Guidelines on Home-Based Learning for Improving the Body-Mass Index and Achievement of International Primary School Students in Bangkok, Thailand

Received: 3 April 2024 **Revised: 1 July 2024** **Accepted: 19 July 2024**

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Abstract: *Home-based learning (HBL) was widely implemented during the Covid pandemic, with limited research into its effects on students' mental and physical wellbeing or academic performance. After two-years of HBL, 40% of the students from the study were classified as overweight based on their body-mass index (BMI). Academically, the number of 'high achievers' decreased by 30% on average, while 'low achievers' increased exponentially. The purpose of this research was to identify during HBL, if there was a correlation between increased BMI and academic performance, and to propose guidelines to improve HBL platforms. The research questions were to determine the average BMI and grade-point average (GPA) of students both prior to HBL and when they returned onsite, then identify if there was a correlation, and propose guidelines to mitigate risks in future scenarios. It was hypothesized that there was a significant relationship between the BMI and academic achievement. The research used quantitative methodology to gather and analyze objective data, including students' height, weight, and grades. Correlational analysis was determined using a Chi-Square Test to measure the strength of the relationship between BMI and GPA, with results used to validate the necessity of guidelines to improve HBL. The research concluded that during HBL, students' BMI increased 2.51 points while GPA data identified a 30% reduction in high-achievers and an exponential increase of low-achievers. Yet, the Chi-Square Test showed no significant relationship between students' BMI and GPA. The results justify the need to implement guidelines to reduce risks associated with HBL. Due to the success of HBL platforms, they are more likely to be adapted in future scenarios, therefore it is essential that we evaluate their impact to ensure better results for students' physical, mental and academic well-being.*

Keywords: home-based learning, academic achievement, body-mass index, guidelines, grade-point average

Introduction

Thailand is struggling with ever increasing rates of obesity. The World Health Organization has stated that nearly one-third of Thailand's population is overweight, with 9% being classified as obese. This is particularly concerning amongst the youth, where approximately 10.5% of children under five years old are obese, while amongst children aged 6-14, the percentage of obese children is 13.9% for that age group. (CTN News, 2020)

The Body Mass Index (BMI) is a system of calculating the level of obesity in a person by dividing the mass (in kilograms) of their body by the square of their height in meters. Body Mass Index (BMI) provides crucial data, as it has been found that children with high BMI have corresponding changes in gray matter volume in brain regions, such as the fusiform gyrus, postcentral gyrus and hippocampus, which severely affects cognitive function and is detrimental to high academic achievement (Migueles et al., 2021).

Academic achievement is the knowledge and skills acquired by students through learning and training (McCoach et al., 2017). Embodied Cognition Theory addresses the influence of the physical structure of the body on the cognitive abilities of individuals. According to Ye et al. (2019), the way and steps in which cognitive processes are carried out are determined by the physical properties of the body. A view of learning based on this theory states that the body is not an irrelevant or obstructive factor in the learning process; the body is the subject of learning and physical health has an important role in shaping the mental activities of learners, such as thinking, judgment and memory (Jiayi and Haosheng, 2018).

Previous studies have found that physical activity leads to certain cognitive advantages, specifically with; math, acuity, and reaction time (Sallis et al., 1990). Consequently, research has shown that overweight students, when compared with normal-weight peers, achieved poor results on math and reading tests (Tobin, 2013).

During the COVID Pandemic, from 2019 to 2022, many schools were forced to lockdown and offer classes and courses online. This limited the options available for students to develop their physical fitness and well-being. Previous research has suggested that when the educational stage changes (i.e.- from onsite to online learning) or academic demand increases, that physical activity tends to decrease (Brooke et al., 2004). Additionally, social-distancing policies and other pandemic restrictions saw students lose their play time, recesses, and breaks. Students could not share equipment, or use school facilities to stay active and exercise to maintain their health. Furthermore, in Thailand, public spaces and private businesses were forced to close, such as parks, beaches, gyms, yoga and dance studios, and even residential fitness centers. Not only were children severely restricted on when, where, how, and with whom they could engage in physical activities, they were additionally required to increase their screen time and remain sedentary for prolonged periods of time while they had to study online. Students were confined to their homes, forced into hours of sedentary screen and study time, and not allowed to use any public or private facilities for physical activity.

