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Selected Physical Fitness Efficiency in the Improvement of Students' Body Mass Index in an Online Learning Environment

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Abstract This experimental study aimed to assess the contribution of a subset of Physical Fitness Tests (PFTs) to the improvement in the Body Mass Index of the participants in an online learning environment. The participants are asked to perform a series of fitness over the course of five (5) weeks by performing individual tests per week, and comparing their pre- and post-test scores while accounting for gender, age, and BMI. The participants are selected via Judgmental Sampling Technique, and the data were collected by using two (2) parts questionnaire. For the first part, personal profiles such as gender (N_{female} = 33(66.00%), N_{male} = 17(34.00%), age (N_{21yo} = 20(40.00%), N_{19yo} = 15(30.00%), N_{20yo} = 15(30.00%), and pre-test Body Mass Index (N_{normal} = 30(60.00%), $N_{underweight}$ = 12(24.00%), N_{obese} = 8(16.00%) are all included. The second part requested the participants to answer the Physical Activity Readiness Questionnaire (PAR-Q). Descriptive statistical methods were used to describe participants' demographic profiles and PFT results. Additionally, One-way ANOVA and Independent Samples T-Test were utilized comparing the before and after performing the selected PFTs according to gender, age and BMI. Finally, Paired samples t-test was used to determine the significant difference between the pre- and post-test scores of the participants after administering the series of PFTs. There is no statistically significant difference in performance between the genders, with the exception of the vertical jump test (69.99 ± 27.50 vs. 38.21 ± 17.78), $t(48) = 4.946$, $p < .05$. Male participants were shown to fare better than female ones. Finally, after five (5) consecutive weeks of executing the selected PFTs, a statistically significant improvement was seen in the individuals' post-test scores (20.45 ± 3.53) compared to their pre-test scores (20.85 ± 3.77), $t(49) = 4.233$, $p < .05$. Restrictions of the experimentation and suggestions for future study are also provided.

Keywords Distance Learning Modality, Efficiency, Physical Education, Physical Fitness Test, Undergraduate Students

1. Introduction

For the most recent number of years, apathy toward physical activity has been viewed as a worldwide pandemic [1]. The percentage of people who are not active

enough to be considered healthy is on the rise, particularly among younger adolescents such as college students [2], [3]. Additionally, as a direct result of the widespread catastrophe that was brought about by the COVID-19 pandemic, the way of life of people all over the world has been deeply impacted [4], [5]. Another factor is the fact that many educational institutions, higher education institutions in particular, have been compelled to close their physical campuses in favor of offering courses exclusively online [6], [7]. This abrupt change in the academic environment had a detrimental impact on the lives of college students, which manifested in issues with their physical health [8], [9]. The focus of physical education classes is on students' health and fitness, and teachers make an attempt to encourage their students to maintain a healthy lifestyle even when they are not on campus. It has been demonstrated in a number of academic studies that a reduction in the amount of time spent engaging in physically active pursuits can have a deleterious effect on an individual's fitness level, resulting in a decrease in muscular strength, agility, and flexibility, as well as poor cardiorespiratory endurance and body composition [9], [10]. When viewed through this lens, establishments of higher education continue to encounter a wide variety of obstacles. Even if there have been significant advances in technology, the social and experiential components of physical education cannot be fully represented in a virtual setting [11]. Physical education has catastrophic results when its true goal and value are not effectively communicated due to the repetition of courses within confined environmental situations and inefficient learning resources [12]. Virtual physical education course has also been shown to have no discernible effect on students' propensity to engage in physically demanding activities or their development of motor skills [13]. The students' diminished motivation and interest, as well as their fewer chances to form meaningful interactions with peers, may be attributable to these reasons. The information presented up to this point has shown that delivering online courses, specifically Physical Education, is difficult for higher education institutions all over the globe even in the aftermath of the pandemic. PE classes might not appear like they would lend themselves to being taught effectively in an online environment.

1.1. Physical Fitness Test (PFT) in an Online Environment

There have been various studies that were conducted in assessing the effectiveness of physical fitness testing in the online environment. Such the findings of [14], results from a fitness test administered to Singaporean students were met with mostly positive reviews. The study indicated that students' positive views on fitness testing were significantly correlated with their satisfaction with the assessment itself. Additionally, the experimental study of [15] reported that integrating an IoT smart sensor into a system for managing college students' physical fitness test results improves process efficiency by 60%, allowing the system to more swiftly respond to the demands of a diverse clientele. On the other hand, the studies that were cited above comprised the only published reports that were identified concerning the effectiveness of measuring one's physical fitness in an online format and through various technological means. In this regard, it is necessary to carry out research to determine whether or not testing one's physical fitness level in an online environment is effective.

