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Effects of Students' Perceived Safety of Public Outdoor Environment on Academic Achievement at University Campus

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Abstract The physical environment can dramatically affect students' feeling and their behavior, educational attainment, and the way in which we do school activities. Unlimited access to campus areas without appropriate securities have reported an increase of crime in school area and safety issues has encouraged school facility planners to install securities devices at every corner of buildings. However, it is still questionable whether this approach is enough to protect students and staffs from the victimization of crime, including thefts, burglaries and sexual offences. There has been continued doubt about the safety of educational facilities where individual college students are studying and enjoying extra-curricular activities. Therefore, the purpose of this study is intended to investigate the effects of perception of safety by students on the level of academic performance at public outdoor environment of university campus. An extensive literature noted that the central element of modern school design principle mainly holds the theory of crime prevention through environmental design (CPTED) and the concept of defensible space. The second generation of CPTED also focused on social soft issues as well as situational factors, which extends beyond mere physical design to include social factors. The correlation analysis found that the effect of sense of safety does appear to be statistically significant on the facilitation of academic achievement. However, the analysis of Chi-square concluded that the perception of safety was not related to demographic and socio-economic profiles of the group except for gender. Further, stepwise multiple regression analysis revealed that the most prime predictor for academic achievement were 'safe public outdoor space/paths' at university campus environment, implying careful design of public open space and sidewalks based on the guideline of CPTED. The study also demonstrated that as the level of positive perception of safety rose, the overall academic achievement also responded to the specified rate (β=.99). Finally, the findings reinforce an evidence that high-quality school environments are a positive factor in student academic performance.

Keywords: CPTED, Defensible Space, Fear of Crime, Sense of Safety(SOS), Academic Achievement, University Campus, Demographic Profile

1. INTRODUCTION

The spatial form and its layout of the on-campus physical environment, especially exercising field and pocket-style recess area between academic buildings and other formal facilities of public outdoor environment have remained largely unchanged for about half century, apart from rapid development of information technology and overall upgrade of our living environment. The physical environment can dramatically affect students' feeling and their behavior, educational attainment, and the way in which we do school activities. With rapid increase of students population in early 2000s, prime goals for college administrators in most universities in Korea was just to build and provide many classrooms and lavatory spaces for students, without concerning a careful layout, systematic landscaping plan, and enough facilities of public outdoor spaces between building blocks at campus area.

In particular, unlimited access to campus areas without fences, based on the policy of fence-opening and green projects for local community[1] has accelerated its vulnerable areas at every campus environment. As a result of that, many educational facilities have reported an increase of crime in school area[2] and safety issues has encouraged school facility planners to install securities devices

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[1] The city of Seoul funded 24 universities for its fence- opening and green projects, which included removal of fence and greenery works of planting trees and flowers to provide local residents with resting place from 2002 through 2010.

[2] Herald Economy, one of the news media, reported that there were many dead-angled areas in campus area and many building groups without CCTV or street lighting provided offenders for ideal place to do wrongdoings. http://news.heraldcorp.com/view.php?ud=20120914000512&md=20120921163636_BK

at every corner of buildings inside and outside area. Traditional crime prevention methods rely heavily on police intervention, locks, and surveillance methods emphasizing the use of cameras and guards (Tseng, et al, 2004). The careful planning of the physical environment to provide feeling of being safe for students was often neglected and processed as a minimum approach. Consequently, many local government and school administrations have induced environmental design method, "CPTED" (Crime Prevention Through Environmental Design) to the design of educational facilities. However, it is still questionable whether this approach is enough to protect students and staffs from the victimization of crime, including thefts, burglaries and sexual offences. There has been continued doubt about the safety of educational facilities where individual college students are studying and enjoying extra-curricular activities.

From the field of academia, many scholars and school planners have equivocally addressed the importance of the Oscar Newman's theory of defensible space, which is eventually a design basis for the immediate application of CPTED. Although the typical building construction of campus facilities with their adjacent public outdoor environment are being built with that method, students are frequently careless about the security of their personal safety and only a small portion of victimized students are paying attention to guard against themselves, thus negatively impacting their educational goals. Critics often attribute the impersonal relationships between urban school settings and such other intrinsic problems as safety and indifferences of up-keeping the physical environment in unappealing perceived outdoor public areas.

