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Experimental study of physical activity environment, positive and negative affect, and motivation

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Abstract

Research points to a connection between affect and physical activity (PA). However, there remains a gap in understanding the impact of PA environment on positive and negative affect, and motivation. A synchronous experiment was done with participants randomly assigned to interventional group ([n = 24] outdoor PA environment) and control group ([n = 23] indoor PA environment). Interventional task was a one mile jog and walk. Participants responded to positive affect and negative affect scale' (PANAS) at baseline and post-intervention and motivation survey at post-intervention. Sample size and power output was determined by G-power. Descriptive statistics, repeated measures and independent sample T-tests were applied for data analysis. Results show a statistically significant decline in negative affect; statistically significant increase in positive affect; insignificant difference in the experimental and control post intervention positive affect $t(42) = .76, p = 0.45$; and negative affect; $t(42) = .25, p = 0.80$; and insignificant difference in outdoor ($M = 4.11, SD = .63$) and indoor ($M = 4.22, SD = 0.62$) situational interest; $t(38) = -.54, p = 0.58$. In conclusion, one mile jog and walk lowers negative affect and increases positive affect. PA has positive effect on affect irrespective of the physical environment.

Keywords: Word, affect, physical activity, physical environment

Introduction

Emotional issues have been extensively investigated, especially from psychological perspective. Emotion is a subjective state of mind that could be reaction to internal stimuli such as thoughts or external stimuli including events that occur in our environment ^[1]. With new research findings, there has been a shift from use of the term 'emotion' to 'affect'. Positive affect is positive emotions and expressions, and negative affect is negative emotions and expressions ^[2]. The question at the core of many scientists is creation of strategies to address emotional problems that are reportedly on the rise. To that end, a group of scientists hypothesized that physical activity (PA) engagement can help reduce negative affect and increase positive affect ^[3].

Even though scientists have investigated effects of outdoor PA on positive and negative affect ^[3, 4, 5], to the best of our knowledge, no study has been done exploring relationship between PA environment, affect, and motivation, among college students. Theoretical framework adopted for this study is socio-ecological model (SEM).

Theoretical Framework

SEM posit that there are multi-level of influences (intrapersonal, interpersonal, community, institutional, and policy) on personal health ^[6]. Intervention strategies at various levels use education, support groups, and organization incentives to positively impact behaviour change ^[7]. Therefore, individual behaviour ought to be understood in the context of the social environment in which individuals live ^[6]. For instance, it has been suggested that PA impact be explored in the context of the social environment ^[8]. In addition, public health challenges, including sedentary lifestyle, are complex and emerge from multiple independent levels ^[9].

Intrapersonal Factor Affect

Intrapersonal factors are personal characteristics such as knowledge, attitudes, and behaviour. In this context we focus on affect. Researchers define affect as a combination of emotional expression and moods ^[2]. In addition, there are two types of affect, positive and negative.

According to researchers [10], indicators of positive affect are active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud, and strong. Indicators. On the contrary, indicators of negative affect are afraid, ashamed, distressed, guilty, hostile, irritable, jittery, nervous, scared, and upset. Intrapersonal factor affect has an effect on individual daily experiences that may influence personal thoughts, opinions, and cognitive approach.

Scientists posit that PA enhances positive affect while reducing negative affect [11]. An experimental study with community members revealed relationship between PA and positive affect [12]. In addition, scientists [14] revealed a relationship between positive and negative affect and PA.

In an experimental study, scientists reported decline in negative affect and increase in positive affect [14]. Notwithstanding, there is relationship between PA and decline in negative affect [5]. Whereas PANAS assumed that the relationship between positive and negative affect with PA is dichotomous [10], other scientists [16] revealed how individuals may possess positive and negative affect at the same time. In other words, presence of positive affect does not necessarily have negative correlation with negative affect. It has also been proposed that PA increases positive affect and reduce negative affect [16].

Interpersonal Factor – Situational Interest

Social support and social networking impacts affect. One key interpersonal factor is situational interest. Situational interest is defined as attentional reaction generated by the social and learning environment [17]. Accordingly, it encompasses active learning among students [18]. As a result, active learning establishes social interaction, teamwork, innovation, interest, and engagement [19]. In other words, behaviour change is not merely achieved through teaching, but includes education and provisions of interventional options [20, 21].

