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THE IMPACT OF AN EDUCATIONAL PROGRAM BASED ON PERFORMING SKILLFUL EXERCISES WITH GRADUAL DIFFICULTY TO IMPROVE CHEST PASS AND BOUNCE PASS SKILLS IN BASKETBALL FOR MIDDLE SCHOOL STUDENTS

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Abstract

The development of motor learning speeds up the execution and enhances accuracy of the tasks. It enables one to recall the motor programmer faster. Fundamentally, tasks should be slowly progressed from easy to difficult in an exercise. **Objective:** Research is conducted for designing an educational program based on easy to hard skill exercises for chest pass and bounce pass in basketball and to test its effectiveness in secondary school students. **Methodology:** A study using an experimental method was conducted on 48 male students of Al-Nobalaa Middle School 2022–2023. By random procedure, the students were assigned to either a control or an experimental group. The experimental group undertook twelve distributed practice exercises in one session per week for six weeks. **Results:** The control group improved but not as much as the experimental group. The experimental group showed 14.26% improvement in speed of chest passes while the control group showed 3.08%, bounce passes accuracy improved by 18.42% vs 12.59%.**Discussion:** The findings are consistent with principles of motor learning that recommend adjusting difficulty in gradual steps and practicing skills in more realistic game contexts. This fourth approach goes beyond just skill teaching. It fosters adaptation of the skills to different situations. The literature is in agreement. **Conclusions:** The proposed program effectively enhanced basketball skills in middle school students. Teachers and trainers are encouraged to adopt this program to achieve similar improvements and explore its application to other skills and diverse populations.

Keywords: Skill Exercises, Chest Pass, Bounce Pass, Basketball.

Introduction

The development of motor learning for sports skills is done through principles and foundations that serve to achieve the mastery of the motor skills, generalization and improvement of abstract motor programs. (Cereda, 2024) These are important for efficient motor performance. We will focus on Ecological Dynamics theory which focuses on how the athlete, exercise and environment interact to help the analyst develop adaptive skills (Davids et al., 2012). Moreover, Nonlinear Pedagogy will ensure that tasks will get progressively more difficult and support the use of new skills outside the game. Motor learning is the learning process, through which any individual can master motor skills during repeated performances. In the process of learning and perfection, the learner undergoes several stages (Petancevski et al., 2022). These frameworks account for both how we move and feel, and they espouse the idea that gaining skills comes via the interactions of different constraints.

In every educational method, it has to show specificity in technique that enables a learner to acquire the skill through a gradual process which has to begin simple and then gradually increase in complexity. This

Proximus Journal of Sports Science and Physical Education
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mechanism guarantees the provision of relevant information and exercises. Moreover, a number of coaches and teachers apply various ideas, methods, and tools to make exercises more complex, directing more effort from learners (Huang et al., 2017; Pesce et al., 2019). There are different factors that physically, mentally, and psychologically affect learning improvement. At these interest levels some coaches or teachers will use innovative strategies to increase the difficulty of exercises that require more effort (Renshaw et al., 2010) The term motor learning strategies refer to many frameworks or approaches that are specific to certain learning conditions (Davids et al., 2012). Education is employing these techniques, both to organize and structure practice that can be used for long-term learning effects and for transfer and generalization (Barzyk and Gruber 2024). To gain the desired results in sports educational process, it is also important to diversify the exercises. At least the techniques to showcase a variety of skill performances that can stimulate and enhance the learners' mental functions. Students who learn basketball can be a decent coach or teacher who has the technical ability to carry out that task (Nugroho et al, 2019). Many specialists emphasize the role of motor learning in steering the learning process as it is an essential component of training and physical education (Moon, 2022) it is important to know and improve how students and athletes learn performance skills.

To enhance the learning of basketball passing techniques, basketball training systems must wholly reflect the player's actions in the game. Basketball requires high-level training on a variety of technical skills (Petway et al., 2020) Always receiving and executing skill exercises help to develop speed and accuracy in performance; without mastery of the skills, speed and accuracy cannot be achieved (Mashkoor and Hameed, 2022). Further, it should be remembered that not every skill can, or may, be executed in one manner only under competition. For instance, basketball passes can be different complexity. The various exceptions specified include stationary passes (on catching the ball), passes after a pivot, stops, feints, a jump, running and one-hand dribbling. Consequently, learners and players pass the ball according to the situation of the game, thus teachers and coaches must analyze every skill in great detail, with varying execution techniques and implementation of game-motor programs (Lee et al., 2014).

