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Examination of the Role of Self-Efficacy and Development of an Integrated Model to Overcome Nursing Staff Shortage CRISIS at Small and Medium Sized Hospitals in KOREA

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Abstract

The purpose of this study was to overcome the nursing staff shortage crisis at small and medium sized hospitals by examining the mediation effects of organizational commitment and job satisfaction on the relationship between job stress and turnover intention. To do so, this study used Price's voluntary turnover model and suggested an integrated model by exploring the moderated mediation effects of changes in self–efficacy. Methods: The survey was conducted with 344 nurses working at small to medium sized hospitals in C city. Data collection was conducted for two weeks, from June 1 to 15, 2016, and the collected data were analyzed using Hayes' macro process models 4 and 8 in SPSS 22.0. Results: The findings indicated that organizational commitment and job satisfaction have indirect effects on the relationship between job stress and turnover intention. Self-efficacy was found to have a moderation effect between job stress and mediating variable pathways and also have a mediation effect on job satisfaction pathways. Conclusion: In order to reduce the turnover intention of nurses in small to medium sized hospitals, it is necessary to develop a practical self-efficacy improvement program and action plan for the nursing work place.

1. Introduction

1.1. Necessity of the research

Nurses, along with doctors, play a key role in patient treatment as important human resources in hospitals[1]. Their turnover is a crucial issue not only in terms of the human resource management of hospitals, but also in terms of national health policies [2]. The roles of nurses have been expanded from merely providing nursing services in the past to providing all types of services related to patient health as a form of integrated nursing services[3]. Despite their expanded roles in hospitals, however, nurses' working conditions have not improved. Instead, they experience many difficulties, including excessive job stress and low satisfaction, which leads many of them to quit their clinical service[4]. As the turnover rate of nurses increases, the quality of nursing services to patients decreases, which causes adverse effects in patients' safety, including risks of medical incidents such as injuries from an increasing number of falls[5]. Further, it is reported that high nurse turnover rates may cause serious losses to hospitals, even up to the point that such hospitals face serious financial challenges[4][6]. In particular, small and medium sized hospitals have general environments that are inferior

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to those of large size hospitals in terms of working capital, working conditions, nurse treatment, and so on[7]. Accordingly, turnover rates in small and medium sized hospitals are relatively high. Indeed, turnover rates of nurses at hospitals accommodating less than 400 sickbeds are 20% to 24%, which is much higher than 12.4%, the average turnover rate for all nurses[8]. According to the "2016 Survey of Current Conditions of Nurse Staff at Hospitals," there are no substantial and realistic measures to decrease nurses' turnover rates, even though workforce management at hospitals is an important issue not only for hospitals but also in terms of national health care workforce policies. Thus, more systematic efforts need to be put forth[9].

As it is a challenge for both hospitals and the government to develop practical policies, this study sought to determine the major factors that influence personal behaviors within an organization. Recent work found that psychological states play a key role in deciding individuals' behaviors related to tasks in an organization[10]. Past research also reported that nurses who are currently working and have not yet quit their jobs suffer from various types of job stress, which likely induces turnover intention, a psychological state that occurs right before the decision to resign[11][12][13]. Since turnover intention is a predisposing factor that best determines turnover behavior, it is vital to predict intention in order to prevent nurses' actual turnover behavior[14][15]. Price(2001)[16] verifies that predisposing factors such as job stress and emotional state impact turnover intention, and job satisfaction and organizational commitment play an important mediation role in reducing this turnover intention, emphasizing the importance of these factors.

Positive psychology has recently drawn attention to the notion that individuals' psychological states significantly impact their behavioral decisions. Positive psychology helps overcome negative emotions and accelerate the transition from a negative psychological state to a positive one. Accordingly, it induces positive behavior

changes[10] and plays a mediating role in relation to parameters of turnover intention such as job satisfaction and organizational commitment[16]. For this reason, it is important for an organization to grasp and manage aspects of its members' positive psychology[16]. Self-efficacy in particular is one aspect of positive psychology that enables individuals to feel confident when successfully performing tasks in any given environment. This is a valuable psychological resource that helps individuals overcome unpleasant situations and induces positive behavior changes[17]. Among various positive psychological resources including optimism, resilience, and hope, self-efficacy plays the most important role in inducing positive behavior changes in an organization[17]. Although self-efficacy is a vital concept when it comes to inducing positive personal behavior in an organization[17], most existing domestic studies on turnover intention regard self-efficacy merely as a predisposing factor, and there is little research that focuses on the role of self-efficacy in relationship to many other variables.

Newman et al.(2014)[18], however, found that positive psychological factors such as self-efficacy optimism, resilience, and hope play a mediating role among major variables of turnover such as stress, personal job involvement, job satisfaction, and turnover intention, which emphasizes the need to conduct replication studies with these variables. Existing studies on the relationship among variables focus mostly on individual mediation effects[19], because methods to examine moderated mediation effects in an integrated manner are complicated and difficult to implement[19]. Recently, Hayes(2012)[20] developed a method to integrate and analyze mediation effects, moderation effects, and moderated mediation effects using the PROCESS Macro. Hayes(2012)[20] underscores the importance of analyzable models and emphasizes the need to analyze target phenomena in an integrated manner. Steel and Lounsbury(2009)[21] point out that there is a limitation in the assumption that one single factor leads to turnover behavior, because

there are a variety of factors affecting turnover intention. Further, research on turnover needs to continue because the existing research on turnover and related theories are incomplete. Accordingly, the aim of this study was to establish a hypothetical model based on Price's(2001)[16] voluntary turnover causality model and similar existing studies, examine the mediation role of self-efficacy, which is an important positive psychological factor, and propose an integrated model of variables that influence nurse turnover at small and medium sized hospitals.

1.2. Purpose of the research

The objective of this study was to examine the effect of job stress in nurses at small and medium sized hospitals on their turnover intention, with organizational commitment and job satisfaction as mediators and to examine the moderated mediation effects of self-efficacy. The specific goals are as follows:

First, this study sought to develop a hypothetical model that explains nurses' turnover intention at small and medium sized hospitals based mainly on their job stress, organizational commitment, job satisfaction, and self-efficacy.

Second, this study examined the causal relationships among variables based on the hypothetical model.

Third, this study examined the direct and indirect effects of organizational commitment and job satisfaction on the relationship between job stress and turnover intention.

Fourth, this study examined the moderated mediation effects of self-efficacy.

1.3. Conceptual framework and hypothetical model

In this study, turnover intention was considered a predisposing factor that predicts turnover behavior, which is based on similar existing studies[15]. Price's (2001)[16] voluntary turnover causality model suggests that job stress, organizational commitment, and job satisfaction are the major variables that impact turnover intention, and this finding is reflected in this study's design. Specifically, job stress is posited to be a predisposing variable that increases the likelihood of turnover intention, while organizational commitment and job satisfaction are posited as major variables that reduce turnover intention and also parameters of the predisposing variable. Thus, in this study, job stress was selected as a causal variable, and organizational commitment and job satisfaction were selected as parameters. According to Newman et al.(2014)[18], positive psychology in an organization moderates the relationships between job stress, personal organizational commitment, job satisfaction, and turnover intention. In light of this finding, the present study selected self-efficacy, one factor of positive psychology, as a moderating variable. The impact of general participant characteristics on the results has been inconsistent in existing studies. Thus, the present study selected age and total career length as covariates[22]. The conceptual framework and hypothetical statistical model were established based on the above-mentioned findings of existing studies, and <Figure 1> displays the details.

Figure 1. The predicted model.
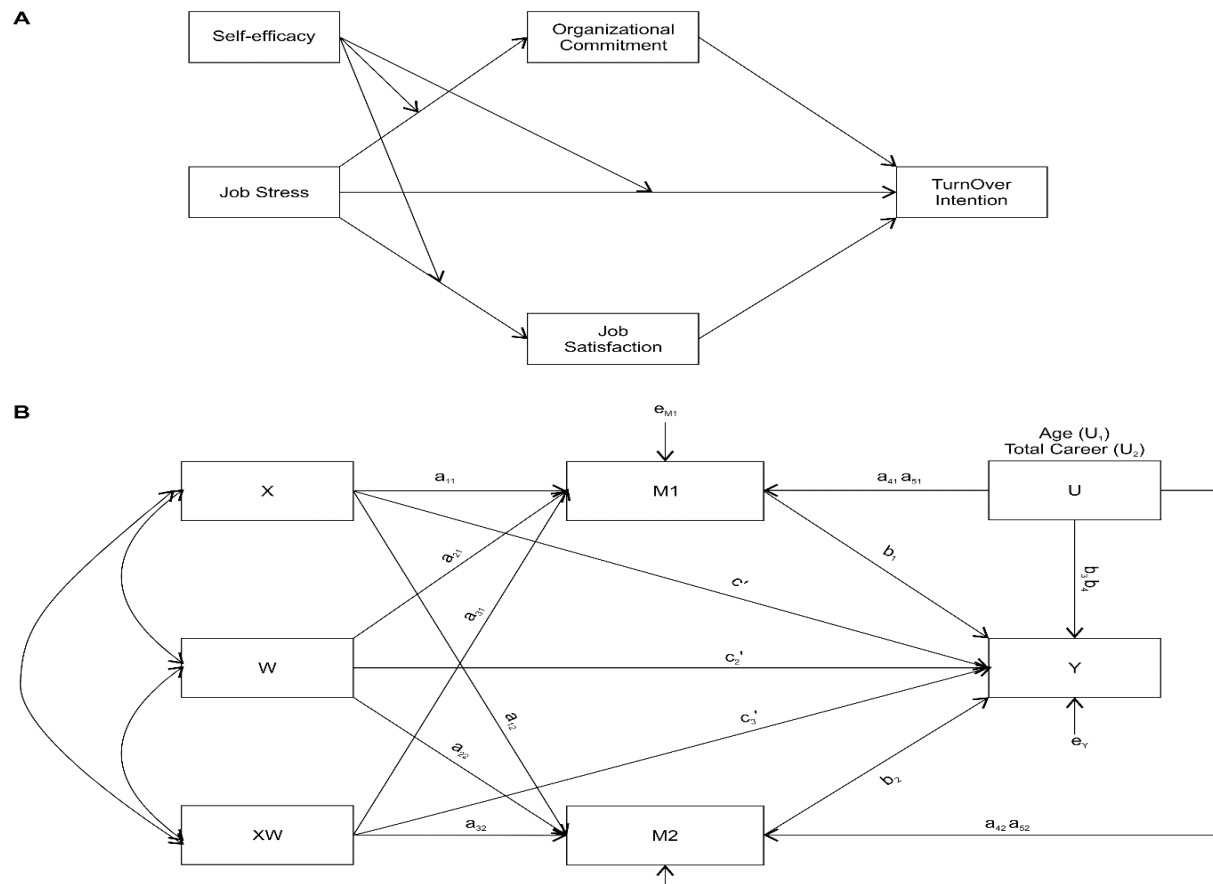
A

B

Note: X: Job Stress, W: Self-efficacy, XW: Job stress x Self-efficacy, M1: Organization Commitment, M2: Job Satisfaction, Y: Turnover Intention, U: Covariate, U1: Age, U2: Total career.

