Effect of Laughter Therapy on Physiological and Psychological Functions Among Medical Students: A Randomized Controlled Trial

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Keywords: Laughter Therapy, Stress Level, Perceived Stress Scale, Undergraduate Medical Students, Malaysia

ABSTRACT

Laughter therapy is highly recommended to have positive impacts on physiological, psychological, and biological function, especially in producing serotonin and helping to inhibit the stress hormone. An open labelled, randomized control trial, the effect of laughter therapy on physiological and psychological functions among undergraduate medical students was conducted in a private medical university in Malaysia. While the control group carried on, as usual, the intervention group underwent laughter therapy, which included paper and pillow fights and comedy shows during three days of intervention. It was necessary to monitor both groups' blood pressure, heart rate, and stress level in assessing the laughter therapy. Assessment of perceived stress was conducted through Google form questionnaire of Perceived Stress Scale while the digital blood pressure equipment was used to measure the blood pressure and heart rate throughout the session. Heart rate and blood pressure were recorded, and perceived stress scale was administered before and after the intervention. However, there was no significant difference in perceived stress between the intervention and control groups after the intervention. These facts imply that neither the pre-intervention nor post-intervention results of this study was able to demonstrate appreciable modifications in the blood pressure, heart rate, or stress level.

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INTRODUCTION

Stress is defined as a non-specific response of the body to any demand [1]. In another word, stress means "feeling troubled or threatened by life" [2]. It can affect everyone regardless of their age, gender, educational status, or socioeconomic status. There are a variety of factors for people to experience stress such as family violence, illness, financial problem and displacement from home. However, a small amount of stress is not harmful. The issue arises when people experience excessive stress in their daily lifestyle. This can result in a negative impact on their physical and mental health [2-3].

Previous studies have been done to investigate the stress level among university students in Malaysia. A cross-sectional study was conducted to investigate stress and academic achievement among undergraduate students in a public university in Malaysia. The researchers found that stress and academic achievement were highly connected. Moreover, the findings revealed that in the medicine and health sciences degree programme, faculty had the highest stress level compared to other faculty [4]. From the above statement, the stress level of a medical student was the highest among other academic course can be concluded. This can lead to deterioration of cognitive skills such as impaired concentration, poor retention, and poor recall, startle response, mental fatigue which can further result in poor academic performance and increased failure rate [5]. To overcome this situation, stress-relieving methods were done to help students for improving their academic performance as well as their health. For instance, abdominal breathing, music therapy, meditation, yoga, massage therapy, and others were done [6]. Nevertheless, laughter therapy was a stress killer due to its effectiveness. Besides, the recommended pharmacological invention is not preferable due to its several side effect. Hence, a non-pharmacological intervention is preferred as the adverse effects can be minimalized [7].

Laughter is a powerful antidote to stress and it can lighten a person's burdens, inspires hopes, connects to others, and keeps them grounded, focused, and alert as well as benefits for health [8]. Therefore, laughter therapy is one of the recommended non-pharmacological approaches. It is suitable for people of all ages to release stress and negative energy, allow them to express their ideas or feeling that would otherwise be tough to express, and eases coping with challenging situations. This technique affects the brain and autonomic system, causing physiological and psychological changes. Laughter therapy acts on a complex mechanism transmitted from the hypothalamus that stimulates different cortical areas [7]. In addition, this therapy improves sleep, and social functions and improves well-being levels by naturally enhancing the mood. From an academic standpoint, research findings are clear that there is a significantly positive relationship between humor and academic success. Evidence suggests that humor enables learning by uplifting the level of motivation [7,9-10].

Laughter therapy is strongly suggested to have effects on psychological and physiological along with biological functions. Laughter is proven to enhance the release of dopamine and serotonin activities [11] and represses stress hormones and acts to buffer the effects of stress on the cardiovascular system. Studies have claimed that vigorous laughter can produce heat, sweat, and stress relief similar to the outcomes of aerobic exercise. These cardiovascular alterations have been investigated through blood pressure (BP), heart rate (HR), and heart rate variability (HRV) [12]. From a psychological standpoint, the psychotherapeutic involvement of laughter resulted in advantageous effects on stress, depression, dementia and insomnia. Moreover, another randomized controlled trial investigated that laughter therapy significantly improved general health, somatic symptoms, insomnia and anxiety, however, it did not improve social dysfunction and depression [13].