This study is important because it contributes something new in addition to the usual way of executing the basketball passing skill. It looks for diversifying execution styles, customizing exercises to specific performance situations and contributing to scientific knowledge of the principle of gradual increase of difficulty. This study could persuade coaches and educators to adopt this approach with useful statistical data as references for basketball researchers and educators out there. Focusing the improvement of skills speed and accuracy of middle school student, the study recognizes that basketball performance is multi-faceted and results from an efficient mix of individual abilities.

Research Problem

According to researchers who observed the process of learning basketball passing techniques in middle schools in Anbar Governorate, we find that the learning process is not consistent with the hopes of achieving the objectives of motor learning and the qualities of an effective educational method for learner. In this setting, passing exercises are carried out mostly in basic forms like stationary chest and bounce passes. In Anbar Governorate, there are training programs of middle schools that do not have individual exercises that gradually increase as occurs in real-life incidents. The emphasis in the education system is different from the game's required skills. Given this context, the researchers propose using gradually challenging repetitions of exercises, derived from fundamental skills, to reflect actual performance scenarios. As advocates of motor learning in basketball, they have identified the research problem scientifically and precisely by posing the following question: *Does an educational program based on performing skill exercises with gradual difficulty improve the chest pass and bounce pass skills in basketball for middle school students?*

Research Objectives

Proximus Journal of Sports Science and Physical Education
Volume 3, Issue 04, April, 2026
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1. The goal of this research is to design a educational program based on an exercise with gradually difficulty whose aim to develop the skill of chest pass and bounce pass in basketball for junior high school students.
2. To find out if a program involving skill exercises that have gradual difficulty has an impact on the basketball chest pass and bounce pass of middle school students.
3. The purpose of this research study was to compare the effectiveness of an experimental educational program me against the control group. The latter of which followed the traditional curriculum.

Research Hypotheses

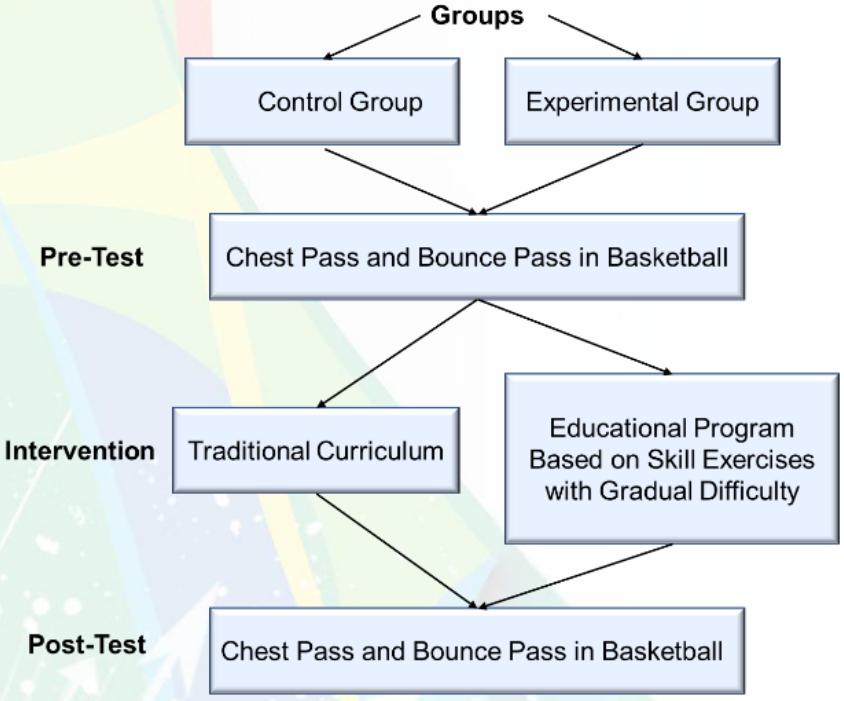
1. "There are statistically significant differences between the pre-test and post-test results for the control and experimental groups in improving chest pass and bounce pass skills in basketball for middle school students".
2. "There are statistically significant differences in the post-test results between the control and experimental groups in improving chest pass and bounce passes skills in basketball for middle school students".

