
Pangyo techno valley festival	2014.10.10	Vent safety accident occurred	16 dead, 11 injured

Ko KH(2019) Performance industry will first plan the Performance, consider the number of visitors suitable for the artist's size, and determine the venue and size of the Performance, and the estimated proceeds from ticket sales for the Performance. The reality is that safety management is inevitably very insufficient as planning for safety is considered at the last stage after this process takes place[15]. Since the concert hall is a facility used by an unspecified number of people, it is characterized by the fact that it is not known who, when, and in what way or form Safety Accidents will occur.

Wang HJ & Lee WG & Son KS(2017) Recently, the number of harmful cases related to concert halls has been on the rise every year, indicating that it is vulnerable to consumers' viewing safety[16].

Park NK & Lee YJ & Yoon MO(2012) As it is a multi-use facility where many people watch at the same time, the evacuation route is complicated and high-density spectators evacuate at the same time in case of a crisis, securing safety and pre-evaluation are very important[17][18][19].

As seen in the Safety Accidents related to the concert hall, it can be seen that popular singers appear, and in large-scale Performances in the form of free form, audiences flock to famous singers, or the safety of facilities is abnormal, leading to a major accident. Through these accidents, safety measures have to be prepared, the Performance law has to be revised to report a disaster response plan, and safety management fees are calculated and used only for safety management purposes.

Lee WK(2013) The local festival itself is commercialized as a place and product to revitalize the local economy, such as tourism[20].

The promotional activities of local authorities and festival strategies to link up are very important.

In addition, Lee SC(2016) It is the Local Festival that has been most interested in discussing the local identity and the economic value of culture[21] in the age of local government, in competition with other local authorities,.

The occurrence of Safety Accidents becomes an indicator of the cultural level and safety of the country and each local government, and this has a profound relationship with the image and economy of the country and each local government.

Kwon YG(2000) Elements of safety facilities have been shown to have the strongest influence on revisiting physicians[22].

<Table 2> summarizes the cases of accidents in which deaths occurred during accidents related to Local Festivals in Korea.

Table 2. Cases of safety accidents at local festivals(2005 ~ december 2019).

Festival name	Date	Accident content	Damage status
Water bath festival	05. 7.30.	Accident of inadvertent drowning while playing in the water for children	1 dead
Sangju bicycle festival (MBC music concert)	05.10. 3.	Among the side events of the bicycle festival, a crushing accident occurred as visitors were rushing to the entrance at the MBC music concert performance event.	11 dead, 162 injured
Amberjack festival	06.11.25.	During the festival, the fishing boat sinks during the fishing experience while riding a small fishing boat that exceeds the quota.	5 dead
Hwang river leports festival	07. 7.27.	Drowning accident occurred during children playing in the water	1 dead
Geumsan ginseng festival	07. 9.10.	An assistant was hit in the head by an arrow at a archery competition during a festival.	1 dead
World city festival	09. 9.27.	An accident occurred in which a light aircraft flying 70m above the festival to commemorate the festival falls on a rope installed at the festival	1 dead, 1 injured

Sobek mountatin azalea festival	2015. 5	Overturn the boat during the water leisure boat experience Event	1 dead
Gangwon mullegil festival	2015. 9	Accident hitting a guardrail while riding a bicycle downhill	1 dead
Geoje island international penguin swimming festival	2018. 1	Swim competition participant's cardiac arrest	1 dead
Jinju namgang water festival swimming competition	2018. 5	Swim competition participant's cardiac arrest	1 dead

Note: Source: Reorganization centered on deaths by referring to the local festival situation management manual of the ministry of public administration and security.

Kim SW(2016) Large-scale human casualties were caused by congestion at the venue and poor safety management systems[23].

From the past to recently, casualties at the Local Festival site were caused by the failure to properly respond to the influx of visitors or the lack of safety devices caused by careless safety. Accordingly, the safety management manual for Local Festivals has been developed under “the Framework Act on Disaster and Safety Management” to play various role in preventing Safety Accidents in Local Festivals, but it is also true that there are still insufficient parts.

4. Conclusion

Whenever a major accident occurs, the necessity and importance of safety-related measures are discussed.

Park YG& Kim DK & Park JK & Kim KH(2014) In addition to threatening the lives of audiences and actors if they neglect the safety of facilities at the concert hall, physical damage such as suspension of performances is significant[24].

Min SH(2013) In an unannounced sudden disaster, the movement of many people is feared to expand to a second disaster such as crushing death[25].

To prevent crushing accidents in the Performance hall, Safety Fences are planned and used as safety guards during the planning stage of the Event or during the security planning stage. However, until now, there are no standards and studies on Safety Fences used for safety at Event venues.

Park JS(2020) Safety considerationEvents of various subjects and methods that have not been implemented have rather sparked disaster and safety accidents;It can also be a cause of irritation[26].

The Public Performance Act requires the investigation and inspection of the safety of stage facilities and their installed conditions, etc., but this is going on with regard to the safety diagnosis of the stage machinery and instruments which are operated in upper and lower facilities of the stage.

In this study, the necessity of regulations on Safety Fences in Performances and Event venues was analyzed. With regard to Safety Fences that play an important role in safety in Performances and venues, the standards for Safety Fences shall be established and minimum placement standards shall be established in consideration of the behavioral characteristics of the audience according to the characteristics of the Event. Moreover, It will be necessary to strengthen the safety of properly using products capable of bearing the load strength.

Despite playing various roles related to the safety of the Event, there are no Safety Fence in-

stallation standards, safety standards, product safety, minimum use standards, etc. This would require an obligation standard, but given the circumstances in the market economy in which costs are incurred, it would be possible to provide guidance to exercise participants as a safety guide by making essential recommendations. Research reflecting opinions from officials such as Event planners, safety officers, and local government safety officers related to Safety Fences will be needed, and this study can mean that it will be a meaningful first step in Safety Fences used at the Event.

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6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Author	JH	-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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A Study on Passengers' Perception of Aviation Safety Information and SAFETY Behavioral Intention

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Abstract

Purpose: *For safety purpose, the airline has a safety education and management system for flight crew and cabin crew so that they can accurately understand and deliver how to deal with emergency situations and how to use emergency equipment. In order to ensure the safety of passengers in unexpected emergencies, passengers must also familiarize themselves with safety information and emergency escape tips. In response, this study applied planning behavior theory to explore the impact relationship between passengers' perception of aviation safety information on aviation safety behavioral intentions.*

Method: *This study conducted an online survey of people with less than a year of air travel experience and collected 352 copies. The final 341 copies of the data, except for 11 copies of the unfaithful answer sheet, were used for empirical analysis and hypothesis verification through statistical programs in SPSS 21.0 and AMOS 21.0.*

Results: *Perceptions of aviation safety information have significant implications for aviation safety attitude, subjective norms, and perceived behavior control. This study shows that perceptions of aviation safety information have a significant positive relationship with aviation safety behavioral intention. On the other hand, the relationship between aviation safety subjective norms and aviation safety behavioral intention does not have significant positive influence.*

Conclusion*: The lack of awareness of aviation safety information by passengers in the event of an aircraft accident may lead to more casualties due to the inability to respond effectively to emergencies. This study investigates the relationship between perception, attitude, subjective norms, perceived behavior control, and behavioral intentions of aviation safety. Therefore, to raise perception of aviation safety information, it is necessary to inform the importance of being directly connected to individual lives and to study that passengers can judge and control themselves through aviation safety education and information provision.*

[Keywords] ***Air Passenger, Aviation Safety Information, Perception, Theory of Planned Behavior, Safety Behavioral Intention***

1. Introduction

Technological advances in aircraft have significantly reduced the proportion of air accidents since before Covid-19, but large and small air accidents are constantly occurring due to the rapid increase in air traffic worldwide.

In response, the airline is making efforts to enhance the safety culture and safety awareness of workers for aviation safety, and especially educate pilot and cabin crew to accurately understand safety training such as emergency procedures and how to use emergency equipment. However, despite the airline's efforts, passengers have often been seen escaping from aircraft escape sites with personal belongings and baggage within the past decade. Therefore, it is necessary to reflect on the meaning of safety education such as safety-related videos, direct safety demonstration, and briefing cards pro-

* This paper summarizes Kyungok Choi's Chungwoon University Master's Thesis.

vided to passengers. Passengers must also familiarize themselves with safety information and emergency escape tips in order to secure their own safety and save their lives in unexpected emergencies[1]. Statistics from the National Transportation Safety Board show that passengers are up to 95% more likely to survive an air accident if they are fully familiar with safety procedures in an emergency[2].

To reduce aircraft accidents, the airline recognizes the need for safety culture and safety awareness management of aviation workers such as airline pilots and cabin crew, and makes great efforts to enhance safety as a top priority[1]. In comparison, research and interest in aviation safety for aircraft passengers are insufficient.

Therefore, this study seeks to see if Ajzen's theory of planned behavior[3], which explains human consumer behavior, can be applied to explain the aviation safety behavior of passengers using aircraft.

In addition, This study would like to conceptually consider the perception of aviation safety information of aircraft passengers through prior research[4][5]. And it then applies to a model of Planning Behavior Theory(TPB) to determine how aircraft passengers perceive aviation safety information, explain the relationship between human attitudes and behaviors, and whether perception of aviation safety information affects aviation safety behavioral intention.

2. Theoretical Background

2.1. Understanding the aviation safety information awareness

The airline delivers cabin safety information to all passengers in case of emergency before takeoff and primary safety information systems that passengers need to know[4].

Cabin safety information is defined by international and domestic regulations as the best way to ensure passenger safety throughout the flight and is classified as a type of direct flight, video screening, emergency seat, briefing card, in-flight safety broadcast, and prepared emergency briefing. Aviation safety perception is emphasized through safety education and training in preparation for safety accidents to reduce the occurrence of aviation safety accidents, which allows effective response in the event of safety accidents[5].

2.2. Understanding the theory of planned behavior

The Theory of Planned Behavior(TPB hereunder) is an extension of the Theory of Reasoned Action(TRA hereunder)[6]. TRA is designed to predict volitional behaviors of this kind and it is utilized to predict human behavior in various fields[7].

TPB is determined by intentions of action and that intentions of action are influenced by attitudes, subjective norms, and perceived behavior control. It means that people take actions considering their behavioral beliefs, through attitudes and intentions, to actual behavior[7]. According to the TPB, the ways human behaviors is decided can be explained as follows. First, The stronger the attitude of a certain behavior is, the more positive the evaluation is to the people around them, and the greater the perceived control that the person can perform the action, the greater the intention to perform the action[8]. In particular, perceived behavior control can be said to be the ability or confidence that individual can perform at a possible level[6][7].

2.3. Relationship between aviation safety information perception and TPB

Aircraft accidents can lead to major accidents, so all airlines should provide aviation safety information for passenger safety before takeoff and passengers should also be aware of safety information. In addition, cabin crew members should successfully lead passengers to emergency escape in the event of an emergency, and passengers should be able to respond to airline accidents by familiarizing themselves with safety information[4].

Awareness of a particular behavior is a cognitive process that humans have and has a significant influence on behavior decision. When humans think they are desirable on an issue, their intentions for the action are formed and subsequently led to actual action[9][10].

Through TPB, which is widely known as cognitive behavior and has been studied in the various fields. In the study of[11], it was found that air passengers' perceptions of pre-flight safety communication had a positive and significant influence on both air passengers' attitudes and perceived behavioral control. Also found that safety information had a positive and significant effect on attitudes, perceived behavioral control, and subjective norms[12].

Hypothesis 1. Perception of aviation safety information will have a significant positive impact on aviation safety attitude.

Hypothesis 2. Perception of aviation safety information will have a significant positive impact on aviation safety subjective norm.

Hypothesis 3. Perception of aviation safety information perception will have a significant positive impact on perceived behavior control of aviation safety.

Hypothesis 4. Attitudes of aviation safety will have a significant positive impact on aviation safety behavioral intention.

Hypothesis 5. Subjective norms of aviation safety will have a significant positive impact on aviation safety behavioral intention.

Hypothesis 6. Perceived behavior control of aviation safety will have a significant positive impact on aviation safety behavioral intention.

Hypothesis 7. Perception of aviation safety information will have a significant positive impact on aviation safety behavioral intention.

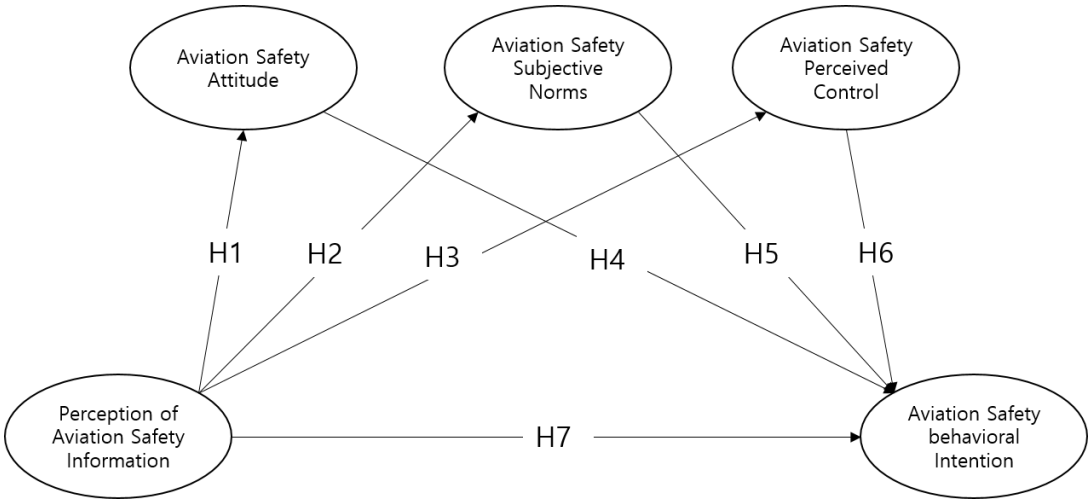
3. Research Design

3.1. Study models and hypotheses

1) Study Models

The purpose of this study is to verify the effects of aviation safety information perception perceived by passengers with air travel experience on aviation safety attitude, subjective norms, perceived behavioral control and aviation safety behavioral intention. The research model is shown in <Figure 1>.