1.2. Purpose of the Study

This study examined the effectiveness of selected Physical Fitness Tests (PFTs) and compared the scores of the participants based on their BMI's pre- and post-test scores, after performing the series of exercises for five (5) weeks, in which participants are presented a single fitness test to perform. The findings of this experimental research can provide empirical support for the effectiveness of conducting Physical Fitness Tests in an online-learning modality.

2. Materials and Methods

2.1. Research Design

This study employed an *experimental design* to compare the participants' Body Mass Index before and after they completed the selected Physical Fitness Tests (PFTs) in an online learning environment for a period of five consecutive weeks. In addition, a comparison of the students' overall performance will also be conducted, with gender, age, and body mass index (BMI) serving as independent factors (pre-test and post-test). The purpose of an experimental study is to achieve the highest possible degree of accuracy and to make the most concrete conclusions attainable with respect to a hypothesis [16]. This study also aimed to determine whether or not these particular PFTs are essential for maintaining healthy students' BMIs, even if the assessments are performed at home.

2.2. Participants

The participants for the study are from one section of first-year undergraduate students taking the degree of Bachelor of Physical Education at a local college enrolled in the course Physical Activities Toward Health and Fitness 1 (PATH-Fit 1) – Movement Competency Training for the 1st Semester, the Academic Year 2022-2023. Additionally, participants are selected using *Judgmental Sampling Technique*. It is a non-probability sampling technique, in which people take part in the study based on the researcher's subjective assessment of who

will produce the most useful data for meeting the goals of the research [17]. In this regard, a selection criterion is formulated in order to acquire the most reliable data possible from the participants. The following criteria are as follows:

- must be at least 19 years old;
- can be either male or female;
- should not have any medical history.

The personal profiles of the participants are illustrated in Table 1, which includes information about their ages, genders, and pre-test Body Mass Index (BMI). According to the data, there were a total of fifty students participated in the experiment project, with the majority of the participants being females [(N_{female} = 33(66.00%), N_{male} = 17(34.00%)]. In addition, the majority of the participants are 21 years old, with those aged 19 and 20 coming in second and third, respectively [(N_{21yo} = 20(40.00%), N_{19yo} = 15(30.00%), N_{20yo} = 15(30.00%)]. Lastly, in terms of participant's body mass index (BMI) for the pre-test, the majority of them fall into the normal category, followed by those underweight and obese [(N_{normal} = 30(60.00%), $N_{underweight}$ = 12(24.00%), N_{obese} = 8(16.00%)].

Table 1. Demographic Characteristics

Variable	Item	*N*(%)
Gender	Male	17(34.0%)
	Female	33(66.0%)
Age	19 years old	*15*(30.0%)
	20 years old	*15*(30.0%)
	21 years old	*20*(40.0%)
Body Mass Index (pre-test)	Underweight (UW)	*12*(24.0%)
	Normal	*30*(60.0%)
	Obese	*8*(16.0%)

2.3. Instruments and Data Gathering

To collect the data from the participants, a survey questionnaire with two parts was utilized. For the first part, personal profiles such as gender, age, and pre-test Body Mass Index are all included. The second part requested the participants to answer the *Physical Activity Readiness Questionnaire* (PAR-Q). All participants that were identified with medical history are automatically ineligible to partake in the experiment.

The participants were given a list of PFTs to complete, including the hexagonal test, Plank test, Hand-wall test, Stork-balance test, and Vertical jump, all of which are being covered in class. Students will take one of these tests once per week for five (5) weeks. The instructor (researcher) will go over the crucial steps and needed equipment in administering the tests below with the students during a specific week before they are to be performed. The class was delivered in an online format; therefore, the students were also given a video clip and a module that explained how to complete the subsequent examinations. The structure of the experiment and the specific assessment that they must undergo each week are shown in Table 2.

Table 2. Physical Fitness Test design for five (5) weeks

Week	Selected physical fitness test (PFT)
Week 1	*Hexagonal Test (s)*
Week 2	*Plank Test (s)*
Week 3	*Hand-wall Test (catches/30s)*
Week 4	*Stork-balance test (s)*
Week 5	*Vertical jump (cm)*

2.4. Monitoring Procedures for Physical Fitness Test Program Adherence

The study employed two (2) methods to ensure that participants actually completed the physical fitness test: (1) having them submit an index card in the college-mandated format detailing the tests they took, and (2) having them submit unedited and uncut video recordings of themselves taking the tests. Both of the required monitoring tools were uploaded to Google Drive by the participants. Students are expected to submit the following weekly as evidence of their continued engagement with the assessment. Astonishingly, 100% of the participants met the criteria and turned in their work on time.