2. Methods

2.1. Research design

This study used a pathway analysis to examine the hypothetical model on the relationships between job stress, job satisfaction, organizational commitment, self-efficacy, and turnover intention in nurses at small and medium sized hospitals.

2.2. Participants

This study was conducted from November 20 to 28, 2017, using nurses working at two small and medium sized hospitals located in C city accommodating about 300 sickbeds respectively. The participating nurses were informed about the purpose, procedures, and survey method for this study. Hair(2006)[23] notes that the appropriate sample size for pathway analysis is 150 to 400. Accordingly, 300 individuals were selected for this study in consideration of the possibility of dropouts, and all of them agreed to participate in the survey. Among the distributed questionnaires, 330 copies were collected during the survey period and of these, 307 copies were used in the final study, 23 copies with incomplete answers were excluded.

2.3. Measures

2.3.1. Occupational stress

Job stress was measured using the simplified job stress tool (Short Form of the Korean Occupational Stress Scale, SF-KOSS) developed by Chang et al.(2005)[24] to measure Koreans' job stress. This tool included a total of 24 questions. The response options ranged from "1" = "Not at all" to "4" = "Very much." Higher scores

indicated higher levels of job stress. When the tool was developed, Cronbach's α = .78, and, in this study, α=.81.

2.3.2. Organizational commitment

Organizational commitment was measured using the Organizational Commitment Questionnaire (OCQ) originally developed by Mowday et al. (1979)[25] and revised by Lee(1998)[26]. This tool consisted of 15 questions, with response options ranging from "1" = "Quite negative" to "7" = "Quite positive." Higher score scores indicated higher levels of organizational commitment. The tool's reliability ranged from Cronbach's α = .82 to α = .90 in Mowday et al.[25], to α = .91 in Lee (1998)[26], to .91 in this study.

2.3.3. Job satisfaction

The Korea-Minnesota Satisfaction Question-naire(K-MSQ), which was originally developed by Weiss et al.(1967)[27] as the Minnesota Satisfaction Questionnaire and revised by Park (2005)[28], was used to measure job satisfaction in this study. The K-MSQ included 20 questions. Responses were scored on a 5-point scale from "1" = "Very unsatisfied" to "5" = "Very satisfied." Higher scores indicated higher levels of job satisfaction. The reliability of the tool ranged from Cronbach's α = .82 in Park (2005)[28] to α = .91 in this study.

2.3.4. Self efficacy

The Self Efficacy Scale(SES) developed by Sherer et al.(1982)[29] and revised by Hong(1995)[30] was used to measure self-efficacy in this study. The SES included a total of 23 questions, which were divided into two sub-domains. There were 17 questions about general self-efficacy and 6 questions about social self-efficacy. Answers to these 23 questions were measured on a 5-point scale ranging from "1" = "Not at all" to "5" = "Very much." Higher scores indicated higher levels of self-efficacy. The SES does not necessarily combine the two sub-domains, but each of them may be used separately to examine

certain findings. This study used the 17 questions on general self-efficacy. The Cronbach's α at the time of development was .86, and, in this study, it was α = .85.

2.3.5. Turnover intention

Turnover intention was measured using the turnover intention tool developed by Mobley(1982)[31] and revised by Kim(2007)[32]. This tool consisted of 5 questions. Responses on this tool were scored on a 5-point scale ranging from "1" = "Not at all" to "5" = "Very much." Higher scores indicated higher levels of turnover intention. The reliability of the tool ranged from Cronbach's α = .87 in the original research to α = .91 in this study.

2.4. Statistical analysis

The collected data were processed using SPSS 22.0. In order to analyze the mediation effect of job commitment and job satisfaction that would impact turnover intention and to analyze the mediation effect and moderated mediation effect of self-efficacy, SPSS PROCESS model 4 and model 8 of Hayes(2012)[20] were utilized. The specific analysis methods were as follows:

Participant demographics and major variables were analyzed based on the overall numbers, percentages, kurtosis, and skewness. In order to examine the direct and indirect effects of organizational commitment and job satisfaction without including self-efficacy, the PROCESS model 4 was utilized. To examine the significance of individual paths and the moderated mediation effects, PROCESS model 8 was utilized. As for the significance of indirect effects of media and moderated media, the confidence interval(CI) was constructed after bootstrapping was conducted 5,000 times. Hayes' PROCESS is a method that analyzes not only the significance of individual paths, but also the significance of interactions and moderated mediation effects of the moderating variable in an integrated manner. Specifically, this method is advantageous when analyzing the moderated mediation effect of continuous

variables (i.e., linear)[20]. "The moderated mediation effect" indicates that the level of significance of the regression coefficient or the direction of the mediation effects may be different depending on the moderating variable[33]. There were procedures to examine the moderated mediation effects. In the first step, the regression coefficient in interactions between the independent variables and moderating variables in an indirect pathway (X→M or M→Y) must be statistically significant for each individual pathway[19]. According to Hayes(2015)[33], however, the insignificance of mediation effects in an individual pathway does not necessary mean that the moderated mediation effect is insignificant. Hayes(2015)[33] proposed that the index of the moderated mediation through which the significance of moderated mediation effects is determined could be measured in PROCESS. As for moderated mediation effects, it is possible to measure the conditional direct/indirect effects depending on the changing value of the moderating variable[33]. Even if the conditional direct/indirect effects are statistically significant, however, attention must be paid to Hayes' idea that moderated mediation effects could be involved. Instead, the moderated mediation effects should be determined based on the significance of the index of the moderated mediation[33]. In this study, therefore, the significance of the moderated mediation effects was judged based on the index of the moderated mediation, and the resulting conditional direct/indirect effects were measured.

2.5. Ethical considerations

With respect to ethical considerations for the research participants, this study was approved by the institutional review board of K University (KU IRB 2017-0041-01) before it was conducted. Information related to research ethics, including the study goal, methods, procedures, privacy, and so on were explained to the participants in either a written or oral format. A written agreement for participation was collected from those who agreed to participate in the survey. Additionally, each participant was provided with an envelope so that they could hide sensitive information related to their turnover intention. Participants were also informed that they could stop anytime they wanted, even if they agreed to participate. Each participant was given a designated gift.

3. Results

3.1. Participant demographics and study variables

Participant demographics and research variables in this study are shown below in <Table 1>. The participants were 5.2%(18) male and 94.8%(326) female. Most of the participants were women. The average age of the participants was 28.23±6.51. The total number of years in their career was 67.43±69.34 months. Of the participating nurses, 74.7%(257) worked in three shifts, and 28.23%(87) worked during the day. Most of them worked in three shifts. With respect to their annual salary, 48.5%(167) made 30 to 35 million won, 37.8%(130) made less than 30 million won, and 13.7% (13.7) made 35 million or more. Results indicated that 39.2%(135) had turnover experience, and 60.8%(209) did not. With respect to their marriage state, 70.9%(244) were single, and 29.1%(100) were married. The percentage of single individuals was relatively high. Of the participants, 32.6%(112) were supporting their families, and 67.4%(232) were not. With respect to the research variables, including job stress, organizational commitment, job satisfaction, turnover intention, and self-efficacy, as well as the two covariates, age and total years in their career, the absolute value for kurtosis was 3 or lower, and the absolute value for skewness was 10 or less, which indicates that all of the variables used in this study satisfied the assumption of equal variance.

Table 1. General characteristics for study variables.

Categories	Sub categories	N(%)	Mean	SD	Skewness	Kurtosis
Gender	Male	18(5.2))				
	Female	326(94.8)				
Age(year)			28.23	6.51	1.35	2.71
Total career (month)			67.43	69.34	1.62	2.58
Shift pattern of duties	Day Shift	87(25.3)				
	Three-shift	257(74.7)				
Annual salary (10 thousand won)	<3000	112(32.6)				
	3000-3500	232(67.4)				
	3500>	47(13.7)				
Turnover experience	Have	135(39.2)				
	Haven't	209(60.8)				
Marital status	Single	244(70.9)				
	Married	100(29.1)				
Duty to support family	Have	112(32.6)				
	Haven't	232(67.4)				
Job stress			3.10	0.40	0.24	0.93
Organization commitment			3.68	0.83	0.70	0.57
Job satisfaction			3.14	0.44	0.24	0.93
Turnover intention			3.02	1.09	0.58	2.22
Self-efficacy			3.01	0.68	0.46	0.13

Table 2. Unstandardized OLS regression coefficients with confidence intervals(standard errors in parentheses) estimating organization commitment, job satisfaction, turnover intention, job stress and self-efficacy.

		OC (M1)		Hypo-thesis		Jsati (M2)		Hypo-thesis		TI(Y)		Hypo-thesis
		B	95% CI			b	95%CI			b	95%CI	
JStre (X)	a11→	-1.35* (0.29)	-1.52,-1.19	Accept	a12→	-0.58* (0.05)	-0.67,-0.49	Accept	c'→	0.49* (0.17)	0.16,0.81	Accept
OC (M1)									b1→	-0.47* (0.08)	-0.63,-0.31	Accept
JSati (M2)									b2→	-0.29* (0.14)	-0.57,-0.01	Accept
SEffi (W)	a21→	-0.01 (0.07)	-0.15,0.14	Reject	a22→	0.16* (0.04)	0.08,0.25	Accept	c2'→	-0.05 (0.11)	-0.26,0.16	Reject
X×W	a31→	-0.28* (0.14)	-0.56,-0.01	Accept	a32→	-0.20* (0.08)	-0.35,-0.04	Accept	c3'→	0.14 (0.20)	-0.26,0.54	Reject
Age (U1)	a41→	0.03* (0.01)	0.02,0.05	Accept	a42→	-0.01 (0.01)	-0.02,0.00	Reject	b3→	-0.06* (0.01)	-0.09,-0.03	Accept
TC (U2)	a51→	-0.00 (0.00)	-0.00,0.00	Reject	a52→	0.00 (0.00)	-0.00,0.00	Reject	b4→	0.01 (0.00)	0.00,0.01	Reject
cons.	iM1→	2.80* (0.29)	2.37,3.23	Accept	iM2→	3.25* (0.12)	3.01,3.49	Accept	iy→	7.03* (0.55)	5.95,8.12	Accept
		R2=0.485				R2=0.406				R2=0.400		
		F=(63.62), p<0.001				F=(46.34), p<0.001				F=(32.00), p<0.001		

Note: JStre: Job Stress, OC: Organization Commitment, JSati: Job Satisfaction, SEffi: Self-Efficacy, TI: Turnover Intention, TC: Total Career, Cons.: Constant, *p<.