This study focused on a particular private international primary school in Bangkok, Thailand. After spending approximately two years doing home-based learning during the pandemic, a significant percentage of students appeared to be overweight, lethargic, easily fatigued, and unmotivated for physical activity when they returned on campus to continue their studies. This lackadaisical attitude was exasperated even further due to further restrictions on play times, social distancing, and the closure of shared facilities such as the gyms, swimming pools, etc. This led the researcher to determine if this lethargic, somnolent demeanor was affecting their academic performance and achievement, and conversely, if improving their Body Mass Index would have a positive correlation on students' achievement results. If it was shown that there is a correlation between being overweight and poorer academic results, then guidelines would be produced to mitigate these risks and

improve students' overall health, wellbeing, and cognitive performance.

This observation of students' increase in weight was supported by reviewing the health records of students to determine their body-mas index. It was shown, that after the home-based learning, 40% percent of the students were determined to be overweight, with half of those students being classified as obese.

Statement of the Objectives

1. To study the body-mass index of international primary school students in Bangkok, Thailand.
2. To study achievement of international primary school students in Bangkok, Thailand.
3. To study the relationship between the body-mass index and achievement of international primary school students in Bangkok, Thailand.
4. To propose guidelines for enhancing healthy habits during home-based learning of international primary school students in Bangkok, Thailand.

Research Questions

1. What is the average body-mass index of international primary school students in Bangkok, Thailand?
2. What is the grade point average of international primary school students in Bangkok, Thailand?
3. Is there a relationship between the body-mass index and achievement of international primary school students in Bangkok, Thailand?
4. What are the Guidelines on home-based learning for improving the body-mass index and achievement of international primary school students in Bangkok, Thailand.

Hypothesis

There is a significant relationship between the body-mass index and achievement of international primary school students in Bangkok, Thailand.

Importance of the Study

This research could be used to better mitigate risks to students' physical and mental wellbeing during future pandemics or lockdowns that require home-based learning to be implemented. Furthermore, this research could be used by schools to justify the effectiveness and need for play time, recess, breaks, exercise, and increased physical activity, both for the physical and mental health of the students.

Scope and Limitations

The scope of this research covered home-based learning platforms that were implemented in an international primary school in Bangkok, Thailand, just after Term 1 of the 2019-2020 academic year until students returned onsite for the 2022-2023 academic year. The study looked at the academic and health records of approximately 300 students that span the school terms in question.

The limitations of this study included the lack of additional relative data such as socioeconomic status, underlying health issues, diet and exercise routines, environmental

factors, etc. that were all additional factors in a student's body mass index and academic achievement. Furthermore, this study was limited to the most recent school lockdowns during the global pandemic.

Theoretical Framework

The correlation between BMI and academic achievement has been well verified by different scholars through cross-sectional and follow-up studies. Previous studies based on tracking data of individuals' BMI from kindergarten to eighth grade found that adolescents with progressively and consistently higher BMI performed worse in reading and mathematics (Hsu et al., 2019). One study of adolescents showed that an increase in students BMI was associated with a greater risk of achieving a lower grade-point average (GPA) (Mo-suwan et al., 1999).

In Thailand, research was conducted to examine the correlation between being overweight and academic performance, the results of which demonstrated a relationship between adolescents who were overweight and poor school performance (Mo-suwan et al., 1999).

A study of students in China also found a correlation between obese students and lower intelligence quotient (IQ) scores (Li, 1995). Chinese scholars investigated 1,380 fifth- and sixth-grade students and found that BMI was negatively associated with language and mathematics performance (Lv et al., 2020).

Shi et al. (2022), identified three key concerns regarding the correlation between obesity and academic achievement. First, research has shown that non-overweight children achieve better results than their overweight peers. Secondly, obesity leads to changes in grey matter volume in the brain, impairs cardiorespiratory function, and reduces working memory. Thirdly, not all obese children suffer academically. Shi et al. (2022) recommends that additional research is needed to address these concerns.