The basic premise for this research is two folded; the first is that physical environment of educational facilities influenced personal perception of safety and the second is well-organized and safe educational facilities are closed related with the level of academic performance. Therefore, the purpose of this study is intended to investigate the effects of perception of safety by students on the level of academic performance at public outdoor environment of university campus.

2. REVIEW OF LITERATURE

2.1 Environmental Design and CPTED in School facilities

Issues that threaten safety have negative consequences for health and well-being, such as physical and emotional trauma, erosion of self-esteem and lack of concentration (Fletcher, P. & Bryden, P, 2009). Several studies report that the central elements of modern school design principle mainly holds the theory of crime prevention through environmental design (CPTED) by C. Ray Jeffrey and the concept, "Defensible Space" by Oscar Newman. The early principle of CPTED (Crime prevention through environmental design) is that a carefully designed physical environment can deter the incidence of criminal activity by eliminating the opportunities for and vulnerabilities to negative environmental influences.

Figure 1. Example of vulnerable fringe areas of the campus ground with limited natural surveillance.

The "CPTED" concept has been bolstered by Oscar Newman by implementing some of the most basic elements of CPTED design for living environment: installation of high fence, delineated pedestrian paths, distinguished facades of buildings, and improved street lighting. In fact, his theory was sprung from the writings of 'The Death and Life of Great American Cities' (1961) by Jane Jacobs, who emphasized on the fact that increased street activity in downtown would diminish the possibilities of crime rate by adding more observation on unwanted visitors.

The main components of the defensible space theory are 'territoriality,' where grounds and buildings are divided into zones of influence on appropriate behavior and use, and 'surveillance,' where grounds and buildings are designed to allow ease of observation (Bennett, 1986). Consequently, Oscar Newman(1972) contended that "the image of a place" was functioned in reducing opportunities of crime and "environmental land use(milieu)" was influenced by surrounding activities on a place and by specific design styles.

Furthermore, the more expanded concept of CPTED of natural surveillance, territoriality and natural access control are design features of a facility or public open space that permit the authorized users to accept the controllability of the location in a given area. In fact, CPTED approach support any message towards an offender or like-minded individual, that there is a risk of identification, intervention or apprehension should any offender be committed, particularly, a serious offence (Cubbage & Smith, 2009). Further, security should be seen as a service that will advance core business, and in a campus context, core business is education (Gips, 1996).

In fact, the very concept of CPTED and defensible space has a limitation from the fact that natural surveillance, territoriality, natural access control and supportiveness are not the case in many areas of the university where this principle of concepts were ineffective in isolated areas of complex campus environment in Korea. Design guideline of CPTED needs to incorporate more wide concept of crime prevention strategy based on the characteristics of socio-cultural settings, as Byun and Ha (2014) noted in the study of 2nd Generation of CPTED; social cohesion, connectivity, community culture, and threshold capacity. In other words, second generation of CPTED focuses on social soft issues as well as situational factors, which extends beyond mere physical design to include social factors, and uses risk evaluations, socio-economic and demographic profiling and includes the effects of active community participation.

Previous crime related studies of overseas and Korea have mainly focused on the vulnerable demographic profile, "female and children" and such perceived risky places as parking garage, classrooms, and fringe areas. Specifically, domestic studies explored wide application of CPTED in school settings, where fear of crime have occurred over the past decade, and overseas' research has been focused on social and situational factors (See Table 1).

Overall, it is important for research on fear of crime in the school settings to consider both individual indicators as well as environmental characteristics to achieve a better understanding of the mechanism through which fear is created and maintained (Peruman-Chaney & Sutton, 2013). Even though most research

maintained the importance of security measures, the application of CPTED design, individual consequences and situational factors, there is no specific regards to the level of academic performance in the well-defined CPTED purposes.