3.2. Research Hypotheses

3.2.1. Pathway analysis

The variables mediating the relationship between job stress and turnover intention, including organizational commitment(M1) and job satisfaction(M2), and the moderating variable, self-efficacy(W), were analyzed using a linear regression analysis. The results are presented below in<Table 2>. Job stress(X) had a negative(-) effect on organizational commitment(M1)(b = -1.35, CI: -1.52, -1.19), and age had a positive(+) effect(U1)(b=0.03, CI: 0.02, 0.05). The mediation effect(X×W) of self-efficacy(W) on the relationship between job stress(X) and organizational commitment(M1) was statistically significant(b = -0.28, CI: -0.56, -0.01). However, total career length had no significant effect on organizational commitment(M1)(b = -0.00, CI: -0.00, 0.00). The explanatory power of this model was 48.5%(F = 63.62, p < .001).

Job stress(X) had a negative(-) effect on job satisfaction(M2)(b = -0.58, CI: -0.67, -0.49), and self-efficacy(W) had a positive (+)

effect(U1)(b = 0.16, CI: 0.08, 0.25). The mediation effect(X×W) of self-efficacy(W) on the relationship between job stress(X) and job satisfaction(M2) was statistically significant(b = -0.20, CI: -0.35, -0.04). However, age(b = -.01, CI: -0.02, 0.00) and total career length(b = 0.00, CI: -0.00, 0.00) had no significant effects on job satisfaction(M2). The explanatory power of this model was 40.6%(F = 46.34, p < .001).

The multiple regression analysis results indicated that job stress(X)(b = 0.49, CI: 0.16, 0.81) had a positive(+) effect on turnover intention(Y), while organizational commitment(M1)(b = -0.47, CI: -0.63, -0.31), job satisfaction(M2)(b = -0.29, CI: -0.57, -0.01), and age(U1)(b = -0.06, CI: -0.09, -0.03) had negative(-) effects on turnover intention(Y). The mediation effect(X×W) of self-efficacy(W) on the relationship between job stress(X) and turnover intention(Y) was statistically insignificant(b = 0.14, CI: -0.26, 0.54). The explanatory power of this model was 40.0%(F = 32.00, p < .001).

3.2.2. Mediation effects of organizational commitment and job satisfaction

The analysis on the mediation effects of organizational commitment and job satisfaction on the relationship between job stress and turnover intention(without including self-efficacy) indicated that the total effect(b = 1.36, CI: 1.12, 1.60), direct effect(b=0.50, CI: 0.17, 0.82), organizational commitment indirect effect(b = 0.66, CI: 0.36, 0.91), and job satisfaction indirect effect(b=0.21, CI: 0.03, 0.40) were all statistically significant. These findings suggest that organizational commitment and job satisfaction have partial mediation effects on turnover intention.

3.2.3. Moderated mediation effects and conditional direct/ indirect mediation effects of self-efficacy

The results of this study indicate that self-efficacy had a moderated mediation effect on job satisfaction(Index: 0.06, CI: 0.03, 0.17). However, organizational commitment had no significant moderated

mediation effect(Index: 0.13, CI: -0.01, 0.32). The level of self-efficacy was high, thus the mediation effect of job satisfaction increased accordingly. As for the direct effect of self-efficacy, its interaction effect was statistically insignificant. The results on the conditional direct/indirect effects, however, indicated that the conditional direct effect of job stress on turnover intention was significant, depending on the changes in self-efficacy Level 3.

Likewise, self-efficacy had no moderated mediation effect on organizational commitment, but, depending on level changes, organizational commitment showed conditional indirect effects in Level 3. The results indicated that self-efficacy had a moderated mediation effect on job satisfaction, but, with respect to conditional mediation effects, only a low level of self-efficacy had a conditional indirect effect <Figure 2>, <Table 3>.
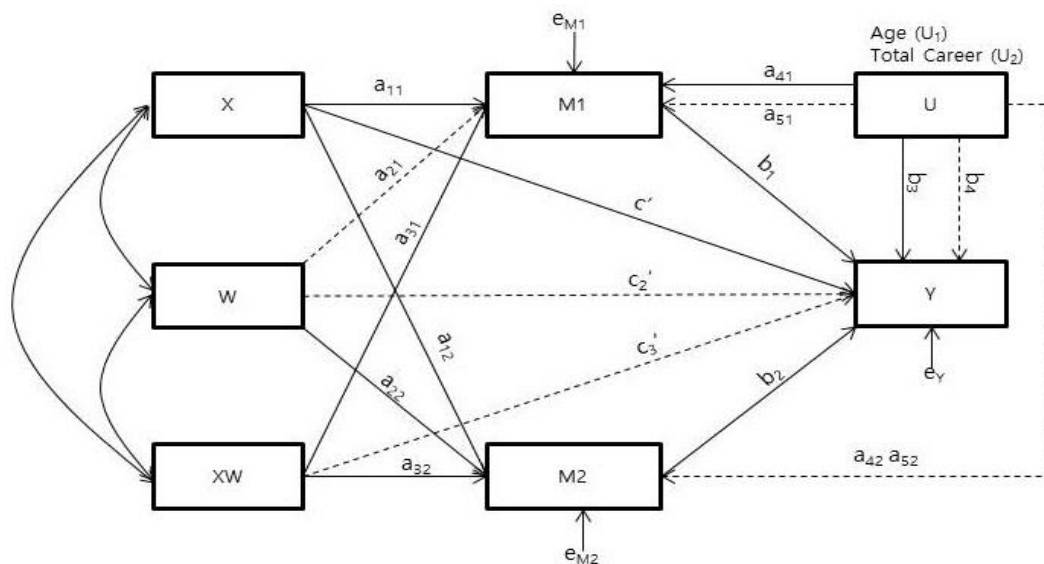
4. Discussion

The aim of this study was to establish and examine a pathway model based on Price's voluntary turnover causality model and preexisting studies that predicts the way self-efficacy, job stress, organizational commitment, and job satisfaction among nurses at small and medium sized hospitals influence their turnover intention. Additionally, the aim of this study was to present an integrated model based on the findings related to the role of self-efficacy, which is a personal positive psychology factor.

Based on the above findings, this study presents the following points for discussion. Job stress of nurses at small and medium sized hospitals is not only a direct determinant of turnover intention, but is also a predisposing variable that reduces both organizational commitment and job satisfaction. The findings also indicate that organizational commitment and job satisfaction reduce turnover intention and play a role as partial mediators between the two predisposing variables, job stress and

turnover intention. This finding corresponds to Price's(2001)[16] research, which examined the indirect pathway of job stress' effect on turnover intention. Price(2001)[16] suggests a model in which job stress has no direct effect on turnover intention. This study, as well as other recent studies at home and abroad, however, indicates that job stress is an important factor with direct effects on turnover intention. Zhang's(2016)[34] research on nurses' turnover intention reported that job stress has the most significant direct/indirect effect on turnover intention, and job stress due to poor working environments or conditions is serious, particularly in small hospitals. Since job stress is a psychological variable related to an organization that impacts personal turnover intention, it is necessary to help individuals develop self-efficacy to enable then to effectively manage stress.

Figure 2. Test of the hypothetical model.

Note: X: Job Stress, W: Self-efficacy, XW: Job stress x Self-efficacy, M1: Organization Commitment, M2: Job Satisfaction, Y: Turnover Intention, U: Covariate, U1: Age, U2: Total career.

Table 3. Conditional direct and indirect effect job stress on turnover intention at values of self-efficacy.

		Self efficacy	Effect	S.E.	LLCI	ULCI
Direct		-0.46	0.42	0.20	0.03	0.80
		0	0.49	0.17	0.16	0.81
		0.46	0.55	0.19	0.18	0.92
	Medicator	Self efficacy	Effect	S.E.	LLCI	ULCI
Indirect	Organization commitment	-0.46	0.58	0.13	0.33	0.82
		0	0.64	0.14	0.35	0.88

		0.46	0.70	0.15	0.37	0.98
	Job satisfaction	-0.46	0.14	0.08	0.01	0.12
		0	0.17	0.09	-0.00	0.35
		0.46	0.20	0.10	-0.00	0.40
Index of moderated mediation	Mediator	Index	S.E.	LLCI	ULCI	Hypothesis
	Organization commitment	0.13	0.09	-0.01	0.32	Reject
	Job satisfaction	0.06	0.04	0.03	0.17	Accept

The need to improve organizational or governmental policies and provide related support has also been emphasized[34]. The findings in this study regarding organizational commitment and job satisfaction, the two factors playing a mediation role between job stress and turnover intention, align with those of previous studies. Organizational commitment and job satisfaction are not only important variables to reduce turnover intention, but they are also positive psychological variables in individuals. Organizational commitment indicates an individual's level of loyalty and commitment to an organization[25], and job satisfaction indicates their level of subjective satisfaction with their given duties[27]. Existing studies regard organizational commitment and job satisfaction as important variables that impact turnover intention. In addition, recent research has reported that job satisfaction is an important personal psychological variable that reduces turnover intention or turnover decisions[35][36]. In order to enhance organizational commitment and job satisfaction, however, it is also necessary to improve related conditions, including the workforce condition, manager's leadership, pay raise, reduction of overtime work, shift-work, and so on[36]. The above-mentioned findings imply that, addressing the causes of job stress in the organization's working conditions is a prerequisite to facilitating positive changes in organizational commitment and job satisfaction

In order to solve turnover problems, it is therefore urgent to address and reduce job stress related to working environments. Otherwise, organizations will likely be unable to prevent individual nurses from making negative turnover decisions. In this regard, not only individuals, but also organizations and the government, need to put forth constant efforts[34]. However, as mentioned at the outset of this study, the issue of poor medical environments in small and medium sized domestic hospitals has not been addressed by either organizations or governmental policies within a short period of time. One alternative to reduce turnover intention is to help individuals develop positive psychological resources so that they can overcome hard circumstances at work with personal positive values and convictions.

Accordingly, this study established a hypothetical model of turnover intention and examined the role of self-efficacy by situating self-efficacy as a major positive psychological variable related to desirable behaviors such as adaptation and problem solving. This study found that self-efficacy has a direct effect only on job satisfaction and moderates the pathways between job stress and organizational commitment and between job stress and job satisfaction. This finding partially corresponds to Newman et al.(2014)[37] findings that positive psychology has direct effects on turnover intention, and it mediates the pathways from stress at work to organizational commitment, job satisfaction, and turnover

intention. Most domestic studies on turnover intention find that self-efficacy impacts turnover intention directly or plays a role as a predisposing variable related to organizational commitment and job satisfaction. In general, however, their findings on organizational commitment, job satisfaction, and turnover intention are inconsistent. According to Yu-mi Kim (2015)[38], self-efficacy as a predisposing variable has no effect on organizational commitment, but has a direct effect on turnover intention. Gun-saeng Kang(2014)[39] found that self-efficacy enhances job satisfaction and organizational commitment. As these findings imply, it is difficult to generalize the idea that self-efficacy functions as a predisposing variable. According to one foreign study, personal positive psychology plays a mediating role in the pathway from job stress to organizational commitment, job satisfaction, and turnover intention[37]. It is therefore necessary to examine this through replication studies.