Although there was a wealth of evidence demonstrating the correlation between increased BMI and negative academic performance, there was a lack research showing the impacts of home-based learning during prolonged lockdowns on students' physical activity and BMI. There was also no clear evidence if home-based learning led to an increase in students' overall BMI, and if students consequently suffered academically due to the effects of pandemic lockdowns, increased screen time, and a more sedentary lifestyle.

Further supporting evidence has also shown that students who played more sports had better academic profiles (Clough, 2019). Thus, monitoring students' Body Mass Index is an important factor that influences academic achievement.

Conceptual Framework

The independent variable in this research was students' body-mass index (BMI). Students' BMI was collected and compared from student records of both pre-home-based learning terms and post-home-based learning terms.

The dependent variable in this research was students' academic achievement results based on their end-of-term examinations and cumulative grade-point average (GPA).

It was theorized that during the pandemic's home-based learning, as a result of lockdowns, online classes, and lack of access and opportunities for physical activities, that students' BMI on average increased due to a more sedentary lifestyle. Furthermore, the

research and data were analyzed to look for a correlation between students BMI and their academic performance and results. It was further hypothesized that students' cumulative GPA might have suffered due to a lack of physical exercise and an increase in the average BMI of students.

RESEARCH METHODOLOGY

Part One: Relationships between Body-Mass Index and Achievement

This research used quantitative methodology to gather and analyze objective data. The data collected included students' height and weight from both pre and post home-based learning school terms. Students' height and weight was then used to calculate their body-mass index (BMI) to determine if they were a healthy weight, overweight, or obese. Students' cumulative grade-point average (GPA) was also collected from both pre and post home-based learning school terms to measure their academic achievements.

This research used a correlational design method to analyze the objective data gathered from the relevant school terms.

Part Two: Purpose Guidelines for Enhancing Healthy Habits during Home-based Learning

Based on the background of the study and the literature review, if it is determined by analyzing the data of students' body-mass index (BMI) and grade-point average (GPA) that there was a correlation demonstrating a negative impact on students' health and achievement, then the researcher will purpose Guidelines for Enhancing Healthy Habits during Home-based Learning. These guidelines can be implemented during future scenarios where home-based learning must be initiated to help mitigate the risks to students' health and improve opportunities for them to excel academically.

The Guidelines are based on suggestions and recommendations from numerous entities used throughout this study and the literature review, including; the World Health Organization (WHO), the Childhood Obesity Foundation, the American Heart Association (AHA), the National Sleep Foundation (NSF), and the Kaiser Foundation Health Plan of Washington. The guidelines have established recommended methods and routines supported by evidence to improve healthy habits during sedentary home-based learning by providing clear procedures and protocols that students and parents can implement at home to encourage a healthier diet, daily exercise, routine sleeping schedules, and creating a more conducive learning environment that is comfortable and free from distractions.

Population

The population for this research was 900 primary level students from Years 1-6 who were enrolled for the 2022-2023 academic year at an international primary school in Bangkok, Thailand.

Sample

The sample group for this research was selected by purposive random sampling because there was relevant data pertaining to their height, weight, and cumulative GPA from both pre and post home-based learning school years and terms. The sample included 308 Year 1-2 primary students who were enrolled in 2019-2020. Then, 3-years later, the

same group of 293 Year 4-5 primary students who were enrolled for the 2022-2023 was used. These students were the same group, but the number was not equal because some students had left the school during the COVID pandemic. The sample size was approximately 300 students out of a representative population of 900 primary level students from Years 1-6 in the same school.

Instrumentation and Data Gathering Procedures

The researcher collected the height and weight records, which were collected from each student at the end of each term for the sample group from Semester 1 2019-20 (that was the last term before home-based learning), and Semester 1 2022/23 when students returned to onsite learning at the school campus. The age, gender, height and weight records from each student were used to calculate their body-mass index (BMI). Students from the research sample were then classified and grouped as either 'healthy weight', 'underweight', 'overweight', or 'obese'. Students with a BMI score between the 5th percentile to less than the 85th percentile were considered as 'healthy weight'. Students with a BMI score between the 85th percentile to less than the 95th percentile were considered as 'overweight'. And students with a BMI score of the 95th percentile or above were classified as 'obese'. All BMI scores were calculated using the Center for Disease Control and Prevention's official BMI Percentile Calculator for Child and Teen (CDC, 2023).