Table 1. Table 1. Previous Research on school facilities with CPTED concept

Classification	Authors	Topic	Remarks (Year)
Physical environmental factors	Tseng, C.H., Duane, J., & Hadipriono, F.	Performance of Campus Parking Garages in Preventing Crime	Overseas (2004)
	Hummer, D. & Preston P.	Target hardening the college campus through stakeholder input: Merging community and the security survey	Overseas (2006)
	Park, Dong-Kyun	Safety Management Strategy of University Campus by utilizing CPTED	Domestic (2009)
	Ryu, Ho-Jeong, Park, Eun-Kyoung & Ha, M-Kyoung	A Study on Environmental Designs for a Safe Campus from Crimes-Based on the Collegian's Perceptions of on-campus Crimes and Fear of Crimes	Domestic (2010)
	Park, Sung-Chul & Kim, Jin-Wook	Expected effect and applicable alternatives of CPTED elements for school crime prevention	Domestic (2011)
	Yun, So-Jin, Lee, Seung-Jae, & Kang, Seok-Jin	A Study on the Applicable Factors for the Crime-free Campus- Focused on the CPTED	Domestic (2012)
	Kang, Seok-Jin, Kang, Gyu-Jin, and Lee, Kyung-Hoon	A Study on the Risk Assessment of Surroundings of Elementary School Focusing on the Pedestrian Safety and Crime Prevention	Domestic (2013)
	Lee, won-Ho & Lee, Seung-Jae	A Study on the Application of CPTED to existing school according to the Field Study	Domestic (2014)
Social soft issues & situational factors	Park, Cheol-Hyun	Characteristics of university and its criminal victimization	Domestic (2001)
	Danis, Fran S.	In search of safe campus communities: A campus response to violence against women	Overseas (2006)
	Starkweather, S.	Gender, Perceptions of Safety and Strategic Responses among Ohio University Students, Gender, Place, and Culture	Overseas (2007)
	Fletcher, P.C., & Bryden, P.J.	Preliminary examination of safety issues on a university campus: Personal safety practices, beliefs & attitudes of female faculty & staff	Overseas (2009)
	Cubbage, C. & Smith, C.	The function of security in reducing women's fear of crime in open public spaces,: A case study of serial sex attacks at a Western Australian university	Overseas (2009)
	Barberet, R. & Fisher, B.S.	Can Security beget insecurity? Security and crime prevention awareness and fear of burglary among university students in the East Midlands	Overseas (2009)
	Gover, A.R., Tomsich, E.A., Jennings, W.G., & Higgins G.G.	An exploratory study on perceptions of safety, fear of crime, and victimization experiences among faculty and staff at an urban university: a focus on gender	Overseas (2011)
	Perumean-Chaney, S.E. & Sutton, L.M.	Students and Perceived School Safety: The impact of school security measures	Overseas (2013)
	Byun, Gi-dong & Ha, Mi-kyoung	A Study on Elementary School Educational Planning for Crime Safety-Focused on the survey of expertise	Domestic (2014)

2.2 Physical environment and Academic performance

While there is a large body of work regarding the effects of CPTED on physical environment at school, there have been few investigations into the impact of CPTED on academic attainments. In very little previous studies, however, physical design influences on student performance have tried to evaluate the impact of that in learning environment. Berner(1993), from a cross-sectional study of academic facilities found that poor physical condition of school facilities in Washington D.C., based upon standardized facility inspection checklists, was associated with impaired performance on achievement test. Limited evidences, mainly consisted of environmental attributes, suggested that poor environmental quality adversely influenced the performance of students (Mendall & Heath, 2004; Higgins, et al, 2005; Shaughnessy et al, 2006; Shield & Dockrell, 2008; Na & Choo, 2009; Agron, 2013; Kim, 2013).

During the 2000s, there has been common belief that high-quality school environments are a positive factor in student academic performance. However, Picus, et al (2005) contended that a school's physical environment has an impact on student achievement, but researchers have had difficulty demonstrating statistically significant relationships between the physical environment and student outcomes, implying no conclusive findings. Since there are few empirical results related to the clear relationship between safe physical environment and student achievement, it is necessary to identify and construct conceptual measuring scale for the impact of perceived safety on student academic achievement, based on existing literature and research concept.