2.5. Data Analysis

The data was processed with IBM SPSS 27 (IBM Statistical Package for the Social Sciences). The demographic profile and the results of the selected fitness assessments were interpreted using descriptive statistics like frequency (f), percentage (%), mean (M), and standard deviation (SD). Table 3 provides a visual depiction of the tabular description of each fitness test. Additionally, Independent Samples T-Test and One-way ANOVA were performed to assess whether or not there was a statistically significant difference in the pre- and post-test performance of participants on various physical fitness tests (PFTs) according to gender, age, and Body Mass Index (BMI). Both the Independent Samples T-Test and the One-Way Analysis of Variance (ANOVA) are parametric tests that compare the means of two and many groups respectively, to see if there is a statistically significant difference between them [16], [18]. Lastly, the Paired samples t-test was used to assess the significant difference between the pre-test and post-test IBM scores of the participants after conducting the physical fitness tests [19].

2.6. Ethical Considerations

The participants were aware of the objectives, the tools, and the tests that were going to be used over the duration of the experiment in order to assess and evaluate their

performance. In addition, an explanation of the beneficial consequences that the inquiry will have on academic institutions of higher learning and the general scientific community has been carried out.

Table 3. Descriptive interpretation per test

Hexagonal (s)		Plank test (s)		Hand-wall (catches/30s)		Stork-balance (s)		Vertical-jump (cm)			
								Male		Female	
t	Rate	t	Rate	Catches	Rate	t	Rate	cm	Rate	cm	Rate
<12	E	>60	E	>35	E	>50	E	>70	E	> 60	E
13-17	G	40-50	VG	30-35	G	40-50	G	61-70	VG	51-60	VG
18-22	F	30-39	G	20-29	A	25-39	A	51-60	AA	41-50	AA
>22	P	20-29	A	15-19	F	10-24	F	41-50	A	31-40	A
		10-19	P	<15	P	<10	P	31-40	BA	21-30	BA
		1-9	VP					21-30	P	11-20	P
								<21	VP	< 11	VP

Hexagonal: E- Excellent, G- Good, F- Fair, P- Poor; Plank Test: E- Excellent, VG- Very Good, G- Good, A- Average, P- Poor, VP- Very Poor; Hand-Wall: E- Excellent, G- Good, A- Average, F- Fair, P- Poor; Stork-Balance: E- Excellent, G- Good, A- Average, F- Fair, P- Poor; Vertical-Jump: E- Excellent, VG- Very Good, AA- Above Average, A- Average, BA- Below Average, P- Poor, VP- Very Poor.

Table 4. Contingency Table on gender, age, and Body Mass Index (BMI)

	Body Mass Index Classification		
Gender	*Underweight/UW* (%)	*Normal/N* (%)	*Overweight/OW* (%)
Male	*2*(11.77%)	*10*(58.82%)	*5*(29.41%)
Female	*10*(30.30%)	*20*(60.60%)	*3*(9.1%)
Age			
19 years old	*5*(33.33%)	*7*(46.67%)	*3*(20.0%)
20 years old	*4*(26.66%)	*10*(66.67%)	*1*(6.67%)
21 years old	*3*(15.0%)	*13*(65.0%)	*4*(20.0%)

Table 5. Results of selected physical fitness tests

	Selected Physical Fitness Test (PFT)									
	Hexagonal (s)		*Plank test (s)*		*Hand-wall (catches/30s)*		*Stork-balance (s)*		*Vertical-jump (cm)*	
Participant	t	Rate	t	Rate	Catches	Rate	t	Rate	cm	Rate
F	7.80	E	22.00	A	16	F	50.00	E	40.64	AA
F	8.55	E	30.42	G	28	A	64.00	E	30.00	BA
F	26.00	P	60.00	E	21	A	55.00	E	30.48	BA
F	7.00	E	42.00	VG	27	A	32.00	A	45.72	AA
F	32.00	P	65.00	E	12	P	50.00	E	81.00	E
F	8.90	E	40.00	VG	20	A	20.00	F	24.00	BA
M	10.00	E	60.00	E	20	A	20.00	F	120.00	E
M	5.18	E	60.00	E	20	A	55.00	E	50.00	A
M	12.00	E	60.00	E	32	G	60.00	E	85.00	E
F	36.00	P	60.00	E	30	G	10.00	P	24.25	BA
F	7.30	E	34.00	G	28	A	50.00	E	40.64	A
F	20.00	F	60.00	E	30	G	50.00	E	45.72	AA
F	12.40	G	30.00	G	20	A	40.00	G	31.00	A
F	7.19	E	21.57	A	30	G	50.98	E	34.00	A
F	6.68	E	65.00	E	21	A	71.00	E	27.00	BA

