



Positive Correlation between the Completion of Physical Exercise Plan and Student's Academic Performance

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Abstract

Life expectancy has doubled, because of progress and development of the medical science in the past two centuries. Therefore, physical exercise has become a very more and more important activity. Nevertheless, college students (young people) usually neglect physical fitness, due to pressures of studies, intense competition and their peaking health condition. Besides, with development of Internet and online social interactions, students spend much portion of their time online rather than in the gym or stadium. Such issues caused health problems for young students such as obesity myopia, which can directly affect people's learning and working efficiency. The purpose of this article is to study and determine the relationship between physical exercise and learning ability (the method and skill of learning, such as learning concentration, learning achievement, self-confidence, thinking flexibility, and independence). We intend to find out whether physical exercise will impact learning ability, to provide an argument that Physical exercise can help their learning ability and efficiency. We use questionnaire to investigate current Rangsit university's students' satiation of physical exercises and learning ability, then analyze the relationship between physical exercise and learning ability. We have found significant linear relationship between the competence percentage of physical exercises and study. Besides, we also detected positive relation between GPA and competence of physical exercise. Generally, physical exercises will help to improve the performance of study. We hope that more and more college students participate in physical exercise, which is also in line with WHO's initiative (WHO, 2018, Physical Activity).

Keywords: *Physical exercise, Learning ability, Study performance, Competence, Correlation*

1. Introduction

Many college students believe that if they want to have good learning outcomes, they should not spend the time on other activities rather than studying and learning. However, such concept might not be correct. A strong mind and body are an important guarantee for better study. That is to say, the quality of mind and body has a direct impact on learning. People's physiological activities and psychological activities are often closely related. Exercise enhances physical fitness, accelerates breathing and blood flow, enhances blood supply and nutrition, and makes thinking more sensitive. And more active participation. In exercise, adjusting the state of mind and producing a good physical condition ensure the normal progress of learning. Usually, physical condition is good, energy is abundant, enthusiasm for learning is high, and the effect is good. It is very beneficial to have sufficient energy. If we want to let learning run on a good track, we should pay attention to physical exercise, maintain good rest and sleep, balance nutrition, and eliminate bad



habits. Spending numerous times studying every day, rather than on physical fitness might lead to myopia and memory loss and obesity. Such living style cannot effectively improve our ability to learn.

In the study at University of British Columbia, researchers found that regular aerobic exercise, which gets your heart and your sweat glands pumping, appears to boost the size of the hippocampus involving verbal memory and learning. Many studies have suggested that the parts of the brain that control thinking and memory (the prefrontal cortex and medial temporal cortex) have greater volume in people who exercise versus people who do not. "Even more exciting is the finding that engaging in a program of regular exercise of moderate intensity over six months or a year is associated with an increase in the volume of selected brain regions," says Dr. Scott McGinnis, a neurologist at Brigham and Women's Hospital and an instructor in neurology at Harvard Medical School (Godman, 2014).

In order to verify this idea, the predecessors have also implemented the corresponding practice. For example, there is a middle school near Chicago that implements the "Zero-hour PE" program, which allows students to arrive at school, run, and exercise seven o'clock before the formal class. It is necessary to exercise until the student's heart rate reaches the highest value or 70% of the maximum oxygen uptake (Ratey, 2008) because of dopamine, serotonin, and norepinephrine are produced during exercise, and these three neurotransmitters are involved in learning. Dopamine is directly related to our emotions and memories. Increased serotonin, better memory, and better learning. There is a direct relationship between norepinephrine and attention, which is most secreted when faced with an enemy's decision to fight or to escape. Norepinephrine enhances the child's concentration.

After the exercise of "Zero-hour PE", students are happy, concentrate on class, remember fast, learn well, and self-confidence and self-esteem have also improved.

In addition to affecting memory, concentration and emotions, some strategic sports activities can also exercise people's thinking skills, such as the success of NBA stars in the investment field. For example, former NBA star Kobe Bryant is announcing the establishment of a \$100 million venture capital fund, with a focus on technology and media companies.