Figure 1. Research model.



Perception of aviation safety information is a total of four sub-concepts, and a total of 16 questions were extracted: 4 questions on the use of emergency equipment for aviation cabin safety, 4 questions on situation awareness and response, 3 questions on safety regulations for cabin safety characteristics, and 5 questions on aviation safety channels[1][13][14][15]. Perception of aviation safety information was defined as 'the state in which aircraft passengers recognize aviation safety information and makes subjective judgments and evaluations' , and was measured with 16 questions and a Likert 5-point scale.

This study derives measurement items based on previous studies[4][11][16][17][18][19] applied based on Ajzen's TPB[3].

Aviation safety attitude was defined as "a state in which aircraft passengers respond favorably to and think favorably of aviation safety information" and measured on a seven-question Likert 5-point scale.

Aviation safety subjective norm is defined as "the degree to which aircraft passengers perceive the opinions of a reference group such as family or friends" and measured on a 5-point Likert scale of 7 questions.

Aviation safety perceived behavior control was defined as "the ease and difficulty that aircraft passengers think about aviation safety rules" and measured on a six-question Likert 5-point scale.

Aviation safety behavioral intention was defined as "predicting that the passengers of the aircraft will execute their intentions when an opportunity comes for safety behavior" and 6-item were measured on the Likert 5-point scale.

4. Empirical Analysis

4.1. Sample properties

This study conducted an online survey of people with less than a year of air travel experience and collected 352 copies. The final 341 copies of the data, except for 11 copies of the unfaithful answer sheet, were used for empirical analysis and hypothesis verification through statistical programs in SPSS 21.0 and AMOS 21.0.

Looking at the demographic results, there were 144 men(42.2%) and 197 women(57.8%), and the airlines used were Korean Air 98(28.7%), Asiana Airlines 82(24%), Domestic Low Cost Carrier 103(30.2%), International Full service Carrier 46(13.5%) and International Low Cost Carrier 12(3.5%).

4.2. Reliability and feasibility analysis

1) Reliability assessment

The reliability assessment of perception of aviation safety information found that "1 question on Situation Cognition and Response" and "2 questions on Air Safety Channel" impeded reliability, eliminating it and re-analyzing reliability analysis. As a result, the overall reliability of perception of aviation safety information was found to be .905, and Cronbach's alpha coefficient for each sub-dimension was from .694 to .908, and it was evaluated that the reliability of the measurement of perception of aviation safety information was sufficient overall.

This study also conducted reliability analysis on aviation safety attitudes, aviation safety subjective norms, aviation safety perceived behavior control, and aviation safety behavior intentions. As a result, two questions in aviation safety subjective norms and one question in aviation safety perceived behavior control were found to undermine reliability, and reliability analysis was re-examined after removal. As a result, Cronbach's alpha coefficient was found to be at least .876 to a maximum of .922.

In this study, analysis was conducted after confirming Cronbach's alpha coefficient and removing six items that impede reliability.

2) Feasibility assessment

Exploratory factor analysis of 13 aviation safety information recognition items derived from reliability verification showed that the KMO was high at .919 and the correlation matrix applied to the factor

analysis was approximate $\chi^2_{(78)}$ = 2756.199(p= .001). It was found that this is not a unit matrix, so the correlation matrix between individual measurement items of perception of aviation safety information was evaluated as suitable for performing factor analysis. There are a total of four factors extracted based on the eigenvalue '1' by principal component analysis, and these four factors account for 76.144% of the total variance in perception of aviation safety information. The factor load of each individual measurement item for perception of aviation safety information was high from at least .642 to at most .864 and commonality was also high from .628 to .847 indicating that 13 individual measurements for perception of aviation safety information were highly feasible.

A total of 7 items were put into the exploratory factor analysis for aviation safety attitude, and as a result, KMO was .901, approximation $\chi^2_{(21)}$ = 1762.561(p<.001), indicating that the correlation matrix applied to the factor analysis was not a unit matrix. As a result, the correlation matrix between individual measures of aviation safety attitude was evaluated as suitable for performing factor analysis. The factor load of each individual measurement item of aviation safety attitude was high from .730 to .891, and the commonality was also high from .532 to .794.

Five items of aviation safety subjective norms were put into exploratory factor analysis, and as a result, KMO was .787, approximation $\chi^2_{(10)}$ = 976.746(p<.001), and the correlation matrix was evaluated to be suitable for performing factor analysis. A total of 1 factor was extracted by principal component analysis, and it was found to explain 67.337%. The factor load of each individual measurement item was high from .751 to .871, and the commonality was also from .564 to .759, indicating that the five individual measurement items of the aviation safety subjective norms had high concentration validity.

An exploratory factor analysis was conducted on the five behavioral control items perceived by aviation safety, and as a result, KMO was .855, approximation χ^2(10) = 901.138(p<.001), and the correlation matrix was evaluated to be suitable for performing factor analysis. A total of 1 factor was extracted by principal component analysis, and it was found to explain 68.292%. The factor load of each individual measurement item of aviation safety-perceived behavior control was high from .771 to .872, and the commonality was also high from .594 to .760. It was evaluated as being secured.

An exploratory factor analysis was conducted for six items of aviation safety behavioral intention, and as a result, KMO was .851, approximate $\chi^2_{(15)}$ = 1388.492(p<.001), and the correlation matrix was found to be suitable for performing factor analysis. A total of 1 factor was extracted by principal component analysis, and it was found to explain 67.522%. The factor load for each individual measurement of aviation safety behavior was high from a minimum of .796 to a maximum of .876, and commonality was also high from .634 to .767, indicating that six individual measurements of aviation safety behavior were highly concentrated.

3) Secondary determinants of perception of aviation safety information

The multi-dimensional Perception of aviation safety information was conducted by conducting a second-order confirmative factor analysis to verify that the relationship between the main composition concept and the second-order dimension has sufficient single dimensions. These indices were shown to meet the overall goodness-of-fit acceptance criteria(normalized-χ^2=3.625, RMR=.025, GFI=.910, AGFI=.866, NFI=.921, TLI=.925, CFI=.941, RMSEA=.088), sufficiently show that each individual measurement has a maximum of .876 sub-convergence at least .639. And each sub-dimensional is also shown to have a statistically significant standardized factor load of .624 to .929.

4) Analyze configuration concepts confirmative factors

This study performs a confirmatory factor analysis on the entire measurement model through a two-step approach proposed by Anderson and Gerbing[20] to confirm its concentrated validity and discriminant validity. It has been shown that most goodness-of-fit indices in model fit do not reach acceptable levels. ($\chi^2_{(580)}$=1524.880(p<.001), normed-χ^2=2.629, RMR=.030, GFI=.791, AGFI=.760, NFI=.836, TLI=.881, CFI=.891, RMSEA=.069). In response, this study conducted an analysis to improve the measurement model by applying the item parceling strategies proposed by Hall, Snell, and Foust[21]. As a result, the item parceling measurement model shows excellent fitness levels($\chi^2_{(94)}$=215.130(p<.001),

normed-χ^2=2.289, RMR=.017, GFI=.924, AGFI=.890, NFI=.938, TLI=.954, CFI=.964, RMSEA=.062).

The standardized factor load for all indicators was found to be statistically significant, ranging from .529 to .940. Furthermore, the AVE was found to be at least .773 up to .934 with both Fornell and Larcker's[22] acceptance threshold of .5 and the CR index was also found to be .918 to .977, significantly above the acceptance threshold of .7.

5) Correlations among configuration concepts

This study conducted a confirmative factor analysis with an item parceling measurement model, and compared the correlation coefficient between each derived construct concept with the root-square value of AVE to confirm discriminant validity. As a result, the largest of the correlation coefficients was .679 and the minimum value was .879 for the root square value of AVE. This shows that the measures used to measure the concept of composition of this study have sufficient discriminant validity.

Table 1. Correlation matrix and discriminant validity.

	A	B	C	D	E
A. Perception of aviation safety information	.879				
B. Aviation safety attitude	.504***	.966			
C. Aviation safety subjective norms	.433***	.648***	.891		
D. Aviation safety perceived behavior control	.432***	.516***	.587***	.889	
E. Aviation safety behavioral intention	.679***	.607***	.535***	.520***	.914
Average	4.507	4.617	4.344	3.998	4.486
Standard deviation	.486	.470	.543	.643	.540

1) Correlation coefficients produced by confirmative factor analysis results.
2) Bottom triangle: correlation coefficients and significance
3) A diagonal line: root square value of AVE

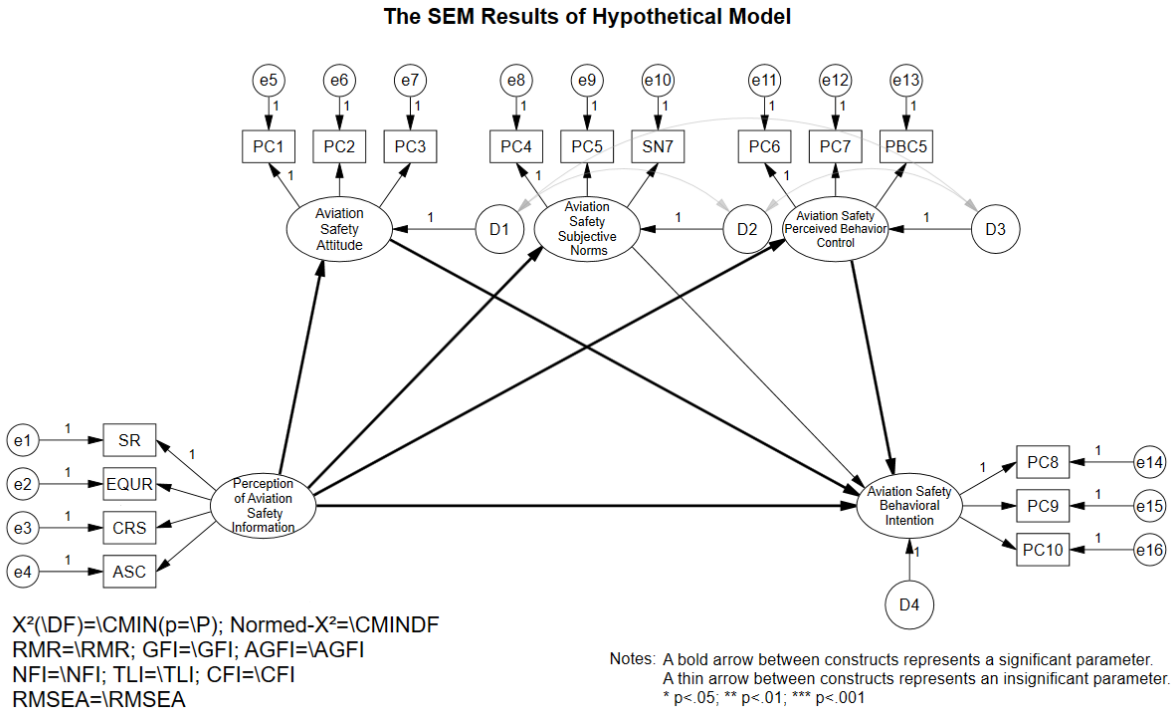
Note: ***p<.001.

4.3. Evaluating research models and verifying hypotheses

This study set the perception of aviation safety information of aircraft users as an independent variable, and investigated the effects of their aviation safety attitude, subjective norms, perceived behavior control, and safety behavior intention.

The model goodness-of-fit index of the structural equations in this study is shown as χ^2 (94)=215.130(p<.001), normed-χ^2 =2.289, RMR=.017, GFI=.924, AGFI=.890, NFI=.938, TLI=.954, CFI=.964, RMSEA=.062. It has been shown to meet the overall acceptance criteria for conformity suggested by Woo[23].

Figure 2. Study model analysis results.



Hypothesis 1 analyzed the impact of airline passengers' perception of aviation safety information on aviation safety attitudes. As a result, the standardized path coefficient between perception of aviation safety information and aviation safety attitudes was .504, t=8.388(p<.001), which was statistically significant. Consequently, Hypothesis 1 adopted that "the perception of aviation safety information will have a positive effect on aviation safety attitudes".

Hypothesis 2 analyzed the effect of perception of aviation safety information on the subjective norms of aviation safety by airline passengers and found that the standardization path coefficient was .433, t=6.753(p<.001), which was statistically significant. Therefore, Hypothesis 2 was adopted.

Analysis of the effect of perception of aviation safety information, which is hypothesis 3, on perceived behavior control for aviation safety shows that the standardized path coefficient is .432 and t=6.838(p<.001), which is statistically significant. Hypothesis 3 was adopted.

Hypothesis 4 analyzes the impact of aviation safety attitudes on safety behavior intentions. The results were statistically significant with a standardized path coefficient of .241 and t=3.612(p<.001), and hypothesis 4 was adopted.

Hypothesis 5 Analysis of the impact of aviation safety subjective norms on aircraft passengers' aviation safety behavioral intent showed that the standardized path coefficient was .100 and t=1.384(p>.05), indicating that it was not statistically significant.

Analysis of the effects of [hypothesis 6] aviation safety perceived behavior control on aviation safety behavioral intention showed that the standardized path coefficient between aviation safety perceived behavior control and safety behavior intention was 0.141 and t=2.313(p<.05), indicating that the effect of aviation safety perceived behavior control on safety behavior intention is statistically significant. Consequently, Hypothesis 6 adopted, "Air safety perceived behavior control will have a positive effect on aviation safety behavioral intention".

