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PHYSICAL INSTRUMENT FOR ASTHMATICS (PIA): A CUSTOMIZED FITNESS TEST FOR PATHFIT STUDENTS WITH ASTHMA

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ABSTRACT

This study aimed to develop and evaluate a customized physical fitness assessment, known as the Physical Instrument for Asthmatics (PIA), for PATHFIT students diagnosed with asthma. Specifically, it determined pre-test and post-test performance and examined whether the intervention improved overall physical fitness. A pre-experimental one-group pre-test–post-test design was employed, involving PATHFIT 2 and PATHFIT 4 students during the second semester of the 2025–2026 academic year. Participants were selected based on a confirmed asthma diagnosis and medical clearance. The study used a modified physical fitness test comprising the six-minute walk test, wall sits, seated leg raises, 30-second walk test, vertical jump, and T-agility test. Results revealed that participants demonstrated improved performance across all fitness components following the intervention. Cardiovascular endurance increased, as evidenced by greater distances covered, while muscular strength and endurance reached higher performance classifications. Improvements were also observed in speed, power, and agility, although slight variability remained among participants. The findings suggest that structured, asthma-sensitive physical activity can enhance physical fitness without compromising safety. The study concludes that the PIA model is an effective and appropriate tool for assessing and improving students' physical fitness with asthma. It is recommended for use in inclusive physical education programs. It may serve as a basis for future research and program development.

KEYWORDS: *Asthma, customized physical fitness assessment, inclusive education, physical activity for health and fitness, Physical Instrument for Asthmatics (PIA)*

INTRODUCTION

Asthma is a persistent global public health concern, particularly among adolescents, due to its impact on physical activity and quality of life. The World Health Organization (2021) reports that around 262 million people worldwide are affected by asthma, with a significant proportion belonging to children and adolescents. This chronic respiratory condition often limits participation in physical activities, contributing to sedentary lifestyles, obesity, and related health complications (Price et al., 2023). Environmental and institutional factors such as healthcare access, school support, and asthma management awareness further influence how adolescents manage their condition and engage in physical activities.

In the Philippines, asthma remains a relevant health issue among school-aged children. The Department of Health (2020) estimates that about 8% of Filipino children have asthma, many of whom experience difficulty participating in physical education and sports. Additionally, only 20% of Filipino youth meet recommended physical activity levels (Philippine Statistics Authority, 2019), reflecting a growing concern on inactivity. Despite this, there is a limited body of research focusing on Filipino students with asthma in school-based physical education contexts, creating both spatial and empirical gaps in literature (Wang et al., 2024; Legaspi et al., 2023). Moreover, there is a lack of fitness assessments specifically designed for students with asthma.

A Physical Fitness Test is a structured tool used to measure physical capabilities such as endurance, strength, speed, and agility. For students with asthma, it is essential in identifying safe exercise limits and guiding appropriate physical activity. However, conventional fitness tests often fail to consider asthma-related limitations, which may lead to exclusion or health risks (Lopes, 2020). Hence, there is a need to develop a customized and inclusive physical fitness assessment for this population.

This study supports the Sustainable Development Goals of the United Nations (SDG 3: Good Health and Well-Being and SDG 4: Quality Education) (United Nations, 2015) and aligns with CHED Memorandum Order No. 39, Series of 2021, which promotes inclusive and quality physical education. Anchored on the Affective-Reflective Theory (Brand & Ekkekakis, 2017), the study recognizes that emotional responses such as fear and anxiety may hinder physical activity participation among students with asthma, while positive experiences may encourage engagement.

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THEORETICAL FRAMEWORK

This study is anchored on the Affective-Reflective Theory (ART) developed by Brand and Ekkekakis (2017), which explains that physical activity behavior is influenced by both automatic affective responses and reflective cognitive evaluations. Individuals with asthma often experience fear, anxiety, and perceived physical limitations that negatively affect their willingness to engage in exercise. Studies show that students with asthma may avoid physical activity due to concerns about symptom flare-ups and lack of confidence in their physical capacity (Sadek Attalla et al., 2022). Conversely, positive and supportive exercise environments can enhance motivation, self-efficacy, and participation (Bacon & Platts-Mills, 2020). Guided by this theory, the study emphasizes the development of a fitness test that not only measures physical capacity but also promotes psychological safety and confidence in participation.