O'Neill invested in Google and received a lot of returns on his IPO. After retiring, he brought his talents to Silicon Valley to enter the investment field, covering Internet finance and mobile video services. Previously, O'Neill also served as a consultant for mobile video company Tout. The company's main competitor is Vine, a short video service provider under Twitter.

Next, O'Neill became an investor in Loyal3, an Internet financial services startup, and part of Loyal3's business was underwriting for other companies. By working with investment banks, you get a certain underwriting commission. So far, Loyal3 has been involved in the IPO new stock underwriting and subsequent issuance of more than a dozen companies, including GoPro, a well-known sports camera manufacturer, and AMC Entertainment, the second largest cinema in the US.

Jordan: He worked with Mavericks boss Cuban to invest \$44 million in sports big data company Sportradar. Sportradar's products are based on collecting data from each player to determine the player's physical function, such as whether the amount of exercise is overloaded. In addition, it helps players optimize their scoring and defensive efficiency. It is reported that the teams of many defending champions have adopted the company's data analysis services. As the owner of the Charlotte Hornets (formerly the



Bobcats), after Jordan invested in Sportradar, the team's record has also improved

The foundation of science is a healthy body - Mrs. Curie. The body is the foundation of all activities. Without a good body, even if we have a clever brain, we will not necessarily achieve great success. Having a good body and no disease will greatly extend our longevity, which will also increase the amount of time we work and study in our lives, and thus have more time and opportunity to succeed (National Center for Chronic Disease Prevention and Health Promotion of US, 2014). At the same time, a good body can give us excellent heart and lung function. We all know that the function of heart and lung is to provide and transport oxygen to the human body. Oxygen is a necessary prerequisite for generating energy. For the heart: the blood output per beat of the heart increases, the number of heart beats per minute decreases, the heart contracts are strong, and the blood supply efficiency is high. For lung function: improve the efficiency and endurance of the respiratory muscles, and the amount of ventilation per breath increases. For blood vessels and blood: increase blood vessel elasticity and function, lower blood lipid concentration, increase capillary density, and increase blood volume. In general, compared with people with poor cardiorespiratory endurance, people with good cardiopulmonary function have more ability to fight fatigue, continue to work, and have stronger immunity, especially the risk of cardiovascular and cerebrovascular diseases (Nankai University Sports Department, 2015).

There are also many stars such as James, Magic Johnson and others who have made achievements in Silicon Valley or investment.

2. Objectives

Learning abilities include learning concentration, academic performance, self-confidence, flexibility of thinking, and independence. The necessary factors of these learning abilities are also the ones during physical exercise. We will exam the relationship between exercise and learning by analyzing planning, execution, modification and outcome in both learning activities and physical activities to judge the relationship between learning ability and exercise. At the same time, we also analyzed the situation of physical exercise and academic performance one by one and explore whether the progress of physical exercise will bring about the progress of learning. If we can successfully prove that physical exercise will improve your ability to learn, then we will give students a way to achieve physical and academic success - to strengthen physical activity.

This study is only focused on students who study in Rangsit university. We will establish a hypothesis theory, using a large number of independent examples of surveys to comprehensively determine whether physical exercise is linked to learning ability: the characteristics of physical exercise will also be reflected in the study life. If the patterns of the traits required by an efficient physical exercise (a well-designed plan, successfully implementation of the plan, concentration, being creative in physical exercise, the strength and time) are found to be similar in learning activities, a preliminary conclusion that physical exercises has positive impact on learning ability can be drawn.

3. Materials and Methods

We collect data of college students' physical exercises and learning activities through



questionnaire. Quantitative analysis was implemented. Information and data were collected through questionnaire. The survey was closed-ended. Because this method was convenient to answer, time efficient, and the data obtained is also convenient for statistics and analysis.

The content of the questionnaire is divided into three parts: the investigation of the physical exercise situation, the investigation of the learning situation, and additional questions.

Participants in the survey need to be current Rangsit University students, regardless of nationality and GPA. The overall learning ability can be influenced or impacted by many factors, such as learning concentration, learning achievement, self-confidence, thinking flexibility, independence, reflection, understanding, language expression, operational ability, computing ability, and etc.