Table 5 continued

F	7.00	E	60.00	E	20	A	50.00	E	27.00	BA
F	6.69	E	60.00	E	7	P	60.00	E	26.70	BA
F	65.00	P	49.98	VG	23	A	65.00	E	32.00	A
F	12.40	G	35.36	G	21	A	75.00	E	115.40	E
F	61.20	P	50.58	VG	22	A	70.30	E	32.00	A
F	11.00	E	60.00	E	35	E	60.00	E	31.75	A
M	4.64	E	45.00	VG	35	E	50.00	E	50.00	A
F	7.52	E	27.00	A	31	G	50.00	E	36.00	A
F	16.50	G	43.00	VG	24	A	50.00	E	43.18	AA
F	10.50	G	60.00	E	22	A	60.00	E	28.00	BA
F	21.00	F	30.00	G	13	P	60.00	E	33.02	A
F	11.70	E	60.00	E	21	A	60.00	E	29.00	BA
F	22.00	F	70.00	E	15	F	64.00	E	42.00	AA
F	19.00	F	52.00	VG	19	F	45.00	G	36.00	A
M	22.00	F	43.00	VG	27	A	41.00	G	43.18	A
F	11.00	E	51.88	VG	33	G	67.20	E	32.00	A
F	11.72	E	42.00	VG	30	G	54.00	G	43.18	AA
F	6.68	E	22.00	A	23	A	26.00	A	30.00	BA
F	45.00	P	40.00	VG	47	E	90.00	E	32.00	A
F	5.65	E	60.00	E	20	A	96.00	E	24.00	BA
F	5.00	E	60.00	E	30	G	50.00	E	58.42	VG
F	26.00	P	27.00	A	33	G	38.00	A	43.00	AA
M	15.00	G	52.00	VG	27	A	17.00	F	50.80	A
F	14.29	G	45.00	VG	21	A	60.00	E	32.00	A
M	20.00	F	39.00	G	20	A	39.00	A	58.42	AA
M	5.77	E	33.00	G	21	A	60.00	E	55.88	AA
M	7.00	E	60.00	E	30	G	2.00	P	71.12	E
M	7.00	E	60.00	E	10	P	60.00	E	71.12	E
M	32.00	P	55.00	VG	18	F	60.00	E	55.88	AA
M	22.00	F	60.00	E	18	F	60.00	E	101.60	E
M	21.90	F	60.00	E	12	P	60.00	E	129.54	E
M	15.40	G	36.31	G	7	P	160.00	E	44.00	A
M	12.75	G	90.00	E	32	G	26.00	A	50.80	A
M	8.00	E	60.00	E	20	A	60.00	E	50.80	A
M	5.80	E	33.00	G	34	G	60.00	E	101.60	E

3. Results

Table 4 typifies the Body Mass Index (BMI) – pre-test classification of the participants with respect to gender and age. Regarding age, most of the male participants fall under the normal classification, followed by those who are overweight and underweight [($N_{male(normal)}$ = 10(58.82%), $N_{male(overweight)}$ = 5(29.41%), $N_{male(underweight)}$ = 2(11.77%)], while female participants fall under the normal classification, followed by those who are underweight and overweight [($N_{female(normal)}$ = 20(60.60%), $N_{male(underweight)}$ = 10(30.30%), $N_{male(overweight)}$ = 3(9.1%)]. Concerning age, most 19 years old fall under the normal classification, followed by those who are underweight and overweight [($N_{19yo(normal)}$ = 7(46.67%), $N_{19yo(underweight)}$ = 5(33.33%), $N_{19yo(overweight)}$ = 3(20.0%)]; most 20 years old fall under the

normal classification, followed by those who are underweight and overweight [($N_{20yo(normal)}$ = 10(66.67%), $N_{20yo(underweight)}$ = 4(26.66%), $N_{20yo(overweight)}$ = 1(6.67%)]; lastly, most 21 years old fall under the normal classification, followed by those who are overweight and underweight [($N_{21yo(normal)}$ = 13(65.0%), $N_{21yo(underweight)}$ = 4(20.0%), $N_{19yo(overweight)}$ = 3(15.0%)]. Based on the table, it can be construed that most of the participants across various gender and age groups are under the normal classification.

The outcomes of the participants' fitness assessments are displayed in Table 5. More than half (52.0%) of the sample scored an "excellent" (<12s) on the hexagonal test. The majority of participants scored “excellent” (>60s) on the plank test, accounting for 44.00% of the total population. Based on their performance on the hand-wall test, nearly half of the participants (48.00%) were classified as "average" (catches/30s). About three-quarters (72.00%) of the sample population scored "excellent" (>50s) on the stork balance test. Finally, 38.00% of the overall sample group scored within the "average" range (41-50cm-male/31-40cm-female) on the vertical-jump test.