Hypothesis 7 assumes that perception of aviation safety information directly affects aviation safety

behavioral intention, with a standardized path coefficient of .454, t=7.141(p<.001), indicating that perception of aviation safety information has a statistically significant impact on aviation safety behavioral intention.

Perception of aviation safety information was shown to account for 25.4%, 18.7% and 18.6% of the total variance in aviation safety attitudes, subjective norms, and perceived behavior control. Furthermore, the final dependent variable, the squared multiple correlation of aviation safety behavioral intention, was .581, indicating that 58.1% of the total variance of aviation safety behavioral intention is accounted for by perception of aviation safety information, aviation safety attitudes, subjective norms, and perceived behavior control.

5. Conclusion

Once an accident occurs due to the popularization of air transport and the large scale of aircraft, the casualties typically range from dozens to hundreds. In order to maximize the survival of passengers, cabin crew members should be able to accurately recognize the situation and take complete safety measures in the event of an aircraft accident. However, the lack of awareness of aviation safety information by passengers in the event of an aircraft accident may lead to more casualties due to the inability to respond effectively to emergencies. This study investigates the relationship between perception, attitude, subjective norms, perceived behavior control, and aviation safety behavioral intention[1][4].

As a result of this study, first, the hypothesis was adopted indicating that perceptions of aviation safety information have significant implications for aviation safety attitudes, subjective norms, and perceived behavior control. Second, it is shown that perceptions of aviation safety have a significant positive relationship with aviation safety behavioral intention. This is the same as studies by[11][12], the findings show that aviation safety information should be followed by regulations and laws for passengers, and that it can be observed and that safety action intentions can be enhanced.

The cabin crew must be responsible for successfully leading the emergency escape of passengers with sufficient knowledge of the relevant cabin safety measures[1]. And these provisions are stipulated in the Aviation Act, and cabin crew are subject to regular emergency escape training. Therefore, supplementary measures are required to familiarize passengers with aviation safety information and safety education in legal terms[13].

On the other hand, the relationship between aviation safety subjective norms and aviation safety behavioral intention has shown that social pressures considered important by air passengers themselves do not have a significant influence. These results show that, unlike other prior studies[12][24], subjective norms, which are factors of social influence and pressure, have no influence on an individual's behavioral intentions. This is the result of the change to a society where personal characteristics are emphasized rather than a collective society[24]. Therefore, to raise awareness of in-flight safety information, it is necessary to inform the importance of being directly connected to individual lives and to study that passengers can judge and control themselves through aviation safety education and information provision.

Unlike cabin crew, however, it is almost impossible for aircraft passengers to conduct practical training to cope with emergencies. Currently, aviation safety education is all about watching safety videos before flight departure, and for passenger concentration and fun, the airline is producing safety videos in various ways and contents[25][26]. The importance of passengers' emergency escape in the event of an accident has emerged for the survival of aviation accidents, and the need for passengers' attention to aviation safety information has been emphasized.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Lead Author & Corresponding Author*	KC	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑
Co-Author	SL	-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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A Scientometrics Research on Physical Activity and Health RISKS of the Elderly

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Abstract

Purpose: *With the deepening of global aging, how to control and prevent the health crisis of the elderly has become the focus of global attention. To address this problem, a large number of studies have been conducted around the world, and physical activity has been shown to be closely linked to health risks in the elderly. In order to sort out the results of many researches, this paper made a scientometrics analysis of the relevant researches in the past 10 years. This can not only systematically understand the current research trend, but also serve as a reference for subsequent research.*

Method: *This study adopted scientometrics and visual analysis methods, thus CiteSpace Visualization based on Java programming was employed as the main tool of the study. Literature searched from Web of Science database from 2010 to present and was used to show the topic evolution of research related to the research topic after analysis.*

Results: *According to the statistics on the time and quantity of the literature on physical activity and health risks of the elderly, it was found that the literature had a stable increasing trend from 2010 to 2012, from 2013 to 2015, from 2016 to 2018, and from 2019 to 2020. Through the analysis of the co-occurring map of institutions on physical activity for elderly, it was found that colleges and universities were the core in the institutions in this field. Geriatrics & Gerontology, Public Environmental & Occupational Health, General & Internal Medicine, Medicine, Nutrition & Dietetics and Physical provided basic for the researches on physical activity and health risks of elderly. The research hotspots were showed as physical activity, risk, risk factor, Older adult, elderly, exercise, mortality, health, prevalence, association. This indicated that the researches on physical activity and health risk of the elderly at this stage mainly focused on the health and physique of the elderly. In the second stage, there were abundant experimental studies on the physical function of the elderly, the physiological dimension of different types of senile chronic diseases, and the risk factors of disease prevention. In the third stage, the researches on the elderly' personal health behavior and lifestyle, social support and health promotion began to be prominent.*

Conclusion: *This paper took Web of Science as the data source and used CiteSpace, a scientific measurement tool, to draw the knowledge map of physical activity and health risks of the elderly scientifically and rigorously, and systematically analyzes the basic characteristics, research hotspots and topic evolution of this research field. However, there are still some limitations in the time period, database and search scope of the research results, which we hope can be solved in the follow-up research.*

[Keywords] ***Health Risk of the Elderly, Scientometrics Research, Physical Activity, Visual Analysis, Knowledge Map***

1. Introduction

Since physiological structure and function decline with age and cessation of use, increasing attention has been paid to the prevention or delay of chronic diseases in elderly by extending

functional health and healthy life expectancy through physical activity[1]. Especially under the current global aging, the importance of physical activity for the health risks of the elderly has been internationally recognized and confirmed in many fields[2].

In recent years, a large number of studies have focused on the effects of physical activity on health risks for the elderly. Physical activity and cardiovascular health risks among the elderly were the most discussed. Studies have shown that physical activity was negatively correlated with blood pressure, lipid profile, obesity, and insulin sensitivity[3], and moderate endurance exercise could have a significant protective effect on the heart[4]. Physical activity was also very effective in the prevention and treatment of orthopedic diseases in the elderly. Numerous studies have shown that systematic muscle building through appropriate exercise was the main component here. People with active lifestyles were less likely to develop chronic back pain and osteoarthritis. Furthermore, physical activity also contributed to the prevention of osteoporosis related fractures and significantly improved mobility in the elderly[5]. In addition, physical activity has also been proved to be beneficial to the treatment of insomnia and depression for the elderly[6][7]. Not only that, but falls have become a major public health problem in industrialized countries with aging populations. Falling often has serious psychological, physical or economic consequences for the elderly. Physical activity is a favorable factor to prevent or alleviate this problem[8]. The researches linking physical activity to health risks for the elderly were so many and the follow-up researches were still conducted, according to a prior study.

In general, most of the studies focused on the impact of physical activity on a specific health risk, and few studies focused on sorting and summarizing. Therefore, this study provided a scientific measurement of the related research in the last 10 years on the topic of physical activity and health risks for the elderly. Scientific and rigorous combing can make numerous research results and differences between studies clearly recognized, and it can also serve as a reference for subsequent research.

2. Methods

2.1. Data source

Data was collected from the Web of Science core collection. In order to ensure the validity of the data and the consistency of the subject and literature, relevant terms were searched by using the Internet, and relevant books were consulted for searching terms. Through the attempts of the search terms and the analysis and comparison of the search formula repeatedly, the search terms were conducted by “TS=(Physical Activity) and (Risk) or (Healthy Risk) and (Elderly)”. Article language and type were chosen “English” and “Article”, data parameters from the start of 2010 to 2021. After the preliminary screening of data collected, specific elimination process is conducted. Repeated and unpublished literature, references without abstract or author were exclude for this study.

It should be noted that the data sources only include statistics before April 1, 2020; Although the principles of uniqueness, accuracy and high correlation were kept as far as possible in the process of data collection, collation and cleaning, due to the factors of huge data, long screening cycle and paper writing cycle, it was still unavoidable that the chart time in data analysis is not consistent with this time. However, based on the preliminary judgment of the collation and analysis of all the data, it was believed that the difference in sample size did not affect the meeting of the actual needs of the research and the overall results.

2.2. Data processing

The research tool is the analysis software of CiteSpace Visualization based on Java programming, which forms a new knowledge network and creates new knowledge units through the reorganization of the literature authors, keywords, research institutions, cited frequency and

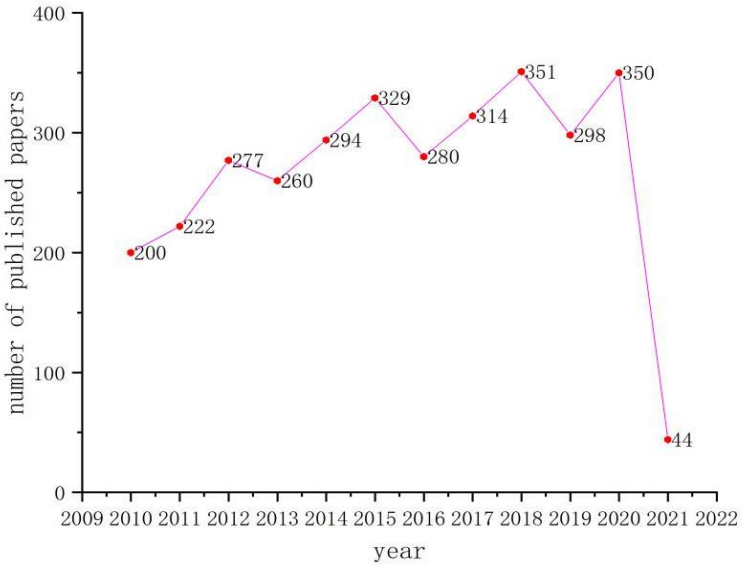
other characteristic information, and is able to realize the pictographic output of input information. Accurately tracking and analyzing the frontier hot spots and dynamic evolution process are conducted in this field[9]. It can not only analyze the overall situation, but also analyze the specific contents of the field of study in multiple dimensions[10].

3. Results

3.1. Publications numbers on yearly basis

For a certain field, the index that can best measure its research hotspots and emerging trend is the number of published papers in this field, and the statistical chart of literature quantity can clearly reflect the scientific research development trend and research hotspots in this field[11]. According to the published time and quantity of the literature on physical activity and health risks of the elderly, it shows that the literature had a stable increasing trend from 2010 to 2012, from 2013 to 2015, from 2016 to 2018, and from 2019 to 2020, and the number of published papers would relatively decrease within one year after each increase. According to this situation, it can be seen that the academic circles have been paying continuous attention to the research on this topic. However, since 2020, the researches related to the current situation on physical activity and health risks for the elderly has declined sharply. This may be due to the shift in focus caused by the spread of COVID19 . See <Figure 1> for details.

Figure 1. Published time and quantity of the literature on physical activity and health risks of the elderly.



3.2. Research institutions

According to the analysis of institutional co-occurring map of the physical activity for the elderly research, Harvard University and National Yang Ming University ranked the highest among all the research institutions with the betweenness centrality of 0.12. Other institutions with high levels of betweenness centrality were Karolinska Institution of 0.11 and University of California San Francisco(0.10). the National Center for Geriatrics & Gerontology published the most articles, with a total of 43. Other institutions that have published more than 30 articles include University of Sao Paulo, Karolinska Institution, and University of Pittsburgh. From the perspective of the quantity of published articles and the betweenness centrality, colleges and universities are the core in the institutions in this field. See <Figure 2> for details.

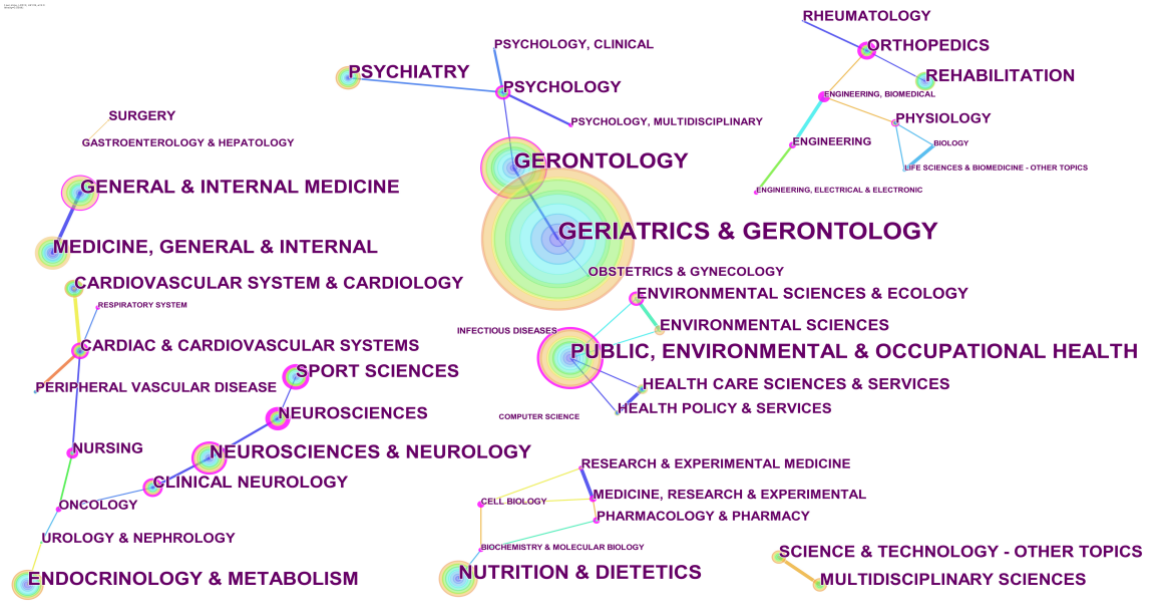
Figure 2. Basic information of research institutions.