This study found that self-efficacy has a mediation effect in the pathway of mediating variables. According to Hayes(2014)[40], however, it might be wrong to conclude that mediation effects are moderated only based on this finding. Before the Hayes(2014)[40] analysis method was available, it was necessary to implement all of the verification procedures to confirm the significance of the mediation effects in the pathway of moderating variables, the significance of the parameters' mediation effects, and so on in order to determine the existence of a moderated mediation effect. Even if such verification procedures were implemented, it was difficult to verify substantial moderated mediation effects since it was possible to confirm conditional mediation effects only when it was possible to estimate significance. Hayes(2014)[40] noted that the significance of mediation effects in the pathway does not guarantee moderated mediation effects, and the insignificance of mediation effects does not guarantee the lack of moderated mediation effects.

Hayes also argued that the significance of moderated mediation effects should not be judged solely based on the significance of the conditional mediation effect, which is typically viewed as an indication of moderated mediation effects. However, according to Hayes, the significance of the moderated mediation effects could be examined using the developed index of moderated mediation effects. This study refers to both conditional mediation effects and the index of moderated mediation effects in order to better understand Hayes'(2014)[40] analysis method. This study not only examines the role of self-efficacy in the developed hypothetical model, but also examines its new moderated mediation role to control the mediation effects of job satisfaction on the relationship between job stress and turnover intention. Hayes'(2014)[40] analysis method is advantageous in that it can determine mediation effects in an integrated model depending on the given model, but it also has limitations in that it can utilize only one independent variable. Thus, the researcher in this study decided which research variables to use based on thorough literature review. Price(2001)[16] excluded general characteristics from variables impacting turnover, but other existing studies viewed general characteristics as an important factor. Accordingly, this study included general characteristics, as well age and total career length, which were controlled separately as covariates. Results indicate that among these variables, only age had positive effects on reducing turnover intention.

It is difficult to organizational commitment and job satisfaction among nurses going experiencing job stress in poor working environments in a short period of time. However, this study indicates that self-efficacy, which is a personal positive psychological factor, can moderate the mediation effects of job satisfaction. When nurses' personal self-efficacy is enhanced, it positively impacts the job satisfaction pathway, thus contributing to decreasing turnover intention. It is expected, therefore, that the findings in this study can be used as

an empirical basis for organizational measures to prevent employees' turnover behavior.

One recent study reported that personal positive psychology could induce positive behavior changes of individuals in an organization, but there have been very few domestic studies that have examined this issue. The present study is of significance in that it suggests improving the self-efficacy of nurses at small and medium sized hospitals is necessary. Self-efficacy enhancement programs for nurses at small and medium sized hospitals can contribute to reducing turnover intention. However, positive psychology includes other elements in addition to self-efficacy, including resilience, hope, optimism, and so on. Future research needs to include these variables as well. Individual nurses' positive psychology may be different depending on the scale of hospitals. Accordingly, future research should also conduct repeated studies with different sized hospitals and their workforce. It also seems necessary to examine the effects of other socio-environmental variables, such as working conditions, leadership, and organizational culture, which have recently been emphasized with respect to organizational management, on turnover intention.

5. Conclusion

This study examined variables that are more likely to impact voluntary turnover intention among nurses at small and medium sized hospitals than those at large size hospitals. In particular, self-efficacy is of significant research value since its substantial role has been supported, and this study proposed an integrated model based on the findings related to the moderated mediation effects. Self-efficacy promotion programs should be developed that help nurses evaluate themselves positively and avoid negative turnover behavior, even in difficult circumstances.

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Enterprise SECURITY Management for IoT Services Based on Event Correlation in Republic of KOREA

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Abstract

With radical development of information and communication Technology, Internet of Things(IoT) era has come. All the things around us are connected through internet so that it enables objects to exchange data with connected devices and is expected to offer new advanced services that goes beyond the value where each existing objects could have offered respectively. Concerns regarding security threat are being raised in adopting IoT as the number of internet-connected appliances are rapidly increasing. So, we need to consider how to protect and control countless objects. However, traditional security systems including intrusion detection systems(IDSs), fire-walls(FWs), anti-viruses(A/Vs), etc., focus on low level attack or anomalies, and raise alerts independently. And IoT services have different types of security frameworks. As a result, it is difficult for human security manager or attack response systems to understand the alerts and take appropriate actions.

In this paper describes the analysis of security methods in the area of IoT and describes a mechanism that analyzes logs generated by IoT devices attacks. Data collected from the lightweight application is sent to the network component for further analysis. The collaborative component is used for collecting data in the distributed network and indicates the possible attacks. Also this paper suggests enterprise security management including IoT services which are based on distributed environments, and presents a practical technique to address this issue, and introduces Event Correlation Model(ECM) which is a simple free text causal language. We show how the concept of class in object-oriented methodology is used to provide scalability to our approach. Graph and coding theories are used for correlation.

[Keywords] Safety of IoT Services, Network Security Management, Enterprise Security Management, Log Analysis, Event Correlation

1. Introduction

The Internet of Things vision is to successfully emerge, for connecting everyday existing objects and embedding intelligence into our environment. The automatic exchange of information between two systems or two devices without any manual input is the main objective of the IoT and it gives a new dimension to the world of information and communication. IoT have security threats, while exchanging information. Different types of security frameworks are used in IoT.

It's been just over a year since the world witnessed some of the world's top online Web sites being taken down for much of the day by Mirai, a zombie malware strain that enslaved IoT devices such as wireless routers, security cameras and digital video recorders for use in large-scale online attacks. A botnet, which is adding new bots every day, has already infected one million businesses during the past years in Republic of Korea and could easily eclipse the size and devastation caused by Mirai, Reaper and IoTroop[1]. The amount

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of logs generated by IoT gateway is too enormous to extract anomalies. So we need to correlate logs.

The definition of correlation is "A causal, complementary, parallel, or reciprocal relationship, especially a structural, functional, or qualitative correspondence between two comparable entities"[2]. The Security event correlation can be defined loosely as the process of making sense of a very large numbers of security events, where making sense entails throwing some of them away, observing cause-and-effect relation between others, inferring an alarm from the culprit event in a misbehaving enterprise[3].

There are several approaches to the event correlation task: rule-based reasoning(RBR), model-based reasoning(MBR), state transition graphs(STG), and so on[3].

A common approach to the event correlation task is to represent knowledge and expertise in a rule-based reasoning system[4]. An RBR system consists of three basic parts including a working memory, a rule base, a reasoning algorithm[3]. The working memory consists of facts. The rule base represents knowledge about what other facts to infer, or what actions to take, given the particular facts in working memory. The reasoning algorithm is the mechanism that actually makes the inference. Using an RBR system to develop an event correlator that covers the entire domain of the enterprise is not a good idea. The enterprise is large, dynamic, and generally hard to understand.

An MBR system represents each component in the enterprise as a model[4]. A model is either a representation of a physical entity(e.g., a firewall, router, anti-virus system, intrusion detection system), or a logical entity(e.g., network session, suspicious process). And a model represents a physical entity is in direct communication with the entity(e.g. via SNMP, Syslog). A description of a model includes three categories of information: attributes, relations to other models, and behaviors. Event correlation is a result of collaboration among models(i.e. a result of the collective behaviors of all models).

The key concepts in the STG approach are a token, a state, an arc, a movement of a token from one state to another state via an arc, and an action that is triggered when a token enters a state[5][6]. The measure of correlation is dependent on the knowledge which represents the attack scenarios.

2. Event Model on IoT Services

2.1. Event normalization

There are multiple pieces of information that can be correlated such as the accepted packet on the perimeter router, the accepted packet on the firewall, the IDS alert that detected a web exploit headed for the webserver, all coming from the same source IP address. Along with the results of the integrity check, the collection of these alarms and status make it easier to confirm and reinforce the determination that the web server was indeed compromised and further action is necessary. In analysis it is ideal to access all the logs from the entire enterprise from a single console, and have them stored in one common database.

A relational database is the most logical central storage facility because it supports querying and reporting. Without a correlation engine, an analyst would first need to get the logs from all these devices, normalize them, and insert them into the database in a common format. In order to have real correlation an absolute prerequisite is normalization[7].

A typical enterprise environment consists of many different types of network devices ranging from border routers, IoT devices, to firewalls, to authentication servers, along with an even wider range of application servers like webservers, email servers, and always-critical database servers. These devices generate logs that are critical to an analyst who is responsible for the security of the site[8]. It is seldom if ever the case that two manufactures will use the same logging mechanism or format their logs identically. For example, a Cisco PIX will not report an accepted packet in the same way as a Check Point firewall or even the same as a Cisco

Router. The fact that the formats are all different makes it virtually impossible to store the log data in a common location such as a database without normalizing the events first.

The <Figure 1> shows example logs from different IoT devices are all reporting on the exact same packet traveling across the network. These logs represent a remote printer buffer overflow that connects to Apache servers over port 80 used for administrating console.

Figure 1. Original IoT device logs.

Check Point:
"14" "30 Jan 2018" "12:10:29" "eth-s1p4c0" "ip.of.firewall" "log" "accept" "www-http" "155.23*.***.***" "10.10.10.10" "tcp" "4" "1355" ""
"" "" "" "" "" "" "" "" "firewall" " len 68"
Cisco Router:
Jan 30 12:10:27: %SEC-6-IPACCESSLOGP: list 102 permitted tcp 155.23*.***.***(1355) -> 10.10.10.10(80), 1 packet
Cisco PIX:
Jan 30 2017 12:10:28: %PIX-6-302001: Built inbound TCP connection 125891 for faddr 155.23*.***.***/1355 gaddr 10.10.10.10/80 laddr 10.0.111.22/80
Snort:
[**] [1:971:1] WEB-IIS ISAPI .printer access [Classification: Attempted Information Leak] [Priority: 3]
01/30-12:10:29.100000 155.23*.***.***:1355 -> 10.10.10.10:80
TCP TTL:63 TOS:0x0 ID:5752 IpLen:20 DgmLen:1234 DF
AP Seq: 0xB13810DC Ack: 0xC5D2E066 Win: 0x7D78 TcpLen: 32
TCP Options (3) => NOP NOP TS: 493412860 0
[Xref => http://cve.mitre.org/cgi- bin/cvename. cgi?name=CAN-2018-0241]

[Xref => http://www.whitehats.com/info/IDS533

All these formats are different and would be practically useless to store in a database without normalizing them first. Looking at the Check Point record it contains the following fields: event id, date, time, firewall interface, IP address of the firewall interface, logging facility, action, service, source IP, target IP, protocol, source port, some Check Point specific fields and then the size of the datagram. This is the most obscure format and it is especially hard to read with all the empty fields that are represented by double quotes.