Data variables we collected are the frequency of physical exercise, the frequency of learning activities; exercise time and study time; existence of exercise plan and study plan; the modification of exercise plan and revision of learning plan; the percentage of completion of exercise plan and of the study. In addition, we ask the participants to self-evaluate their outcome of physical exercise and use it as the measurement of outcomes of physical exercise. The academic performance (GPA) is used to measure the outcome of learning activities.

After the questionnaire being collected and data are stored, we use SPSS to analyze the data. In order to use the correct testing methods, first, we performed normality tests on all variables which are scale data level. If the data distribution is normal, we follow parametric analysis. If the data is not normally distributed, we will perform nonparametric analysis for those non-normal distributed scale data. For nominal data and ordinal data, non-parametric analyses are implemented. As the scale data assumption cannot be met, parametric analysis cannot be used.

Next, we calculate the correlation between the variables belong to the same trait but generated in different activities. For example, whether completion of physical exercises is correlated with completion of learning activities. If correlation is being detected, we would like to further determine whether a specific linear relationship exist by using linear regression analysis. The reason of using linear regression is simply because it is easy and within my ability as a college student and it is suitable in our study and serves the purpose of our study design. Of course, there should be other more advanced analysis to generate more accurate models to describe the relationship between those traits. However, in our opinion, linear relationship should also be acceptable.

The questionnaire that we sent out is presented as Appendix 1.

4. Results and Discussion

4.1 The results of descriptive statistics of traits in exercise and study activities

In this part, we will report and analysis the results of descriptive statistics and correlation analyze in the order of different traits. Each section will report and analyze the same/similar trait impact physical exercises and learning activities. Due to the limitation of the article, results of descriptive statistics computed by SPSS are not presented here in details. Instead, we will describe the main findings from descriptive statistics.



In the frequency of physical exercise and the frequency of learning, we set 7 levels, namely: 1=daily, 2=3 times a week, 3=2 times a week, 4=once a week, 5=once in two weeks, 6=occasionally, 7=never. In the frequency of physical exercise and the frequency of learning, we set 7 levels, namely: 1=daily, 2=3 times a week, 3=2 times a week, 4=once a week, 5=once two weeks, 6=occasionally, 7=never. on average student at Rangsit University exercise twice a week (mode=3 representing 2 times a week). Also, we can know that at least 50% of the students only exercise once in a week, as the median is 4=once in a week. As the data measurement level of frequency is actually nominal data, so only mode and median have real meanings.

Do students at Rangsit University spend their time more on the learning activities? The mode and median of frequency for study is 1 and 2 respectively, which indicates that most of the students at Rangsit University engage in study activities daily, and at least 50% of the students at Rangsit University study 3 times in a week. If the data itself is accurate, students at Rangsit University study more often than they exercise.

In the study of study time and exercise time, we set 5 levels for exercise time: 1=20 minutes or less, 2=21-40 minutes, 3=41-60 minutes, 4=61-80 minutes, 5= more than 80 minutes. There are also 5 levels for learning time: 1=40minutes or less, 2= 41-80 minutes, 3=81-120 minutes, 4=121-160 minutes, 5=more than 160 minutes.

The median and mode of learning time were 2=41-80 minutes (96 people). The median and mode of exercise time were also 2=21-40 minutes (94 people). It is to say, most of the students at Rangsit University and at least 50% of the student spend 21-40 minutes in either studying or exercising.

In the investigation of the study plan and the physical exercise plan, we set up three levels, namely: 1=long term plan, 2=short term plan, 3=no plan. The mode and median are both 2=short term plan (118 people). The mode and median of the study plan are 1 = long term plan (158 people). So, students at Rangsit University usually have a short-term plan for their exercise and a long-term plan for their study. Students seems do not consider physical exercise as a systematic activity.

In the investigation of the revision period of the physical exercise plan and the study plan, we set up five levels, namely: 1=1-15 days, 2=16-30 days, 3=31-45 days, 4=46-60 Days, 5=more than 60 days. From the data collation (Table 16 - 17), we can find that the mode of the exercise program adjustment cycle is 1=1-15 days (124 people), and the median is 2=16-30 days. Such results revealed that most of the students at Rangsit University would update and improve their plans for studying and exercises less than every 15 days. However, at least 50% students' plans would last for 15 days to a month.