Visible	Count	Cent...	Year	Institutions
☑	43	0.06	2012	Natl Ctr Geriatr & Gerontol
☑	41	0.10	2011	Univ Calif San Francisco
☑	39	0.03	2011	Univ Sao Paulo
☑	38	0.11	2011	Karolinska Inst
☑	36	0.09	2011	Univ Pittsburgh
☑	29	0.12	2011	Harvard Univ
☑	28	0.08	2012	Boston Univ
☑	27	0.03	2011	Vrije Univ Amsterdam
☑	26	0.09	2011	Univ Copenhagen
☑	25	0.01	2011	Chinese Univ Hong Kong
☑	25	0.06	2011	Columbia Univ
☑	24	0.10	2012	UCL
☑	22	0.02	2012	Lund Univ
☑	20	0.07	2012	Duke Univ
☑	20	0.12	2011	Natl Yang Ming Univ
☑	20	0.06	2012	Univ Minnesota
☑	20	0.04	2012	Univ Melbourne
☑	19	0.02	2012	China Med Univ
☑	19	0.03	2013	Umea Univ
☑	18	0.01	2013	Uppsala Univ
☑	18	0.01	2011	Seoul Natl Univ
☑	18	0.04	2011	Nagoya Univ
☑	18	0.04	2012	Monash Univ
☑	18	0.03	2011	Univ Washington
☑	17	0.01	2013	Yonsei Univ
☑	17	0.01	2012	Univ Gothenburg
☑	16	0.05	2013	Univ Calif San Diego
☑	16	0.04	2012	NIA
☑	16	0.05	2012	Univ Sydney
☑	16	0.07	2011	Inst Salud Carlos III
☑	16	0.02	2012	INSERM
☑	16	0.01	2012	Univ Tokyo

3.3. Relevant subjects

The integration and cross-development of multi-disciplines is the main trend of the current sport development, and the cross-cooperation of multiple disciplines promotes the development of the current research on physical activity for the elderly[12]. The co-occurring map of physical activity and health risks of the elderly by subject category in <Figure 3> intuitively shows the research results of physical activity of the elderly published by various subjects. The larger the nodes in the figure, the greater the number of published researches on physical activity and health risks in the elderly. The larger the node is, the higher the frequency is. The links refers to the occurrence of keywords in the same article. The betweenness centrality represents the core degree of a key node in the field. According to <Figure 3>, it can be found that the subjects with a high ranking in this field are: Geriatrics & Gerontology, Public Environmental & Occupational Health, General & Internal Medicine, Medicine, Nutrition & Dietetics and Physical.

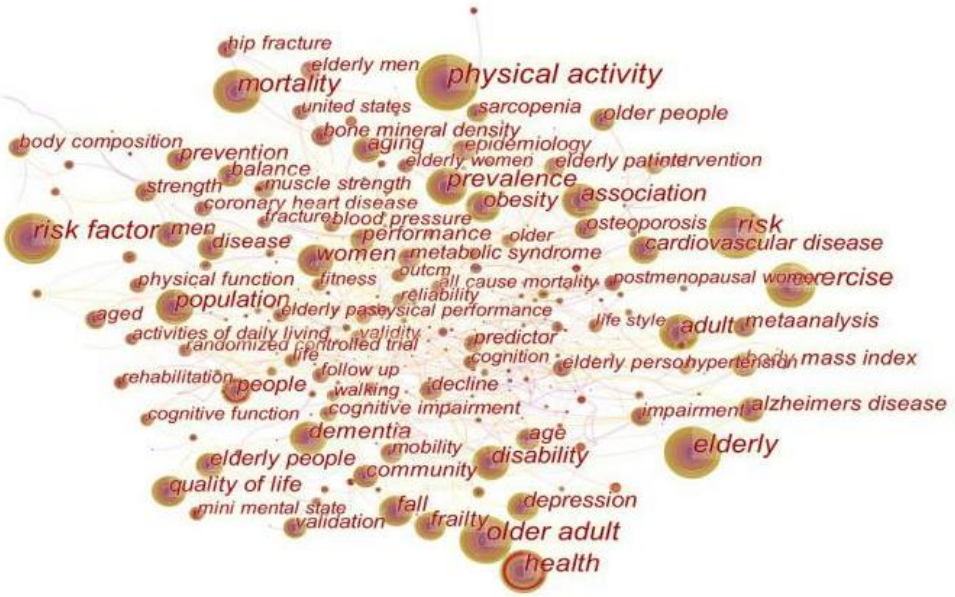
Figure 3. Subject co-occurring map.



3.4. Research hotspots

Key words are the concentration and refinement of the core contents of the literature, and the frequently appeared keywords can reflect the research hotspots in this field. Based on the keywords in the literature database, the keyword analysis function of CiteSpace software was used to draw the keyword co-occurring map of the research on physical activity and the health risk of the elderly in <Figure 4>, so as to facilitate the main research hotspots and research trends in the field. Among them, the size of the node represents the frequency of keywords. As shown in <Figure 4>, the top 10 keywords are physical activity, risk, risk factor, older adult, elderly, exercise, mortality, health, prevalence, and association.

Figure 4. Co-occurring keywords map.



Among them, the appearing frequency of key words of physical activity, risk, risk factor, older adult, elderly, exercise, and health are high because they are highly consistent with the research topic of physical activities and the health risks of the elderly. The Association's high frequency is due to the fact that physical activity and health risks for older adults is combined studies, so they often appear in key words. In addition to the keyword above, mortality and prevalence is another term for death. A mortality rate is the number of deaths due to prevalence a disease divided by the total population. Prevalence is a measure of disease that allows us to determine a person's likelihood of having a disease. Morbidity is another term for illness. A person can have several co-morbidities simultaneously. So, morbidities can range from Alzheimer's disease to cancer to traumatic brain injury. Morbidities are NOT deaths. Prevalence is a measure often used to determine the level of morbidity in a population. The reason for high frequency of mortality and prevalence is that the subjects studying physical activities and health risks of the elderly mainly focus on Geriatrics & Gerontology, Public Environmental & Occupational Health, General & Internal Medicine, Nutrition & Dietetics and Physical. The studies related to mortality and prevalence are relatively concerned by the subject of appeal. Moreover, these two key words cover the risk consequences caused by health problems of the elderly, so mortality and prevalence appear more frequently compared with other key word nodes on the way.

3.5. Research theme

Burst terms are keywords obtained through Burst Detection, which indicate that a variate has great changes in a specific period and has received great attention from researchers. It can reflect the evolution of the research topic from the time dimension and show the research focus in a specific stage[13]. The burst terms from the researches on physical activity for elderly were extracted by CiteSpace V software, including 25 keywords, as shown in <Figure 5>. By setting different starting and ending time of each keyword and combining with the spatiotemporal progress law of the researches on physical activity and health risk of the elderly, this paper cuts the evolution of the research topic in three stages.

In the first stage(2010-2013) of the study on physical activity and health risk of the elderly, the main burst terms were hip fracture, elder men, bone mineral density, weight lo, prediction, etc. This suggests that research on physical activity and health risks of the elderly at this stage focused on the health and physical fitness of the elderly, such as muscle strength, bone density, overweight, balance and risk of falls, etc. For example, empirical studies have followed up and shown that physical activity has a positive impact on balance and a negative impact on falls in elderly patients with Alzheimer's disease[14]. A randomized controlled study in 2012 examined balance through a combination of Wii Fit and modified physical activity in the elderly with an average age of 75.09±10.26, and got an accurate benign results[15].

Executive function, physical activity, coronary artery disease, gait, low back pain and quality were the major burst terms in the second stage(2014-2017). This indicates that this stage is more inclined to follow up research on disease prevention of the elderly. There were abundant experimental researches focusing on physical activities on the physical function of the elderly, physiological dimensions such as different types of chronic diseases of the elderly, and risk factors of disease prevention. For example, a study of the elderly in Brazil confirmed that physical activity could reduce risk and improve insomnia by investigating sociodemographic characteristics, physical leisure activity, daytime napping occurrence and duration, insomnia symptoms, and drug use[16]. Studies have also shown that moderate physical activity had a positive impact on the incidence of cardiovascular disease, quality of life and life expectancy in the elderly[17].

People, burden, multimorbidity, loneliness, instrumental activity, health were the major burst terms in the third stage(2018-2021).This phenomenon indicates that the research topic of physical activity and the health risk of the elderly has gradually shifted from the relevant experimental research to the practical research of validity verification. At this stage, the research on the elderly' personal health behavior and lifestyle, social support and health promotion began to highlight. This also proved that under the guidance of a series of policies such as the Global

Intersectoral Framework of Action for Health Promotion and Health Equity(2016), physical activities for the elderly has been focused, which has led to the expansion of the global research on physical activities for the elderly in both depth and breadth. For example, a large follow-up study in the United Kingdom assessed the future association between physical activity and mortality from cardiovascular disease and cancer and suggested that middle-aged and the elderly, including those with cardiovascular disease and cancer, could gain substantial longevity benefits through more active physical activity to change quality of life[18]. A study from China investigated the relationship between sedentary behavior, physical activity and health care expenditure among the elderly in China, and finally concluded that physical activity had a positive impact on the healthy lifestyle and quality of life of the elderly[19]. In addition, some studies believe that physical activity is beneficial to the physical health and social integration of the elderly[20].

Figure 5. Burst terms map: top 25 keywords with the strongest citation bursts.

Keywords	Year	Strength	Begin	End	2010 - 2021
hip fracture	2010	7.25	**2010**	2011	
bone mineral density	2010	6.4	**2010**	2011	
elderly men	2010	6.4	**2010**	2011	
cigarette smoking	2010	4.61	**2010**	2013	
adl	2010	4.17	**2010**	2013	
older women	2010	3.93	**2010**	2012	
weight lo	2010	3.93	**2010**	2011	
hong kong	2010	4.05	**2011**	2012	
event	2010	4.84	**2012**	2013	
chronic kidney disease	2010	4.06	**2012**	2014	
prediction	2010	3.9	**2012**	2013	
executive function	2010	4.33	**2014**	2015	
physicalactivity	2010	4.29	**2014**	2016	
coronary artery disease	2010	4.12	**2014**	2015	
gait	2010	4.88	**2015**	2016	
low back pain	2010	4.21	**2015**	2016	
dietary pattern	2010	5.43	**2016**	2021	
gait speed	2010	5.31	**2016**	2017	
quality	2010	3.95	**2016**	2021	
people	2010	5.81	**2017**	2018	
burden	2010	4.86	**2017**	2021	
multimorbidity	2010	4.86	**2017**	2021	
loneliness	2010	4.46	**2017**	2021	
instrumental activity	2010	4.3	**2017**	2021	
health	2010	5.03	**2018**	2019	

4. Conclusion

With the increase of the elderly , the deterioration of the elderly' health, loneliness, lack of social role and other problems have become the challenges that modern society has to face[21]. As an effective means to improve these problems, physical activity has been gradually paid attention to, and a large number of studies have been conducted around the world combining physical activity with the health of the elderly and the health risks of the elderly. For example, studies have shown that physical activity can regulate the influence of stress on the self-esteem of the elderly, and then improve the quality of life[22]. Qigong, as a kind of physical activity, not only improves the skeletal condition of the elderly, but also has a positive impact on their family harmonization, interpersonal relationship, physical and mental health, and life quality[23][24][25].

The Web of Science was selected for this study as the data source and CiteSpace used, a scientific measurement tool, to draw the knowledge map of physical activity and health risks of the elderly. It made a systematic analysis of the basic characteristics, research hotspots and topic evolution of this study field. From the results of this study, physical activity and the health risks of the elderly have been the subject of much attention in universities and research institutions in recent years. Physical activity, risk, risk factor, older adult, elderly, exercise, mortality, health, prevalence were focused to study by Geriatrics & Gerontology, Public Environmental & Occupational Health, General & Internal Medicine, Medicine, Nutrition & Dietetics, and Physical related studies. After 10 years of evolution, the topic has been enriched and expanded in the process, and new research continues, and the field will continue to evolve.

Unfortunately, this study only combs the research results from 2010 to 2021 and lacks an analysis of the evolution of previous studies. The search keywords are limited by setting physical activities and health risks of the elderly as search terms, which may lead to the omission of some key research results taking sports, exercise and disease as keywords. In addition, only the core database of Web of Science was used in this study, and other excellent databases such as Scoups, CNKI and KCI were not selected, which is also one of the factors limiting the comprehensiveness of the research results. It is hoped that the above problems can be solved in the following research.