Previously, this therapy has been conducted among the elders in a daycare setting once a week for four weeks. Seventeen participants joined the intervention, and the age group of the participants was 77 years. Stand-up comedy was used as laughter therapy. After the therapy has been conducted, the results show a reduction in blood pressure, heart rate, and a decrease in salivary Chromogranin A (CgA) whereas there were elevated levels of plasma serotonin compared with the levels before the therapy was done. The physiological function was evaluated through a survey after the therapy [13]. In the university setting, a quasi-experimental study was conducted on the effect of laughter yoga on general health among nursing students in Iran. The findings revealed that there has been a positive effect on the student's general health after the therapy [14].

It is known that there is always a high level of stress among medical students that results in low self-esteem and affects academic achievement [15]. According to Linn& Zeppa it is seen that unfavorable stress has more consequences compared to favorable stress and it depends on how the stressors are being perceived. The stress prevalence was measured in public and private medical schools in Malaysia and reported as 41.9% and 46.2 % respectively [16].

Research has been conducted that stress has a varying effect on mental and physical health where there is difficulty in managing anger and irritability, being anxious, nervous and hopelessness, decrease in mood and focus, lack of sleep and loss of appetite, increased heart rate and stomach cramps [17]. Therefore, therapy can help in improving the effect physiological and psychological function among medical students. Literature is limited on laughter therapy in Malaysia, especially for the effect of laughter therapy among medical students in Malaysia Therefore, there is a need to investigate the effect of laughter therapy among medical students. This study aimed to investigate the effect of laughter therapy on physiological and psychological function among undergraduate medical students in Malaysia.

METHODS

Study Design and Setting

This study was a randomized controlled trial that included one intervention group and one control group to investigate the effect of laughter therapy on blood pressure, heart rates and stress level. This study was conducted from August 2022 to September 2022 in a private medical university in Malaysia.

Sample size and sampling

The sample size was calculated by using the 'Open Epi' sample size calculator with a power of 80%, 95% confidence interval (2-sided), with a mean difference of 4.57 [18]. A sample size of 16 participants is required in each group. While considering the attrition of 20%, the final estimated sample size was 20 in each intervention and control group.

In this study, purposive sampling which was a type of non-probability sampling technique was used to recruit the participant. A Google Form was shared with the participants which include background information, a consent form and questions on the personal profile such as name, age, gender and others. The participants were selected based on the inclusion and exclusion criteria as indicated below.

Inclusion criteria:

1. Students who were willing to participate in this study with consent provided
2. Students who were studying undergraduate medical programme in the study institution

Exclusion criteria:

1. Students who did not give their consent
2. Students with cardiac, respiratory, and gastrointestinal problems
3. Students with recent Covid symptoms (e.g.: runny nose, cough, sore throat, and others)
4. Students who had injuries or bone fracture

A simple random sampling method was used for the randomization by using the online randomization software (https://www.randomizer.org/). Forty students were randomly assigned to their corresponding group which resulted in 20 students in the intervention group and another 20 students in the control group.

Intervention Procedures

(I) Pre-intervention procedure

The student who was willing to participate, however, had exclusion criteria were excluded. The intervention group and control group started with a small briefing about the experiment and guide them with instructions to follow. The blood pressure and heart rate were measured by referring to the latest version of MacLeod's 14th edition textbook using a digital blood pressure device. The stress level was assessed by using the 'Perceived Stress Scale' [19].

All the measurements were collected and listed in the data collection form. The Control group was instructed to leave the area and continued with their usual normal daily activity. First aid kit and transport were prepared for any emergencies during the intervention.

(II) During Intervention

The intervention group was assigned to a specific room where the participants underwent laughter therapy. There were 3 sessions for the laughter therapy. One session per day for 10 minutes. For the first session, the participants were required to play paper fight in the room with a break time of 2 minutes in the middle. Then, the blood pressure and heart rate were measured before they left.