Hexagonal: E- Excellent, G- Good, F- Fair, P- Poor; Plank Test: E- Excellent, VG- Very Good, G- Good, A- Average, P- Poor, VP- Very Poor; Hand-Wall: E- Excellent, G- Good, A- Average, F- Fair, P- Poor; Stork-Balance: E- Excellent, G- Good, A- Average, F- Fair, P- Poor; Vertical-Jump: E- Excellent, VG- Very Good, AA- Above Average, A- Average, BA- Below Average, P- Poor, VP- Very Poor.

Table 6 displays the average mean score on the performance of the participants after performing all the selected physical fitness tests with respect to gender, age, and body mass index (pre-test). Based on the findings, most of the female participants (17.47 ±15.16) performed higher in the hexagonal test compared to males (13.32 ± 7.91), but both yielded a “good” rating (13-17s); male participants (53.31 ±14.15) performed better in the plank test compared to females (46.54 ±14.74), but both yielded a “very good rating” (40-50s); female participants (24.01 ± 7.76) performed better in the hand-wall test compared to males (22.52 ± 8.44), but both yielded an “average” rating (20-29 catches/30s); female participants (54.35 ± 17.50) performed better in the stork-balance test compare to males (52.35 ± 33.45), but both yielded a “good” rating (40-50s); lastly, male participants performed better in the vertical-jump test compared to females, which yielded a “very good” (61-70cm) and “average” (31-40cm) rating, respectively. Additionally, 20-years old participants performed better in the hexagonal tests (17.06 ± 19.15), followed by those who are 19- (16.61 ±9.63) and 21-years old (14.89 ± 10.43) respectively, but yielded a “good” rating across age groups (13-17s); 19-years old participants performed better in the plank test (14.89 ±10.43), followed by those 21- (49.30 ± 15.75) and 20-years old (46.77 ± 14.27), but yielded a “very good” rating across age groups (40-50s); 20-years old participants performed better in the hand-wall test (24.58 ±7.15), followed by those 21- (24.28 ± 9.57) and 19-years old (21.42 ± 6.19), but yielded an “average” rating across age groups (20-29 catches/30s); lastly, 21-years old participants performed better in the stork-balance test (57.26 ± 32.99), followed by those 20- (56.82 ± 10.02) and 19-years old (45.73 ± 17.52), and yielded an “excellent” (>50/s) and “good” (40-50/s) ratings respectively. Finally, participants who are underweight performed better in the hexagonal test (14.08 ± 8.62), followed by those who are normal (15.61 ± 14.60) and overweight (20.69 ±13.71), and yielded a “good” (13-17/s) and “fair” (18-22/s) rating respectively; overweight participants performed better in the plank test (51.41 ± 10.17), followed by those who are normal (48.70 ±15.41) and underweight (47.48 ± 16.45), but all yielded a “very good” rating (40-50/s); normal participants performed better in the hand-wall test (24.81 ± 6.31), followed by those who are overweight (24.75 ±12.62) and underweight (19.44 ± 7.11), and yielded an “average” (20-29 catches/30s) and “fair” (15-19 catches/30s) rating respectively; lastly, overweight participants performed better in the stork-balance test (60.37 ±47.40), followed by those who are underweight (57.75 ± 10.48) and normal (50.24 ± 18.46), and yielded an “excellent” (>50/s) rating across groups.

Results from a variety of physical fitness tests taken by the participants are presented by gender in Table 7. The Independent Samples T-test revealed that there was no statistically significant difference in performance between the sexes on the hexagonal [t(47.966) = -1.274, p =.209], plank [t(33.636) = 1.581, p = .123], hand-wall [t(30.094) = -.607, p = .548], or stork-balance [t(20.622) = -.230, p = 820]. Male participants fared better than female participants in the vertical jump (69.99 ±27.50 vs. 38.21 ± 17.78), as shown by a statistically significant difference [t(48) = 4.946, p < .05].

The results of a one-way ANOVA comparing the participants' ages to their scores on a variety of fitness tests are shown in Table 8. Based on the findings, no significant difference was observed in between groups after performing hexagonal (F(46.761, 8498.678) = .129, p = .879), plank (F(100.671, 10569.539) = .224, p = .800), hand-wall (F(94.554, 2995.360) = .742, p = .482), stork-balance (F(1351.334, 26389.259) = 1.203, p = .309), and vertical-jump (F(2455.867, 31088.420) = 1.856, p = .168) tests.