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6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Lead Author	XB	-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*	HS	-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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A Study on the Operational Factors of Case Study for INTENALIZATION in the Business Continuity Management System in Commercial Bank

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Abstract

Purpose: *This paper aims to investigate the relation between BCMS operating factors and organization internalization. To achieve the purpose of this study, the followings detailed objectives are established. First, the differences are clarified through comparative analysis by investigating the operating status of the BCMS of domestic commercial banks according to the Financial Supervisory Service's BCP standards. Second, the operating factors are analyzed and organized to see if they affect the internalization of each bank's BCMS organization in the BCMS operation process. Third, to examine the methodology of organizational internalization of the bank BCMS, in-depth interviews are conducted with the relevant expert group, and the methodology of organizational internalization of the banking BCMS is proposed.*

Method: *In order to study the operating factors for internalization of BCMS in organization, the author investigated BCP operating level by comparison analysis the BCMS status quo of the four commercial Banks in Korea. The operating factors identified as scope of this study are BIA(Business Impact Analysis), RA(Risk Assessment), Business Management Strategy and BCP exercise, In addition, an FGI(Focus Group Interview) was conducted for BCM experts to study the methodology for raising the level of organizational internalization of BCMS. The FGI conducted qualitative surveys through in-depth interviews with the experts.*

Results: *The operating way for BCP exercise, cycle and exercise types etc, are the factors to impact the level of BCMS organization internalization. The author derived the methodology for the BCMS internalization to the Bank, it is considered in terms of education and training for staffs, activation of communication between organizations and individuals, BCMS operating standards in detailed level to avoid any doubts in BCM operation and organizational culture.*

Conclusion: *The author reached the conclusion that organization need to enhance the cognitive level of the members through education/BCP exercise, activated communication, operating detailed BCP procedure, interest and participation of top-management and establishment organization's culture which respect the BCM, especially in order to form an organizational culture, mutual respect and the formation of a trust relationship are continuously needed since culture is not formed in short period of time.*

[Keywords] ***BCMS, BCP Exercise, Bank, Internalization, Crisis***

1. Introduction

As both the frequency of disasters and the scale of disaster damage are increasing worldwide, efforts are needed to reduce disaster risk and strengthen resilience[1]. In this rapidly changing society, people face problems that have not been identified in the past, or sometimes fluid situations[2]. COVID-19 is having a rapid impact on society as a whole. Many scholars predict that the pandemic will not end up as an event but become a routine[3]. Disaster continues to occur around the world due to failure to proactively cope with the spread of COVID-19[4]. Disaster has continued to occur around the world over the past few decades, including SARS in 2002 and Corona 19 in 2020. If such disasters fails to do

normal work or delays it for more than a certain period of time, the damage will inevitably increase significantly to organizations. Therefore, organizations' business continuity management capabilities have become essential, not optional, to minimize disaster damage. Continuous efforts are needed to establish a business continuity management system(BCMS) and to secure the organization's business continuity management capabilities[5]. In particular, banks are more closely related to risk than other industries, so business continuity management is mandatory for banks. Therefore banks in Korea were the first to establish BCMS in accordance with the Business Continuity Plan(BCP) operating standards proposed by the Financial Supervisory Service(FSS, 2006) in October 2006.

However, organizations that have already adopted BCMS cannot be considered to have organizational capabilities at a level that satisfies BCM operations. Even though the organization establishes BCMS systematically, its resilience does not work properly in the event of a crisis if it is not the level of internalization that can be understood and implemented by its members. Therefore it is required the establishment of specific measures to internalize BCMS to the organization. Furthermore, detailed investigative analysis and research of how BCMS is being applied to organizations during BCMS operations is needed. Korean banks are establishing BCMS to meet the requirements of the BCM best standards proposed by the Financial Supervisory Service, a regulatory body. However, there is a difference in the level of BCMS operations and organizational internalization of each bank, and there is a lack of domestic research related to this

With the development of the Internet today, we live in a cyber space formed by computers and the Internet, in addition to the real space on our feet. In particular, as each sector of society pursues work efficiency, cyberspace is now recognized as an essential issue for the national economy and security, with hundreds of thousands of computers connected by fiber optic cables to form a huge neural network. As a result, more and more individuals or certain groups are conducting terrorism on cyberspace to fulfill their economic and political purposes[6].

This study applied the research methodology of YongKyun Jung's master's thesis(preceding study) however it has different points with the preceding study in the following aspects.

First, it is the timing of the study. The preceding study was conducted on 2018 and the bank's current BCMS operations are changed, therefore it is necessary to re-investigate the operational status quo at the present time. In particular, it is important to investigate the BCMS operation of the banks under the unprecedented pandemic situation of COVID19.

Second, the organization's interest and efforts for BCMS are higher than ever under the COVID19 situation which has continued since 2020. In addition, the bank's BCMS officials have accumulated professional working experience in responding to real crises. Consequently, it is able to provide realistic and considerate feedback on internalization of BCMS in organization.

The following is the originality of this study. So far there have been very few research cases on the relation between BCMS operating factors and organization internalization of BCMS. In addition, qualitative studies through in-depth interviews with experts in charge of the bank's BCMS operations are also differentiated from other studies. BCM has received worldwide attention from Morgan Stanley case in the event of 9.11 and the Financial Supervisory Service in Korea was the first to complete the BCMS deployment in accordance with BCP standards in October 2006[7]. In other words, Korean banks have operated BCM as a management system since 15 years ago and BCM managers of the banks are the group to working-level experts. Therefore, the results of in-depth interviews with the expert group could provide the good methodology for internalization of BCMS in organization and it can be applied to other industries.

2. A Case Study on the Current Status BCMS of Commercial Banks in Korea

2.1. BCMS specifications of the banks

In 2006, the Financial Supervisory Service introduced an exemplary measure for the banks to comply with the Basel Convention on the soundness of financial institutions. The composition of the model standards focuses on business impact analysis(BIA) and risk assessment(RA), BCM strategy and

planning, alternative workplaces(BCP centers), BCP exercises, etc. Details of this model set out criteria for the scope of BCP establishment, criteria for establishment alternative operations, BCP exercise based on organizational hierarchy, data backup and ITDR centers which are common requirements of BCMS. The overall composition of the BCP operating standards is as shown in <Table 1>[8].

Table 1. The overall compositions of the BCP operating standards.

Chapter	Contents
1. General rules	Explanation for necessity and terms of BCP(business continuity plan)
2. Role of BCP organization	Role and responsibility of board, top management and BCM (business continuity management) team for BCP establishing and execution
3. BIA and RA	Execution and scope for BIA and RA
4. Establishing BCM strategy	Considerations for BCM(business continuity management) strategy
5. Establishing BCP	Requirements for establishing BCP, crisis management procedure and establishing procedure of business resumption
6. Securing of an alternate operation site	Requirements for an alternate operation site
7. BCP exercise	Type and cycle for BCP exercise
8. Monitoring and reporting	Reporting to board and top management

2.2. Bank's BCMS deployment status

2.2.1. BIA(business impact analysis)

A business impact analysis(BIA) predicts the outcomes of interruption of a business task and procedure and assembles data expected to create recuperation approaches. BIA is the way toward deciding the criticality of business exercises and related resource necessities to guarantee operational versatility and coherence of tasks during and after a business disruption[9]. The BIA provides for recognition of critical operations and sales activities to operate in times of crisis, and for determining recovery targets such as recovery time objectives(RTO) and recovery point objectives(RPO) depending on the importance of those operations and sales activities[10]. To determine the level of recovery targets, the impact on the entire financial market as well as individual banks must be considered. In addition, the risk of a crisis leading to a suspension of work should be assessed in consideration of the effects of financial losses, possible violations of the regulation, customer/organizer/internal support, and reputation loss. In addition, banks that adopt BCMS are required to periodically conduct BIA and retain analysis results, and ISO 22317 is applied to implementation methods.

Table 2. Status of establishment of BIA and alternative workplaces for 4 case banks.

Type	Bank	BIA cycle	The numbers of critical duties	BCP center	Remark
Local bank	A	once a year	about 695	275 seats	BCP center and head office are located within 2 hours distance
	B		about 537	185 seats	
	C		about 890	317 seats	
Foreign bank	D		about 610	175 seats	

The 4 banks determine and maintain the size of alternative workplaces based on the results of the BIA. The BIA was implemented once a year, and additional BIA was implemented in the event of reorganization and IT system changes. Through the analysis of business impact, the bank's loss on risks exposed to natural and social disasters or other accidents is evaluated. The extent of the losses are considered to have a non-financial impact on financial losses, potential violations of regulation, customer and members of the organization and internally supporting and reputation losses.

In addition, key tasks, recovery target time(RTO) and necessary resources(people, work-related systems, etc.) derived from BIA are reflected in alternative workplaces. Alternative workplaces hold documents for the performance of core tasks selected through the BIA, and major data are being updated in real time through the headquarter, IT and IT DR(Disaster Recovery) center.

To sum up the commonalities and differences of the 4 banks, such as <Table 2>, the use of the BIA implementation cycle, analysis methods and results was almost similar. However, there were some differences between banks in terms of the number of key tasks derived from BIA analysis. These differences are largely attributable to differences in the size of each bank's organization, not to differences in the methods of business impact analysis or criteria for defining core tasks. On the other hand, all of the banks' alternative workplaces are located in distances within two hours of their headquarters. This is because the Financial Supervisory Service stipulates a recovery target time within 3 hours for important tasks such as payment of funds.

2.2.2. RA(risk assessment)

The ability of the risk assessment process depends on the risk identification step, as unidentified risks can result in unknown and unmanageable risks[11]. The BCP operating standards require banks to conduct risk assessments to identify risk factors that can cause organizational resource loss, identify the influence of those factors, and prioritize risks. In aging with ISO 31000, the existing method of controlling risk factors shall be evaluated and measures for improvement shall be prepared when conducting risk assessment[12]. In addition, safety diagnosis of major workplaces, such as the headquarter, IT center, customer contact center, etc., and key tasks that may be negatively affected in the event of risk shall be identified. The banks are establishing risk reduction measures through RA for major businesses, and <Table 3> summarizes the RA status of the 4 banks surveyed.

Table 3. Status of RA for 4 case banks.

Type	Bank	Cycle	Workplace	Remark
Local bank	A	Once a year	Head office/IT center/client contact center/IT DR center/ BCP center	1. Branches; assessment for facilities and power supplying etc, 2. Ad hoc; in case that system/organization changed
	B			
	C	Twice a year		
Foreign bank	D			

Each bank conducts risk assessments for its headquarters, IT centers, customer contact centers, IT DR and BCP centers. Risk factors considered in risk assessment include human disasters(network penetration, terror, union strike, disturbance etc.), natural disasters, infrastructure disasters(disruption of electricity supply, communication networks, etc.). Accordingly, IT center and IT DR center are located in buildings designed for IT security and the 4 banks also manage risk at an acceptable level for risk for major businesses through risk assessment.

2.2.3. Business continuity strategy

Business Continuity Strategy is a phase within the BCM planning process. It is the conceptual summary of preventive(mitigation) strategies, crisis response strategies and recovery strategies that must be carried out between the occurrence of a disaster and the time when normal operations are restored[13]. According to the BCP operating standards, the bank shall have a business continuity strategy to continue its core work in the event of a disaster or a disruption[14]. <Table 4> is a business

continuity strategy of the 4 banks surveyed and considers the work environment, risk characteristics, cost and effectiveness when formulating strategies.

Table 4. Business continuity strategy for 4 case banks.

Type	Bank	Diversification strategy	Duplication strategy	Preparation strategy
Local bank	A	Client contact center	IT center / IT DR center	Headquarter / branches
	B			
	C			
Foreign bank	D			

Each bank is applying diversification strategies, replication strategies, and preparation strategies as business continuity strategies. In the case of customer contact centers, one task is suspended by performing the same task in two or more centers, a diversification strategy is used to transfer the task to another customer contact center in event of crisis. Customer contact centers usually perform the same tasks, so diversification strategies are possible. IT centers and IT DR centers are preparing duplication the same data at the same time for data loss. The headquarter and the branch office have designated alternative workplaces in advance and are using preparatory strategies to move to alternative workplaces and resume work in the event of an emergency. In such cases, the BCP Center is the alternative workplace for headquarter, and the branch operates another branch in the nearby area as the alternative workplace. The BCP Center establishes the same level of business system as the headquarter, and operates on a scale where the critical tasks can be recovery within recovery time objective(RTO).

In the case of a business branch, a nearby branch is designated and operated as an alternative workplace of business because all branches perform the same category of work. In conclusion, it can be seen that each bank's business continuity strategy uses the same strategy as Table 4, and that each business continuity strategy applies to is the same.

2.2.4. BCP exercise

Business continuity planning(BCP) is the process involved in creating a system of prevention and recovery from potential threats to a company. The plan ensures that personnel and assets are protected and are able to function quickly in the event of a disaster[15]. The BCP operating standards require that banks conduct exercise to verify BCP effectiveness. Examples of exercise include enterprise-wide IT disaster recovery, branches and emergency response exercise. The exercises shall be conducted at least once a year and call tree tests, simulation exercise(e.g., Table Top Test, etc.) shall also be conducted at regularly intervals. The results of the survey on the current status of BCP exercise of 4 case banks shall be as shown in <Table 5>.

Table 5. BCP exercise for 4 case banks.

Type	Bank	Top management	Headquarter	IT disaster recovery	Call tree
Local bank	A	Nothing	Twice a year	Once a year	Once a year (Included in HQ exercise)
	B		Once a year	Once a year	
	C		Twice a year	Twice a year	
Foreign bank	D	Once a year	4 times a year	Twice a year	Twice a year

<Table 5> shows that the BCP exercise of local banks(A, B, C) and foreign banks(D) differs in type and implementation cycle. This is because Bank D, a Korean subsidiary of British banks, maintains BCMS in a form that meets both the Financial Supervisory Service's BCP operating standards and its own BCP

standards, unlike local banks in Korea. In addition, if there is a difference between regulators' standards and D Bank's own global standards, it is adopted and operated on a higher level basis. On the other hand, local banks operate BCP exercise based on the minimum standards set by the BCP operating standards. As such, the differences and contents of exercise conducted by each bank vary as follows.

2.2.4.1. Top management exercise

Top management exercise is not conducted by local banks(A, B and C), but only conducted by Bank D. Bank D is conducting a tabletop test in which management presents a hypothetical crisis and discusses countermeasures, measures and internal and external communications. The reason why management training is carried out as a tabletop test is that mission of top management in the event of an organization's crisis is important to understand the overall situation and to take countermeasures and communicate at an enterprise-wide level.

2.2.4.2. Headquarter exercise

Assuming that a crisis situation occurs at the bank's headquarters and cannot perform its duties, it shall be carried out in the form of moving to an alternative workplace of business(BCP Center) to restore its duties. This is because each bank adopts a preparatory strategy to use alternative workplaces in accordance with the business continuity management strategy of its headquarters department. During the Headquarter exercise, the management of Local Bank(A, B, C) except for Bank D was replacing the top management exercise at the level of observing BCP training.