OBJECTIVES OF THE STUDY

The study aimed to develop and evaluate a customized physical fitness test for PATHFIT students with asthma during the 2nd semester of AY 2025–2026. Specifically, it sought to (1) determine the pre-test performance of PATHFIT students with asthma condition using the customized physical fitness test in terms of health-related fitness (six-minute walk test, wall sits, and seated leg raises) and skill-related fitness (30-second walk test, vertical jump, and T-agility test); (2) determine the post-test performance of PATHFIT students with asthma condition using the same fitness components; (3) compare the pre-test and post-test performances; and (4) develop a Physical Fitness Model known as the Physical Instrument for Asthmatics (PIA).

CONCEPTUAL AND ANALYTICAL FRAMEWORK

The study follows a three-phase process: pre-test, intervention, and post-test, which serves as the basis for developing the Physical Instrument for Asthmatics (PIA) model.

In the pre-test phase, students with asthma are assessed using a modified physical fitness test consisting of the six-minute walk test, vertical jump, wall sits, seated leg raises, 30-second walk test, and T-agility test. These activities measure cardiovascular endurance, strength, speed, power, and agility while ensuring safety for participants.

In the intervention phase, structured and progressive physical activities are introduced based on the results of the pre-test. These activities aim to improve physical fitness components while considering asthma-related limitations and ensuring safe participation. In the post-test phase, the same set of modified fitness tests is administered to evaluate improvements and determine the effectiveness of the intervention. The results from the pre-test and post-test are compared to assess progress and validate the model.

This process leads to the development of the Physical Instrument for Asthmatics (PIA), a customized physical fitness assessment designed to ensure inclusivity, safety, and improved physical performance among students with asthma.

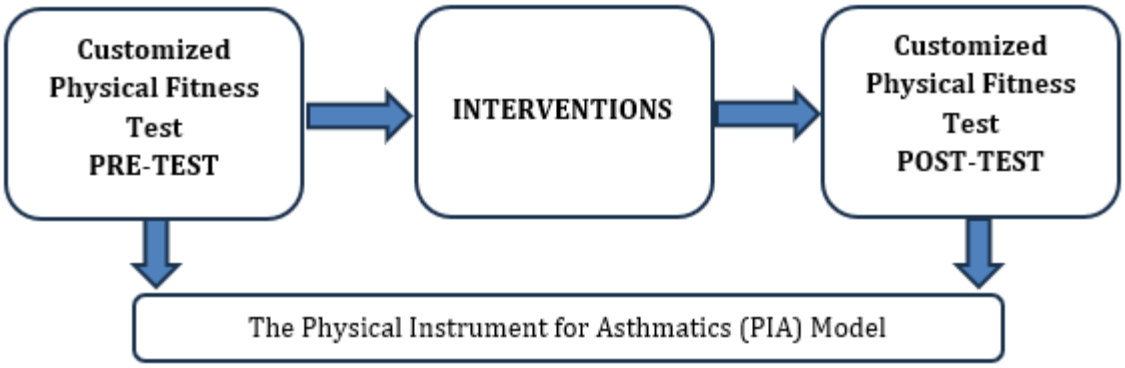


Figure 1. Research Paradigm

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METHODS

This study utilized a pre-experimental one-group pre-test–post-test design to determine the effectiveness of a customized physical fitness test for PATHFIT students with asthma. The design involved measuring participants' physical fitness levels before and after a structured intervention without a control group. This approach was appropriate for assessing changes within a single group where random assignment was not feasible. The study followed a sequence of pre-test, intervention, and post-test, with differences in results used to evaluate the effectiveness of the program, consistent with Freitas et al. (2024).