In the survey of the completion of physical exercise and study plans, we set up five levels, from 1 to 5. They represent 1 (0-20% completion), 2 (21%~40% completion), and 3 (41% ~60% completion), 4 (61%~80% completion), 5 (81% or more completion). The percentage here means if a student self -evaluate on average how much percentage of the plans had be implemented at the end. If the data value is 1, it is to say the student think usually he or she achieved 0-20% according to his or her original plan.

The mode we computed using SPSS is 3 (41%~60% completion), respectively: the mode of completion of physical exercise plan is 3 (41~60% completion), There are 102 people, accounting for 37.8% of the total. The mode of completion of the study plan is also 3 (41% to 60% completion) , which is



102 people. From the data we can find that the completion level of the exercise plan and the study plan are 3 (41%-60% completion), which also reflects that there is a great space of improvement for the self-control and task completion of the students who are from Rangsit University.

4.2 Normal distribution detection

The null hypothesis of normality test is data are the normal distributed. According to Table 2, the values of Asymp .Sig of all the variables are equal to "0" (less than 0.01), therefore null hypothesis should be rejected, thus, alternative hypothesis that the distribution of the variable is not normal should be accepted which indicates that all the variables tested are NOT normally distributed. The results can be interpreted as exercise, frequency, learning frequency, exercise time, learning Time, exercise plan, study plan, plan adjustment cycle, completion of exercise plan, and completion of study plan are not normally distributed. So, non-parametric analysis should be applied when testing these data variables.

Table 1 The results of normality test for traits in physical exercises and learning activities

One-Sample Kolmogorov-Smirnov Test					
	Exercise Frequency	Exercise Time	Plan of Exercise	Modifying Exercise Plan	Completion of Exercise Plan
Kolmogorov-Smirnov Z	2.655	3.431	3.598	4.318	3.326
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000
	Study Frequency	Study Time	Plan of Study	Modifying Studying Plan	Completion of Study Plan
Kolmogorov-Smirnov Z	4.258	4.117	5.959	3.634	3.510
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000

After normal distribution is tested and confirmed as non-normal, we should implement our first analyzing to determine whether the same trait in different kind of activities are correlated or not. If the two variables are correlated, then we can further our analyzing by fitting a model (linear model) to describe the relationship between the same trait in different activities of physical and learning.

4.3 Correlation between the Traits of Exercise and Study

As we discussed above, non-parametric analysis should be used for all the variables. However, we used both parametric (Pearson correlation test) and non-parametric test (Spearman's correlation test) to provide robustness. If both tests provide the same conclusion, it would be perfect. If the result of Pearson correlation contradicts with the ones from Spearman's correlation. We should rely on Spearman's correlation, as it is the valid analysis when data are not normal.

We found that except for the variables of whether students have a plan, modifying for exercise and study plan and, completion of exercise and study plan, all other variables' correlation are not significant. We only report the significant results of correlation between the "paired" traits between exercise and study.



Table 2 revealed something interesting. The Pearson test of physical exercise plan and learning plan measures the correlation coefficient between planning for physical exercises and study is 0.467 (significant at 1%), also Pearson Correlation = 0.467 (significant at 1% level). The difference between the results of the two testing methods is not much. So, we can assert that planning for physical exercises and for studying are positively correlation to each other at median level. Furthermore, students who better planned for physical exercises probably would have a better plan for their study and vice versa.

Table 2 Results of correlation between the plans for exercising and studying

	Correlations	Study Plan
Exercise Plan	Pearson Correlation	0.467***
	Sig. (2-tailed)	0.000
	N	270
	Spearman's rho	0.450***
	Sig. (2-tailed)	0.000
	N	270

Note: *** presents the coefficient is significant at 1%.

As seen in Table 3, the Pearson and Spearman's correlation coefficient of modifying physical exercise plan and learning plans is 0.417 (significant at 1%) and 0.407 (significant at 1%) respectively. So, it is to say modifying exercises plans and modifying study plans are positively correlated to each other at median level, which implies that if a student updates his or her exercises plans every 15 days, probably he or she would modify his or her studying plan within similar periods of time and vice versa. Similar, if a student only modifies his or her studying plan more than every 60 days, it is highly possible that he or she would not modify his or her exercise plan within 60 days.