2.2.4.3. IT disaster recovery exercise

IT Disaster Recovery exercise is a training that tests system recovery procedures at IT centers and IT DR centers in the event of an IT system failure at banks. IT disaster recovery exercise differs from other BCP exercise in that it is conducted over the weekend for system testing and that it is organized by the IT department. Each bank had a different cycle of exercise, but the method of implementation was the same.

2.2.4.4. Call tree exercise

Call tree exercise is to inspect the contact system between the members of the organization in the event of a crisis outside of business hours. Therefore, training is conducted after the end of business hours and is for all employees. Each bank conducts call tree exercise once a year. However, D bank is being conducted twice a year, so it is different from other local banks in terms of the number of tests.

Based on the above bank's BCMS operation, we can recognize the banks operate at the same level for BIA, RA and BC(business continuity) strategies and is meets the minimum requirements of the Financial Supervisory Service's BCP operating standards. However, in the case of BCP exercise, there is a difference between domestic local banks(A, B, C) and foreign D banks in terms of the type and number of exercise. Foreign D banks were not only conducting top management exercise conducted by table top testing but also had more training sessions than local banks(A,B,C). Taken together, local banks in Korea are responding in a form that meets the minimum standards set by the Financial Supervisory Service, and foreign D banks are effectively managing their BCM operations.

2.3. Case analysis

2.3.1. Cyber terror by North Korea

DDos attacks on government sites such as Korean White house, Naver, financial institutions and U.S. Forces Korea temporarily paralyzed the service[16].

2.3.2. IT outsourcing of the Korea development bank

In 1999, the Korea Development Bank became the first primary financial sector to pursue a full outsourcing of IT operations. The Korea Development Bank's attempt has drawn much attention as most

banks are reluctant to outsource other companies' methods due to financial accidents, security, and strike risks. Since then, the Korea Development Bank has constantly diagnosed problems in outsourcing and devised various supplementary measures to improve them. As a result of these improvements, KDB's IT outsourcing has become the first financial IT outsourcing system to have a responsible operating system that is more pioneering than other banks[17].

2.3.3. Korean credit card company and bank hack

In April 2001, a hacker was arrested for leaking and selling important credit information, such as resident numbers and credit card numbers, by hacking the system of credit card transaction approval and payment companies connected to famous credit card companies and banks in Korea[18].

3. In-Depth Interview on Organization Internalization of BCMS

3.1. In-depth interview

BCMS In-depth interviews were conducted with 8 BCM experts from the four banks surveyed to investigate and evaluate the internalization of the organization. In-depth interviews were conducted by face to face meeting and conference calls during May 2021.

Interviewees stated their opinions on BCP exercise, perceived level of BCM and crisis response capabilities in their respective banks. The composition of interviewees is as shown in <Table 6> below.

Table 6. Interviewees.

Type	Interviewee	Working experience	Title	Position	Remark
A bank	a	5 years	General manager	Team manager	Interview were conducted in head office of the banks
	b	4 years	Assistant manager	Staff	
B bank	c	4 years	General manager	Team manager	
	d	4.5 years	Assistant manager	Staff	
C bank	e	6 years	Senior general manager	Team manager	
	f	5 years	General manager	Team manager	
D bank	g	5 years	Senior general manager	Team manager	
	h	7 years	Assistant manager	Staff	

To assess the degree of BCMS internalization of each bank, an FGI(Focus Group Interview) was conducted with a total of 20 questions on BCP exercise, BCM recognition and crisis response capabilities.

3.2. Results of in-depth interview

In-depth interviews showed differences between local banks and foreign banks in BCP exercise, BCM awareness level and crisis response capabilities, as follows by sector.

3.2.1. BCP exercise

The biggest difference between the local banks(A, B, C) and foreign D bank is their understanding of and participation in BCP exercise. Local banks are found to have poor participation by executives

and employees, including top management in the exercise. In particular, in the case of top management, it was evaluated that they lacked a sense of participation in the training themselves. On the other hand, the foreign bank has a high level of participation and cooperation among organizational members in BCP training. In the case of foreign D banks, the top management exercise introduced in 2016 was an opportunity to remind organizational members of the importance of BCP by making them aware that management also carries out BCP exercise. The BCM expert of D Bank said that the continuous exercise of seven times a year was an important opportunity for the members of the organization to spread the BCP culture.

3.2.2. The awareness level of BCM

For the proliferation of related documents within the organization, all banks responded that they are conducted periodically, indicating that there was no difference between the banks. However, local bank(A, B, C) officers undervalued the level of awareness of staffs and management of business continuity. On the other hand, foreign banks showed differences in the level of recognition among executives and employees. On the other hand, foreign bank differed from local banks in that BCM education programs are included in the training of new staffs and there was a business proposal system related to BCP.

3.2.3. Crisis response capability

The BCM experts in local banks responded that crisis response capabilities were unreliable. They said that this is due to the lack of organizational understanding and participation in BCM. On the other hand, experts in foreign bank responded that the organization is capable of responding to the crisis, citing the BCP operation case during the 2016 union strike. In particular, they had confidence in the resilience of the organization through cooperation between BCP team, management and executives in the event of a crisis.

3.2.4. Summary of in-depth interview

The details of in-depth interviews on the internalization of BCMS could be summarized as follows:

3.2.4.1. Importance of education and communication in BCP exercise

Judging that the previous BCP exercise was not smooth, Bank C conducted pre-training for exercise participants from 2016 and shared the case that the exercise was more successful than before as a result of writing mission cards reflecting the opinions of each department

3.2.4.2. Clarifying responsibilities for BCP exercise improvements

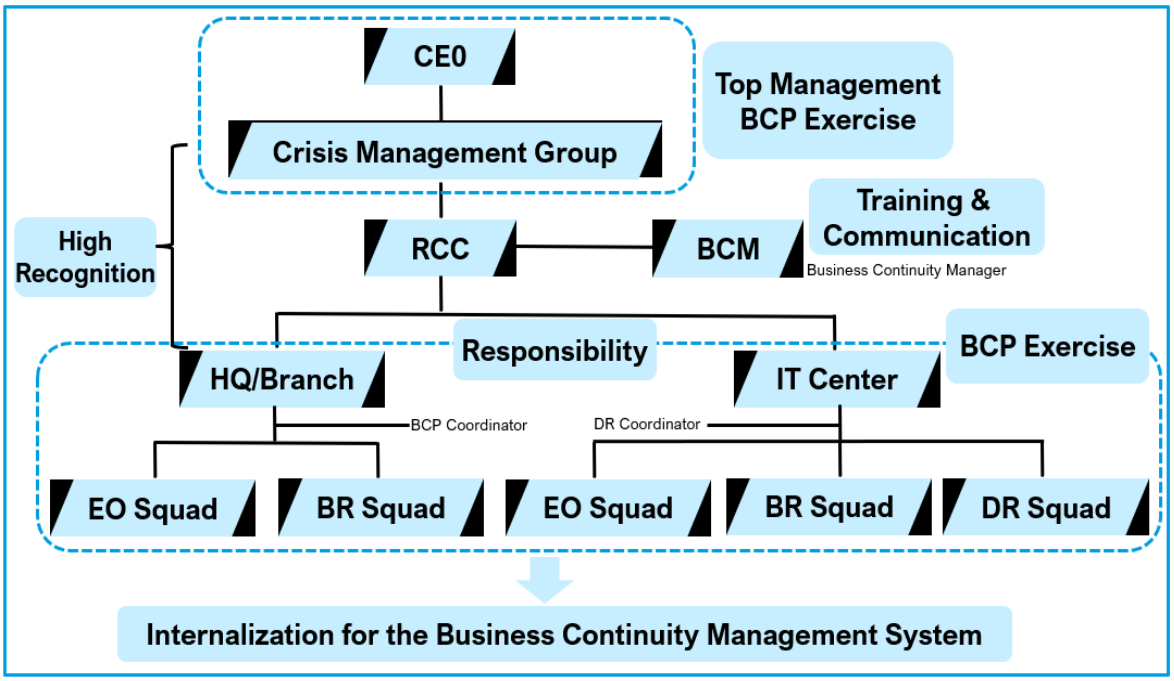
Clear responsibility is given for improving deficiencies at the end of the exercise. Experts in Bank D said improvement measures were implemented smoothly after the end of the exercise after introducing guidelines that would hold the department responsible for the improvement of each department's business system in the BCP Center

3.2.4.3. BCP exercise method and times

The recognition level of the organization shall be improved by the top-down method and the increase in the exercises. With the approval of top management, Bank A increased headquarter exercises twice a year, which allowed it to overcome resistance from its members and conduct additional exercise and improved the organization's ability to deal with crises.

Taken together, the in-depth interview results showed that important factors for organization internalization of BCMS are to raise BCM awareness of staff and to promote enterprise-wide BCP exercise, education and communication. The above factors and organizational internalization relationships are mapped out as shown in <Figure 1>.

Figure 1. Internalization elements of BCP.



Note: RCC: Recovery Control Centre, HQ: Headquarter, EO: Emergency Operation, BR: Business Resumption, DR: Disaster Resumption.

3.3. Correlation of organizational internalization factors

Organizational internalization can be defined as the process by which new strategic tasks are introduced to the organization and settled in the members. In other words, internalization has been achieved at the level at which organizational members agree on new values and acknowledge their need to apply them voluntarily to their working way. Internalization of value has the effect of organizational immersion in organizational members[19]. It also means recognizing the core values of an organization, feeling the matching values between individuals and organizations, and voluntarily immerse and act[20]. Looking at the operational factors of BCM and the requirements for organization internalization, we can see that BCP exercise is an important factor that affects organizational internalization. Therefore, the scope of BCP exercise and the implementation cycle, etc. result in differences in the level of recognition of BCM of the organization. According to the explanation of “Corporate Disaster Management Standard(Ministry of Public Administration and Security)”, the correlation between BIA, RA, BC strategy and BCP exercise is as shown in <Table 7>.

Table 7. Correlation between BIA, RA, BC strategy and BCP exercise.

Type	Details	Remark
BIA	Analysis of critical duties, required resources and RTO	Used as basic data for establishing business continuity strategy
RA	Assessment for risk factors that affect critical duties	
Business continuity strategy	Establish a strategy for the risk reduction based on the results from BIA and RA	
BCP exercise	Testing the business continuity strategy established through BIA and RA	

BCP strategies are elaborated through BIA and RA results and their execution and effectiveness are verified through BCP exercise. The strategy is established by reflecting the results of the organization's BIA and RA and BCP exercise is to practice repeatedly to realize the established the strategy. According

to the cooperate disaster management standard by Ministry of Public Administration and Security in Korea, "Organizations should regularly conduct and evaluate exercises to verify and effectively implement disaster mitigation activities procedures and plans in line with their goals." An enterprise shall continuously train its chief managers and members to establish and recognize the goals and importance of disaster mitigation activities as the culture of the organization[21]." That is, BCP exercise shows that BCMS can be internalized to entire organization.

3.4. The method for BCMS organization internalization

Five ways to internalize the organization can be summarized through in-depth interviews .

First, in terms of education and exercise. The way to maximize the learning effect in education is repetitive learning. Conducting BCP exercise periodically is a good way to increase and embody members' awareness of BCP. Therefore, to efficiently and systematically conduct BCP educations and exercise, it is necessary to manage what training all employees received from employment and how many times they participated in the training. In addition, BCP managers need institutional support to support the completion of external curriculum and encourage the acquisition of relevant certificates.

Second, activation of communication between organization and individuals is required. Unilateral education and exercise of members is not enough to effectively implement organizational internalization. This is because the goal of communication for organizational internalization is to share values and enhance understanding through communication on new systems, such as strategic tasks. Therefore, organizations need to implement BCP proposals system, share experiences and feedback to encourage employees to participate, rather than relying solely on top-down training or exercise.

Third, specific BCMS operating standards are set and implemented. In general, organizations tend to meet only the scope when the minimum operating standards are set for a task. In particular, this trend is strongly found when tasks that are not directly related to an organization's sales or revenue, such as BCMS. Therefore BCMS operating standards improved in detail and operated in accordance with the procedures will help to increase the level of organization internalization.

Fourth, it is important to improve top-management’s interest and participation in the BCM. This is because due to the nature of the organization, all members of the organization have strong tendency to pay attention to and participate in the work that management recognizes and emphasizes the importance.

Finally, it is necessary to establish a cooperative and reliable organizational culture among members. Organizational cultural factors are more important requirements than education, exercise and communication. However, organizational culture does not form in the short term. Therefore, mutual respect and trust relationships should be continuously promoted to form an culture in organization level and incentives through evaluation should also be considered. The level of internalization of the organization shall be increased by creating a culture in which knowledge is shared and teamwork is enhanced by examining the organizational culture.

4. Conclusions

In order to operate the execution and effectiveness of BCM, it is necessary to go beyond simply establishing BCMS within the organization to the stage of internalization of the organization. In this study, we investigated and analyzed BCMS operation status for BIA, RA, BC strategy, BCP exercise, etc. in the banking sector which established and operated BCMS first in Korea. In addition, the relationship between BCMS operations and internalization is studied through a review of the different levels of BCMS internalization for each bank.

Four domestic commercial banks were selected and studied and the results showed that there was a difference in the operation of BCMS banks built on the same BCP operating standards by FSS. In addition, relationships were derived by analyzing and organizing operational factors that affect the internalization of the BCMS organization of banks in the BCMS operation process.

In-depth interviews were conducted to reveal the differences between banks in BCP education and

exercise, awareness of BCM and crisis response levels. It also considered the importance of education and exercise, strengthening communication within the organization, and forming an organizational culture based on concrete BCMS operations and responsibility and trust and proposed ways to internalize BCMS organizations. It is recommended that this study is prepared by adding methods for internalization of the organization based on Yongkyun Jung's master's thesis, "A Study on the Operational Factors of the Business Continuity Management System for its Internalization into an Organization"[5].