Additionally, the researcher collected students' Final Term Grades from Semester 1 2019/20 and Semester 1 2022/23. Only grades from their core academic subjects were included. The core academic subjects used to calculate their GPA were English, Math, Science, Chinese and Thai. Finally, students from the research sample were classified and grouped as either 'high achiever', 'average achiever', or 'low achiever'. Students who had a final score percentage of 80% or higher (GPA = 2.7 - 4.0) were classified as 'high achievers', while students with a percentage of 60%-79% (GPA = 1.0 - 2.3) were classified as 'average achievers', and students with a percentage of 59% (GPA = < 1.0) or lower were classified as 'low achievers'.

Data Analysis

SPSS was used to calculate the mean average of students' BMI and final term grades (GPA) from both pre and post home-based learning school terms. Correlational analysis was computed using chi-square to measure the strength of the relationship between BMI and GPA and their association with each other.

RESEARCH FINDINGS

Body Mass Index

The body-mass index of the sample population is summarized in Tables 1 and 2.

Table 1: Data Summary of Body-Mass Index 2019-20

No	Category	Frequency	Percentage
1	Under weight	22	7.14
2	Healthy weight	210	68.18
3	Over weight	37	12.02
4	Obese	39	12.66
	Total	308	100.00
	Average BMI = 16.14		

Table 2: Data Summary of Body-Mass Index 2022-23

No	Category	Frequency	Percentage
1	Under weight	12	4.09
2	Healthy weight	165	56.31
3	Over weight	58	19.80
4	Obese	58	19.80
	Total	293	100.00
	Average BMI = 18.65		

Based on the data presented in both Table 1 and Table 2, the average body-mass index of the sample population increased 2.51 points during the home-based learning terms. The percentage of students who were deemed to be 'healthy weight' dropped from 68.18% prior to home-based learning down to 56.31% of the sample population. During the years students spent doing home-based learning, the number of students who were overweight increased from 12.02% to 19.80%, and the number of obese students increased from 12.66% to 19.80%.

Therefore, in regards to the research question 1) What is the average body-mass index of international primary school students in Bangkok, Thailand; it can be noted that the average body-mass index increased from 16.14 to 18.65 during home-based learning.

Academic Achievement (Grade-Point Averages)

The academic achievement of the sample population is summarized in Tables 3 and 4.

Table 3: Data Summary of Grade-Point Averages 2019-20

No	Category	Frequency	Percentage
1	High achievers (Percentage of 80 up)	238	77.27
2	Average achievers (Percentage of 60 - 79)	64	20.78
3	Low achievers (Percentage of 59 down)	6	1.95
	Total	308	100.00
	Average GPA = 85.06%		

Table 4: Data Summary of Grade-Point Averages 2022-23

No	Category	Frequency	Percentage
1	High achievers (Percentage of 80 up)	140	47.78
2	Average achievers (Percentage of 60 - 79)	117	39.93
3	Low achievers (Percentage of 59 down)	36	12.29
	Total	293	100.00
	Average GPA = 76.42%		

Based on the data presented in both Table 3 and Table 4, the average GPA of the sample population decreased from 85.06% (GPA = 3.0) (high achievement) to 76.42% (GPA = 2.0) (average achievement) during the home-based learning terms. The percentage of students who were deemed to be 'high achievers' dropped from 77.27% prior to home-based learning down to 47.78% of the sample population. That is a 29.49% reduction in high achieving students during the home-based learning program. Although some of these high-achieving students became 'average achievers', resulting in an increase of average students from 20.78% to 39.93%, the percentage of low achieving students exponentially expanded from only 1.95% to 12.29% of the sample population.

Therefore, based on the data, it is evident that during home-based learning there was a 29.49% reduction in the number of high achieving students, while simultaneously the number of low achievers increased exponentially to represent 12.29% of the sample population. In regards to research question 2) What is the grade-point average of international primary school students in Bangkok, Thailand; we can determine that the average GPA of students decreased from a high achievement average of 85.06% (GPA = 3.0) to a standard average of 76.42% (GPA = 2.0) during home-based learning.