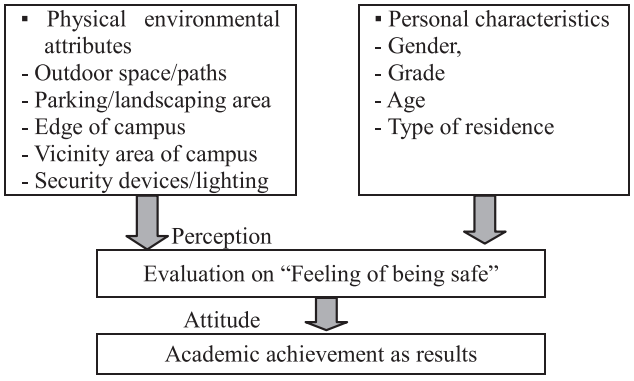


Figure 2. Hypothesized casual links relating public outdoor environmental attributes of campus to academic performance of college students.

College students' demand to improve their educational achievement is strong, and they have also needed to attain other diverse academic activities at campus setting. Sufficient documentation of the adverse effects of unsafe environment at campus on student achievement, however, has not been available to motivate more detailed and practically applicable CPTED guidelines as an efficient strategy to increase student academic performance and to gain public attention. Further, conceptual expansion of physical environmental attributes goes beyond safety issues to explore in-depth linkage that connect perception of safety and academic attainment for priority strategies and design implementation.

3. METHODOLOGY

In order to examine the effects of college students' experiences for being safe on academic achievement, it is necessary to explore what the level of academic attainment at particular physical environment at university campus. For that purpose, one set of college student group was asked for survey in a selected campus. A questionnaire on a five-point li-kert scale was designed to evaluate six components of safety related issues: 1=strongly disagreed and 5=strongly agreed. Twenty-eight survey statements regarding sense of safety and four questions, asking personal characteristics of College students were employed in instrumentation. The actual survey data samples were collected from June 2014 through September 2014. 440 survey samples were responded and 421 collected for analysis through SPSS program. Each scale of major concepts (i.e., Public outdoor space/path, parking/landscaping, edge area of campus, vicinity area to campus, security devices/lighting, self-reported level of academic achievement and satisfaction) was calculated by average means of each component. In order to verify appropriateness of survey index, Cronbach's Reliability test was performed to verity the stability of 32 survey indices (α= .8805).

Table 2. Profile of Target population as of October 2014 (S University Campus)

Division	Area & population
Site area	508,690m2
Physical education area	37,447m2
Building area	224,646m2
Accommodation capacity of Dormitory	1,600 (Accommodation rate: 13.9%)
Student population (Sub-total: 11,503)	- Undergraduate: 10,161 - Graduate: 1,342
Faculty & staffs	751

4. SURVEY RESULT AND DISCUSSIONS

4.1 Personal characteristics by sense of safety and academic achievement

In order to examine personal characteristics on the sense of safety, χ2 analysis were performed (presented in Table 3). Every individual characteristics showed moderate results of assessment on the university campus environment by evaluating 3.2 points on 5 points Li-kert scale. The Chi square analysis (χ2) revealed that each group's individual characteristics was not statistically significant except for gender through the test of Likelihood Ratio at the level of p=.001; gender, age, grade and type of residence. Age, which is considered as an important indicator of crime related studies, was not also confirmed by statistics, implying total survey population is homogeneous peer group as unit analysis. Residential type did not yield any statistically significant meaning to the sense of safety, regarded as stable psychological base, on the condition that students commuting from family owned residence feel higher safety level than any other groups (group of family owned residence reported m=3.27 versus dormitory m=3.19).

Table 3. Descriptive statistics of Safety and χ2 Analysis

Individual characteristics		N	%	Sense of Safety	χ2
Gender	- Male	249	59.1%	3.27	322.97 (432.56**)
	- Female	158	37.5%	3.23	
	Total	407	96.7%	3.26	
Age	~19 years	12	2.9%	3.20	975.98
	~29 years	374	88.8%	3.25	
	~39 years	17	4.0%	3.23	
	40 years~	15	3.6%	3.52	
	Total	418	99.3%	3.26	
Grade	- Freshman	118	28.0%	3.25	1293.72
	- Sophomore	144	34.2%	3.30	
	- Junior	79	18.8%	3.29	
	- Senior	59	14.0%	3.13	
	- Post Bac.	19	4.5%	3.26	
	Total	419	99.5%	3.26	
Residence Type	- Family H.	199	47.3%	3.27	967.69
	- Relative H.	7	1.7%	3.24	
	- Rental H.	135	32.1%	3.26	
	- Dormitory	66	16.4%	3.19	
	Total	410	97.4%	3.26	

n= 421, ** p <.01, Likelihood Ratio

This means that the demographic and socio-economic profiles of college students are not specifically influenced from the issue of safety at existing campus environment. As shown in Fig. 3, it is notable that female students have slightly lower sense of safety at their physical environment. Previous research argued that university campus might be a high-risk environment where female students were more victimized than other groups, and negatively impact educational goals for women (Cubbage & Smith, 2009; Fletcher & Bryden, 2009; Barberet & Fisher, 2009; Danis, 2006). This result implies that female students tend to have more fear of crime, thus seeing themselves at higher risk of crimes against the person.