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6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Lead Author	YJ	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑
Corresponding Author*	CC	-Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Co-Author	SR	-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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Development of GAMIFICATION Model for Flipped Learning

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Abstract

Purpose: *This study aims to develop a gamification model for flipped learning for the systematization and simplicity of gamified teaching and learning design for teachers and for learners' enjoyable, self-directed learning during the pre- and post-classes. As the world has recently experienced a crisis in the form of the COVID-19 pandemic, teaching and learning environments have changed a lot. Flipped learning can be used as an alternative strategy for improving educational effectiveness while considering the issue of learners' safety in crisis situations. Flipped learning enables mastery learning and improves learning effects with a learning style that suits students and increases learner participation.*

Method*: To verify the validity of the gamification model for flipped learning derived through FGI , the content validity and face validity were verified by a group of experts using a testing tool. The criteria established for selecting the group of experts were those who had a doctorate degree in a major field or had more than ten years of educational experience and who are currently teaching in universities or public educational sectors. The validity test criteria consisted of 'validity,' 'utility,' and 'usefulness' as a class design model, and 'understanding' and 'value' for the explanation , and they were each scored on a 5-point Likert scale.*

Results: *The average value of the validity for each evaluation item was found to be within the range of 4.2 to 4.6, indicating that all the elements of the model were properly recognized. The calculations for each evaluation factor also show that the ratio(CVR) was distributed within the range of 0.75 to 1.00. A final model for flipped learning classes incorporating gamification was derived, validated, and verified. The four procedural elements of flipped learning using gamification are navigate(N), aim(A), build(B), and implement(I).*

Conclusion: *A gamification model for flipped learning, consisting of navigate, aim, build, and implement(NABI) procedures, was developed and has been proven to be valid. A strategic approach was needed to improve the current state of flipped learning, and gamification, which can lead to the active participation of participants, was necessary. These attempts will serve as a significant opportunity to implement flipped learning more dynamically. It is also expected that gamification will be a catalyst for learners' enjoyable, effective, memorable, sustainable and meaningful learning experiences inside and outside the classroom.*

[Keywords] ***Gamification Model, Flipped Learning, Instructional Strategy, Self-Directed Learning, Mastery Learning***

1. Introduction

Recently, as the educational paradigm has changed from being teacher-centered to learner-centered, many innovative teaching-learning models are being introduced. As a part of such efforts, flipped learning has achieved positive effects in various subjects in the classroom[1][2][3][4][5]. Meanwhile, the teaching and learning environment has changed a lot as the world has recently experienced a crisis in the form of the COVID-19 pandemic, and a change in the physical form of classroom instruc-

tion is required as a representative method[6]. Therefore, flipped learning can be used as an alternative to improve educational effectiveness while considering the issue of learners' safety in crisis situation[7][8]. Flipped learning can maximize the efficiency of education through pre-learning online to build basic knowledge and then through various collaborative learning tasks performed face-to-face or non-face-to-face. In particular, flipped learning enables mastery learning and improves learning effects with a learning style that suits students and increases learner participation. However, the biggest drawback of flipped learning is that it is difficult for instructors to provide additional class support activities during its implementation. For learners, it is difficult to participate in voluntary learning due to a lack of fun and interest. To solve this problem, there has recently been an increasing number of attempts to combine gamification with flipped learning[9]. Gamification refers to inducing the active participation, immersion, and enjoyment of participants by applying game-like thinking and game mechanics to a context other than a game[10]. When designing a class that combines gamification with flipped learning, it is difficult to effectively inform both teachers and students because there is a difference in what should be considered from the teacher's perspective and what should be performed from the learner's perspective. The disadvantages of such complications have been discussed[11]. Thus, this study develops and examines the validity of a gamification model for flipped learning to implement mastery learning more effectively. The research questions are as follows:

1) What procedures does the gamification model for flipped learning consist of?

2) Is the gamification model for flipped learning valid?

2. Theoretical Background

2.1. Flipped learning

2.1.1. Concept

In the 21st century, education that meets the paradigm of future education has become possible through the rapid development of information technology and innovative changes in teaching methods. However, e-learning and blended learning have been actively carried out as part of the improvement measures for teaching methods using information and communication technology(ICT), but they have not been successful. In particular, the most significant cause of the failure of blended learning was the lack of training methods and management systems linking the online and offline elements. Despite blended learning having been used to maximize online efficiency and offline educational effectiveness, the blended learning is a demanding teaching method for students[9]. There was dissatisfaction with regard to the amount and quality of online learning and the teacher's lack of real-time interaction. Besides, there was the inconvenience of familiarizing oneself with other educational content that was not required in an offline context. Consequently, a lack of successful cases of blended learning has been observed in the educational field.

However, interest in 'flipped learning' as a new educational method has recently emerged. Flipped learning is a form of blended learning that allows learners to acquire prior knowledge through self-directed learning before classes and to collaborate with peers to solve problems in classes, as well as developing creativity through coaching by teachers. Flipped learning can be used in a variety of subjects. However, a systematic teaching design is needed prior to the classes. The 'PARTNER model' is an instructional design for designing courses, so it may be limited to accommodating all stages[12]. The procedures of flipped learning can be explained in terms of pre-class, in-class, and post-class(PIP) stages[7].

In order to master new teaching methods, both teachers and learners will have the burden of accepting and utilizing a lot of information. It is also important to have the flexibility to accept the paradigm shift rather than to worry. Such a teaching strategy is necessary, and

innovative teaching methods, such as gamification, which is effective to boost student motivation and participation, will lead to positive educational consequences.

2.1.2. Characteristics

Flipped learning is a representative learner-centered teaching-learning model with several features and advantages[12]. The most noticeable point is that all matters related to learning have a structure through which the learner is made aware of the content and completes the learning through tasks in class. In traditional teacher-centered classes, learners are busy accepting new learning content within a limited amount of time, and this type of education ignores their individual understanding of learning[7]. It is difficult for teachers to answer learners' questions or deal with aspects that they do not understand in class. However, in flipped learning, class time is used to solve these problems, so teaching and learning time can be used more meaningfully and efficiently.

Also, in a self-directed learning process, learners take responsibility for their own learning. The reasoning behind this is that if they do not complete the pre-class activities on their own, the collaborative learning in face-to-face classes may not go smoothly as a result, which provides them with opportunities to have a sense of ownership with regard to their learning. After all, this offers the advantage of maximizing the effectiveness of their education by allowing them to actively participate through self-directed learning.

2.1.3. Limitations and challenges

Resources are no longer limited but are transformed into the keywords of creativity, sensibility, convergence, and connection. The core competencies required of learners are complicated, and diverse comprehensive problem-solving abilities must evolve from their existing simple problem-solving abilities. However, in order for next-generation learners to develop the competencies required, unilateral lecture-style education, which has been implemented for the last two thousand years, must be recognized as having limitations. Currently, there is a need for an innovative educational system that can motivate learners themselves to think deeply and exercise collective intelligence with others rather than alone. However, there are various shortcomings in the current educational field in terms of learner-centered teaching methods. Teachers need to develop their digital literacy skills, and learners need self-directed learning abilities[13]. In the future, an advanced system of teaching-learning will require teachers' multi-learning management skills, and learners will be required to make their own efforts to increase their self-directed learning and metacognition. A teaching strategy can promote such efforts and achieve educational goals through subjectivity by maximizing learning motivation. It may also allow learners to take the initiative with regard to their learning to achieve educational goals independently, which is expected to improve the effectiveness of education overall.

2.2. Gamification

2.2.1. Concept

Gamification refers to creating a gameful experience by applying game elements or mechanics to a non-game context, thereby inducing active participation, enjoyment, and participants' flow[14]. In other words, gamification is the pursuit of valuable fun by incorporating the enjoyable elements of games into valuable tasks that are less fun, like learning and work[15]. Gamification is being actively utilized, especially in the education sector[15][16][17][18]. It has been reported as applying game elements and mechanics to education, performing the learning experience in the context of gameplay, strengthening learners' motivation to learn, actively participating in the learning process, and contributing to an enjoyable experience for learners, meaning that they are more immersed in their learning[16][17].

2.2.2. Characteristics

Gamification in the field of education has the advantage of enhancing confidence, self-efficacy, and self-determination as learners feel enjoyment and strong immersion in the learning process[15][16][17][18]. It has been reported that increased engagement has a positive effect on strengthening learning motivation[15][16][17][18].

Gamification classes have been designed based on the MDA Framework[17]. It consists of game mechanics, referring to the rules of the game, game dynamics related to game system, and aesthetics, which encompass the player's experience in terms of the game mechanics and feelings. Gamification elements in education include quests, rewards, rewards schedules, avoidance, leaderboards, and status[15]. In addition, the main fun aspects of the PLEX framework that are used in gamification in the field of education are challenges, competition, completion, control, discovery, exploration, expression, fantasy, fellowship, simulation, and sympathy[15].

Table 1. Elements of gamification mechanics and playful experiences in the PLEX framework.

Categories	Elements	Playful experiences in the PLEX framework
Quests	Unlocking, countdown, scaffolding, communal, discovery, etc.	Challenge, competition, completion, control, discovery, exploration, expression, fantasy, fellowship, simulation, sympathy
Rewards	Points, badges, levels, progression, authority, virtual items, etc.	
Rewards schedules	Fixed interval reward schedules, fixed ratio reward schedules, variable interval reward schedules, variable ratio reward schedules	
Avoidance	Disincentives, leaky bucket	
Leaderboards	Macro leaderboard, micro leaderboard, direct & indirect competition	
Status	Avatar, social graph	

2.2.3. Limitations and challenges

Gamification in the educational field is not suitable for all learners[15]. The learning motivation provided by it is more effective for middle- and lower-level learners, as higher-level learners can achieve their learning outcomes through traditional teaching methods. Gamification allows middle- and lower-level learners to experience high learning involvement while having fun[15].

Looking at the educational gamification models developed so far, it is often difficult for teachers to design gamified teaching-learning[12]. In addition, there are many concerns about how educational gamification will be accepted by students, and this can cause a heavy burden at the implementation stage. On the other hand, learners have pointed out the disadvantage of such methods not feeling like a game and instead being cumbersome[10]. Therefore, in this study, if the procedure of designing gamified instruction is not complicated and fields that require educational gamification are found, it is necessary to develop an easy and simple model for gamification.

2.3. Flipped learning using gamification

Several studies have obtained positive effects by using gamification in flipped learning to enable mastery learning. Gamification has had a positive influence on flipped learning in terms of students' achievement and engagement[19]. This study used gamification elements, such as points, levels, badges, achievements, collections, weekly and general leaderboards, teammates, and statistical graphs. In the pre- and post-class phases, a teacher facilitated a ques-

tion and answer session with students using a board and Moodle learning management system(LMS), and the in-class learning consisted of several gamified quizzes and tests. Moreover, gamification in flipped learning was effective at improving learning achievement, learning anxiety, motivation, and autonomy[20].

A study by Segura-Robles et al. showed that gamified flipped learning, when compared to traditional flipped learning, had a significant effect on autonomy, relations with others, satisfaction/enjoyment, extrinsic/intrinsic motivation, and learning achievement[21]. This result suggests that a gamified flipped learning model should be designed.

Meanwhile, Safaour conducted a study on the benefits regarding personal skills/abilities that are associated with targeted nontraditional teaching methods and analyzed the flipped classroom, gamification, case studies, self-directed learning, and social media, which are all examples of such methods[22]. Reflecting the findings of this study, it suggested the need to design gamified flipped learning.

Manzano-Leon performed a meta-analysis of 57 'gamification in education' studies published from 2016 to 2020 based on the MDA framework[9]. As a result of the analysis, the mechanics corresponding to the game rules among the gamified elements indicated a frequency of use corresponding to the following order: points, badges, rewards/rankings, levels/prizes, and achievements. The equivalent order for the dynamics corresponding to the game system was as follows: challenges, playful activities/tasks, and events/roles/feedback/choices/competition, and it was found that only 'narrative,' as a part of the 'aesthetics,' represented 'fun' for the game player. This study indicated that gamification elements are beneficial when implementing educational gamification flipped learning classes.

A gamified flipped learning design model needs to consider learners' needs, so agile methodology has a positive effect in the educational field when designing teaching and learning. Agile methodology, which has been commonly employed for software development, means constantly changing and developing elements based on users' responses and needs[22].

As a result of examining the previous studies, applying gamification mechanics to flipped learning may have potential regarding educational effectiveness and supplementing the shortcomings in terms of both gamification and flipped learning. Gamification instructional models for flipped learning are extremely limited, so this study develops a model that can create synergy effects and examines its validity. Also, it suggests that a model that can implement gamification classes with a minimal application of gamification elements is needed, because gamification design is complicated.

3. Development of Gamification Model for Flipped Learning

In this study, a model including both procedures and elements for gamified flipped learning design was developed through the analysis of previous studies. Even if the instructor has an understanding of flipped learning, a burden is experienced with regard to the procedures and elements of gamification design[23]. Therefore, this study developed a model for the design of gamified flipped learning classes using the agile method used for game development.