So that these events possibly be productively stored in a database, It must first be decided which fields are interesting and develop a schema to accommodate the different fields that are populated by these devices. Choosing the fields must be content driven not based on semantic differences between what Check Point may call target address and what Cisco calls destination address. To accomplish this normalization, a parser must be coded to pull out those values from the event and populate the corresponding fields in the database. The events shown on <Figure 1>

can be normalized as follow fields. [Date]: [Time]:[Event_Name]:[Src_IP]:[Dst_IP]:[Target_Port]:[Device_Type]:[ETC]

This would be ideal for an analyst investigating an incident. With the data organized like this one could pull all records containing a value that is of interest or sort by any field that may be relevant. The problem is that entering this data into a spreadsheet manually is relatively easy in low volume but to get a program to do it is much more difficult. For instance the Check Point firewall reports target port as www-http not 80 like most devices. Therefore there must be a lookup mechanism to ensure that www-http gets translated into port 80 otherwise this value would be useless during correlation.

2.2. Event consequence

Let's define the set of all events generated by node i as Σ_i. The total set of all the Σ_i in a system with n nodes is $\Sigma_T = \Sigma_1 \cup \Sigma_2 \cup ... \Sigma_n$. It is clear that the system's alphabet will increase linearly as the number of nodes in the system increases.

Security systems can be characterized as a collection of objects organized in a way to provide specific services to the end user[9]. An object can be defined as a distinct entity in the system. It can be a hardware entity, a software process, a communication link, etc. A node consists of one or more objects. A system consists of a finite set of node classes(e.g., IDS, FW, etc.). For each of these classes, there exist one or more instances of such a class.

3. Event Correlation

3.1. Event correlation model

We define a pattern as a concatenation of events, e.g. $p1 = e_1e_2e_3$ without regard to the arrival sequence. Therefore, $e_1e_2e_3$, $e_3e_2e_1$, $e_2e_1e_3$, etc., are the same pattern. Furthermore, the multiplicity of an event within a pattern is equivalent to a single occurrence. Σ^k denote the set of words with length k. Thus, $\Sigma^k = \{w|\ w$ is a word over Σ and $(|w| = k)\}$. For example, if $\Sigma = \{e_1, e_2, e_3\}$, $\Sigma^2 = \{e_1e_2, e_1e_3, e_2e_3\}$. Let denote that $\Sigma^+ = \Sigma^1 \cup \Sigma^2 \cup \Sigma^3 \ldots = \cup \Sigma^k$. Note that Σ^+ is the set of words that might be constructed from one or more events of Σ, and is the largest set of possible words we might observe from an entity being modeled. Let L(C) be the language of a class, e.g., an object. A language is a set of words that can be constructed from the alphabet. Therefore, L(C) is a subset of Σ^+.

An event pattern may consist of tens or hundreds of events. These events are the contribution of many objects throughout the system. The number of events generated by each object and the number of objects involved in a pattern are dependent on the type of the pattern and the size and complexity of the system. Given this framework, the correlation process is divided into two phases: local correlation, which is an object level correlation, and global correlation, which combines the outcomes of the local correlation process in a way to determine a higher-level picture of the system behavior.

This model is appropriate for the problem at hand. What we are saying is that objects generate events in two situations: (1)changes in the state of the object itself; and (2)the object's reaction to external changes. In both cases, an object's behavior is based on its own limited view of the system. The global correlation process collects and assembles these object's views to determine the system view.

3.2. Correlation matrix

As events arrive at the Enterprise Security Manager(ESM), or are read from the event log offline, we use the topology information part of the event to identify the source of the event. The topology information provides us with the node instance and the object name of the source of the event as well as the node's hierarchy in the system. The event will be stored in the object's queue in a FIFO fashion. If this is the first event generated by the object, a new queue is created and the event is placed first in the queue. The event is assigned a number based on the object's alphabet and is labeled as an uncorrelated event. This means that the event has not been identified as part of a pattern yet. The queue length is a system dependent parameter. We have used a length of twenty based on our system's empirical evidence. Using this technique, old events will be pushed out of the queue as more events arrive at the queue[10].

With the arrival of every new event in an object's queue, uncorrelated events are used to form a vector called a "running vector". A similarity measure is applied to the running vector and every vector(pattern) in the object's class template. The vector that is most similar to the running vector is declared as its match. All events that contributed to the pattern are labeled as "correlated" and can be removed from the queue. A local correlation result, i.e., a composite event, will be generated as a result of the match. If however, no match is found, no action is taken.

Defining bipartite graphs in local correlations start with the definition of event-pattern pairs. This knowledge is stored in text files, which are then read into the system during initialization[11].

In local correlation where an object class within a node class is the focus, each event-pattern pair consists of the three fields:

• LCEC: Local Composite Event Code which is the result of a local correlation;

• PEC: Primitive Event(s) Code is a set of primitive events represented numerically. This is a subset of the object's alphabet;

• LCED: Local Composite Event Description. It is a text description of the local correlation result. It is used by the human operator to describe the correlation result if needed.

To illustrate the above, we use <Figure 2> as an example. First, assign a unique LCEC value for each pattern as follows: $p_1 = 1$, $p_2 = 2$, and $p_3 = 3$. Second, assign a unique PEC value for each event as follows: $e_1 = 1$, $e_2 = 2$, $e_3 = 3$, $e_4 = 4$, $e_5 = 5$, $e_6 = 6$, $e_7 = 7$, and $e_8 = 8$. Third, assign a unique LCED field to each pattern. This can be a simple description of the pattern, which can be used by the operator. Finally, each field is separated by a delimiter(e.g., vertical bar |).

1 |3 5 6 7| Firewall blocked a session

2 |1 2 4 5| Firewall passed a session

3 |3 7 8| Firewall detected an intrusion

Figure 2. Correlation matrix.

	P_1	P_2	P_3
e_1	0	1	0
e_2	0	1	0
e_3	1	0	1
e_4	0	1	0
e_5	1	1	0
e_6	1	0	0
e_7	1	0	1
e_8	0	0	1

3.3. Global and temporal correlation

We define a correlation zone(CZ), as a logical entity that represents a collection of objects. A CZ is modeled as a bipartite graph where one set of nodes represents the correlation patterns and the other represents the composite events. A CZ subscribes to the composite events, which are received from objects within the system. The bipartite graph must consist of one or more pattern nodes and the composite events must be from two or more objects within the system. The objects can be located within the same node or different nodes or a combination of the two. A CZ is represented by a queue, which receives composite events from the objects it subscribes to. Like the local correlation decoder, the CZ uses the same approach to identify arriving patterns. The CZ is identical to the concept of an object and its approach to event correlation. The only difference is that a CZ does not generate events and therefore it does not have its own alphabet. Instead, the user defines its alphabet and its language according to known causal relationships. The global correlation process is recursive. This means that a CZ class can be made of smaller set of CZs. This concept fits well given the hierarchical nature of security systems for example network based intrusion detection system, internal/outside firewalls.

While the events in local correlation are the object's alphabet, the global correlation's alphabet is made up of the composite events subscribed to by the CZ based on casual relationships. Therefore, a CZ can be represented by any arbitrary bipartite graph that consists of patterns and composite events. Our objective in this step of the correlation process, however, is to address the scalability issue while finding a solution that works. This can be achieved by using the class concept we explained in the local correlation step.

Defining bipartite graphs in global correlations is similar to that of local correlation. It starts with the definition of event-pattern pairs. This knowledge is stored in text files, which are then read into the system during initialization.

The temporal relationships between events are as important as causal relationships. We plan to utilize the temporal relationships in two different areas, (1)reducing false positives and therefore improve the accuracy of the correlation results; and (2)solving the problem of variable length codes.

Local and global entities are represented by queues where events arrive for correlation.

Spurious and delayed events among others are the cause of false positives. The events stay in the queue until they are flushed out by the FIFO effect. This FIFO effect is helpful but not enough to solve the false positive problem completely. Next, we introduce ways to incorporate the temporal relationships between events to improve the false positive problem.

There are three levels at which a temporal relationship can operate: (1)event level; (2)pattern level; and (3)queue level. We start with the event level temporal relationships. Here, events are considered as independent entities. Only the aging concept will be considered at this level. Three different types of aging techniques can be employed: (1)Threshold: an event will be active until a predefined value is reached when it is considered obsolete and should be removed from the queue. This behavior can be modeled as a step function; (2)Mathematical functions: an event is assigned a weight based on its age in the queue. Upon arrival in the queue, an event has a weight of 1. This weight decreases as time goes by until the weight becomes zero and the event is removed from the queue. The weight value follows the behavior of some function. Finding the best model for event aging is not simple and is system dependent. Simple functions such as linear or truncated exponential can be easily implemented and might be a good starting point.

If we treat all the different events within a queue equally, then the same techniques described for an event level can be applied to a queue. As an example, consider the threshold level technique. Here, we assign a threshold value for a queue where any event older than that value will be considered obsolete and must be removed. The queue level temporal relationships can be seen as a simplified version of event level temporal relationships.
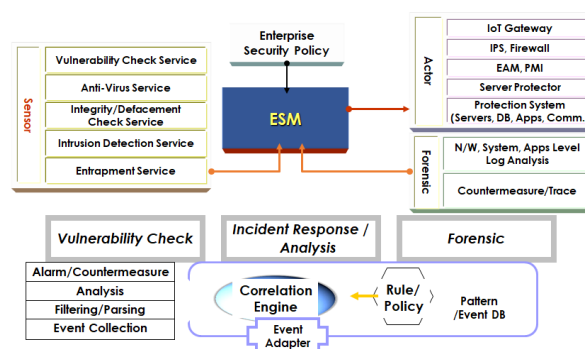
The last technique uses the pattern level temporal relationships. Here, every set of events that make up a pattern is treated differently. This is true of the same event belonging to different patterns.

There is a need for a temporal language to allow for the specification of a variety of temporal relationships between a set of events. In detecting communities[5], an overview of existing temporal logic programming languages was given. While in machine learning[3], provided composite event specification language that can be used to express complex temporal relationships between events. For now, we will define the following single operator: All events comprising a pattern must arrive within a specified period of time. This temporal constrained operator is useful in eliminating old and unrelated events.