The study was conducted at Saint Mary's University, Bayombong, Nueva Vizcaya, Philippines, during the 2nd semester of AY 2025–2026. The university provided appropriate facilities such as open spaces and physical education areas, ensuring a safe environment for fitness testing. Coordination with faculty and health personnel ensured proper supervision and safety protocols, especially for students with asthma. The participants were PATHFIT 2 and PATHFIT 4 students diagnosed with asthma. A total of 11 students participated (8 from PATHFIT 2 and 3 from PATHFIT 4). Participants were selected through purposive sampling based on medical certification confirming asthma diagnosis and clearance for physical activity. Inclusion required informed consent, while students with other medical conditions, recent severe asthma attacks, or incomplete medical clearance were excluded to ensure safety and data reliability.

The main instrument used was a Customized Physical Fitness Test (PIA-based assessment) adapted from validated tests to suit students with asthma. Modifications included replacing the 3-minute step test with the six-minute walk test (Andrade et al., 2014), push-ups and curl-ups with wall sits and seated leg raises (Onal et al., 2024), sprinting with a 30-second walk test (Lieberstein et al., 2018), and standing long jump with vertical jump (Ostojić et al., 2010). The T-agility test replaced the hexagon test (Schiwe et al., 2019), while BMI, flexibility, balance, and coordination tests were retained due to their low physical demand and safety for asthmatic participants. A standardized rating scale was used for consistent evaluation.

Data collection followed three phases: pre-test, intervention, and post-test. The pre-test established baseline fitness levels, followed by a structured intervention involving safe and progressive physical activities tailored for students with asthma. The post-test used the same assessments to measure improvements and determine the effectiveness of the intervention. Data were analyzed using descriptive statistics such as mean and standard deviation, while pre-test and post-test results were compared to identify changes in performance. Ethical considerations were strictly observed, including informed consent, parental consent when necessary, medical clearance, confidentiality, and safety monitoring throughout the conduct of the study.

RESULTS AND DISCUSSION

Table 1*: Pretest Scores for Health-Related Fitness Test*

Subject	Six- walk test (Cardiovas. Endurance)	QD	Wall Sits (Muscular Strength)	QD	Seated Leg Raises (Mus. End.)	QD
	Meters		*Minute*		*Repetitions*	
1	450	Good	0.46	Good	10	Excellent
2	550	Excellent	0.52	Very Good	8	Good
3	456	Good	1	Excellent	3	Poor
4	444	NI	1	Excellent	5	NI
5	481	Good	1	Excellent	7	Fair
6	472	Good	1	Excellent	7	Fair
7	640	Excellent	1	Excellent	10	Excellent
8	580	Excellent	1	Excellent	11	Excellent
9	496	Good	1	Excellent	10	Excellent
10	427	NI	0.51	Very Good	10	Excellent
11	551	Excellent	1	Excellent	10	Excellent
Desc.	**504.27**	**Very Good**	**0.86 (1.26)**	**Excellent**	**8.27**	**Good**

The six-minute walk test yielded a group mean of 504.27 meters, classified as Very Good, with individual performances ranging from 427 to 640 meters. While several students achieved "Excellent" ratings, others fell within "Good" and "Needs Improvement" levels, indicating variability in aerobic capacity. This supports Matsunaga et al. (2020), who emphasized that asthma control and severity significantly influence functional exercise capacity. These findings suggest that while students with asthma can perform moderately to highly in endurance tasks,

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individualized pacing and asthma management are essential to reduce performance variability.

For muscular strength measured through wall sits, the group obtained a mean of 0.86 minutes, interpreted as Excellent. Most participants performed within "Very Good" to "Excellent" ranges, indicating that static strength is less affected by asthma due to its low respiratory demand. This aligns with Privitera and Privitera (2023), who found that structured physical exercise can be safely performed by individuals with asthma and may enhance physical conditioning.

Muscular endurance, measured through seated leg raises, recorded a mean of 8.27 repetitions, categorized as Good. Although some students reached "Excellent" levels, others scored lower, indicating variability in core endurance. Vasconcello-Castillo et al. (2021) noted similar inconsistencies in physical performance among adolescents with asthma. Overall, results show that while strength and endurance are generally adequate, individualized training is needed for lower-performing students.