3.1. Elements of gamification model for flipped learning

Segura-Robles considered the aspects of autonomy, relations with others, satisfaction/enjoyment, extrinsic/intrinsic motivation, and learning achievements for the effective implementation of gamified flipped learning[23]. In addition, the goal-access-feedback-challenge-collaboration(GAFCC) gamification design model presented in the gamified flipped learning study of Huang and Hew focuses on motivation needs and aims to utilize the SPSS statistics program for graduating students, and it used a class design[24]. In the flipped learning class, the biggest reason identified for why students could not complete the task was a lack of mo-

tivation, so gamification was applied to compensate for this. As a result, the students experienced higher completion rates and activated higher quality artifacts in flipped activities[24]. In the GAFCC model presented in this study, four factors were selected to enable gamified flipped learning, with a minimum number of gamification factors in consideration of the reinforcement of learners' learning motivation and the convenience of the instructor in terms of designing the gamified flipped learning: challenges, scaffolding feedback, competition, and rewards. It is possible to design a gamified class using one or more of these elements in the whole or part of the flipped learning process. When designing gamified flipped learning, the following elements should be considered: the 'challenge' for achieving learning goals, 'scaffolding feedback' for making challenges easy, 'rewards' for adding fun and motivation as a game, and 'competition' for creating a game environment. The terms are described as follows.

a) Challenges: Teachers provide missions and quests for learners' challenge.

b) Scaffolding feedback: Scaffolding feedback is provided individually, at the group level, and whole class at the 'in-class - pre-class - in-class - post-class(IPIP)' stages so that learners can raise their levels when completing missions and quests.

c) Rewards: Rewards may be provided in various ways, such as through points, badges, levels, and virtual items. The timing and rate of reward payments may be adjusted by reflecting on the learners' opinions.

d) Competition: In the classroom, the game is designed based on a multi-game approach that involves one or many competitions and challenges. It may reduce the students' burden regarding affective domain to compete between a teacher and students or between students' past and present themselves. Particularly, self-game mode may lead students' self-directed learning routine related to mastery learning through competition between students' themselves.

3.2. Procedure of the gamification model for flipped learning

In general, the class stages in flipped learning are sequentially operated as pre-, in-, and post-class phases. Because preparatory lessons are required for cooperative learning during the in-class stage, learners have the responsibility to perform pre-class activities. In the in-class stage, problem-solving learning is carried out through collaboration with peer learners. Lastly, in the post-class stage, learning reflection takes place.

Due to the features of gamification, a game needs to be started in class because it requires the orientation of game rules and simulations. The flipped learning stage of this study can be largely divided into 'in-class - pre-class - in-class - post-class(IPIP)' stages. Flipped learning using gamification begins in-class, and this is followed by pre-, in-, and post-class activities with regard to the next class. In addition, the gamification elements and mechanics of challenges, scaffolding feedback, competition, and rewards can be used in the whole or part of the IPIP process.

The four procedural elements of the gamification for flipped learning model are navigate(N), aim(A), build(B), and implement(I). Each of these procedures contains three aspects: instruction, gamification strategies, and the learners' learning strategies.

3.2.1. Navigate(N)

a) Instruction: In the in-class phase, teachers navigate teaching and learning by observing, interviewing, and evaluating learning, and diagnose learners' current situations. In addition, teachers examine what areas need improvement in terms of learners' learning, and analyze the teaching situation, scaffolding, and overall feedback.

b) Gamification strategies: These are implemented in order to improve the problems discovered during the instruction phase. In particular, in consideration of the fact that the game activities used in the in-, pre-, in-, and post-class stages should be organically linked, aspects regarding learners' learning experiences and instructors' gamification class management are

examined. In relation to gamification strategies, the educational gamification field often utilizes challenges, scaffolding feedback, competition and rewards. It also utilizes strategies discovered in the navigate stage that suit the teaching situation.

c) Learners' learning strategies: In the pre-class stage, learners themselves examine and check their learning situations in the self-game mode. They self-evaluate what areas need improvement in order to improve their skills, and establish the future direction of their learning. In other words, learners navigate their learning situations so that they can practice self-directed learning.

3.2.2. Aim(A)

a) Instruction: In the in-class phase, teachers set goals for adaptive learning.

b) Gamification strategies: The scope of the educational gamification to be used in the in- and pre-class stages and the aims of the gamification are determined. Goals are also set for fun elements that learners will experience during gamification. The aim element also uses competition, rewards, challenges, and scaffolding feedback, among other gamification strategies.

c) Learners' learning strategies: In the pre-class phase, learners themselves set goals to improve their skills in the self-game mode.

3.2.3. Build(B)

a) Instruction: Teachers build and create learning experiences that learners will experience in the in-, pre-, in- and post-class phases by considering learning content.

b) Gamification strategies: During the in-class stage, learners create enjoyable learning experiences, and in the post-class phase, game rules are created by taking into account game elements, mechanics, and story elements by utilizing challenges, scaffolding feedback, rewards, and competition.

c) Learners' learning strategies: In the post-class stage, learners create activities that allow them to develop their skills in the self-game mode. The types, procedures, quantities, etc. of these activities are determined on their own, and this can strengthen self-determination.

3.2.4. Implement(I)

a) Instruction: In the in-class phase, teachers implement group work, which is also taught based on examining whether the content of the class is meaningful and contributes to internalization.

b) Gamification strategies: During the in-class stage, teachers implement the simplest game developed. At this time, the collection of data related to gameful experiences from learners' feedback is required. At this stage, if necessary, game rules are created by applying gamification elements. Teachers need to check which parts to modify and supplement while implementing game rules. As teachers implement game rules, they return to the navigate stage and navigate the implementation.

c) Learners' learning strategies: In the post-class phase, learners perform the internalization of the learning content on their own in the self-game mode. At this time, students work through activities that are helpful to them as individuals, and teachers provide them with an opportunity for self-feedback.

The game elements checked in the second navigate stage are navigated again to see if the elements are in line with the aim and the scope, and the fun elements are also re-modified. In the second build phase, the game is upgraded by reflecting the need for modification. In the second class, while the revised game is being implemented, it is necessary to take the learners' responses and feedback. This agile method is used when developing games, and it is

also incorporated into gamified teaching-learning design. It does not mean developing a complete game system from the beginning of development, but developing an optimized game system through repeated modifications. This NABI procedures can reduce the teachers' burden of a gamified flipped learning development, as well as can increase the students' game-like experiences through constantly being upgraded.

3.3. Model validation test

The validation of the gamified flipped learning model was tested based on the criteria from the selected expert group as a focus group consisted of one professional flipped learning consultant, one gamification expert, and two professors and instructional design experts with doctorate degrees in educational engineering. The validity test criteria consisted of 'validity,' 'utility,' and 'usefulness' as a teaching-learning design model, and 'comprehension' and 'value' for the explanation of the model, and they were each scored on a 5-point Likert scale. To verify, the validity ratio(CVR) was calculated by quantifying the consensus opinion.

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}}$$

The feasibility questionnaires were delivered and collected by email and face-to-face, and the results of the validity test by experts are as follows.

Table 2. Results of the validation on gamification model for flipped learning.

Items	Validity questionnaires	M	SD	CVR
Validity	It is a valid design model for flipped learning classes that combine elements of feasibility games and mechanics.	4.6	0.54	1.00
Usability	The gamification-integrated flipped learning class design model that applies elements of usability games and mechanics can be used in classes.	4.4	0.54	1.00
Usefulness	The gamification-integrated flipped learning class design models with elements of usable games and mechanics is useful for teachers and learners.	4.6	0.54	1.00
Comprehension	It is a gamification integrated flipped learning class design model that applies elements of understanding games and mechanics to make it easier for teachers to understand when designing classes.	4.2	0.44	1.00
Value	The gamification-integrated flipped learning class design models that applies valuable elements of games and mechanics can contribute to learners' active participation in learning.	4.6	0.54	1.00

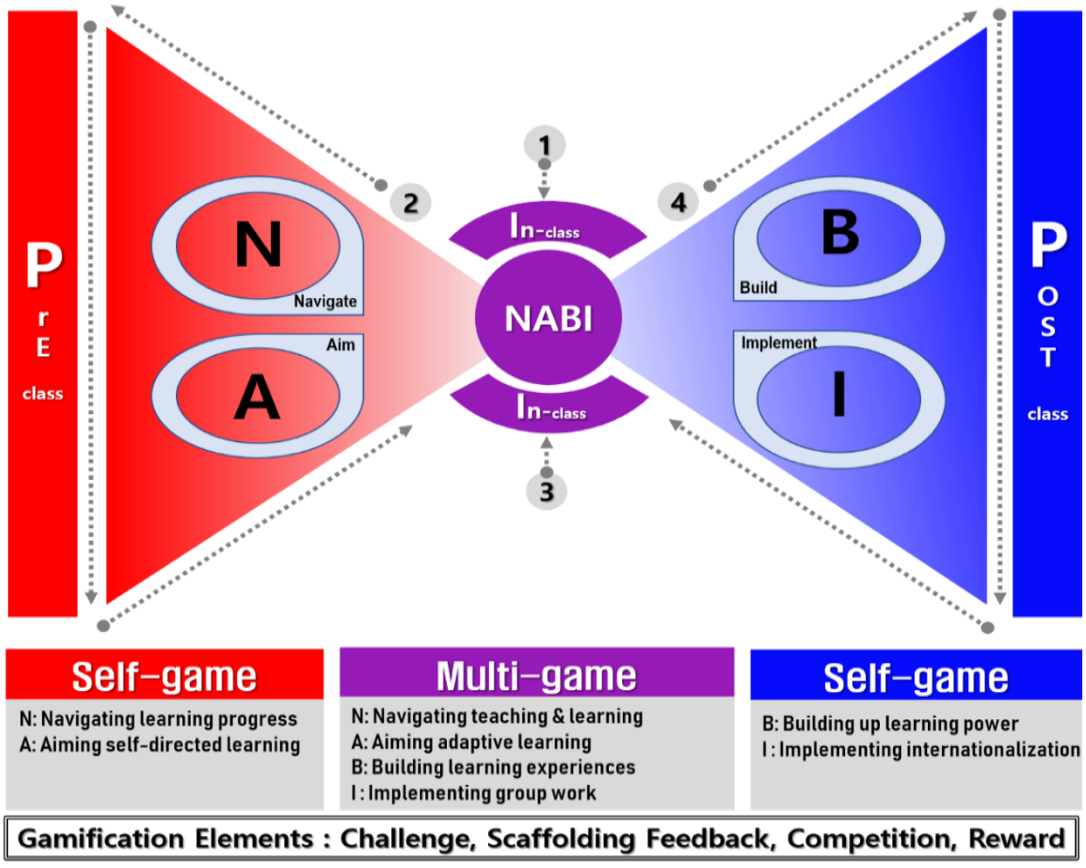
As shown in <Table 2>, the average value of the validity for each evaluation item was found to be within the range of 4.2 to 4.6, indicating that all elements of the model were properly recognized. The calculations for each evaluation factor also show that the ratio(CVR) was distributed within the range of 0.75 to 1.00. When the number of cases(N) is 5, the minimum CVR value for obtaining content validity is 0.99[25]. Therefore, content validity was obtained for the model developed in this study.

In particular, in this study, the recommendations of experts were accepted in order to develop a more complete model. First, as overall opinions, a clarification of what functions and roles each element of navigate, aim, build, and implement(NABI) performs in the in-, pre-, in-, and post-class phases was requested. Second, the experts requested accurate guidance as to how the class proceeds by specifying the flow of the order of the in-, pre-, in-, and post-class stages. Therefore, in the final model, detailed NABI elements were specified for each stage of the self-game and multi-game modes and the order of the classes was indicated using numbers, based on the experts' opinions.

3.4. Gamification model for flipped learning: the NABI model

A final model for flipped learning classes using gamification has been derived, validated, and verified. The four procedural elements of flipped learning using gamification are navigate(N), aim(A), build(B), and implement(I). This model includes each procedure and concept by substituting 'butterfly' in English in the shape of a butterfly into 'NABI[nah-bee]' in Korean pronunciation. It contains an infinite number of images as it has the meaning of circulating through navigate(N), aim(A), build(B), and implement(I). The in-class phase with the teacher represent a multi-game mode, and the pre- and post-class phases are self-game modes as self-directed learning for mastery learning. This model contains 1)instructional design for teachers, 2)learning procedures for learners, and 3)gamification strategies.

Figure 1. Gamification model for flipped learning: NABI model.



4. Conclusions and Educational Implications

4.1. Conclusions

In this study, a gamification model for flipped learning is developed and consists of navigate, aim, build, and implement(NABI) procedures. The NABI model, a gamification model for flipped learning, has been proven to be valid. There are many advantages of flipped learning, but learners often feel bored or have difficulties during flipped learning implemented by teachers. A strategic approach is needed to improve this, and the introduction of gamification, which can lead to the learners' active participation, is necessary. However, as shown in pre-

vious studies, gamified instructional design is complicated, making it a burden for many teachers to implement. To address these limitations and challenges, the NABI model has been developed and validated.

4.2. Expected effect and limitations

The NABI model can be applied simultaneously to both teachers and learners. From the teacher's perspective, applying the NABI model to a flipped learning class can lead to learners' mastery learning. From the learners' perspective, NABI model will play a meaningful role in actively changing passive learning attitudes. Self-game mode will be used to self-directed learning during pre- and post-class phases. Therefore, it is expected that the implementation of the NABI model will serve as facilitators for teachers to implement flipped learning more easily, and for learners to actively participate in learning. Based on this NABI model, gamified flipped learning classes are needed to conduct at the actual teaching and learning sites. It is necessary to conduct empirical research to receive feedback from learners. Depending on the learning content and target students, the consequences of implementation will be varied.

4.3. Educational implications

Under the COVID-19 pandemic, blended learning classes are underway, combining online and offline instruction. During this crisis period, flipped learning classes using technology have become a part of students' natural routines. They have provided a positive opportunity for learners to feel less burdened with regard to using technology for their studies, which has always been considered one of the limitations of flipped learning. In particular, this can create a foundation for self-directed learning through gamification so that learners, who are the subjects of learning, can participate more actively in these situations. In addition, it is crucial to conduct more diverse empirical studies on flipped learning classes using gamification with regard to various learners and learning contents. These attempts will serve as a significant opportunity to implement gamified flipped learning more dynamically. Gamification will be a catalyst for learners' enjoyable, effective, memorable, sustainable, and meaningful learning experiences inside and outside the classroom.

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6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Lead Author	JFC	-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 ☑
Corresponding Author*	JC	