4. Implementations and Evaluations

4.1. Implementations

Figure 3. Architecture of enterprise security management system.
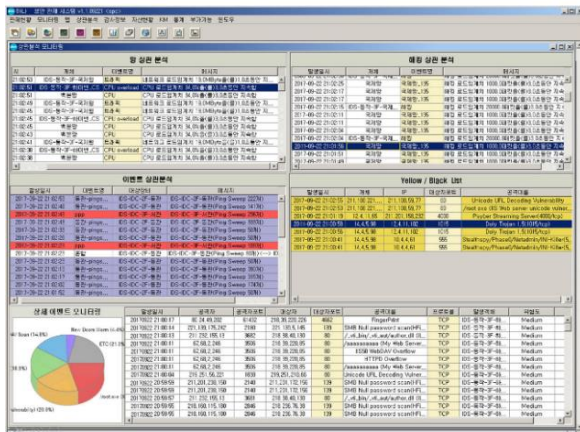

We have implemented an off-line intrusion alert correlator using the method discussed in Section 3. <Figure 3> shows the architecture. It consists of an event manager, an event log, event correlator, and a security manager. All these interact with a DBMS, which provides persistent storage for the intermediate data as well as the correlated alerts. The program was written in Java, with JDBC to access the database. The knowledge base contains the necessary information about hyper-alert types as well as implication relationships between predicates. In our current implementation, the hyper-alert types and the relationship between patterns are specified in an ECL. When the alert correlator is initialized, it reads the ECL file, and then converts and stores the information in the

knowledge base. Our current implementation assumes the alerts reported by IDSs are stored in the database. Using the information in the knowledge base, the alert event manager generates hyper-alerts as well as auxiliary data from the original alerts. The correlation engine then performs the actual correlation task using the hyper-alerts and the auxiliary data.

<Figure 4> shows the correlated logs. Pie graphs depicted on left side are clustered for each networks(domains) and log table depicted on right side are listed by original logs.

Figure 4. Examples of correlated logs.

4.2. Evaluations

To consolidate precision and recall into one measure, we can use the harmonic mean of precision and recall[12]. Purity can be easily manipulated to generate high values. Consider when nodes represent singleton attack(of size 1) or when we have very large pure combination attacks(ground truth = majority label). In both cases, purity does not make sense because it generates high values.

A more precise measure to solve problems associated with purity is the normalized mutual information(NMI) measure, which originates in information theory[13][14]. Mutual information(MI) describes the amount of information that two random variables share. In other words, by knowing one of the variables, MI measures the amount of uncertainty

$$NMI = \frac{\sum_{h \in H} \sum_{l \in L} n_{h,l} \log \frac{n \cdot n_{h,l}}{n_h n_l}}{\sqrt{(\sum_{h \in H} n_h \log \frac{n_h}{n})(\sum_{l \in L} n_l \log \frac{n_l}{n})}}.$$

reduced regarding the other variable. Finally we can evaluate the ratio of false positive and false negative NMI measures as follows, where L and H are labels and found detections; n_h and n_l are the number of data points in global correlation h and with label l. l is the number of nodes in community h and with label l; and n is the number of nodes.

An NMI value close to one indicates high similarity between communities found and labels. A value close to zero indicates a long distance between them. As a results we observed that NMI integrated into one.

5. Conclusions

As large organizations move to manage enterprise security as a critical business process, correlation of events from disparate security devices is absolutely essential for success. Without the efficiency and effectiveness that correlation introduces into the security process workflow, organizations will never catch up to the level of threat that they current face. A foundation technology for correlation is data normalization. A key attribute that should be focused on when evaluating enterprise management solutions is the scope and deployment of the normalization mechanisms. Effective correlation will only be available if the normalization process can capture and organize 100% of the relevant security information for every device and source in the network.

So, we have introduced a framework for event correlation in security systems. We showed how the concept of class in object-oriented methodology is used to provide scalability to our approach. Graph and coding theories are used for correlation. Finally, temporal reasoning was investigated for this framework.

We introduced model, ECM with a simple free text causal language. We introduced a new decoder for pattern identification. Entities and their queues are created only if they generate events and are deleted once their queues are empty. This helps reduce memory

requirements and decrease system complexity. Temporal relationships have been shown to be effective alongside the causal relationships between events.

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Development of Evaluative Indicator of SAFETY Education for KOREA Army

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Abstract

Purpose; This paper intends to develop evaluation indicators of safety education for the Republic of Kore Army(ROKA) personnel. In Korea, there are a lot of accidents and disasters that Korean people had never been experienced including earthquakes, fire casualties, and marine accidents. There are many physical and psychological risk factors including explosion, injury, fire, traffic accident, and psychological violence, etc. Researchers suggest that ROKA soldiers are vulnerable to daily risk factors but do not receive enough safety education due to the lack of appropriate manual, instructor, and time. This study thoroughly reviewed the literature including the US Army field manual on the safety education and studies of industrial safety. Seventeen areas of safety management in the military bases were described in the field manual and counter-measures of each area were reviewed. Thirty evaluative indicators were presented based on the literature review and the value of each indicator was suggested as a milestone for designing and conducting the safety education. The 30 indicators are composed based on the CIPP(context-input-process-product) model and each of the indicator implies theoretical meanings and practical suggestions. The indicators begin with analyzing the hazard of the workplace and they contain : (1)collecting and analyzing the hazards in the workplace, (2)collecting and analyzing the information about the health management system, (3)making the safety management plan in the workplace, (4)reflecting the opinions of military personnel in making the safety management plan, (5)investigating the implementation of health education and evaluation for military personnel, (6)reflecting the military personnel's need for health and safety education, (7)evaluating the leader's interest in the safety and health promotion, (8)investigating the military personnel's consciousness of safety, (9)employment of officer in charge of safety management, (10)percentage of the officers in charge of the safety management, (11)employment of the officers in charge of safety and health education, (12)qualification of the officers in charge of the safety and health education, (13)presence of department of safety and health management and education, (14)volume of contents of the safety and health education, (15)Percentage of budget for safety and health education, (16)implementation of regulations on safety and health, (17)specification of educational objectives on safety, (18)review of the appropriateness of the safety education objectives, (19)diversity of educational method for the safety education, (20)specification of the safety education contents, (21)implementation of the educational plan, (22)checking the military personnel's awareness of the safety objectives, (23)the military personnel's satisfaction in the safety education, (24)participation of the military personnel in the safety education, (25)availability of resources for the safety education, (26)communication about the contents of the safety education, (27)changes in the consciousness of the safety, (28)changes in the knowledge of the safety, (29)changes in the attitude toward the safety, (30)changes in the real actions in the safety management and implementation.

[Keywords] *Safety, Republic of Korea Army, Safety Education, Evaluation, Indicator*

1. Introduction

There are a lot of risk factors in the contemporary society in the area of home, school, community, and workplace. About 86% of Korean adults feel unsafe in their daily life[1].

In the military base, many causes of accident are emerging due to lack of appropriate facility, safety education to the personnel, safety regulation, or reckless behavior. Among the causes, lack of safety awareness is the most crucial factors for the beginning of accidents[2]. The leaders must teach their subordinates to keep the safety awareness by giving them information about functional and operational knowledge in detail in using every day facilities.

ROKA suggests the concrete safety regulations to personnel and requires the commanders and staffs to educate the army personnel regularly with safety rules. Military personnel's physical and psychological performance and welfare are affected by the overall education of safety and health[3].

The problem, however, is that there are not enough evaluative indicators for the effectiveness of the safety education. Therefore, this study intends to specify the evaluation indicators for the ROKA's safety education. For that purpose, the researcher

2. Preceding Research

'Safety' is a condition that a man does not feel of any threat from external or internal environment[4]. Soldiers in safe environment perform better than peers working in poor safety[5]. They are more likely to have prosocial and healthy behaviors(showing socially desirable cognitive skill). Health and safety are foundations of high quality performance and unity in the military organization[6].

In the US Army, about 61% of soldiers feel unsafe in the battle area[7].Thus, the army authority gives detailed rules and regulations for health and safety to protect its members[8]. The US army suggests 5 steps to control and reduce the risk factors: (a)identifying hazards, (b)assessing the hazards, (c)developing controls and making risk-management decision, (d)implementing controls, and (e)supervising and evaluating the effect of control measures. The standard for risk management is leadership at the appropriate level of authority making informed decisions to control hazards or accept the risks[8].

In detail, the US army specifies 17 the risk control areas: (1)Accident reporting,(2)Workplace safety, (3)Transportation safety, (4)Family and off-the-job safety, (5)Range safety, (6)Explosive safety, (7)Aviation safety, (8)Tactical safety, (9)Radiation safety, (10)System safety, (11)Hazardous materials operation, (12)Research, development, test, and evaluation(RDTE) activities. (13)System safety management and engineering, (14) Operations involving the use of ionizing and nonionizing radiation, (15)Public safety, (16)Family, dependent, and off-the-job accident prevention, (17)Other loss control elements.

The US Army regulation says that leaders and managers are responsible for integrating risk management into all Army processes and operations. Safety and occupational health staffs provide risk management training, tools and other related assistance. Leaders and managers must ensure that physical standards for facilities and equipment meet or exceed safety and health standards established in pertinent statutes and regulations and in the Army regulations. The staffs are in charge of risk management process and it is incorporated in regulations, directives, special orders, training plans, and operational plans to minimize accident. The risk regulations are developed for all operations entailing risk of death, serious injury, occupational illness or property loss. The risk assessment matrix can be tailored by the commander for the type of hazard identified. For example, the matrix in the regulation should be used for hazards involving unsafe or unhealthful

working conditions and other hazards associated with base operations. The risk assessment matrix should be used for military training and operational hazards when thee staffs and commanders design the safety education. Effective safety educations will reduce the risk factors by enhancing the military personnel's awareness of the safety in the work and operation. The effective safety education also promotes the commanders' and staffs' consideration of safety in their military decision-making process for military training and operations.

For that purpose, military officers in charge of safety management should develop safety education program and evaluation standards to identify the effectiveness of the education. Kirkpatrick's CIPP(Context-Input-Process-Product) model gives useful direction for that purpose. The education staffs implement actions to meet responsibilities contained in the accident prevention plans of higher headquarters and to provide focus and continuity to safety program efforts.

First, the officer in charge of safety management and education officer design the occupational health and safety training in all Army activities and personnel including civilian employees. Second, they provide all the members in the army with training and education necessary to achieve the skills listed below:

(1)Recognizing the hazards and accident risks associated with their duties and work environment and know the procedures necessary to control these risks and work safely. (2)Knowing their accident prevention related rights and responsibilities as outlined in relevant statutes and regulations. (3)Recognizing the safety responsibilities of their leaders, supervisors, and commanders. (4)Providing unit members with safety education and promotional materials such as posters, films, technical publications, pamphlets, incentive items, and related materials. (5)Ensuring personnel are protected from reprisals for exercising lawful rights. All Army personnel, both military and civil-

ian, will be protected from coercion, discrimination, or reprisals for participation in the Army safety program.

Such procedures will include provision to preserve individual anonymity of those submitting safety and health complaints when requested; to ensure prompt, impartial investigation of allegations of reprisal; and to provide corrective action when such allegations are substantiated.

The above protection against reprisal extends specifically to the right of an Army civilian to decline to perform an assigned task because of a reasonable belief that, under the circumstances, the task poses an imminent risk of death or serious bodily harm and that there is insufficient time to seek effective redress through normal hazard reporting and abatement procedures.

The officers need to establish specific plans to assure continuity of safety and health program services during tactical operations or mobilization. These plans will address mission definition, organizational concepts, and staffing and operational procedures required to assure maximum safety function support to the combat mission. Officers are supposed to make such plans in all organizations and commands for combat or combat support.