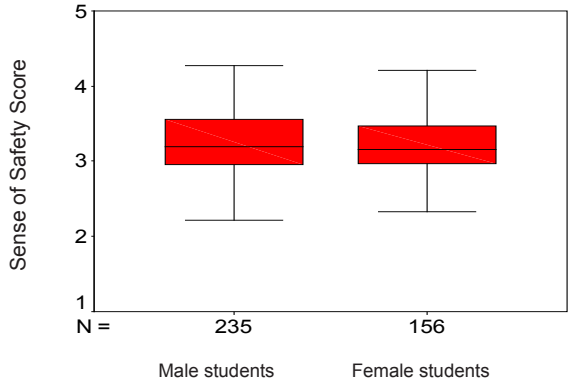


Figure 3. Relationship between Gender and Safety

Regarding the influence of personal profiles on the academic achievement, the χ2 analysis of Table 4 shows that gender is statistically significant component (p=.017). On the other hand, it appears that students who are residing in university dormitory reported higher academic attainments than other groups and

student group commuting from their relative housing the least academic performance. It could be argued that students' positive perceptions of campus climate and somewhat strong sense of cohesion to the campus environment might link direct built environment to student academic achievement.

Table 4. Descriptive statistics of Academic achievements and $\chi 2$ Analysis

Individual characteristics		N	%	Academic Achievement	$\chi 2$
Gender	- Male	249	59.1%	3.42	27.48* (p=.017)
	- Female	158	37.5%	3.41	
	Total	407	96.7%	3.41	
Age	~19 years	12	2.9%	3.68	43.51
	~29 years	374	88.8%	3.38	
	~39 years	17	4.0%	3.49	
	40 years~	15	3.6%	3.85	
	Total	418	99.3%	3.41	
Grade	- Freshman	118	28.0%	3.41	48.27
	- Sophomore	144	34.2%	3.43	
	- Junior	79	18.8%	3.38	
	- Senior	59	14.0%	3.36	
	- Post Bac.	19	4.5%	3.63	
	Total	419	99.5%	3.41	
Residence Type	- Family H.	199	47.3%	3.44	49.08
	- Relative H.	7	1.7%	2.93	
	- Rental H.	135	32.1%	3.36	
	- Dormitory	66	16.4%	3.46	
	Total	410	97.4%	3.41	

n= 421, * p <.05

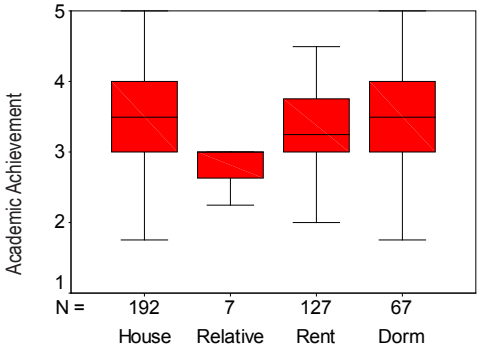


Figure 4. Relationship between Residence type and Academic Achievement

4.2 Environmental factors related to safety

As indicated in Table 5, each index regarding the sense of safety in university campus showed mid range score from 2.47 to 3.68. Among five major components, students assessed vicinity area to campus as the highest safe area (M=3.38). On the other hand, public outdoor space and paths are the least secured area (M=2.75), along with students' low participation in sports and club activities (M=2.47), thus diminishing the opportunities of natural surveillance over public outdoor area (See Fig. 5). Specifically it was reported that many gloomy areas were existed in S university campus environment.