The results of a one-way ANOVA comparing the participants' Body Max Index (pre-test) to their scores on a variety of fitness tests are shown in Table 9. Based on the findings, no significant difference was observed between groups after performing hexagonal (F(224.838, 8320.601) = .635, p = .534), plank (F(75.719, 10594.491) = .168, p = .846), hand-wall (F(261.669, 2828.245) = 2.174, p = .125), stork-balance (F(910.442, 26830.150) = .797, p = .456), and vertical-jump (F(380.722, 33163.565) = .270, p = .765) tests.

Table 6. Contingency Table for gender, age and Body Mass Index (BMI) on selected physical fitness tests

Variables	**HT *(s)***		**PT *(s)***		**HWT *(s)***		**SBT *(s)***		**VJT *(cm)***	
Gender	M ± SD	R	M ± SD	R	M ± SD	R	M ± SD	R	M ± SD	R
Male	13.32 ± 7.91	G	53.31 ± 14.15	VG	22.52 ± 8.44	A	52.35 ± 33.45	G	69.99 ± 27.50	VG
Female	17.47 ± 15.16	G	46.54 ± 14.74	VG	24.01 ± 7.76	A	54.35 ± 17.50	G	38.21 ± 17.78	A
Age										
19 years old	16.61 ± 9.63	G	50.29 ± 14.66	VG	21.42 ± 6.19	A	45.73 ± 17.52	G	-	-
20 years old	17.06 ± 19.15	G	46.77 ± 14.27	VG	24.58 ± 7.15	A	56.82 ± 10.02	E	-	-
21 years old	14.89 ± 10.43	G	49.30 ± 15.75	VG	24.28 ± 9.57	A	57.26 ± 32.99	E	-	-
Body Mass Index (Pre-test)										
Underweight	14.08 ± 8.62	G	47.48 ± 16.45	VG	19.44 ± 7.11	F	57.75 ± 10.48	E	-	-
Normal	15.61 ± 14.60	G	48.70 ± 15.41	VG	24.81 ± 6.31	A	50.24 ± 18.46	E	-	-
Overweight	20.69 ± 13.71	F	51.41 ± 10.17	VG	24.75 ± 12.62	A	60.37 ± 47.40	E	-	-

Table 7. Independent Samples T-test measuring the difference in performance of various physical fitness test with respect to gender

Physical Fitness Tests	**N**	**M ± SD**	**SE**	***df***	***t*-test**	**Sig.**	**Decision**
Hexagonal (s)							
Male	17	13.32 ± 7.91	1.91	47.966	-1.274	.209	Not significant
Female	33	14.47 ± 15.15	2.63				
Plank (s)							
Male	17	53.31 ± 14.15	3.43	33.636	1.581	.123	Not significant
Female	33	46.54 ± 14.74	2.57				
Hand-wall (catches/30s)							
Male	17	22.53 ± 8.44	2.05	30.094	-.607	.548	Not significant
Female	33	24.01 ± 7.76	1.35				
Stork-balance (s)							
Male	17	52.35 ± 33.45	8.11	20.622	-.230	.820	Not significant
Female	33	54.34 ± 17.49	3.05				
Vertical jump (cm)							
Male	17	69.99 ± 27.50	6.67	48	4.946	.000	Significant
Female	33	38.21 ± 17.78	3.10				

Table 8. One-way ANOVA test measuring the difference in performance of various physical fitness test with respect to age

Physical Fitness Tests		Sum of Squares	*df*	Mean Square	F	Sig.
Hexagonal (s)	Between Groups	46.761	2	23.381	.129	.879
	Within Groups	8498.678	47	180.823		
	Total	8545.439	49			
Plank test (s)	Between Groups	100.671	2	50.336	.224	.800
	Within Groups	10569.539	47	224.884		
	Total	10670.210	49			
Hand-wall (catches/30s)	Between Groups	94.554	2	47.277	.742	.482
	Within Groups	2995.360	47	63.731		
	Total	3089.914	49			
Stork-balance (s)	Between Groups	1351.334	2	675.667	1.203	.309
	Within Groups	26389.259	47	561.474		
	Total	27740.592	49			
Vertical-jump (cm)	Between Groups	2455.867	2	1227.933	1.856	.168
	Within Groups	31088.420	47	661.456		
	Total	33544.287	49			

Table 9. One-way ANOVA test measuring the difference in performance of various physical fitness test with respect to Body Mass Index (pre-test)