Table 2*: Pretest Scores for Skill-Related Fitness Test*

Subject	30-second Walk Test (Speed)	QD	Vertical Jump - Male (Power)	QD	Vertical Jump - Female (Power)	QD	T-Agility Test (Agility)	QD
	Meters		*Centimeters*		*Centimeters*		*Seconds*	
1	48	NI			32	VG	12.05	NI
2	51	Good			35	VG	9.33	Exc.
3	44	NI			40	Exc.		
4	44	NI			28	Good		
5	46	NI			37	VG	11.07	Good
6	48	NI	41	Good			10.03	VG
7	48	NI			30	VG	10.08	VG
8	53	Good	48	Good			8.82	Exc.
9	52	Good	40	Good			10.09	VG
10	35	Poor			35	VG	10.12	VG
11	47	NI	53	VG			8.63	Exc.
Desc.	**46.91**	**NI**	**44.5**	**Good**	**35.0**	**VG**	**10.02**	**Exc.**

The 30-second walk test produced a mean of 46.91 meters (Needs Improvement), indicating moderate speed capacity with noticeable variability. This aligns with Eddolls et al. (2021), who reported inconsistent speed performance among youth with asthma due to differences in physical activity exposure and symptom control.

Vertical jump results showed 44.5 cm for males (Good) and 35.0 cm for females (Very Good), indicating moderate muscular power. This suggests that explosive strength is relatively preserved in students with asthma, consistent with Lima et al. (2020), who found that resistance training improves muscular performance in asthmatic adolescents.

Agility results showed a mean of 10.02 seconds (Very Good), with performance variation across participants. Zhang et al. (2022) explained that agility performance in individuals with asthma is influenced by exercise tolerance and airway responsiveness. Overall, results indicate that skill-related fitness is functional but requires structured improvement interventions.

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Table 3. ***Post-test Scores for Health-Related Fitness Test***

Subject	Six- walk test (Cardiovas. Endurance)	QD	Wall Sits (Muscular Strength)	QD	Seated Leg Raises (Mus. End.)	QD
	Meters		*Minute*		*Repetitions*	
1	492	Good	0.55	Very Good	10	Excellent
2	580	Excellent	1	Excellent	10	Excellent
3	500	Very Good	1	Excellent	8	Good
4	480	Good	1	Excellent	10	Excellent
5	502	Very Good	1	Excellent	8	Good
6	582	Excellent	1.12	Excellent	10	Excellent
7	610	Excellent	1	Excellent	10	Excellent
8	582	Excellent	1.21	Excellent	13	Excellent
9	516	Very Good	1	Excellent	10	Excellent
10	458	Good	1	Excellent	10	Excellent
11	560	Excellent	1.18	Excellent	14	Excellent
Desc.	**532.91**	**Very Good**	**1.01**	**Excellent**	**10.27**	**Excellent**

Cardiovascular endurance increased to a mean of 532.91 meters (Very Good), with several students approaching or reaching "Excellent" performance. This indicates improved aerobic capacity, supported by findings that structured exercise significantly enhances functional capacity in individuals with asthma (Privitera & Privitera, 2023).

Wall sit performance improved to a mean of 1.01 minutes (Excellent), reflecting substantial gains in muscular strength. Seated leg raises increased to 10.27 repetitions (Excellent), surpassing baseline values and indicating improved muscular endurance. These findings align with Springer (2025), who emphasized that exercise training improves physical performance in children with asthma.

Overall, the results confirm that the intervention effectively enhanced health-related fitness without triggering asthma-related complications, supporting the safety and effectiveness of the PIA framework.