For the second session, there was a reminder for both control and intervention groups in the morning through WhatsApp. The control groups were required to assemble in the badminton court while the intervention group needed to assemble in the room. Then, blood pressure and heart rate were measured for both groups. However, only the control group was allowed to leave after the measurement. The intervention group was required to undergo laughter therapy by playing pillow fight for 10 minutes with a break time in the middle. After that, the blood pressure and heart rate were measured again by the participants in the intervention group.

For the last session, there was a reminder for both control and intervention groups in the morning through WhatsApp. The control groups were required to assemble in the room while the intervention group needed to assemble in the other room. The intervention group was required to measure their blood pressure and heart before laughter therapy. During the session, a comedy show was played and participants in the intervention group watched it for 10 minutes without break time. Meanwhile, the control group did not require to do anything.

(III) Post-intervention procedure

After the third session, the blood pressure and heart rate were measured in both control and intervention groups. In addition, both groups were required to answer the Perceived Stress Scale before leaving the room. Details of the intervention procedure are presented in Figure 1.

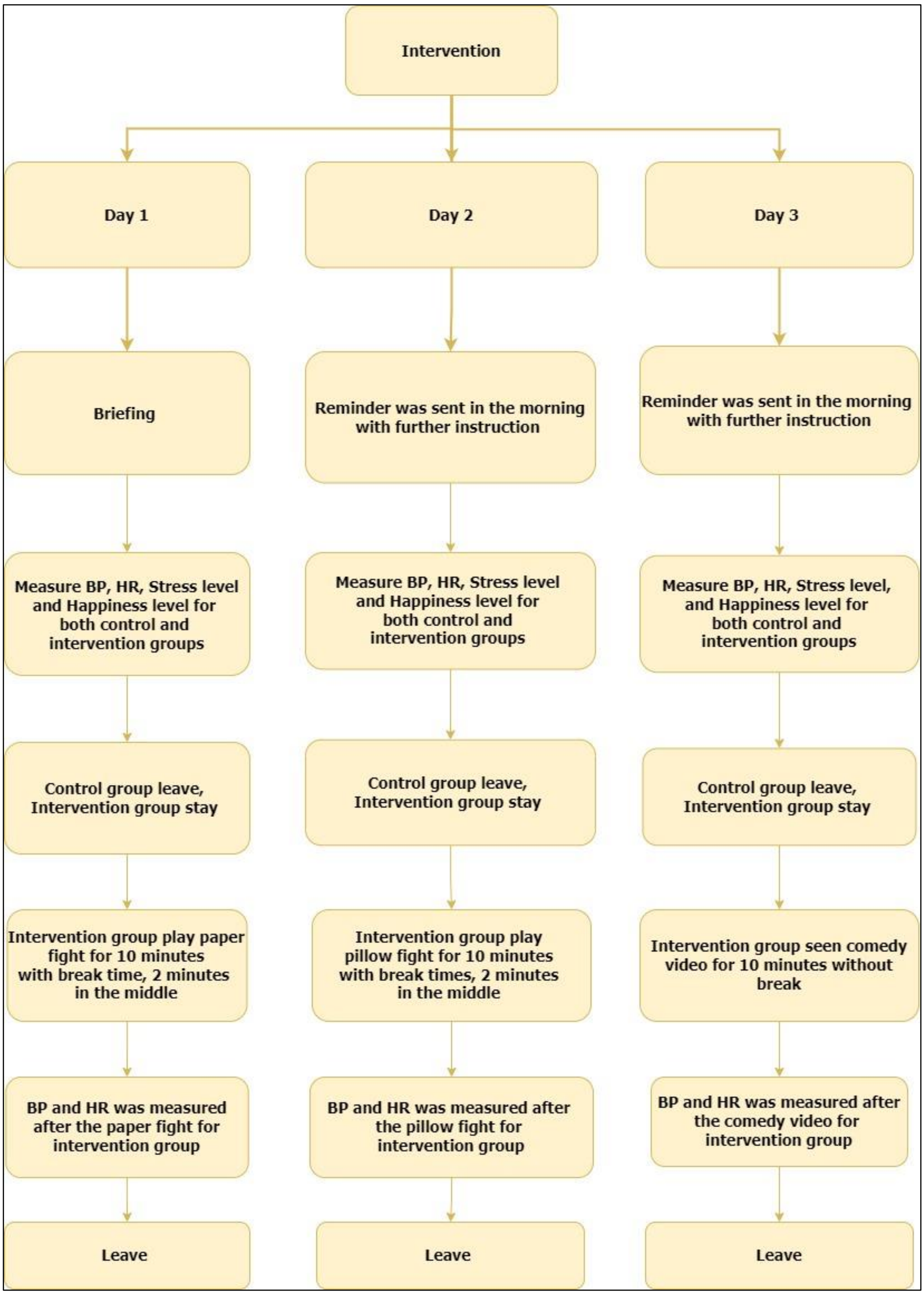

Figure 3. Summary of the intervention procedure (Note. HR: Heart Rate, BP: Blood Pressure)

Data processing and analysis

Data was saved in a Microsoft Excel spreadsheet and analyzed by using EPInfo statistical software (version 3). Descriptive analysis was reported by frequency, percentage, mean and standard deviation. Furthermore, data was analyzed by using unpaired T test, paired T test, Chi Square test and Fisher's Exact test.

Ethical consideration

An informed consent form was given to the participants before the intervention and it included the details of the study. The participation was solely voluntary and the participants explained the purpose and method of this study. The data and information were kept confidential and the results were only used for the study purpose. This study was approved by the research ethics committee from Manipal College University Malaysia (MUCM), Malaysia.

RESULTS

Table 1 shows the baseline characteristics of participants among the intervention and control groups (n=40). The mean (SD) baseline for age in the intervention group was 21.95 (1.40) and the mean (SD) of age in the control group was 22.21 (1.15). Approximately half of the participants (55%) were of Indian ethnicity in both groups. Two-thirds of the participants were female in both intervention (65%) and control groups (75%). Approximately 55% of the participants in the intervention group and 60% in the control group were aware of the laughter therapy, however, none of the participants attended laughter therapy before (Table 1).