Chi-Square Test

In order to answer the research question 3) Is there a relationship between the body-mass index and achievement of international primary school students in Bangkok, Thailand; and to validate the authenticity of the hypothesis of this research paper, a Chi-Square Test was conducted to determine what, if any, correlation there was between students' body-mass index and their cumulative grade-point average.

Table 5: Relationship between the body-mass index and achievement of international primary school students in Bangkok, Thailand; Data 2019-20 (Pre-home-based learning)

No	Category	High achiever	Average achievers	Low achievers	Total achievers
1	Under weight	14	7	1	22
	Percentage	4.55%	2.27%	0.32%	7.14%
	Chi Square	68.833	34.000	-	157.300
	df	66	30	-	153
	Significance	0.382	0.281	-	0.389
2	Healthy weight	164	31	15	210
	Percentage	53.25%	10.06%	4.87%	68.18%
	Chi Square	484.235	341.979	4840235	1175.878
	df	522	338	522	1152
	Significance	0.880	0.429	0.880	0.306
3	Overweight	30	6	1	37
	Percentage	9.74%	1.95%	0.32%	12.01%
	Chi Square	168.167	12.000	-	226.625
	df	168	12	-	240
	Significance	0.482	0.446	-	0.723
4	Obese	30	8	1	39
	Percentage	9.74%	2.60%	0.32%	12.66%
	Chi Square	293.750	38.250	-	464.208
	df	288	35	-	462
	Significance	0.395	0.324	-	0.462
	Total	238	52	18	308
	Percentage	77.28%	16.88%	5.84%	100.00%
	Chi Square	1223.893	664.191	24.000	3061.516
	df	1254	675	20	3000
	Significance	0.723	0.609	0.242	0.213

Regarding Observed values as presented in Table 5, in the year 2019-20, most of the students were High Achiever students (238), there were 52 Average Achiever students, and there were only 18 Low Achiever students. For the Healthy weight group, most of the students were High Achievers students (164), there were 31 Average Achiever students, and there were only 15 Low Achiever students. For the Overweight group, most of the

students were High Achievers students (30), there were 6 Average Achiever students, and there was only one Low Achiever student. For the Obese group, most of the students were High Achiever students (30), there were 8 Average Achiever students, and there was only one Low Achiever student. As shown in Table 5, there was no relationship between the body-mass index and achievement of international primary school students in Bangkok, Thailand; Data 2019-20 (Pre-home-based learning). The hypothesis was rejected.

Table 6: Relationship between the body-mass index and achievement of international primary school students in Bangkok, Thailand; Data 2022-23 (Post-home-based Learning)

No	Category	High achiever	Average achievers	Low achievers	Total achievers
1	Under weight	5	5	2	12
	Percentage	1.71%	1.71%	0.68%	4.10%
	Chi Square	20.000	15.000	2.000	96.000
	df	16	12	1	88
	Significance	0.220	0.241	0.157	0.263
2	Healthy weight	83	64	18	165
	Percentage	28.33%	21.84%	6.14%	56.31%
	Chi Square	567.139	646.000	216.000	2463.041**
	df	555	666	204	2256
	Significance	0.351	0.704	0.269	0.001
3	Overweight	27	25	6	58
	Percentage	9.22%	8.53%	2.05%	19.80%
	Chi Square	204.375	229.167	24.000	912.372
	df	192	238	20	891
	Significance	0.257	0.648	0.242	0.302
4	Obese	25	23	10	58
	Percentage	8.53%	7.85%	3.42%	19.80%
	Chi Square	195.486	223.292	60.000	1194.236
	df	192	216	48	1152
	Significance	0.417	0.352	0.115	0.189

As shown in Table 6, there was no relationship between the body-mass index and achievement of international primary school students in Bangkok, Thailand; Data 2022-23 (Post-home-based learning), except for healthy weight students, which was the only relationship shown in this study. Therefore, in regards to research question 3) Is there a relationship between the body-mass index and achievement of international primary school

students in Bangkok, Thailand; no relationship was found, except for the isolated group of healthy weight students post-home-based learning. The hypothesis was rejected.