Table 3 Results of correlation between modifying plans for exercising and studying

	Correlations	Study Time
Exercise Time	Pearson Correlation	0.417***
	Sig. (2-tailed)	0.000
	N	270
	Spearman's rho	0.407***
	Sig. (2-tailed)	0.354
	N	270

Note: *** presents the coefficient is significant at 1%.

**Table 4** Results of correlation between modifying plans for exercising and studying

	Correlations	Study Time
Exercise Time	Pearson Correlation	0.797***
	Sig. (2-tailed)	0.000
	N	270
	Spearman's rho	0.798***
	Sig. (2-tailed)	0.000
	N	270

Note: *** presents the coefficient is significant at 1%.

Next, we can perform a Pearson correlation test on the two sets of data to find out whether the situation of completion of plans when engaging in exercise and studying are correlated to each other. Table 4 reports that, the correlation coefficient for both testing methods (Pearson and Spearman's) are the same as 0.797 (both significant at 1%). We can say that completion of the plans or saying the ability of completing the plans for physical exercises and studying activities are strongly positively correlated to each other. Implying that if a student can carry out a plan for exercise well then, he or she should be able to finish the plan for studying at least at the same level.

In the interpretation of Pearson and Spearman's analysis, we can see that both of the testing shows a significant linear relationship between the completion of the study plan and the completion of the sports program. Because Spearman's in-depth analysis is more complex, we directly use Pearson detection and its linear regression analysis as the final result. According to Table 7, the fitted linear model should be:

$$\text{Completion of Study Plan} = 1.115*** + 0.720 \text{ Completion of Exercise Plan}***$$

Note: The Completion of plans should be 1, 2, 3, 4, 5. *** indicates that the coefficient value is significant at 1%.

This model provides more details of the relationship between the completion of physical activity and study plans. The student who can achieve certain level of completion of exercise plan will have higher level of completion of plans in studying, which is around 1.835 times better. However, please be careful when we interpret the results, as our data is nominal data rather than scale data, thus, such direct comparison is meaningless.

Table 5 Results of Linear Regression Model of Completion of Plans in Exercises and Studying

		Coefficients						
		Unstandardized		Standardize	t	Sig.	95% Confidence	
Model		B	Std.	Beta			Lower	Upper
1	(Constant)	1.115***	0.113		9.841	.000	0.892	1.338
	Completion of Exercise Plan	0.720***	0.033	0.797	21.623	.000	0.655	0.786

Note: *** Represents that that coefficients are significant at 1%. The dependent variable is Completion of Study Plan.



In the next analysis, we simply group the exercise frequency, exercise time, exercise plan, physical exercise plan adjustment cycle and physical exercise plan completion degree, and then analyze the GPA situation of different groups to go to preliminary understanding the improvement of physical exercise traits will lead to an improvement in academic performance. However, we did not find any significant results when compare grouped data except grouped exercise plan and GPA. Thus, the results of grouped exercise plan and GPA is reported hereafter. In completion of physical exercise, we divided the data into 3 groups. Completion 1: less than 40%, Completion 2: 40% - 60%, Completion 3: more than 60%. To analyze whether the increase of completion rate of physical exercise plan will lead to GPA growth. Comparing completion 1 and completion 3, we can find obvious changes, whether it is mean, median or mode. In completion 1, mode and median are both 3 ($3.0 > \text{GPA} \geq 2.5$), in completion 2, median is 2 ($3.5 > \text{GPA} \geq 3.0$), Mode is 3 ($3.0 > \text{GPA} \geq 2.5$). In Completion 3, Median and mode are both 2 ($3.5 > \text{GPA} > 3.0$), we find that from completion to completion 3, The GPA has changed, and as the degree of completion increases, the academic performance (GPA) will also increase. Therefore, we suspect that the improvement in the completion of the physical exercise program will lead to the improvement of academic performance.

In order to explore the specific relationship between the completion degree of the physical exercise program and the GPA, we also conducted a Pearson linear relationship test, to find out if there is a linear relationship between the two. The reason of using Pearson linear relationship test is because, in the previous test we found the results of Pearson's and Pearman's correlation test are consistent with each other. Pay attentions to that GPA is recorded here as nominal data. The smaller value of GPA means the GPA score is higher in such group. Thus, the negative correlation here indicates a positive correlation between the percentage of completion of exercise plan and real GPA scores.

Table 8 Results of correlation relationship between grouped completion percentage of exercise plan and GPA

	Correlations	GPA
Completion of Exercise Plan	Pearson Correlation	-0.277***
	Sig. (2-tailed)	0.000
	N	270

Note: *** presents the coefficient is significant at 1%.

Interpreting the Pearson linear relationship test results (as Table 8), we found that the completion of physical exercise and the GPA passed a significant test and negatively correlated. That means GPA will be increased with the improvement of the completion percentage of physical exercise plan. In another way to way, when the percentage of completion for students' exercise plan improved, their GPA is also improved.

5. Conclusion

There is a meaningful connection between physical exercise and learning. Through this survey analysis, we found that some of the characteristics of physical exercise will also respond to learning. For example, there is a positive linear relationship between the completion of the exercise program and the



completion of the study plan. $Y = 1.115 + 0.720 X$. Y is the completion degree of the study plan, and X is the completion degree of the exercise program. That is to say, while the physical exercise program can be completed well, the learning plan can be completed well. Therefore, for some students who are not able to complete their own study plan, they can choose to set up a physical exercise program for themselves to exercise their ability to accomplish their goals or plans through physical exercise, to strengthening their learning ability and physical health.

At the same time, physical exercise can also positively affect academic performance. Through the analysis of the completion of physical exercise program - GPA, we can see that as the completion of physical exercise program increases, the average GPA of students will also increase. Students with a high degree of completion will have a greater chance of achieving a high GPA. However, we did not exam whether there are significant differences among different groups of way of studying (such as different frequency, time, planning, modifying planning, and completion of plans). So, we cannot directly establish a causal reason between the complementing level of exercises and GPA levels.

Nevertheless, we do have proved that if students planning their physical exercises, modifying the plan regularly and implementing the plan well, they will perform even better in their studying regardless how often and how long they exercise and study. The possible explanation for such findings might be because that planning well and seeing the plan through in exercise are indicators of the someone with powerful execution, therefore, when they are using such powerful execution in studying which requires better execution power, their academic performance will be much better. Yet, we can actively train our ability of planning, the habits of constantly modifying plans and the power of execution when we do physical exercises, as it should be much easier to achieve than improve those abilities and habits when we are suffering from studying.

Therefore, in order to improve the academic performance, develop the ability planning, the habits of constantly modifying plans and the power of execution in studying especially when doing physical exercises could definitely improving our academic performance.

Although there are some problems in this survey and analysis, it can still prove that there is an inevitable connection between learning ability and physical exercise, that is: some characteristics of people will be shown together in physical exercise and learning ability. Our research is different from the research results of the study at University of British Columbia, our survey did not fully prove that physical exercise will bring about improvement of memory or thinking ability, but we found that some good habits of physical exercise also reflects in the learning process. Compared to Zero-hour PE, we are also unable to track the learning process of every sample and the changes in learning status. Zero-hour PE is more concerned with physical exercise, which will bring about a significant change in the state of learning, focusing on the analysis of the process, and our survey is based on the results of the study. Although the focus of our survey is different, but the results all prove the fact that learning is positively related to physical exercise.

Academic achievement is only a display of learning ability in a certain aspect. There are many ways we can exercise and improve our learning ability, not only through academic study, but also physical exercise. Improve your ability to execute while improving your ability to plan and complete your plan while



you have a healthy body. The improvement of student's executive ability and the improvement of self-control ability will be our most valuable core competence. Through this research, we also found that the students of Rangsit University still lack physical exercise, which will also affect students' physical quality and the common progress of knowledge. We call on schools to promote and promote physical exercise, and to set up courses to teach students how to exercise properly, improve their physical fitness, and improve their ability to perform and control themselves

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