Table 1. Baseline characteristics of participants among the intervention and control group (n=40)

Variables	Intervention (n=20)	Control (n=20)	P
Age (mean, SD)	21.95(1.40)	22.2(1.15)	0.540[a]
	n (%)	n (%)	
Ethnicity			
Chinese	3 (15.00)	4 (20.00)	
Indian	11 (55.00)	11 (55.00)	
Malay	2 (10.00)	2 (10.00)	
Others	4 (20.00)	3 (15.00)	1.00[c]
Nationality			
International	2 (10.00)	3 (15.00)	
Malaysian	18 (90.00)	17 (85.00)	0.633[c]
Gender			
Female	13 (65.00)	15 (75.00)	
Male	7 (35.00)	5 (25.00)	0.490[b]
History of illness			
No	20 (100.00)	18 (90.00)	
Yes	0	2 (10.00)	0.147[c]
Awareness of laughter therapy			
No	9 (45.00)	8 (4.00)	
Yes	11 (55.00)	12 (60.00)	0.749[b]
Attended laughter therapy			

No	20 (100.00)	20 (100.00)	
Yes	0	0	1.000[c]

[a]Unpaired T Test
[b]Chi Square Test
[c]Fisher's Exact Test

Table 2 shows the baseline perceived stress scale measured by using the intervention and control groups. Approximately half of the participants reported having moderate or high stress in both groups. There were no significant differences in perceived stress, systolic blood pressure, diastolic blood pressure and heart rate of the participants in the intervention and control groups (Table 2).

Table 2. Baseline perceived stress measured among the intervention and control group (n= 40)

Variable	Intervention (n=20)	Control (n=20)	P
Perceived stress	n(%)	n(%)	
Low	0	0	
Moderate	11 (55.00)	9 (45.00)	
High	9 (45.00)	11 (55.00)	0.527[a]
Blood Pressure	Mean (SD)	Mean (SD)	
SBP (mmHg)	116.50 (14.45)	118.85 (9.03)	0.541[b]
DBP (mmHg)	73.85 (7.84)	79.05 (10.43)	0.083[b]
Heart rate			
Heart rate	83.05 (11.79)	89.35 (11.18)	0.091[b]

[a]Chi-square
[b]Unpaired T Test

Perceived stress among the participants in the intervention group before and after the laughter therapy intervention was compared and reported in table 3. The number of participants who had a low level of stress in the intervention group before the laughter therapy was none and the number of participants who had a low level of stress in the intervention group after the laughter therapy was 5%. The number of participants who had a moderate level of stress in the intervention group before the laughter therapy was 55% and the number of participants who had a moderate level of stress in the intervention group after the laughter therapy was 70%. The number of participants who had a high level of stress in the intervention group before the laughter therapy was 45% and the number of participants who had a high level of stress in the intervention group after the laughter therapy was 25%. However, there is no significant difference in stress levels between the intervention group before and after the laughter therapy (P=0.320) (Table 3).