Community Factors- Walking Trail

A Seminal work [7] describes community factors as relationships among institutions and organizations, within defined boundaries. Thus, community includes campus location, built environment, parks, and walkability. In this study, community factor investigated is walking trail. While it is agreeable that PA has an effect on affect, there seems to be conflicting finding on the association between affect and PA environment. Recent studies suggest that exercising outdoor in natural setting has considerable health benefits including increase in positive mood and reduction in aggression [3, 22]. PA done outdoors not only improves positive moods, but also lowers negative moods [23]. In an experimental study, scientists [16] found higher positive affect among athletes that engaged in outdoor PA. More specifically, participants in the outdoor environment reported significant increase in positive affect irrespective of the intensity of the PA. Indoor and outdoor walks have an impact but the outdoor environment supports a higher positive affect [24].

Institutional Factors – Indoor and Outdoor PA Facilities

Institutional factors include campus climate, distance to buildings, and common lounge places. For the purpose of this study, the focus is on an indoor track and outdoor walking trail. At least one study [25] established a significant increase in positive affect following the moment of increase in PA. Besides, scientists have also revealed positive association between PA and positive affect [26]. On account of this, there is direct positive correlation between PA and positive affect.

A study involving 10-minute and 30-minute walk reported significant improvement in positive affect, but insignificant difference based on time taken [27]. Hence, 10-minute and 30-minute walk treatments had similar benefits.

In spite of suggestion that PA environment impacts affect, other researchers posit that PA environment has no significant effect on affect. Recently, researchers identified relationship between PA and mood [28]. In addition, evidence points to increase in positive moods between prompt and post treatment [27]. Probably, positive affect result from social interaction and instant enjoyment in the outdoor PA environment [29].

In summary, there remains a gap in understanding the effect of PA environment on both positive and negative affect and in exploring the impact of PA environment on motivation. Using SEM, this study investigated the PA environment, affect, and motivation. This study will explore closing the gaps of understanding of PA environment on positive and negative affect.

Purpose of the study

The purpose of this research was to investigate the impact of PA on negative and positive affect and situational interest among college students. It was hypothesized as follows:

H₁: One-mile jog or walk will reduce negative affect.

H₂: One-mile jog or walk will increase positive affect.

H₃: Outdoor PA environment will have higher effect on affect.

H₄: Situational Interest is higher among outdoor than indoor participants.

Materials and Methods

Ethics

The study was conducted in accordance with the Declaration of Helsinki with written informed consent obtained from participants. Prior to data collection, researchers got approval from the university Institutional Review Board (IRB), Protocol number 18-192-R1.

Participants

Participants (N = 61) were students in a 4-year university in South-eastern USA.

Data Instruments

This study used three instruments: PANAS, Situational Interest Scale, and the environment was indoor running track and outdoor trail. Positive affect and Negative affect scale (PANAS) developed by Watson *et al.* (1988) [10] was adopted to assess participants' emotional status at baseline and post intervention. PANAS is divided into two segments (positive and negative affect). A total of 10 items were used to measure positive affect and 10 items to measure negative affect (e.g., indicate the extent you have felt this way over the last week). All items were measured on a five-point scale, 1= 'not at all' 5= 'extremely'. These items focused on assessing impact social environment on motivation towards outdoor and indoor PA engagement. Motivation was assessed by Situational Interest Scale [21]. Four items measured 'total situational interest' (e.g., "What we were learning today looks fun to me"; "What we were learning was interesting"). Three items measured students' instant enjoyment (e.g., "What we were learning was appealing to me"; "What we did was enjoyable for me"). Intention was measured with three items that were modified to suit PA (e.g., "I wanted to know more about how to do PA were doing today"; "I wanted to analyse and have a better handle on PA we were doing today"). All items were

measured on five-point Likert scale ranging from 1 = ‘strongly disagree’ to 5 = ‘strongly agree’. Community and environment assessment focused on indoor running track and outdoor trail. Participants were randomly assigned to either indoor or outdoor group. Students engaged in one mile walk or jog followed with PANAS survey.

Randomization

A randomized controlled trial was used for this research. At the onset of the study, participants (N = 61) that consented completed baseline PANAS survey (pre-test). After baseline, 14 participants withdrew from the study. Final analysis was based on participants (N= 47) that participated in all phases (baseline questionnaire, treatment, and post treatment questionnaire). After baseline, researchers used block randomization designed to ensure equal sample sizes for the two groups (experimental and control). Experimental group (outdoor) had 23 participants and control group (indoor) had 24 participants.

Intervention

Intervention was 1-mile jog or walk done indoor (control group) and outdoor (experimental group). Questionnaires were administered at baseline and post intervention. Intervention task was one mile jog or walk in the randomly assigned groups. Participants engaged in intervention tasks at individual pace, but not more than 45 minutes. Experimental group participants walked one mile on a trail in the university district garden area, whereas control group participants jogged and run one mile indoor. At the end of the study, participants

that participated in all phases received a 15-dollar gift card.

Data Analysis

Sensitivity analysis was conducted using G*Power [29]. Normal distribution of the data was checked using kurtosis, skewness, and Shapiro-Wilks. Internal reliability of different scales was measured using Cronbach’s alpha [30]. Data were subjected to descriptive and inferential analysis using IBM SPSS Statistics v28 software package [21]. Repeated measures t-test for positive and negative affect was done at baseline and post-test to test effect of jog and walk on affect. Independent sample t-test was performed to test impact of PA environment on motivation.

Results

Sample size

G-Power analysis revealed that to test group means using repeated measures t-test, a sample of 45 was required to achieve medium effect size (d= .50), an alpha of .05, and power 0.95. With a sample of 47 participants, it meets the threshold required for this study design.

Descriptive Results

Participant’s mean and median age were 29.36 SD = 12.517 and 25, consecutively. Majority of the participants were women (60.7%). Racial composition was 54.1% Caucasian, 31.1% African American, 8.2% Hispanic, 3.3% Asian, and 3.3% others. A flow chart of the grouping process is provided in figure 1 below.

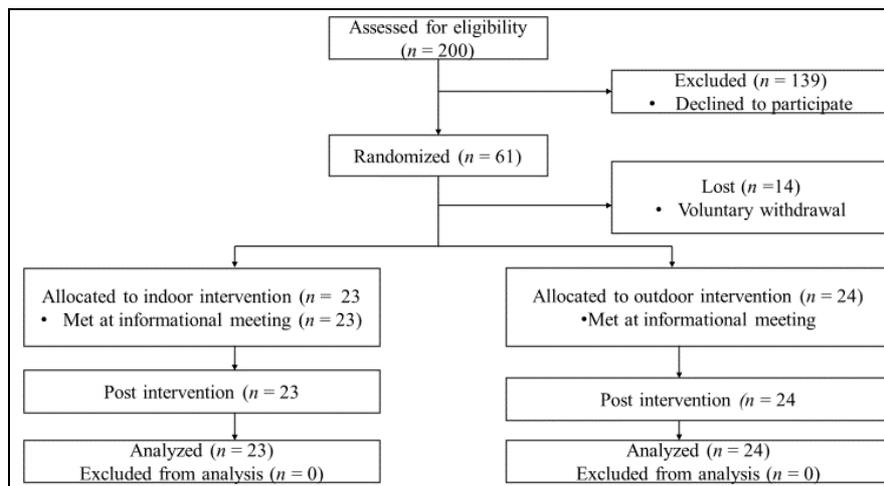


Fig 1: Participants’ flow chart

Reliability Tests

Reliability test was done using Cronbach’s alpha. Affect scale had five subscales each with 10 items, whereas situational interest scale had 19 items. The measurement instruments were reliable with a value ranging from $\alpha = 0.824$ to $\alpha = .937$ as presented in table 1.

Table 1: Cronbach’s Alpha (1951) Results

Variable	Cronbach's Alpha	N of Items
Baseline +ve Affect	.937	10
Baseline -ve Affect	.905	10
Post Exer +ve Affect	.854	10
Post Exer -ve Affect	.824	10
Situational Interest	.857	19

Descriptive statistics were done by testing affect at baseline

and post-test. Results are presented in table 2 below. Of the sample, 57.4% had previously participated in outdoor PA. Seventy seven percent of the sample participated in all phases of the study (baseline questionnaire, intervention, and post-test).

Table 2: Baseline and posttest affect results

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	BNA Mean	2.0578	45	.75963	.11324
	PNA Mean	1.3556	45	.41427	.06176
Pair 2	BPA Mean	3.6356	45	.87598	.13058
	PPA Mean	3.9733	45	.65658	.09788

From the results, negative affect was below midpoint (scale - 5) at baseline and post-intervention. In addition, there was a decline in negative affect at baseline and post intervention

(figure 2). Besides, the mean scores for positive affect were above midpoint at both baseline and post intervention. Likewise, there was an increase in positive affect after intervention. Examination of mean scores revealed that

participants' levels of total situational interest ($m = 4.16$, $SD = .62$), Instant enjoyment ($M = 4.20$, $SD = .59$), and Intention ($M = 3.72$, $SD = .71$) were above mid-points.

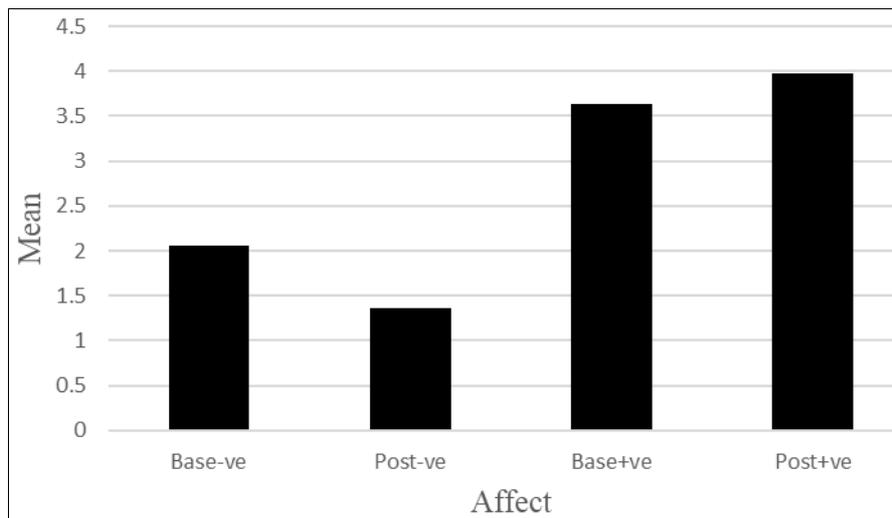


Fig 2: Affect at baseline and post-intervention

Repeated measures T-Tests were done to analyse affect at baseline and post-intervention. From the total sample ($N = 47$), experimental group (outdoor) had 23 participants, and

control group (indoor) had 24 participants. Test results revealed a statistically significant decline in negative affect, and increase in positive affect. Results are shown in table 3.

Table 3: Paired sample T-Test results

		Paired Differences					t	DF	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	BNA Mean – PNA Mean	.70222	.83434	.12438	.45156	.95289	5.646	44	.000
Pair 2	BPA Mean – PPA Mean	-.33778	1.11626	.16640	-.67314	-.00242	-2.030	44	.048

Note: BNA = Baseline negative affect; PNA = post intervention negative affect; BPA = Baseline positive affect; PPA = Post intervention positive affect.

Independent sample test results show statistically insignificant relationship between environment and affect (positive and negative). That is, there was a statistically insignificant difference in the scores for outdoor ($M = 2.2$, $SD = .75$) and indoor ($M = 1.99$, $SD = 0.77$) baseline negative affect; $t(42) = .76$, $p = 0.45$. Also, there was insignificant difference in the

scores for outdoor ($M = 1.38$, $SD = .48$) and Indoor ($M = 1.35$, $SD = 0.36$) post intervention negative affect; $t(42) = .25$, $p = 0.80$. Notwithstanding, further results did not establish significant difference in positive affect and environment (table 4).

Table 4: Independent Samples Test based on environment and positive affect

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	DF	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
BPA	Equal variances assumed	.223	.639	.017	42	.987	.00455	.26945	-.53922	.54831
Mean	Equal variances not assumed			.017	41.082	.987	.00455	.26945	-.53958	.54867
PPA	Equal variances assumed	2.977	.092	-1.772	42	.084	-.33636	.18981	-.71942	.04670
Mean	Equal variances not assumed			-1.772	38.800	.084	-.33636	.18981	-.72036	.04763

Note: BPA = Negative affect at baseline; PPA = Positive affect after intervention

Independent sample T-Tests was conducted to test post intervention situational interest level in experimental and control groups. Results revealed statistically insignificant difference in the scores for outdoor ($M = 4.11$, $SD = .63$) and indoor ($M = 4.22$, $SD = 0.62$) situational interest; $t(38) = -.54$, $p = 0.58$.

Discussion

Results from this study fully supported H_1 . In other words, PA

engagement has indirect effect on negative affect. After PA treatment, there was a decline in negative affect. One mile jog or walk significantly reduce negative affect. Thus, students experiencing negative affect may receive health benefits by engaging in at least one-mile jog or walk. Data findings from this study support previous research that has shown how PA reduces negative affect [13,14]. Even though this study is more specific to one-mile jog or walk by college students, the findings are applicable to populations with similar

characteristics. Consequently, this study contributes to a better understanding the effect of PA environment on positive and negative affect, besides motivation.

Data Collected supported H₂. Positive affect was directly impacted with PA intervention. Results from this research collaborated with other findings that have shown that PA intervention increase perceived positive affect and expression among individuals [3, 12, 14]. Similar to other scientific outcomes, walking and running helps increase positive affect irrespective of time taken or pace [16]. These findings are important as it points out to the overarching benefits of PA on affect. As a demonstration, students should be encouraged to understand that the health benefits of PA are not tied on pace but rather the engagement. Overall, major finding is that one mile jog or walk both have an effect on both positive and negative affect. The engagement in a one mile walk or jog significantly increase positive affect and decrease negative affect.

On the contrary, results did not support H₃. Despite the connection between PA and affect, effect of the PA environment on affect was insignificant. This finding contrasts the previous studies [23, 27] which suggested that outdoor environment, controlling for type of activity, has more benefits to affect rather than indoor environment. Notwithstanding, these findings support studies that have hypothesized relationship between PA environment and affect [22, 27, 28].

Data analysis from this study did not support H₄. Despite evidence of the relationship between PA and situational interest, the impact of environment was insignificant. Motivation might be driven by other factors, such as health benefits. For instance, perceived affective outcome has been reported to be a major motivation towards PA [29]. Nevertheless, findings suggest association between outdoor environment, such as trails, with PA motivation and engagement [3, 27]. These findings are relevant especially to the campus community and policy makers to address the PA needs for their students. Also, results are relevant to retailers and gym equipment manufacturers to conduct feasibility studies with the view of addressing specific needs of their customers.

Findings from this study provides proof that among the health benefits of PA intervention are increase in positive affect and decline in negative affect. However, there is no significant relationship between PA environment and affect. Thus, from socioecological model perspective, factors that contribute to individual, interpersonal, and community levels also influence motivation. Notwithstanding, this study had one limitation. Researchers did not control participants' PA experiences.

Conclusion

The purpose of this research was to investigate effect of one-mile jog and walk on positive and negative affect. Besides, the study explored the PA environment and situational interest. Findings from this study revealed that PA has effect on both negative and positive affect. PA intervention increases positive affect and lowers negative affect. In the second place, PA environment did not have a significant effect on negative and positive affect. Thirdly, PA environment has no effect on motivation.

To the best of our research findings, this is the first study that explored the effect of PA environment on affect and motivation. Most importantly, these research finding point to the emotional health benefits accruing from PA engagement. In addition, results point to value attached to availability and

accessibility of both outdoor trail and indoor tracks on university campuses. With increasing emotional issues affecting college students, it is not only important for universities to provide indoor and outdoor trails and tracks, but students should also be educated on the emotional health benefits of walking and jogging. This study helps address various areas of health education and promotion such as establishment both indoor and outdoor running tracks, development of personal skills; and enhancement of health literacy.

Finally, this study had one limitation. The sample size was small and hence inferential statistics should be kept to a minimum.

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