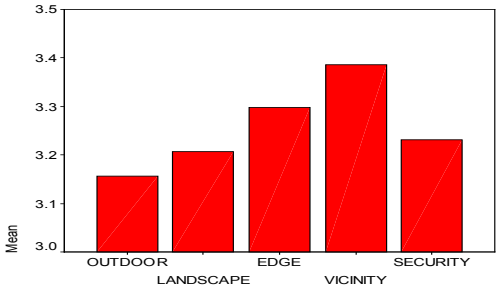


Figure 5. Mean Scores of Major Safety components

Table 5. Level of Safety in university campus (n=421)

Safety related index	Survey item	M*	SD
Public outdoor space & path (M=3.15)	Every physical education facilities laid out open	3.41	.93
	Every physical education is open to local community	3.68	.96
	There is no gloomy space in campus	2.75	1.02
	Participate in sports and club activities	2.47	1.21
	Sidewalks are open from every side	3.33	.01
	Sidewalks are regularly patrolled	3.10	.92
	Linkage between bldgs. are secured well	3.34	.93
Parking & landscaping (M=3.21)	Visitors parking are separated from staffs	3.04	.84
	Visitors parking are monitored from cctv	3.01	.86
	Landscaping element do not block views	3.40	.76
	Low height of planting around openings of bldg.	3.37	.77
Edge area of campus (M=3.30)	Number of campus entry are minimalized	3.45	.86
	Gates are located for easy monitoring from road and parking lot	3.41	.87
	Entries are monitored for visitors and parking	3.41	.99
	Sub-entrances are secured during night time	2.92	.99
	Fences are transparent for easy monitoring	3.19	.91
Vicinity area to campus (M=3.38)	Campus bldgs. are located close to road outside	3.51	.87
	Sidewalks and road are separated in campus area	3.53	.83
	Sidewalks and playground are naturally monitored by neighbors	3.41	.82
	Vicinity area of campus are regularly patrolled	3.07	.85
Security devices & lighting (M=3.23)	Security devices are installed in every space/ bldg.	3.30	.83
	Lighting devices in sidewalks and recess area of campus are not glare and appropriate	3.31	.84
	Street lighting are installed with regular spacing	3.15	.91
	Benches and street furniture are installed for easy monitoring	3.15	.85

* Mean values are recorded on 5 point-Likert scale
(1= strongly disagreed, 5= strongly agreed)

4.3 The effects of perceived safety on college students' academic achievements

In order to identify the effects of perceived safety on academic performance, mean value of major safety related component scores were operationally defined to perform correlation and multi-regression analysis.

As shown in Figure 6, Pearson correlation analysis provides an empirical evidence for a solid relationship between sense of safety and academic achievement (p=.571, <.01). Each component of

safety related index also shows solid relationship among these variables. This results also confirms previous Kim's research (2013) on the relationship between perceived public outdoor space and academic achievement (p=.288 <.01). The finding also adds its strength to the recent study that educational design of educational facilities can influence a student's academic performance by as much as 25 percent (Argon, 2013).

Academic Achievement					
.571**	Outdoor space & Paths				Sense of Safety .571**
.461**	.557**	Landscaping & Parking			
.420**	.450**	.429**	Edge area		
.497**	.533**	.536**	.546**	Vicinity area	
.502**	.544**	.472**	.495**	.556**	Security devices

** Correlation is significant at the 0.01 level (2 tailed)

Figure 6. Pearson Correlation analysis between Sense of Safety and Academic Achievement

In an effort to investigate what major predictors of SOS in each group and variables are impacting on academic achievement, linear stepwise regression analysis was performed. As shown in Table 6, the factor of 'public outdoor space/paths' among five components did significantly related to academic achievement (See Model A).

In the examination of each variables effect, "Sidewalks are open from every side," is the most influential predictor in academic achievement, followed by "Security devices are installed in every space/bldg." and "Low height of planting around openings of bldg." (See Model A'). From the standpoint of safety issue in campus environment, these predictors confirms solid evidence of the basic CPTED concept application and defensible space theory, while closely related to the students' academic achievement.

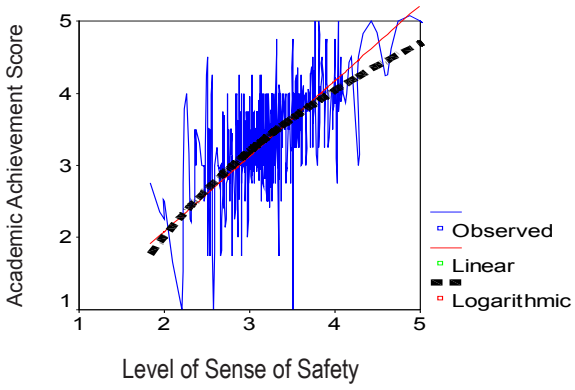
As Picus and colleagues (2005) contended that high-quality school facilities are a positive factor in student achievement, the results of regression analysis are consistent with the common belief of many design professionals and school facility planners that well-organized and carefully designed educational environment has a substantial influence on the promotion of students' academic performance and improvement of their successful college lives.

Table 6. A regression analysis for safety and academic achievement

Reg. Model	Predictors	Reg. coefficients	Std. Error	Bata Weight	F	Sig.
Model-A (major compo-nent)	Outdoor	.605	.043	.569	196.3	.000*
	Constant	1.503	.139			
	R2=.324, Adj. R2=.323					
Model-A' (survey index)	Index 5	.216	.031	.299	71.69	.000*
	Index 21	.217	.034	.273		
	Index 11	.194	.037	.230		
	Constant	1.324	.146			
	R2=.346, Adj. R2=.341					

* p <.01
** dependent variable: composite score of academic achievement
*** Index 5 refers to Sidewalks are open from every side;
Index 21 indicates Security devices are installed in every space/bldg.
Index 11 refers to Low height of planting around openings of bldg.

The linear graph in the following Figure 7 indicates that as students' perceived sense of safety at campus environment goes up, the level of academic performance does correspond to the rate of regression coefficient.



* d.v. = academic achievement, i.v.= sense of safety
** Curve fit; Beta=2.91, β=.99, F=18373, p=.000, R2=.978, Adj.R2=.978

Figure 7. Regression analysis, showing the interrelationship between sense of safety and academic achievement

5. SUMMARY AND CONCLUSION

5.1 Summary and discussion

In order to investigate the effects of sense of safety on academic achievement, an extensive literature explored found that the central elements of modern school design principle mainly holds the theory of crime prevention through environmental design (CPTED) and the concept of defensible Space. Further investigation also noted that the very concept of CPTED of natural surveillance, territoriality and natural access control were design features of a facility or public open space that permit the authorized users to accept the controllability of the location in a given area. The second generation of CPTED also focused on social soft issues as well as situational factors, which extends beyond mere physical design to include social factors, and uses risk evaluations, socio-economic and demographic profiling and includes the effects of active community participation.

The research found that when the current physical settings were controlled for other correlated but basically irrelevant factors to this investigation as a whole, the effect of sense of safety does appear to be statistically significant on the facilitation of academic achievement. However, the analysis of Chi-square concluded that the perception of safety was not related to demographic and socio-economic profiles of the group except for gender. It is important for research on fear of crime in the school settings to consider both such individual indicator as gender-female as well as environmental characteristics to achieve a better understanding of the mechanism through which fear is created and maintained. Further, stepwise multiple regression analysis revealed that the most prime predictor for academic achievement were 'safe public outdoor space/paths' at university campus environment, implying careful design of public open space and sidewalks based on the guideline of CPTED.

The study also demonstrated that as the level of positive perception of safety rose, the overall academic achievement also responded to the specified rate (β=.99). In other words, the study

concluded that 'sense of safety' in physical campus environment is major influential component to students' academic performance.

5.2 Limitations and Implication for future research

Several research limitations exist. Because of the location of survey site and subject size of target population, it may not possible to generalize the results in other university campuses. Since the study included new composite score of sense of safety, and self-reported academic achievement, the results cannot be generalized to traditional study of CPTED and defensible space theory. Moreover, any conclusion concerning the measurement of sense of safety must be limited to the survey respondents who experienced campus environment in full. It is possible that those who did not reply to the survey were less supportive of the research concepts. Conclusions regarding students' attitude and their evaluations will have to be limited to the assessable variables provided by the survey responses based on limited experiences of college life in campus environment. Notwithstanding the limitations, the research is one of few studies to examine sense of safety at university campus in relation with academic achievement and the findings provide a new direction for a true value of safe built environment.

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