Table 3. Comparison of perceived stress among the participants in intervention group before and after laughing therapy intervention (n=20)

Perceived stress	Before n (%)	After n (%)	P
Low	0	1 (5.00)	
Moderate	11 (55.00)	14 (70.00)	
High	9 (45.00)	5 (25.00)	0.320

Table 4 shows the comparison of perceived stress among the participants in the control group before and after laughter therapy intervention. The number of participants who had a low level of stress in the control group before and after the laughing therapy intervention was none. The number of participants who had a moderate level of stress in the control group before the laughter therapy intervention was 45% and the number of participants who had a moderate level of stress in control groups after the laughter therapy intervention was 65%. The number of participants who had a high level of stress in the control group before the laughter therapy was 55% and the number of participants who had a high level of stress in the control group after the laughter therapy was 735%. The P value was analysed by Chi-Square Test which carried out the value of. There is no significant difference in stress levels between the control group before and after laughter therapy intervention (P=0.204) (Table 4).

Table 4. Comparison of perceived stress among the participants in control group before and after laughing therapy intervention (n=20)

Perceived stress	Before n (%)	After n (%)	P
Low	0	0	
Moderate	9 (45.00)	13 (65.00)	
High	11 (55.00)	7 (35.00)	0.204

Table 5 shows the effect of laughter therapy on perceived stress among the intervention and control groups. The number of participants who had a low level of stress in the intervention group was 5% and there was none,0% in the control group. The number of participants who had a moderate level of stress in the intervention group was 70% and the number of participants who had a moderate level of stress in the control group was 65%. The number of participants who had a high level of stress in the intervention group was 25% and the number of participants who had a high level of stress in the control group was 35%. However, there was no significant difference in stress levels between the intervention and control group (P=0.73) (Table 5).

Table 5. Effect of laughter therapy on perceived stress among intervention and control groups (n=40)

Perceived stress	Intervention (n=20)	Control (n=20)	P
	n(%)	n(%)	
Low	1 (5.00)	0	
Moderate	14 (70.00)	13 (65.00)	
High	5 (25.00)	7 (35.00)	0.731

Table 6 presents the effect of laughter therapy on blood pressure and heart rate among intervention and control groups. The mean (SD) baseline for systolic blood pressure (mmHg) in the intervention group was 116.50(14.45) and the mean (SD) of systolic blood pressure (mmHg) in the control group was 118.85(9.03). The mean (SD) baseline for diastolic blood pressure (mmHg) in the intervention group was 73.85(7.84) and the mean (SD) of diastolic blood pressure (mmHg) in the control group was 79.05(10.43). There was no significant difference in systolic diastolic blood pressure (mmHg) between the intervention and control groups.

The mean (SD) baseline for heart rate in the intervention group was 83.05 (11.79) and the mean (SD) of heart rate in the control group was 89.35(11.18). There was no significant difference in heart rate between the intervention and control groups (Table 6).

Table 6. Effect of laughter therapy on blood pressure and heart rate among intervention and control groups (n=40)

Variable	Intervention (n=20)	Control (n=20)	P
	Mean (SD)	Mean (SD)	
Blood pressure SBP (mmHg)	116.50 (14.45)	118.85 (9.03)	0.541
DBP (mmHg)	73.85 (7.84)	79.05 (10.43)	0.083
Heart rate	83.05 (11.79)	89.35 (11.18)	0.091

DISCUSSION

The open-labeled, randomized controlled trial investigated and compared the effects of laughter therapy on the subjective physiological and psychological state by exerting laughter therapy sessions on the active intervention and non-therapy control groups among undergraduate medical students. The impact of laughter therapy on stress level before and after the intervention were analyzed throughout the therapy in the intervention group. Moreover, the heart rate and blood pressure were compared among the participants from both groups to estimate their physiological state.

This study was conducted between two groups - Group A (intervention) and group B (control). The intervention group was made to participate in laughter therapy for three days continuously whereby the control group was left with no therapy and told to live by their normal routine.
Although previous studies assessed the effect of laughter therapy, it was conducted among the elderly population [13], teachers [16], and non-medical students [15]. Previous studies were conducted on nursing students' anxiety, satisfaction with life, and psychological well-being during the COVID-19 pandemic [10]. In that study, Canan Eraydin and Sule Ecevit Alpar reported the positive effect of laughter intervention applied on nursing students by conducting the studies for five weeks (10 sessions). The result showed the levels of satisfaction with life in the intervention group (received laughter therapy) increased significantly ($p < 0.001$) [10]. Moreover, the positive effects of laughter therapy have been demonstrated among college students in which there was a significant difference in response to stress levels from 2.04 points in the pre-test to 1.71 points in the post-test in the experimental group [6]. A similar study was conducted on the elderly community (60 years and above) to measure the psychological and physiological effect of this therapy, once a week for 4 consecutive weeks. From the psychological standpoint, the study exhibited significant improvement in their social function, bodily pain, and motivation for rehabilitation [13]. A study on the effect of workplace laughter groups on personal efficacy belief, pointed out, the individuals who underwent the laughter therapy experienced a notable enhancement in their mental health, self-efficacy, and their productivity [20].

In this study, the results showed no significant effects on stress level and perceived happiness after the therapy in the intervention group (group A) in which the significant difference between happiness between the intervention and control group was unchanged. Although the changes were not significant, the proportion of the participants with high perceived stress was lower in the intervention group (25%) compared to the control group (35%). The non-significant findings of the effect of laughter therapy in this study could be contributed to the short duration of the intervention which was conducted for three days. In the previous studies, laughter therapy intervention was conducted from four to five weeks [6, 13]. Moreover, the study was conducted a week before the examination which was challenging to gather all the participants to gather during a busy schedule.

From the physiological effect, heart rate and blood pressure were not significantly different between the groups after the intervention. This finding is contrary to the previous study conducted among the elderly population, in that a significant reduction in the blood pressure and heart rate in comparison to those readings before the therapy (intervention). The study also proved the upsurge of plasma serotonin concentration after several therapy sessions in contrast to the initial days before the therapy [13]. In this study, the physiological parameters such as blood pressure and heart rate were not affected by laughter therapy. Differences in age groups of the participants, elderly group [13], and adult undergraduate students' groups, underlying physiological conditions, and duration of intervention might be able to be explained for the differences in findings.

CONCLUSION AND RECOMMENDATIONS

As the research has demonstrated, the findings of this study suggested that there were no significant effects of laughter therapy on physiological and psychological functions among participants, relative to the control group. These data suggest that neither the pre-intervention nor post-intervention findings of our study were able to show significant changes in blood pressure, heart rate, and stress level. Nonetheless, a reduction in the proportion of students with high stress before and after the intervention in the intervention group was observed in this study.

It is recommended that future studies would have a larger sample size drawn which includes different study years and student populations nationwide. [21]. There should also be a longer time frame to conduct the intervention. It is also suggested that future studies could have a better resource to conduct a variety of activities regarding the therapy.

Limitations

There were some limitations in this study. The sample was only among 40 students from one batch in the university population. Many students could not participate as it was conducted near exam weeks and students do also find it tiring to participate as it was conducted in the evening after the lecture classes. In addition, the study was conducted in a very short time frame which was for three days due to the time constraint to conduct the study.

ACKNOWLEDGEMENTS

We would first like to thank all the participants who spared their time to participate in our research. Besides, we would like to express our sincere gratitude to the Pro Vice-Chancellor Professor Dr. Adinegara Lufti Abas, and Dean Professor Dr. Jayakumar Gurusamy for their support throughout the conduct of the research. Apart from that, we would like to thank the Higher management of MUCM, Research Ethics Committee, Manipal University College Malaysia, for approving our research.

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