Physical Fitness Tests		**Sum of Squares**	***df***	**Mean Square**	**F**	**Sig.**
Hexagonal (s)	Between Groups	224.838	2	112.419	.635	.534
	Within Groups	8320.601	47	177.034		
	Total	8545.439	49			
Plank test (s)	Between Groups	75.719	2	37.860	.168	.846
	Within Groups	10594.491	47	225.415		
	Total	10670.210	49			
Hand-wall (catches/30s)	Between Groups	261.669	2	130.834	2.174	.125
	Within Groups	2828.245	47	60.175		
	Total	3089.914	49			
Stork-balance (s)	Between Groups	910.442	2	455.221	.797	.456
	Within Groups	26830.150	47	570.854		
	Total	27740.592	49			
Vertical (cm)	Between Groups	380.722	2	190.361	.270	.765
	Within Groups	33163.565	47	705.608		
	Total	33544.287	49			

The results of a one-way ANOVA comparing the participants' Body Max Index (post-test) to their scores on a variety of fitness tests are shown in Table 10. Based on the findings, no significant difference was observed between groups after performing hexagonal (F(6727.395, 1818.044) = .722, p = .768), plank (F(8579.136, 2091.074) = .801, p = .704), hand-wall (F(2887.580, 202.333) = 2.785, p = .064), stork-balance (F(25685.439, 2055.153) = 2.439, p = .092), and vertical-jump (F(31112.432, 2431.855) = 2.496, p = .086) tests.

The comparison of the participants' post-test scores to their pre-test scores is presented in Table 11. It is possible to deduce, on the basis of the findings, why there was a shift in the pre-test scores of the participants after they had been putting themselves through the selected physical fitness tests for a period of five weeks.

As can be shown in Table 11, there was a statistically significant difference between the scores obtained on the pre-test (20.85 ± 3.77) and the scores obtained on the post-test (20.45 ± 3.53); t(49) = 4.233, p < .05. In light of the findings, one reasonable conclusion that can be drawn is that participation in the various physical fitness tests that were chosen may have contributed to an improvement or reduction in the Body Mass Index of the students.

Table 10. One-way ANOVA test measuring the difference in performance of various physical fitness test with respect to Body Mass Index (post-test)

Physical Fitness Tests		Sum of Squares	*df*	Mean Square	F	Sig.
Hexagonal (s)	Between Groups	6727.395	41	164.083	.722	.768
	Within Groups	1818.044	8	227.256		
	Total	8545.439	49			
Plank test (s)	Between Groups	8579.136	41	209.247	.801	.704
	Within Groups	2091.074	8	261.384		
	Total	10670.210	49			
Hand-wall (catches/30s)	Between Groups	2887.580	41	70.429	2.785	.064
	Within Groups	202.333	8	25.292		
	Total	3089.914	49			
Stork-balance (s)	Between Groups	25685.439	41	626.474	2.439	.092
	Within Groups	2055.153	8	256.894		
	Total	27740.592	49			
Vertical (cm)	Between Groups	31112.432	41	758.840	2.496	.086
	Within Groups	2431.855	8	303.982		
	Total	33544.287	49			

Table 11. Body Mass Index (BMI)-based pre- and post-test scores of participants after completing a series of physical fitness tests

Post-test						*Pre-test*					
Participants	BMI	Class	Participants	BMI	Class	Participants	BMI	Class	Participants	BMI	Class
1	17.52	UW	26	16.99	UW	1	18.02	UW	26	17.02	UW
2	18.35	UW	27	18.90	N	2	18.37	UW	27	18.50	N
3	22.92	N	28	17.24	UW	3	23.05	N	28	18.01	UW
4	18.65	N	29	18.59	N	4	19.05	N	29	18.00	N
5	17.76	UW	30	15.17	UW	5	18.02	UW	30	16.22	UW
6	20.50	N	31	28.01	O	6	21.20	N	31	27.59	O
7	23.15	N	32	20.20	N	7	23.45	N	32	19.50	N
8	26.44	O	33	18.15	N	8	25.02	O	33	18.30	N
9	23.79	N	34	20.80	N	9	22.25	N	34	19.50	N
10	29.03	O	35	29.10	O	10	28.06	O	35	28.35	O
11	19.23	N	36	18.75	N	11	18.06	N	36	18.00	N
12	29.45	O	37	21.62	N	12	29.25	O	37	21.33	N
13	19.20	N	38	17.36	UW	13	18.50	N	38	17.30	UW
14	18.75	N	39	26.96	O	14	18.25	N	39	26.00	O
15	17.24	UW	40	24.80	N	15	16.45	UW	40	23.25	N
16	22.00	N	41	23.41	N	16	21.75	N	41	23.30	N
17	17.92	UW	42	14.76	UW	17	17.05	UW	42	15.15	UW
18	19.80	N	43	22.08	N	18	19.00	N	43	21.20	N
19	17.33	UW	44	25.36	O	19	16.55	UW	44	25.20	O
20	19.50	N	45	18.52	N	20	18.50	N	45	18.60	N
21	21.19	N	46	24.80	N	21	20.20	N	46	23.50	N
22	20.90	N	47	16.14	UW	22	19.50	N	47	16.85	UW
23	18.50	N	48	26.80	O	23	17.25	UW	48	25.58	O
24	18.59	N	49	20.80	N	24	18.01	UW	49	21.25	N
25	17.52	UW	50	18.50	N	25	18.02	UW	50	18.70	N