Table 4. ***Posttest Scores for Skill-Related Fitness Test***

Subject	30-second Walk Test (Speed)	QD	Vertical Jump - Male (Power)	QD	Ver. Jump - Female (Power)	QD	T-Agility Test (Agility)	QD
	Meters		*Centimeters*		*Centimeters*		*Seconds*	
1	51	Good			35	VG	11.03	G
2	56	Good			35	VG	8.19	Exc.
3	47	NI			43	Exc.	10.17	VG
4	45	NI			33	VG	9.81	Exc.
5	50	Good			41	Exc.	10.31	VG
6	52	Good	43	Good			9.6	Exc.
7	58	Good			34	VG	9.14	Exc.
8	61	Exc.	61	Exc.			8.06	Exc.
9	60	Exc.	57	VG			9.38	Exc.
10	43	NI			39	VG	10.02	VG
11	64	Exc.	61	Exc.			8.21	Exc.
Desc.	**53.36**	**Good**	**52**	**VG**	**37.14**	**VG**	**9.45**	**Exc.**

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Speed increased to a mean of 53.36 meters (Good), while agility improved to 9.45 seconds (Excellent). Vertical jump performance also improved, reaching 52 cm for males (Very Good to Excellent) and 37.14 cm for females (Very Good).

These improvements reflect the effectiveness of structured speed, power, and agility training. Eddolls et al. (2021) and Lima et al. (2020) support that properly designed exercise programs significantly improve physical performance in adolescents with asthma. Despite improvements, variability among participants suggests the need for continued individualized progression.

Table 5. ***Comparison Between Pretest and Posttest Results***

Paired Samples Statistics, Correlations, and Differences										
Type		Mean	N	SD	Corr.	Sig.	t	df	Sig.	Decision
Pair 1	Pre-Minute Walk	504.27	11	67.05	0.732	0.01	-2.77	10	0.02	*Rej. Ho*
	Post-Minute Walk	532.91	11	51.11						
Pair 2	Pre-Wall Sits	.86	11	.235	.623	.041	-2.5	10	.029	*Rej. Ho*
	Post-Wall Sits	1.0	11	.171						
Pair 3	Pre-Seated Leg	8.2	11	2.53	.620	.042	-3.3	10	.008	*Rej. Ho*
	Post- Seated Leg	10.2	11	1.79						
Pair 4	Pre-30 Sec Walk Test	46.9	11	4.9	.768	.006	-4.8	10	.001	*Rej. Ho*
	Post-30 Sec Walk Test	53.3	11	6.9						
Pair 5	Pre-Agility	10.02	9	1.07	.951	.000	6.34	8	<0.001	*Rej. Ho*
	Post-Agility	9.33	9	1.04						

Group Statistics and Test of Difference (When Grouped by Sex)								
Type	Sex	N	Mean	SD	t	df	Sig.	Decision
Pre-Vertical Jump	M	4	44.50	6.14	3.79	10	<0.001	*Rej. Ho*
	F	7	33.86	4.14				
Post-Vertical Jump	M	4	55.50	8.54	5.01	10	0.001	*Rej. Ho*
	F	7	37.14	3.85				

Paired sample analysis revealed statistically significant improvements across all fitness variables.

Cardiovascular endurance increased significantly ($p = 0.02$), muscular strength improved ($p = .029$), and muscular endurance also showed significant gains ($p = .008$). Speed and agility demonstrated strong statistical significance ($p \leq .001$).

Table 5. *Comparison Between the Pretest and Posttest Results*

These results confirm that the intervention significantly improved both health-related and skill-related fitness components. This is consistent with Wanrooij et al. (2020), who reported that structured exercise interventions improve physical fitness outcomes in individuals with asthma.

Comparative analysis also showed that PATHFIT 4 students performed better than PATHFIT 2 students, likely due to greater exposure to structured physical activities. This aligns with WHO (2022), which emphasizes that repeated exposure to physical education improves motor competence and performance.

Sex-based comparison revealed significant differences in vertical jump performance, with males outperforming females in both pretest and posttest results ($p < .001$). This is consistent with physiological differences in muscle mass and strength development (Wiśniewska et al., 2021). However, both groups showed improvement, indicating that training benefits all participants regardless of sex.