The safety officers also need to conduct annual safety and loss control program evaluations to identify the effectiveness of their effort. An effective safety education program is to reduce injuries and illness. The program directors are to ensure that all injuries and illnesses have been thoroughly investigated and the facts from the investigation have been documented on appropriate reports and forms.

Accident reports and compensation claim forms have been properly completed designating the injured employee's major command and servicing civilian personnel office. Compensation claims are challenged and controverted when necessary. Officers then establish procedures to ensure required evaluation for personnel are provided, used, and maintained in accordance with regulations.

Safety officers need to make sure that military personnel are furnished when performing industrial activities similar to those performed by civilian personnel. When required, safety will be funded from appropriated fund accounts available at the installation or activity. Special clothing and equipment include clothing and equipment is needed for the protection of personnel to perform their assigned tasks efficiently under extreme conditions or situations. These include but are not limited to heat, cold, wetness, pressure, environmental pollution (for example, toxic or hazardous gases, vapors, fumes, or materials); deleterious animal, insect, parasitic, or amoebic life; or any combination of these conditions.

Commanders are authorized to give daily safety education and test to their subordinates to protect them from any hazard. For the safety education and preparation, the following criteria must be met: (1)The use of special clothing and equipment would serve a military purpose. (2)The purchase of such clothing and equipment from commercial sources would not be practicable or would cause undue hardship on the individual concerned. (3)The clothing and equipment issued would be returned to the issuing organization when no longer required. (4)Environmental differential pay. Environmental condition needs to be checked before the commanders deploy their subordinates.

Conversely, the requirement to wear protective clothing in any particular work environment does not, of itself, provide justification for environmental inconsideration. For all activities in which official visitors and transients may be potentially exposed to hazards, the host, guide, or area supervisor will conduct a risk assessment of the work location to determine the appropriate protective measures. The hazard(s) to an acceptable level without requiring the use of protection, those measures may be employed(that is, eliminate foot hazards-no safety shoes). However, if it is determined that a safe level of risk cannot be obtained by using these procedures, then the host, guide, or area supervisor will be responsible

for providing and assuring the proper use of protective device and the official visitors and transients will be required to wear the specified protective wear.

Safety officers need to establish and operate an effective explosives safety program to include exercising supervision over subordinate organizations to ensure that effective explosive safety procedures are implemented and maintained to include specific plans to correct violations of explosives safety standards. They can publish a command program to implement ammunition and explosives safety standards and to identify responsibilities for all subordinate organizations(including tenants) that store, handle, use, or transport explosives. They ensure qualified safety personnel review explosives safety site plans, safety submissions, and facility designs for new or modified explosives sites or facilities within the safety arcs of explosives operations. The safety officers ensure qualified occupational safety personnel review explosives safety waivers and exemptions for facilities and equipment and provide the commander with essential risk data regarding the deficient situation.

Effective range safety procedures are needed to be implemented and sustained to include safety office review of all new range construction and all range waivers. The command procedures are also to be implemented for leisure and recreational safety programs and the responsibilities for all subordinate organizations and installations are to be specified. Effective tactical water safety procedures are to be described in the operational regulations.

(a)Establishing and operating a safety program for mountain operations and steep area climbing activities and publicize appropriate to the geographic area.

(b)Providing for inspection of plain area operations for all-seasonal facilities, equipment, and adjacent areas on Army owned or leased properties. Such inspections will assure that safety and health requirements are met.

(c)Providing sufficient safety equipment, communication equipment, first aid facilities, protective devices, and other equipment at Army-controlled operations and daily activities for medical and protective usage.

(d)Issuing standing operational procedures for aerial operations and airborne activities. Safety officers should assure that all aerial operations and airborne facilities and equipment comply with safety and occupational health requirements. Army aerial commanders and staffs must prepare lifesaving equipment and safety-related trainings for all members in the aerial units.

(e)Informing personnel of the hazards of acting alone, in cold or heated area, during hours of darkness, severe weather or in unauthorized areas.

The Military personnel would get a lot of benefits through the safety officers activities described above: they would (a)avoid any possible and predictable hazards, (b)educate their peers and junior members to estimate possible hazards in their actions, (c)suggest ideas to improve safety conditions inside and outside base to reduce hazard level. The problem for the officers, however, is that there are not enough evaluation indicators for the safety education or activity. This study would suggest the evaluative indicators.

3. Developing the Evaluative Indicator of Safety Education

Based on the review of literature, the researcher developed safety education indicators. Oh & Lee[9] summarized a vast volume of literature about safety and health education at the workplace. They suggested various factors to evaluate and improve the safety education: (1)collecting and analyzing the hazards in the workplace[10], (2)collecting and analyzing the information about the health management system[11], (3)making the safety management plan in the workplace[12], (4)reflecting the opinions of military personnel in making the safety management plan, (5)investigating the implementation of health education and

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4. Discussion and Conclusion

As the ROKA emphasizes the human right and safety of the military personnel, the importance of the safety education is getting stronger. The commanders and staffs, however, feel more difficulty in planning, preparing, implementing, and evaluating the safety education.

The risk factors and hazards in the workplace in the military bases are the main targets of the safety education. ROKA authority requires all the military officers, NCOs, and staffs to take the safety education via on-line and off-line. When the ROKA authority intends to implement and evaluate the safety education, the evaluative indicators are essential as the basis for the safety education.

The academic circle has been presenting many studies accumulated about the safety and health education. The researchers use qualitative and quantitative methods for the studies and the outcomes of the studies indicate importance of the evaluative standards[33]. This study suggests the validated indicators for planning and evaluating the safety education for ROKA personnel. The researchers thoroughly reviewed the literature for the military safety education, and organized the evaluative indicators. The preceding researchers conducted the studies through interviews with workplace inspectors, leaders, and employee to draw the standards. In addition, the researcher also conducted survey to experts in the area of safety examination, safety design, and safety implementation. This study would set up the milestone for the safety education and design of the safety implementation, improvement, and evaluation.

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CRISIS of School Violence in KOREA: Understanding Bystanders in School Violence Applying the Theory of Planned Behavior

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Abstract

This study focused on the role of the bystander in the school violence situation and tried to understand the choices of the bystander by applying "Theory of Planned Behavior". In school violence situations, there are bystanders in addition to bullies and victims, and bystanders play significant roles in the situation. Sometimes their choices can determine the outcome of the school violence.

According to TPB(behavior, intention, attitude, subjective norms and perceived behavioral control), the reasons why they choose to be an outsider rather than a defender can be interpreted as follows. They perceive the indifferent behaviors of a bystander and its results as positive and believe that others around will remain outsiders. Also, there is no difficulty in being a bystander, as it does not require an active action.

On the other hand, they do not show the behavior of defenders because they perceive the defender's behavior and its result as negative, believe that the students in a classroom have the norm against the defender's behavior. Even if they want to take an action, they do not know what to do. And they may not be confident in taking an action even when they know what to do.

In order to resolve school violence, the bystanders should respond effectively to the situation as defenders of victims. To this end, it is necessary to actively utilize the result of verifying bystander selection in school violence applying TPB. In particular, we must improve students' attitudes toward the outsiders' and defenders' behaviors and the behavioral outcomes. And Concrete and explicit norms for helping behaviors should be built in their classroom. Finally, we need to inform students how to help victims and improve their confidence in those behaviors. So, we will be able to solve school violence problems by reducing outsiders and increasing defenders when designing and operating an anti-bullying program based on the TPB in the school environment.

[Keywords] *Crisis, Theory of Planned Behavior, School Violence, Bullying, Bystander*

1. Introduction

School Violence has emerged as a social problem in Korea, and the government announced 'Measures for the Intervention of School Violence' in 1995, and enacted "Laws for Prevention and Intervention of School Violence" in 2004. Also, many studies have been conducted to clarify the causes of school violence. But they mainly focused on the individual's traits and environments of the bullies and victims. However, there are many bystanders besides bullies and victims in the situations of school violence. They witness the school violence and influence on the school violence directly or indirectly. Considering that human behavior is influenced by the actions and reactions of others around them, we need to pay attention to bystanders. In the past, there was little interest in the bystanders, who account for the largest proportion in the school violence scene comparing to victims and bullies.

School Violence occurs mainly in the school, especially in the classroom. And it is the students who witness it first. Bystanders are not directly involved in a school violence but can play a variety of roles in the development of the school violence. They can take actions that help the bullies or the victim, or ignore the scene without doing anything. These behaviors can be largely divided into the outsiders, assistants of bullies, and defenders of victims. Depending on which roles the bystander chooses, school violence may be intensified or resolved early[1]. As different outcomes can be expected depending on the behaviors of the bystanders, interest in the roles of the bystanders surrounding the bully and the victim is increasing. So, beyond the approach which is focused on victims and bullies, programs for other members of the situation need to be prepared and operated for the prevention and intervention of school violence. In particular, it is necessary to reduce assistants of bullies and outsiders and increase defenders who control bullies and supports victims.

We will examine the bystander in the school violence situation and review various theories and studies that can explain the behavior of bystanders. These will enable us to understand the behavior of bystanders in the context of school violence. Finally, we will examine the choice of bystander behavior based on the theory of planned behavior(TPB) which is used to effectively explain and improve human behaviors in various domains.

2. School Violence and Bystander

2.1. Understanding of school violence

In "Laws for Prevention and Intervention of School Violence", school violence refers to different actions involving physical, mental damage on people or property damage caused by various negative behaviors that occur in or out of school. This definition specifically addresses very various types of school violence so that they can set the scope of school violence. However, that has limitations that it cannot reveal the context or structure in which school violence occurs.

To understand the phenomenal nature of school violence, it is noteworthy of referring to Olweus' definition of bullying. He named the violence in school as "bullying" and defined as behavior that one or more people are doing constantly and repeatedly harm other people[2]. Its main characteristics are the imbalance of power between the bully and the victim, repetition, and persistence. And it includes physical, verbal, and relational behaviors to harass or deliberately disturb others. School bullying discussed in Korea can be seen in a similar context and is sometimes referred to as peer victimization or group alienation. Compared with the legal definition of school violence, his definition emphasizes characteristics that have not been studied yet, and it excludes temporary and casual aggressive behaviors in the relation of equal counterparts.

As mentioned earlier, the studies on School Violence have traditionally sought to identify and characterize personal characteristics of bullies and the victims- psychological characteristics in the cognitive, the emotional and the behavioral domains. However, as research has deepened, doubts have arisen if personal characteristics could diagnose the cause of bullying precisely. The one of criticism was that there were some cases in which those who were once bullied became bullies and those who bullied became victims of school violence. There were no fixed personal characteristics of victims and bullies, and they could be changed. The second is that the individual characteristics presented are not a causal factor directly related to school violence, but tentative or unidentified characteristics. The third criticism is that it did not consider the characteristics of the school environments where the characteristics of bullies and victims were made and enforced. In general, individual characteristics are formed by the influence of family and social environments. But school violence occurs in the context of the school environment[3].