The Guidelines on home-based learning for improving the Body-Mass Index and Academic Achievement of international primary school students in Bangkok, Thailand composed of Part 1: Guidelines for Healthy and Underweight students, Part 2: Guidelines for Overweight students, and Part 3: Guidelines for Obese students. The researcher used a questionnaire given to three experts (an administrator, a teacher, and a parent, all with Master Degrees or higher in education) to ensure validity and reliability.

Table 7: Results of the Three Experts' Evaluation of the Guidelines for Enhancing Healthy Habits During Home-based Learning of international primary school students in Bangkok, Thailand

	The 1st Expert	**The 2nd Expert**	**The 3rd Expert**	**Total**	**Average**	**Level**
Part 1: Introduction						
Background	5	5	4	14	4.67	Very good
Purpose	5	5	5	15	5.0	Very good
Part 2: Sections of Guidelines						
Guidelines of Healthy Weight Students	5	5	5	15	5.0	Very good
Guidelines of Overweight Students	4	5	5	14	4.67	Very good
Guidelines of Obese Students	4	5	5	14	4.67	Very good
General suggestion for All sections	4	5	5	14	4.67	Very good
Role of School Heads and Teachers	4	4	4	12	4.0	Good
Conclusion	5	5	5	15	5.0	Very good
Totals	36	39	38	113	37.67	
Average	**4.5**	**4.88**	**4.75**		**4.71**	**Very good**

As shown in Table 7, the average of the Results of the Three Experts' Evaluation of the Guidelines for Enhancing Healthy Habits During Home-based Learning of international primary school students in Bangkok, Thailand was suitable at the Very Good level (4.71).

SUMMARY AND CONCLUSION

Discussion

The researcher found that there was no relationship between the Body-Mass Index and Academic Achievement of international primary school students in Bangkok, Thailand in 2019-2020 and in 2022-2023. The hypothesis was rejected. This result related to some other educators' conclusions. Almarshad et al. (2020) concluded that weight did not show any influence on academic performance when the BMI alone was compared with the academic performance of the students for a short duration (one year). Ahmad et al. (2019) concluded that the academic performance, with Body Mass Index, has no significant relationship with each other. Alswat et al. (2017) stated that there was no correlation between Body Mass Index, waist circumference, and school performance. Students who achieved excellence in the overall grade are more likely to attend private school, live with well-educated parents, get optimal sleep hours per night, and they seldom eat outside the home. Additionally, U. Franz Atare & Nkangude A. T (2014) concluded that Body-Mass Index was not related to academic performance, so there was no basis to judge a student generally by body mass profile rather than conducive learning environment, and genetic endowments which continue to influence academic performance. These findings were in line with Muhammad et al. (2018) who revealed that there is a weak and negative correlation between BMI and the academic performance of female participants. Similarly, Anderson et al. (2017) demonstrated a significant negative correlation between BMI or obesity and academic performance. An observation by Bahammam et al. (2012) showed a lower obesity prevalence among excellent students rather than average ones. In addition, the present results are supported by the findings of Suraya et al. (2017), which stated that BMI is not related to academic performance.

The first research question addressed the problem of students' body-mass index and how it might have changed during home-based learning. During the two years of home-based learning, students' average body-mass index increased by 2.51 points. The percentage of students who were a 'healthy weight' prior to home-based learning decreased from 68.18% of the sample population down to 56.31% of the students. In regards to the data collected from the post home-based learning term, 19.80% of the sample population was considered obese with another 19.80% being identified as overweight. The number of students who were deemed to be an 'unhealthy weight' accounted for a nearly 39.6% of the sample population by the end of home-based learning. This ratio of 'healthy weight' to 'unhealthy weight' (60:40) far exceeds the data from CTN News (2020) that stated that 13.9% of Thai children between the ages of 6-14 are obese.

The second research question addressed the problem of the impact of home-based learning on students' academic achievement. Students' overall grade-point average dropped from a high-achiever score of 85.06% (GPA = 3.0) down to an average-achiever score of 76.42% (GPA = 2.0). This was the result of a nearly 30% reduction of high achieving students from the sample population during the two years of home-based learning. Even more concerning and noteworthy, was that the number of students deemed 'low-achievers' increased exponentially from 1.95% to represent 12.29% of the sample population. With a 30% reduction of high-achieving students and the number of low-achievers increasing exponentially, it is clearly evident that home-based learning over a two-year period had a negative impact on academic achievement.

The third research question addressed if there is a correlation between increased body-mass index and academic achievement. Despite no correlation being shown in this study (except for the 'healthy weight' group and academic achievement in the Post HBL survey), due to the wealth of other research that demonstrates a correlation between students' body-mass index and their academic achievement, this study still produced valuable data by providing validation for the fourth research objective, which is to create guidelines for enhancing healthy habits during home-based learning.

Therefore, the fourth research question addressed the need for guidelines to be established to mitigate the risks to students' physical health and mental well-being during prolonged periods of home-based learning. Over the years in Thailand, there have been several instances that required schools to close for prolonged periods, such as flooding, political upheavals (protests, coups, etc.), global pandemics, and natural disasters, all of which could occur at any time in the future, therefore justifying having an action plan in place for such incidents. Therefore, to address the fourth research objective of this study, the evidence has justified the need and the benefit of having guidelines and policies in place to protect and enhance students' mental and physical health and well-being in the event of future home-based learning scenarios.

Conclusion

This study found that there was no relationship between the Body-Mass Index and Academic Achievement of international primary school students in Bangkok. However, there is validation to show that being overweight or obese can have direct physiological and psychological impacts on students' academic performance. Being overweight or obese was shown to impair memory and reduce cognitive functioning (Carnell et al., 2012; Hoeman, 2007; Maayan et al., 2011; Lokken et al., 2009; Parisi, et al., 2010; Miller et al., 2009). Additionally, the impact of being obese and overweight can negatively affect students, both socioemotionally and psychologically, including their self-esteem, confidence, motivation, self-efficacy, and relationships with others (Perez-Lloret et al., 2013; Geier et al., 2007; Eisenberg & Aalsma, 2005; Falkner et al., 2001; Erickson et al., 2000). This provides further justification for the need to implement policies and guidelines to safeguard students mental and physical health. Therefore, the guidelines from this research were based on the analysis of the data, the genuine health risk to students, and the need to implement policies to safeguard students and ensure academic success regardless if students are learning at home or in school.

Recommendations

It is dangerous to assume that everything about home-based learning was flawless, or to assume that home-based learning is a thing of the past. In fact, due to the recent success of implementing home-based learning strategies, it is even more likely to be adapted in future scenarios, and therefore it is essential that we evaluate the impact, both positive and negative, to ensure better results for students' physical and mental well-being.

For immediate action, this research could be used to conduct a rigorous evaluation of the home-based learning platforms, specifically to identify the significant reduction in students' academic performance. Arguably, home-based learning is not 'learning' at all if students are not progressing academically. Identifying the cause and resolutions of the

negative impact on students' academic achievement is essential for future scenarios when home-based learning must be utilized.

Additionally, as opportunities present themselves, the Guidelines should be implemented to measure their effectiveness, identify areas of improvement, and provide amendments that are suitable for various contexts based on the culture, environment, and reasons for implementing home-based learning. More action research could be done to further develop the Guidelines.

For future studies, it is recommended to identify additional factors that may have a significant influence on students' body-mass index and academic achievement However, this would likely require more qualitative research such as interviews, case-studies, and open-ended questionnaires, but would provide a deeper analysis of extenuating circumstances, such as individuals' socioeconomic status, underlying health issues, dietary restrictions, exercise routines, family's educational status, and environmental factors.

Additionally, future studies could narrow the scope to identify specific isolated groups and produce more tailored results. For example, would different guidelines be needed for boys instead of girls, or younger children versus adolescents, or for students with disabilities, or even for students in different cultural or ethnic groups.

Therefore, in conclusion, although this research helped to identify some of the genuine risks to students' physical health and mental well-being during prolonged home-based learning scenarios, it is just the first of many opportunities to use the recent global pandemic to identify the real impacts and weaknesses of home-based learning in order to be better prepared and have better policies and platforms in place when future lockdowns are required.

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