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Customized Physical Fitness Test for PATHFit Students with Asthma

PHYSICAL INSTRUMENT FOR ASTHMATICS				
Name (Optional)		Level of Asthma Condition	Age	Sex
Class Time	Days	PATHFIT 2 Student ☐	PATHFIT 4 Student ☐	
PART I: HEALTH-RELATED FITNESS TESTS				
1. Six- minute walk test (Cardiovascular Endurance)				
Distance: _____		**Time: _____**		**Score: _____**
Resting Heart Rate (pulse rate before the test)		Training Heart Rate (pulse rate immediately after the test)		Recovery Heart Rate (pulse rate after a one-minute rest)
2. Wall Sits (Strength) Score: _____		**3. Seated Leg Raises (Strength) Score: _____**		
Time (sec):		No. of Repetitions:		
PART II: SKILL-RELATED FITNESS TESTS				
1. 30-second walk test (Speed) Score: _____		Time (sec)		_____
2. Vertical Jump (Power) Score:				
(Distance in cm)		First Attempt	Second Attempt	Third Attempt
3. T- Agility Test (Agility) Score: _____				
Time (sec):				

Figure 2. ***Crafted Physical Fitness Test for Students with Asthma (PIA Model)***

The findings support the development of the Physical Instrument for Asthmatics (PIA) as a safe, structured, and effective fitness assessment model. All participants were able to complete the tests without asthma-related complications, confirming the safety of the protocol. The integration of progression principles and FITT guidelines ensured gradual intensity adaptation suitable for students with asthma.

The PIA model effectively measures physical fitness while prioritizing safety, inclusivity, and performance development. It provides a reliable framework for assessing and improving the fitness levels of students with asthma in school-based physical education programs.

CONCLUSIONS

1. The pretest established a baseline showing that students with asthma can perform well in fitness components, but variability exists due to differences in asthma severity, conditioning, and experience, highlighting the need for differentiated interventions.
2. The PIA interventions effectively improved both health-related and skill-related fitness, with significant gains in endurance, strength, speed, power, and agility, proving that structured, asthma-sensitive programs are beneficial.
3. Statistical analysis confirmed significant improvements across all fitness components, with stronger gains in strength and skill-related areas, while endurance improvements were positive but varied, indicating the need for continuous training.
4. The Physical Instrument for Asthmatics (PIA) is an effective, safe, and inclusive tool for assessing and improving fitness among students with asthma.

RECOMMENDATIONS

1. Implement tiered, asthma-sensitive programs with progressive and scaffolded activities to address varying fitness levels.
2. Continue and enhance the use of the PIA framework in physical education, emphasizing individualized monitoring and safe progression.
3. Promote longer-term and consistent participation in structured physical activity, especially to improve endurance.
4. Adopt and expand the use of PIA in similar educational settings due to its proven effectiveness and safety.

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APPENDICES
Research Instrument

Customized Physical Fitness Test for PATHFit Students with Asthma

PHYSICAL INSTRUMENT FOR ASTHMATICS			
Name (Optional)	Level of Asthma Condition	Age	Sex
Class Time / Days	PATHFIT 2 Student ☐	PATHFIT 4 Student ☐	
PART I: HEALTH-RELATED FITNESS TESTS			
1. Six- minute walk test (Cardiovascular Endurance)			
Distance: _____	**Time:** _____	**Score:** _____	
Resting Heart Rate (pulse rate before the test)	Training Heart Rate (pulse rate immediately after the test)	Recovery Heart Rate (pulse rate after a one-minute rest)	
2. Wall Sits (Strength) **Score:** _____		**3. Seated Leg Raises (Strength)** **Score:** _____	
Time (sec):		No. of Repetitions:	
PART II: SKILL-RELATED FITNESS TESTS			
1. 30-second walk test (Speed) **Score:** _____	Time (sec)	_____	
2. Vertical Jump (Power) **Score:**			
(Distance in cm)	First Attempt	Second Attempt	Third Attempt
3. T- Agility Test (Agility) **Score:** _____			
Time (sec):			

Student Signature:	Checked and Evaluated: