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Original Article

CLASS PROGRAM WITH BUOYANCY AID: EFFECTS TO THE SWIMMING PERFORMANCE OF BEGINNERS

PROGRAMA DE AULA COM AUXÍLIO DE FLUTUAÇÃO: EFEITOS NO DESEMPENHO DE NATAÇÃO DE INICIANTES

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RESUMO

O presente estudo foi conduzido para determinar os efeitos de um programa de seis semanas com colete de flutuação no desempenho de iniciantes na natação. Participaram 30 estudantes universitárias (i.e., NGrupo experimental = 15 e NGrupo controle = 15), que são iniciantes na natação (com competências de Nível 1 da Federação Internacional de Natação), em um estudo quase-experimental que incluiu análises de séries temporais entre os grupos e dentro de cada grupo. A intervenção teve duração de seis semanas, com avaliações semanais realizadas. As participantes passaram pela intervenção (2 dias por semana durante seis semanas, 1 hora por sessão) e foram avaliadas semanalmente através de um teste de desempenho em nado crawl, sem auxílio de flutuador, no segundo dia de cada semana de aula. O teste de Friedman foi utilizado para identificar diferenças significativas no desempenho de natação dentro dos grupos e o teste U de Mann-Whitney foi utilizado entre os grupos. Tanto o grupo controle quanto o grupo experimental apresentaram melhorias significativas na distância de natação. As estudantes iniciantes treinadas com o colete de flutuação apresentaram um desempenho superior ao das estudantes treinadas no programa tradicional. Houve forte evidência de que o programa de aulas com colete de flutuação é altamente eficaz na melhoria do desempenho de iniciantes na natação. O programa de aulas com colete de flutuação pode ser adotado por professores de educação física em suas aulas de natação para maximizar o tempo e o esforço no cumprimento dos objetivos do curso. Estudos similares podem ser conduzidos com diferentes participantes ou outros estilos de nado.

Palavras-chave: Flutoador; Aulas de natação; Colete salva-vidas; Educação física; Desempenho na natação.

ABSTRACT

The present study was conducted to determine the effects of a six-week class program with buoyancy vest to the performance of swimming beginners. There were 30 female college students (i.e., NExperimental group =15 and NControl group =15), who are swimming beginners (with International Swimming Federation Stage 1 competencies) participated a quasi-experimental study that includes between groups and within each group time series data analyses. The intervention had a duration of six weeks with weekly assessment conducted. Participants underwent the intervention (2 days a week for six weeks, 1 hour per session) and were assessed weekly through a crawl stroke swim-off performance test without buoyancy aid on the second day session of each class week. The Friedman Test was utilized in finding the significant differences in the swimming performance within groups and Mann Whitney U Test was used between groups. Both the control and experimental group showed significant improvement in their swimming distance performance. The beginner-students trained with buoyancy vest performed better than the students trained in traditional program. There was strong evidence that the class program with buoyancy vest is highly effective in improving the performance of swimming beginners. The class program with the buoyancy vest may be adopted by physical education instructors in their swimming classes to maximize time and effort in accomplishing the desired course goals. Similar studies may be conducted with a different set of participants or other swimming strokes.

Keywords: Buoyancy aid; Swimming classes; Life vest, Physical education; Swimming performance.

Introduction

The benefits of swimming have been known worldwide from wellness to therapeutic as well as disaster preparedness. Among the different physical activity options, swimming is normally on the list of preferences. In schools with formal setting, swimming is now included in most curriculum indicating its relevance to the present society.

In the K to 12 Curriculum such as the Health Optimizing Physical Education[1], swimming fundamentals are included as a mandatory subject for senior high school in the Philippines. Likewise, at the tertiary level, swimming activities are conducted as a requisite in

physical education classes or as a sporting event. With the increasing acceptance of swimming as a skill to learn, varied strategies must be delivered by instructors and trainers to meet the purpose and requirements of each competency with the consideration of different factors that may affect the quality of training.

With the varying number of students and the time allocation to swimming classes, swimming pedagogies need innovations such as using of buoyancy aids, or other equipment. Teaching swimming to students is a challenge for instructors who are tasked to accomplish the competency goals along with its time frame. Nurturing swimming beginners early on allows them to improve into achiever-athletes eventually[2]. The quality of training on an athlete's swimming performance is significant. This factor is linked to the guidance that the trainers provided to swimmers from the beginning[3]. Many beginners still find it difficult to swim in school programs due to various fears, including the fear of drowning, which shows that swimming requires floating skills to begin[4]. Young beginners may be subjected to plyometric exercises to improve speed and agility in learning to swim[5] or integrate training accessories such as swim goggles that can provide more benefit for young swimmers that are afraid of water[6].

In the beginning swim classes, overcoming a strong fear of water, especially for girls, proved to be the biggest challenge for both teachers and students[7]. Learning problems in swimming may vary in information needed, and practice required. But the teacher's key role is to connect students with the essentials. Effective learning depends on the teacher tailoring content to each student's needs and goals, making it challenging enough to be motivating and promote skill development[8]. Swimming skills such as entry and exit in bodies of water, controlling breathing, floating, turning, and propelling are essential competencies in keeping safe or reducing drowning in any individual[9]. Teaching styles has significant influence in promoting motor acquisition in swimming such as the inclusive teaching style that appears much effective over command style[10].

New techniques and innovations appeared in terms of improving the quality of training in swimming particularly in beginners considering the different factors that affect the success of the training program. Instructors may explore contextualized approaches. A study experimented on the effect of a combat swimming training program (CSTP), with and without equipment, on swimming performance among male army officers have revealed significant results, that all groups presented similar peak lactate and peak heart rate values and suggest that only the CSTPE group improved swimming performance in both the 400-m and 4 × 50-m trials [11]. Teachers in teaching swimming must consider that students have individual differences particularly in the cognitive, affective, and psychomotor skills. With the aim of addressing learners' distinct qualities, a study conducted using the ISLAMT2E strategy on static swimming tools has been found to be effective in improving students' freestyle swimming skills[12]. An experiment was conducted to determine the impact of using a buoy on the performance of the 50-meter breaststroke, as well as the differences between the effects of high, medium, and low leg length on the trainees' results. The fishing net buoy was found to be more significant than using the board buoy and pull buoy[13]. Other trainers in different environment mostly use aquatic equipment for diverse purpose in the context of promoting the attainment of aquatic skills[14].

Understanding how different training tools impact young swimmers' performance can help trainers optimize their training programs as well as in developing good technique and among beginners[15]. The FINA launched the special program called 'Swimming for All– Swimming for Life' that provided standard criteria in teaching swimming at a global scale where the use of floating mats and kickboards are suggested as aid particularly in the period of adaptation[16].

The present study featured a class program that was designed with swimming workout essentials and innovation. The experiment using buoyancy aid among swimming beginners may

provide viable knowledge on its applicability in enhancing training experience to both trainers and trainees. This research aimed to determine the effects of a class program with a buoyancy vest (CPBV) to the performance of swimming beginners.

Methods

Sample

There were 30 female college students (N_{All}=30; $N_{Experimental\ group}$=15; $N_{Control\ group}$=15; Age_{All}=18-20), who are swimming beginners with International Swimming Federation Stage 1 competencies[17]. They have abilities such as safe entry into the safe exit out of water, simple immersion at low levels, transitions between different body positions, can open eyes under water, and has respiratory control in the entry and jumping combination tasks. The participants underwent a quasi-experimental design study, however four participants did not qualify or failed to take the post-test. Availability sampling was used to determine the sample size of 30 which was then reduced to 26 at the concluding period of the study. All the participants were majors in physical education taking the swimming class with the same instructor.

Procedures

Participants underwent the intervention for two days a week for six weeks with one hour per session. The subjects were directed to comply with the necessary consent and preliminary health assessment. The study secured approval from the Institutional Ethics Committee of Aklan State University certifying that it observed the ethical standards and guidelines. Likewise, this study observed the guidelines defined in the Declaration of Helsinki[18]. Informed consent was given to the participants stating their roles and important details of their participation.

The study used a quasi-experimental design with time series data analyses. The flow of the study illustrating the variables involved can be found in Figure 1. The experimental group were subjected to a class program with buoyancy vest (CPBV) as shown on Table 1 while the control group followed a traditional class program utilizing kickboards. Both groups underwent the respective interventions for two days a week for six weeks with one hour per session. They were assessed weekly through a crawl stroke swim-off performance test without buoyancy aid on the second day session of each training week except on the first week. Proper warm-up and cool down exercises were done before and after of each class session. Assistants for the start and finish as well as encoders were deployed particularly in the conduct of assessments. Lifeguards and medical personnel were likewise on the swimming pool area as a safety measure.

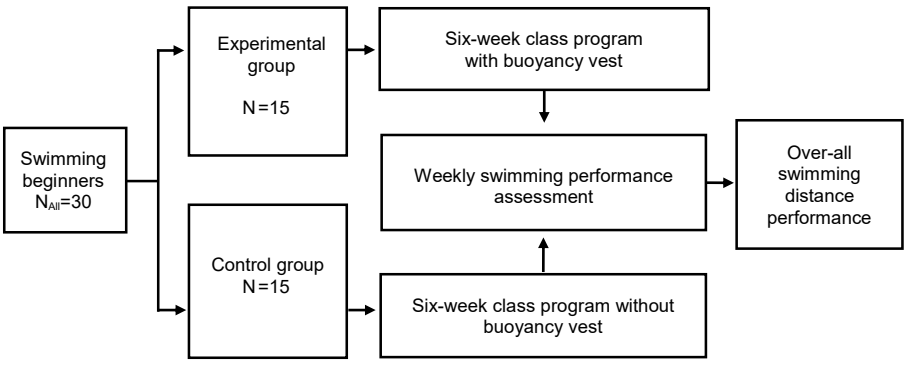

Figure 1. Flow of the study
Source: Author

The participants were trained in a standard swimming pool with eight lap lanes with depth begins at 3.5 feet and 7 feet at the deepest end in a facility located inside the property of the University. The duration of each session is one hour or 60 minutes. As shown in Table 1, the experimental group was subjected to CPBV that includes the use of buoyancy vest and guided by the principles of training such as overload, specificity, reversibility, the FITT Principle (frequency, intensity, type and time) and the Rest, Recovery & Periodization)[19]. The class program for the control group observed similar principles but was designed using kickboards. Both groups include breathing exercises, gliding drills, arm pull, and flutter kick drills.

Table 1. Class Program with Buoyancy Vest

Week	Session	Warm-Up (5min)	Class Proper (50min with 5min Rest at the Half)	Cool Down (5min)	Duration
1	1	Neck Stretches; Shoulder Stretch and Rotation; Arm Circles; Side-Bend Stretch; Torso Rotation; Forward/ Side Lunges; Wrist Flexion/ Extension; Knees Rotation; Standing knee to Chest; Quad Stretch; Ankle Circles; Jumping Jack; and Breathe In-Breath Out	Breathing exercises; Gliding with Buoyancy Vest; Stationary Flutter Kick (Hold at the Pool Gutter)	Neck Stretches; Shoulder/Triceps Stretch; Overhead Stretch; Chest Stretch; Side-Bend Stretch; Wrist Flexion/ Extension; Forward/ Side Lunges; Standing knee to Chest; Quad Stretch; Ankle Stretch/ Flexion; and Breathe In-Breath Out	60min/1hr
	2		Walking with Breathing/Head Turning Drill; Head Down Gliding with Buoyancy Vest; Flutter kick with Head Turning for Breathing (within the 10m mark of the pool)		60min/1hr
2	1		Walking with Breathing/Head Turning Drill; Head Down Gliding with Buoyancy Vest; Flutter kick with Head Turning for Breathing (within the 15m mark of the pool)		60min/1hr
	2		Head Down Gliding with Buoyancy Vest; Flutter kick with Head Turning on One Side (then Other Side) Repeatedly for Breathing- (within the 20m mark of the pool)		60min/1hr
3	1		Head Down Gliding with Buoyancy Vest; Flutter kick with Head Turning on Left and Right Alternately for Breathing (within the 20m mark of the pool)		60min/1hr
	2		Head Down Gliding with Buoyancy Vest; Flutter kick with Head Turning on Left and Right Alternately for Breathing (within the 25m mark of the pool)		60min/1hr
4	1		Head Down-Gliding with Buoyancy Vest; Flutter Kick with One Arm Pulling Repeatedly, Head Turning for Breathing; Repeat with the Other Arm Pulling Repeatedly (within the 20m mark of the pool)		60min/1hr
	2		Head Down-Gliding with Buoyancy Vest; Flutter Kick with One Arm Pulling Repeatedly, Head Turning for Breathing; Repeat with the Other Arm Pulling Repeatedly (with combo-variations within the 25m mark of the pool)		60min/1hr
5	1		Head Down-Gliding with Buoyancy Vest; Flutter Kick with Alternating Arms Pulling, Head Turning for Breathing (Within the 25m mark of the pool)		60min/1hr
	2		Crawl stroke swim-off with Buoyancy Vest; Crawl stroke swim-off without Buoyancy Vest (Within the 30m mark of the pool)		60min/1hr
6	1		Crawl stroke swim-off without Buoyancy Vest; (Within the 30m mark of the pool or beyond)		60min/1hr
	2		Crawl stroke swim-off without Buoyancy Vest; (Within the 30m mark of the pool or beyond)		60min/1hr

Note: *Kickboard was used for the control group instead of the buoyancy vest
Source: Author

Statistical analysis

Descriptive statistics were used for data gathered such as of the monitoring assessments and the posttest. The Friedman Test was utilized in finding the significant differences in the swimming performance within groups and Mann Whitney U Test was used to find the significant difference in the swimming performance between groups. Level of significance was set at 0.05 and the statistical tests were all calculated with the use of the IBM SPSS version 22[20].

Results

The swimming performance of the control group as indicated on Table 2 shows improvement from the baseline performance ($\bar{x}$=4.6 m) up to the post-performance ($\bar{x}$=9.1 m). The group show weekly increase in distance as indicated for week three to week six with $\bar{x}$=5.1m, $\bar{x}$=6.0m, $\bar{x}$=7.2m, and $\bar{x}$=9.1m respectively. The over-all mean of swimming distance performance for the control group is $\bar{x}$=4.5 m.

Table 2. Swimming performance of the control group

Subject	Week 1 (meters)	Week 2 (Baseline) (meters)	Week 3 (meters)	Week 4 (meters)	Week 5 (meters)	Week 6 (Post-test) (meters)	Total Distance Swimming Performance (meters)
1	0	4.6	4.8	5.5	6.8	9.0	4.4
2	0	5.0	5.5	6.2	7.0	9.2	4.2
3	0	4.8	5.0	6.2	7.5	9.7	4.9
4	0	4.8	5.0	5.8	7.0	8.8	4.0
5	0	5.0	5.8	6.8	7.9	9.0	4.0
6	0	4.0	4.8	6.0	7.3	9.5	5.5
7	0	4.5	5.2	6.0	7.5	9.0	4.5
8	0	4.3	4.8	5.6	6.8	8.5	4.2
9	0	4.8	5.0	5.8	7.3	8.6	3.8
10	0	4.0	5.0	6.2	7.5	9.0	5.0
11	0	5.0	5.5	6.0	7.5	8.8	3.8
12	0	4.5	5.2	5.7	6.8	9.0	4.5
13	0	4.0	4.5	5.8	7.2	9.8	5.8
TOTAL	**0**	**59.3**	**66.1**	**77.6**	**94.1**	**117.9**	**58.6**
MEAN	**0**	**4.6**	**5.1**	**6.0**	**7.2**	**9.1**	**4.5**

Source: Author

The indicated increase in the swimming performance of the students from week two to week six was found to have a significant difference (chi-square = 52.00, p-value = 0.000) presented on Table 3. This suggest that a significant improvement is evident in the swimming distance performance of the control group during the traditional swimming program.

Table 3. Difference in the Swimming Performance of the Control Group

Week	Mean	Chi square Value	p-value	Decision
2	4.6			
3	5.1			
4	6.0	52.00	0.000*	Reject Ho
5	7.2			
6	9.1			

Note: Legend: * - significant at 0.05 level
Source: Author

Further analysis in the swimming performance of the control group (see Figure 2) revealed that the significant improvement in the control group happened in week two and week four (adj. p-value = 0.013), week two and week five (adj. p-value = 0.000), week two and week six (adj. p-value = 0.000), week three and week five (adj. p-value = 0.013), week three and week six (adj. p-value = 0.000), and week four and week six (adj. p-value = 0.013). These results suggest that in traditional swimming program, students need at least two weeks of class sessions to improve in their swimming and engaging in longer classes will result in a better swimming distance performance.

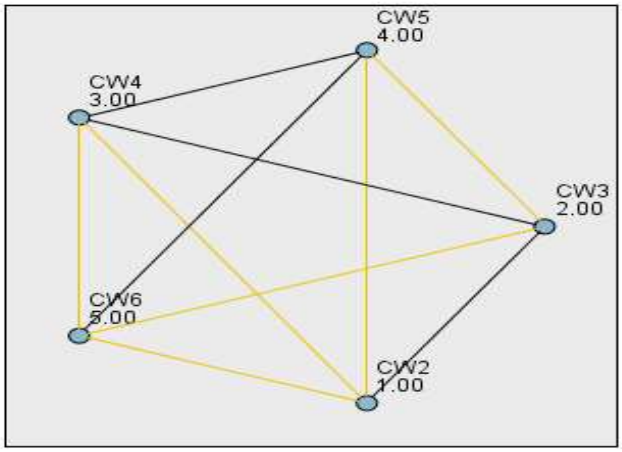

Figure 2. Pairwise comparisons of the swimming performance in the control group.
Note: **CW2** (Control group Week 2). **CW3** (Control group Week 3). **CW4** (Control group Week 4). **CW5** (Control group Week 5). **CW6** (Control group Week 6). Significance level: .05.
Source: Author

The swimming performance of the experimental group as indicated on Table 4 also shows improvement from the baseline performance ($\bar{x}$=5.3 m) up to the post-performance ($\bar{x}$=12.6 m). The class shows weekly increase in distance mean as indicated for week three with $\bar{x}$=6.6 m; week four with $\bar{x}$=8.6 m; week five with $\bar{x}$=10.8 m; and $\bar{x}$=12.6 m for week six. The over-all mean of swimming distance performance for the experimental group is $\bar{x}$=7.2 m.

Table 4. Swimming performance of the experimental group

Subject	Week 1 (meters)	Week 2 (Baseline) (meters)	Week 3 (meters)	Week 4 (meters)	Week 5 (meters)	Week 6 (Post-test) (meters)	Total Swimming Performance (meters)
1	0	5.0	6.5	8.2	10.5	12.5	7.5
2	0	5.5	7.0	9.5	11.5	13.0	7.5
3	0	5.8	7.5	10.0	11.8	13.2	7.4
4	0	5.5	6.8	8.2	10.6	12.2	6.7
5	0	5.6	7.0	9.2	11.5	13.0	7.4
6	0	4.8	6.3	8.2	10.5	12.5	7.7
7	0	5.0	6.4	8.4	10.7	12.2	7.2
8	0	5.4	6.2	8.3	10.8	12.5	7.1
9	0	5.6	6.0	8.2	10.5	12.3	6.7
10	0	5.5	6.1	8.5	10.2	12.5	7.0
11	0	5.8	6.3	8.3	10.3	12.7	6.9
12	0	5.4	6.5	8.6	10.5	12.4	7.0
13	0	4.5	6.7	8.2	10.6	12.3	7.8
TOTAL	**0**	**69.4**	**85.3**	**111.8**	**140**	**163.3**	**93.9**
MEAN	**0**	**5.3**	**6.6**	**8.6**	**10.8**	**12.6**	**7.2**

Source: Author

Moreover, Table 5 showed that the improvement of the experimental group in their swimming performance is significant (chi-square value = 52.00, p-value = 0.000) suggesting that the use of buoyancy vest in the class program is an effective method in improving the swimming distance performance of the students.

Table 5. Difference in the Swimming Performance of the Experimental Group

Week	Mean	Chi square Value	p-value	Decision
2	5.3			
3	6.6			
4	8.6	52.00	0.000*	Reject Ho
5	10.8			
6	12.6			

Note: Legend: * - significant at 0.05 level
Source: Author

Using pairwise comparisons, it is evident that the significant improvement in the experimental group (see Figure 3) materialized in week two and week four adj. p-value = 0.013), week two and week five adj. p-value = 0.000), week two and week six (adj. p-value = 0.000). Significant improvement is also visible in week three and week five adj. p-value = 0.013), week three and week six adj. p-value = 0.000), and week four and week six adj. p-value = 0.013). These implies that using buoyancy vest, students' swimming performance will have significant improvement in at least two weeks of classes. Moreover, the results also implies that longer training using the buoyancy vest will result in a better swimming distance performance.

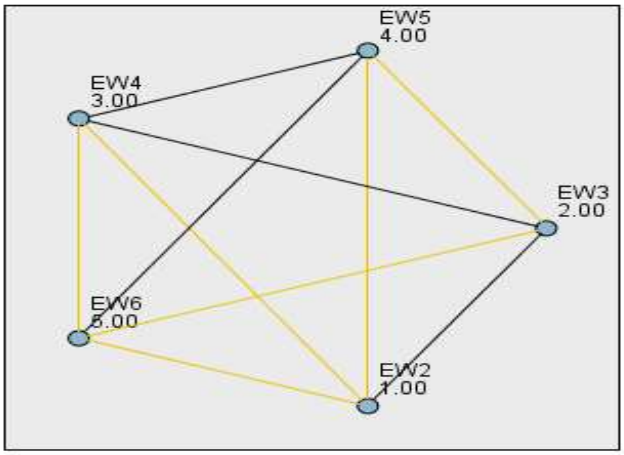

Figure 3. Pairwise comparisons of the swimming performance in the experimental group.
Note: **EW2** (Experimental group Week 2). **EW3** (Experimental group Week 3). **EW4** (Experimental group Week 4). **EW5** (Experimental group Week 5). E**W6** (Experimental group Week 6). Significance level: .05.
Source: The Author

While both the control and experimental group showed significant improvement in their swimming performance, Table 6 showed that students trained with buoyancy vest performed better than the students trained in traditional program (z-value = 4.399, p-value = 0.000). The better performance of the students in the experimental group is evident in all weeks of classes specifically in week two (z-value = 3.566, p-value = 0.000), week three z-value = 4.347, p-value = 0.000), week four z-value = 4.358, p-value = 0.000), week five z-value = 4.354, p-value = 0.000), and week six z-value = 4.359, p-value = 0.000). These results further imply that

utilizing buoyancy vest in the swimming class program provided the students in the experimental group with 0.7 m to 4.4 m advantage than the students in the control group.

Table 6. Difference in the Swimming Performance of the Control and Experimental Group

	Mean	Mean Difference	Z-Value	p-value	Decision
Week 2					
Control Group	4.6	0.7	3.566	0.000*	Reject Ho
Experimental Group	5.3				
Week 3					
Control Group	5.1	1.5	4.347	0.000*	Reject Ho
Experimental Group	6.6				
Week 4					
Control Group	6.0	2.6	4.358	0.000*	Reject Ho
Experimental Group	8.6				
Week 5					
Control Group	7.2	3.6	4.354	0.000*	Reject Ho
Experimental Group	10.8				
Week 6					
Control Group	9.1	4.4	4.359	0.000*	Reject Ho
Experimental Group	12.6				
Average					
Control Group	4.5	2.7	4.339	0.000*	Reject Ho
Experimental Group	7.2				

Note: Legend: * - significant at 0.05 level
Source: Author

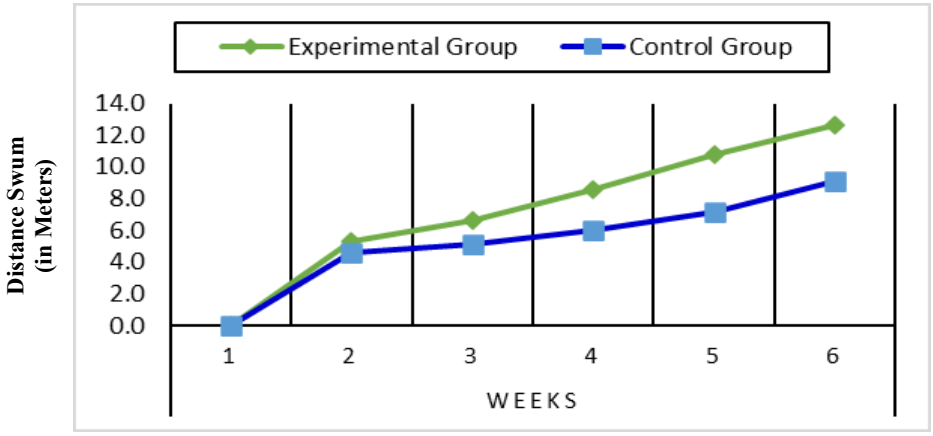

Figure 4. Visualization of the difference in the performance of the students in the control and experimental group.
Source: Author