The bullying in Korea has reflected a special characteristic of the school environment. Students have school life in the same class with the same classmates all year round. Furthermore, the teacher responsible for the

class is the same for the year. In such an environment, it is difficult for a student to reveal one's tendencies, and these cannot be the objects of interest. Also, the harmony and unity of the class become important values. As a result, many researchers have become interested in the atmosphere and norms in classes or schools[4]. There have also been efforts to identify the collective phenomenon in the context of school violence [5].

2.2. Role of bystanders in school violence

A bystander is a person who has been "uninvolved in the event" in its dictionary meaning. However, a bystander in school violence situations is a person who has witnessed bullying behavior. There are many bullies, victims, and bystanders who have watched school violence situations[6]. As bystander' behaviors have a decisive influence on the bully's subsequent actions, bystanders play an important role in the further development of the situation[7].

The roles of bystanders in school violence can be divided into 4 different categories such as outsider, defenders of the victims, enforcers of bullies and assistants of bullies[8]. But there are some difficulties in distinguishing between enforcers and assistants of bullies because these two types show high correlation. Thus, it is commonly classified into three categories such as outsiders, defenders of victims and assistants of the bullies[9]. Defenders of a victim try to console or help victims, and can play a role in breaking the imbalance of power. Assistants of bullies are those who engage in or encourage bully's actions. They conform to bullies because they get vicarious satisfaction from bully's actions or are afraid of becoming a victim if they don't assist bullies. Finally, outsiders pretend not to see the incident and making no actions. If the bystander does not stop him, bullies become more confident in his violent behavior and continue their bullying behaviors. On the contrary, bystanders can reduce school violence if they are on the side of victims. It is certain that helping victims may act as a burden on the bully as they are the major part of bystanders.

As such, the role of the bystanders in the school violence situation is important. Positive feedbacks in verbal or nonverbal ways to support or encourage bullies make them repeat the action. On the other hand, the behaviors to control the bullies or to defend the victim are effective interventions against the bully's violent behaviors. So It is necessary to examine the process and reasons for the bystander's choice by expanding the subjects of the study to all the youth constituting the school environment rather than confining them to the bullies and the victims.

2.3. Bystander's attitude and behavior in school violence

In general violence cases, the presence of a witness affects the aggressors to stop the violence. They think that they have to follow social norms better than when he is alone without a witness. However, Even if school violence is done in the classroom where most of the classmates are present, this phenomenon tends not to occur. That's because students who have witnessed the situation have a negative attitude toward violence, but they act as outsiders without the act of controlling the bully. Also, they may behave differently from their own positive attitudes toward helping behaviors in real situations[10].

Olweus suggested the model effects, responsibility diffusion, and changes in the perceptions of victims[2]. The model effect refers to the social transmission of aggressive behavior. It means that those who have observed the bully's behavior become aggressive for a variety of reasons, although they were not aggressive before the observation. Responsibility diffusion means that the guilty feeling for aggressive behaviors decreases when there are many aggressors, and the responsibility to help the victim decreases when there are many witnesses[11]. Finally, there is a change in perception that the victim deserves that. At first, they feel compassion for the victim, but it is justified that he deserves being bullied to mitigate their guiltiness.

In addition, there were efforts to investigate the causes why the bystanders failed to intervene focusing on the group and try to explain them through social norms. Social

norms are the expectations of a particular group in relation to the appropriate attitudes, beliefs, and behaviors that group members think that they should have[12]. Because the members of a group are not likely to choose a behavior that violates the norms of the group, their behaviors may be decided depending on how they understand the group norms. In school violence, the norms of the class or peers act as the social norms. In the context of school violence, the bystanders are aware of the implicit and explicit social norms and take actions on assistants of bullies, defense of victims or outsiders[13].

As such, bystanders make decisions considering situational elements and make actions in the context of school violence. According to the Decision-Making Model by Latané and Darley, bystanders identify the problem, determine if it is an emergency situation, consider the level of individual responsibility, select the specific intervention method, and then exercise interventions[14]. Reversely, lack of awareness, failure to judge a high-risk situation, lack of responsibility for intervention, lack of intervention, and audience inhibition make the intervention unavailable[15]. Situational characteristics have an influence on individual choice. If there is a problem in decision making at each step, it can lead to 'cycling' between the steps and result in 'blocking', which means it does not go to the next step. When this process is lengthened, the likelihood of indecision and inaction becomes higher. By applying this theory, we can understand why bystanders are choosing the roles. It is also possible to explain why those who have negative attitudes against bullying show uninterested behaviors.

But they have a limitation that they do not include broader cognitive elements such as attitudes and beliefs. TPB can help to understand bystander behaviors in school violence situations because it can explain the relationship between attitude and behavior.

3. Theory of Planned Behavior and the Bystander Intervention in School Violence

3.1. Understanding the theory of planned behavior

The Theory of Planned Behavior(TPB hereunder) is an extension of the Theory of Reasoned Action(TRA hereunder)[16]. It is the theory that is used to predict and explain various human behaviors[17]. TPB considers social behaviors of human as reasoned and planned. That's because people make actions considering behavioral beliefs, normative beliefs and control beliefs. Of course, these beliefs may be inaccurate, unfounded, and biased, but people think and act according to these beliefs, resulting in behaviors that fit these beliefs.

Behavioral beliefs form attitudes to specific behaviors that are favored or unflavored. Normative beliefs lead to subjective norms related to the perception of social pressure and Control beliefs are shown as perceived behavioral control. These three elements are combined to create the intention of behavior. The intention of the specific behavior is the strongest predictor of human behaviors[18][19].

According to the logic of TPB, the way human behavior is chosen can be understood as follows. The stronger the attitude of a certain behavior is, the more positive the evaluation is to the people around them, and the greater the confidence that the person can perform the action, the greater the intention to perform the action. Especially, perceived behavioral control can influence behavior through intent to perform certain behaviors as well as directly through behaviors. Once actual behavioral control becomes possible, it becomes possible for the person to move one's intentions into action when there is an opportunity for actions[18].

TPB has a rigorous social-cognitive structure that is theoretically helpful to understand human behaviors. And that has been empirically validated and used in the studies on sexual health and condom use, consumer attitudes, market research, alcohol and drug use, exercise, blood donation or organ donation, and general health behaviors.

3.2. Bystander intervention in school violence by applying the theory of planned behavior

TPB is generally well suited as a framework for bystander behavior studies. That's because TPB can explain the elements influencing the intervention behaviors of bystanders. Since TPB includes social influences related to intention, the effects of social norms on communication processes can be taken into account[20]. There are studies that address the conceptual relations between bystander behaviors and the components of the TPB in various types of violence. In particular, studies have been made that show that TPB theory and its components are empirically useful when explaining the involvement of nearby people in the bullying situations[21] [22][23].

In school violence, the bystanders can be an assistant of bullies, a defender of victims or an outsider. School violence can be resolved early if bystanders who occupy the majority in the situation change their positions from an outsider to a defender of controlling the bully or helping the victim. Therefore, it is important to interpret the reasons why they become outsiders and do not take action as defenders using TPB. As we have seen above, Human behavior can be predicted through intent to act. Such intentions are influenced by the attitude(positive or negative the evaluation of the action and the outcome), subjective norms(the perception on the peer groups' evaluation of the behavior), and perceived behavioral control(confidence in conducting the behavior).

The reason why bystanders choose an outsider role is that they think that indifferent behaviors or the outcomes are positive, that most of the surrounding students take the same position and think it positive, and that it is easy because they do not need to take any actions. In a similar way, bystanders don't choose defender behaviors because they negatively recognize the result of the defender behavior and its outcomes, and the classmates do not behave as a defender or view the defender behavior negatively, and they do not know what action to take to be a defender or don't have the confidence to actually make it even if they know what to do.

In Korea, researchers found that bystanders chose to be an outsider because of the distrust of adults and fear of retaliation in responsibility and indifference[24]. Girls in the middle school knew that they should understand and help the victim, although they had a conflict between helping the victim and recognizing herself as a third person[25]. Also, elementary school students chose to engage themselves or act to help victims directly or indirectly under the influence of a classroom atmosphere encouraging behavior to help victims, sympathy for the victim, and moral judgement[26]. Middle school boys chose defender behavior even in situations where helping behavior was difficult and the results of helping behavior were frightening.

Therefore, based on the results of applying TPB, the following efforts should be made to reduce the outsider behaviors and increase defender behaviors in school violence. In the dimension of attitude, it is necessary to let them perceive that the result of the outsiders' behavior is negative and that the problem can be solved by the defender action. The program content should include reasons why the school violence problem is resolved through defender behavior in bullying situations. Second, in the case of subjective norms, it is necessary to specify and clearly articulate the class norms that reject outsider behaviors and encourage defender behaviors. Since students take into account the judgments and standards of classmates on specific behaviors, schools and teachers should provide opportunities to make formal norms after students have determined the actions necessary to resolve school violence. In the case of perceived behavioral control, the following method can be considered. The outsider's actions are not difficult to practice because they do not use special methods. But defender action requires special effort. The students will not practice defender behavior when students have a desire to help but do not know how to help, or students know how to help but do not have the ability or confidence to do it. Therefore, to improve defender behaviors,

students need to be trained and have opportunities to practice how to help in school violence situations. Besides, an environment should be established in which helping victims can lead to positive outcomes.

4. Conclusion

School Violence has become a social problem in Korean society. Strategies and programs have been implemented according to various research results to solve school violence. Although various approaches have been taken to intervene and resolve school violence problems, existing methods have mainly dealt with bullies and victims only. However, it is the bystanders that occupy the largest part of the school violence situation, and school violence may be resolved at an early stage depending on the behaviors that bystanders choose. If they choose wrong roles, school violence can be more serious in the course of the continuously repeated processes.

In this respect, it is important to take a comprehensive look at the reasons why bystanders choose the specific roles. We have to develop strategies to improve their behaviors based on the reasons why they choose their behaviors. Previous researchers tried to explain the bystander phenomenon in school violence and understood it as a result of the model effect, responsibility diffusion and change of perception of the victim. Also, they have used the bystanders' intervention decision-making model. However, there are cases where it is difficult to explain the intervention behavior with existing approaches.

Therefore, this study has investigated the reason why bystanders choose outsider or defender actions applying TPB. The reason why the bystander becomes an outsider in school violence is as follows. They perceived the behavior as an outsider and the outcomes as positive. They also thought that their friends would show the similar behavior by evaluating the outsider behavior positively. Moreover, the outsider role does not require any special effort, so students are easy to choose the role.

The reasons why there are only a few defender behaviors are as follows. They perceived the defender behavior and its consequences as negative. They also thought that the peer students would negatively evaluate helping behavior for victims. Furthermore, Students need enough confidence to practice helping behavior as well as knowledge of how to help. Based on the interpretation of TPB, applying methods and programs to reduce bystander behavior and increase defender behavior will increase the likelihood of addressing school violence.

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