Class: UW-Underweight, N-Normal, O-Obese

Table 12. Pre-test versus post-test scores after performing the selected physical fitness tests

Scores		Paired Differences				t	*df*	Sig.
		M ± SD	SE	95% Confidence Interval of the Difference				
				Lower	Upper			
1	Pre-test - post-test	.41 ± .68	.09642	.21443	.60197	4.233	49	.000

4. Discussion

The results showed that there were no significant differences by gender (with the exception of the vertical jump), age, or BMI (pre- and post-test) for any of the PFTs performed. These results may run counter to those of previous scholarly papers that have found differences in physical fitness assessments across students of different genders, ages, and body mass indexes [20]. Nevertheless, participants' performance on the chosen PFTs for this study did not differ significantly by gender, age, or body mass index. After the participants had completed the selected physical fitness tests on a weekly basis for a period of five weeks in a row, a statistically significant difference was found between their pre-test scores and their post-test scores. Even though this took place in an online environment, it is plausible to postulate that the PFTs that the students were required to complete contributed to a significant improvement in their body mass indexes. The findings of these experiments were consistent with those obtained by other researchers, who have demonstrated the efficacy of conducting physical fitness assessments online [16], [21]. On the other hand, no previously published articles were discovered to have been carried out in conjunction with this current investigation that initiated the chosen PFTs in an online environment. In light of this issue, it is strongly suggested that another study with the same objectives be carried out in order to ascertain whether or not the results of this study may be accepted or rejected.

Furthermore, there are other factors that need to be taken into consideration which may also affect the performance of the participants in PFTs. It has been discovered, that individuals' dietary patterns are substantially associated with their body mass index which may affect individuals' performance [22]–[25]. This means that the BMI will be higher if there is a higher score of unhealthy patterns, and vice versa. Factors related to lifestyle choices were also found to have a strong correlation with BMI. Individuals' body mass indexes have been found to be related to a variety of lifestyle factors, including but not limited to insufficient physical activity, smoking, and excessive alcohol consumption [26]–[30]. In this regard, the inclusion of other elements indicated previously in an experimental study may be undertaken in order to assess whether or not there is a substantial difference between the results of the participants when taking into account such variables.

5. Conclusions

This assessment was carried out to evaluate the efficacy of the identified physical fitness tests in a digital environment. The participants were drawn from a population of undergraduate students at City College of Angeles who are currently pursuing a Bachelor of Physical Education degree. After the five-week experiment was completed, the findings revealed that the particular physical fitness assessments that were investigated are beneficial to students of both genders, ages 19-21, and even for those who fall into the category of being underweight or obese, even within the context of an online educational setting. In this regard, this study lends credence to the notion that college instructors of physical education may make ongoing use of the aforementioned evaluations in order to gauge the levels of physical fitness possessed by their students. The continual use of these assessments can be accomplished by taking a pre-test and post-test methodology, determining which students are at risk, and encouraging them to participate in healthy lifestyle choices that can improve their general health and well-being. It is conceivable that this approach will only be efficacious if teachers apply a serious and careful monitoring strategy to their students. This monitoring should focus mostly on students' acquiescence with the assessments that they will be necessitated to complete.

This experimental research would like to concentrate an emphasis on its limitations, which are extremely significant aspects to take into consideration throughout the process. To begin, participation is restricted to only those students working toward the Bachelor of Physical Education degree. The findings of this study cannot, therefore, be extrapolated to apply to other degrees offered by the local college or to other types of teacher education programs. As a result, the findings of this research indicate that doing a similar study with the participation of other students from other programs is strongly recommended. In addition, other institutions from all around the world may carry out the same procedures in order to determine whether or not the findings may be confirmed or refuted. Lastly, this research did not take into account the participants' dietary habits, lifestyle choices, any other physical fitness evaluations or other physical activities. Therefore, it is highly suggested that comparable experiments be conducted while taking into account the other variables that were mentioned previously. In conclusion, this study makes a novel contribution to the

existing body of information in the form of knowledge about the efficiency of the selected physical fitness tests in the improvement of the participants' Body Mass Index (BMI) while taking place in an online setting environment.

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Conflict of Interest

The authors declare no conflict of interest.

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