Discussion

The present study aimed to determine the effect of a class program with buoyancy vest (CPBV) to the swimming performance of beginners. The utilization of the buoyancy vest in the class with swimming beginners was found to be effective as compared to the FINA suggested

class program with kickboard[16]. The assessment results of swimming beginners trained with (CPBV) from the baseline performance to the posttest, shows a substantial increase in swimming distance capability as compared to the other group. With the inclusion of swimming in the basic education[1] as well as in tertiary level, innovations such as using buoyancy aids would help trainers or physical educators attain their goals aside from using kickboards[16]. With the present study focused on learning the crawl stroke, it signifies that certain equipment such as the buoyancy vest can be used to improve specific physical or technical skills as contrary to previously inferred that not all equipment is accepted to be advantageous in assisting swimming beginners[14].

Fear of water among novice is considered as a real challenge for trainers[6], however, the results of the present study shows that such task can be resolved by using buoyancy aid. The use of buoyancy vest would act as stepladders for swimming beginners[21] and was confirmed that it progressively helps learners through the results of the current experiment. This study agrees to the prior knowledge on the benefits of confidence in learning skills such as improvement of participation, learning enjoyment, reduced test anxiety, increased interest in goal seeking, and among others[22]. The periodical assessment process of this study contradicts to the single post assessment implemented in earlier studies. In support of the former, having the progression data would detect the exact point of improvement or decline.

This could guide the trainers in the decision-making regarding training program design. The weekly testing of progress would also contribute in gaining confidence and trust to the training program that would result to increased enthusiasm and focus. This study supports the proper feedbacking during training that would promote a culture of improvement[23]. Swimming trainers use aquatic equipment in consideration of innate purposes[14]. With the limited swimming pools in the Philippines, training may be conducted in rivers, lakes, or even at sea. These conditions make the usage of buoyancy vest purposeful for training and safety.

Swimming training is indeed a challenging task for physical educators and trainers. This poses a risk of long training duration or worst, drowning mishaps. For these reasons, instruments are needed to assist and facilitate the teaching of the motion skills to the students. Some students struggle greatly without a tool to assist them in completing the swimming training procedure. In a related study, it was emphasized that the use of back buoy and flipper test has a notable difference from the group that did not use any aids in terms of swimming distance[24]. These can be an addition to other aids used in different studies such as kickboard, leg float, face mask, swim fins, snorkel, deep float, float belt, buoyancy belt, and hula hoops. The present study has proven that an innovative buoyancy vest can also be added to the list that can be utilized for swimming programs particularly those that caters beginners. With this, teachers or trainers has the role of continuously finding ways to improve the learning experience as well as the extent of skills to be learned in participating the program. On the basis of current studies, new things in swimming training are required in order to give swimming instruction achievable and aligned with the learning objectives[25].

Considering that the intervention in this study focused on the crawl stroke, the researcher acknowledges the potential of different outcomes with other swimming techniques or participants' maturity level. Other limitations of this study include the subjects of the study who were all females and in the tertiary level. Moreover, the uncontrollable external factors such as food intake and physical activities of the participants are considered additional limitations of the study. Therefore, further studies on the effectiveness of the swimming class program focusing other swimming strokes and different set of variables may be explored.

Conclusion

The results of this study showed strong evidence that the class program with the use buoyancy vest among swimming beginners have significant effect in their swimming distance performance. While it is generally accepted that athletes need to go through an adaptation phase where they develop the necessary physiological and psychological qualities, the class program with buoyancy vest explored in this study revealed promising results of minimizing time consumption where adaptation was embedded to the training proper of a specific swimming stroke particularly the crawl. The use of buoyancy vest as part of the swimming class program can allow swimming beginners to be introduced to stroke-specific training earlier even they are still learning to float or gaining confidence in the water. The monitoring of progress through periodical assessments such as swim-off without flotation aids can be a good strategy in finding the effects of interventions made. It could also promote sustained motivation and engagement among the trainees with proper feedbacking. Considering that the intervention in this study focused on the crawl stroke, the researcher acknowledges the potential for different outcomes with other swimming techniques or participants' gender and/or maturity level. Innovative teaching methods are crucial in swim instruction to overcome the known and unknown factors toward accelerating skill acquisition.

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