Research Scope

1. **Human Scope:** Second-grade students at Al-Nobalaa Middle School for Boys.
2. **Temporal Scope:** From November 12, 2023, to December 23, 2023.
3. **Spatial Scope:** The basketball court at Al-Nobalaa Middle School for Boys, Ramadi, Anbar Governorate, Iraq.

Method

Researchers ran an experimental research design with two equivalent groups they chose by the coin-toss method where students of A and B section represented the control and experimental groups. Since participants and the instructor could not be blinded, due to the educational nature of the program, there is a potential for bias. The design of the experimental research is shown in Figure 1.



Proximus Journal of Sports Science and Physical Education
Volume 3, Issue 04, April, 2026
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ISSN (E): 2942-9943

Figure 1. Experimental research design.

Population and Sample

Research on the use of checklists for developing critical thinking skills at the second grade: 70 students of A and B class at Ramadi, Anbar governorate during 2022-2023 The sample was chosen on purpose and out of 75, 17 students were excluded for their irregular attendance while another 10 students were excluded for conducting a pilot study. Thus the final sample consisted of 48 students.

With 24 students each, these students were randomly assigned control and experimental groups. Class A served as the control group whereas Class B served as the treatment group. The sample contained 68.57% of the total population.

To control the factor other than the treatment in the research, they made sure that the height, age, body mass gave a value according to the coefficient of variation (C.V) value 1-30. It shows that they are homogeneous enough. The homogeneity of sample is shown in Table 1 below. The sample for the final study included 48 students (with half in each group); however, the logistical and administrative issues at the school precluded conducting a formal power analysis for the study. The sample number of people was selected after taking into account those who missed the study and those who took part in the pilot studies. For better generalizability, applying statically power analysis to determine the correct sample size in future studies is important.

The Directorate of Education in the Anbar Governorate approved the ethics. Prior to data collection, verbal informed consent was obtained from the parents and guardians of the students. All participants provided assent to be in it.

Table 1. Sample Homogeneity (N = 48)

Variable	Unit of Measurement	Mean	Standard Deviation	Coefficient of Variation (C.V.)
Height	cm	158.17	3.42	2.16
Age	years	12.26	1.13	9.21
Body Mass	kg	61.32	2.17	3.53

Data Collection Methods and Tools/Equipment

Data Collection Methods

1. Arabic and international references.
2. Internet resources.
3. Supporting research team.
4. Testing and measurement.

Tools and Equipment

1. HP laptop computer.
2. Height and weight measurement device.
3. Basketball court.
4. Basketballs.
5. Two stopwatch timers.
6. Metric measuring tape.
7. Electronic calculator.

Research Implementation Steps

After reviewing scientific references, the researchers identified the tests required for the study and presented them to experts and specialists for validation. Below is an outline of the research tests:

Selection of Research Tests

Proximus Journal of Sports Science and Physical Education
Volume 3, Issue 04, April, 2026
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

1. **Chest Pass Test** *(Mohammed et al., 2021)*

- **Test Name:** Rapid Passing and Receiving Test
- **Objective:** To measure the speed and accuracy of the chest pass.
- **Tools and Equipment:** Smooth wall, flat surface, electronic stopwatch, official basketball, whistle, and colored tape.
- **Performance Description:**

The participant stands behind a marked line on the ground, positioned 270 cm from the wall. Upon the signal, the participant performs a rapid chest pass to the wall and receives the ball as it rebounds. This is repeated until 10 successful passes are completed.

- **Test Conditions:**
  - The participant must remain behind the marked line.
  - Each pass must cross a line on the wall at a height of 90 cm from the ground.
  - The ball must not be directly hit; it should be received and passed again.
  - If the ball falls to the ground, the participant retrieves it and resumes from behind the line. Only passes that do not touch the ground are counted.
  - The participant completes 10 passes.
  - Participants are allowed two attempts, with the best score recorded.
- **Scoring:**
  Timing starts with the first successful pass and ends when the 10th pass touches the wall. The time is recorded in seconds and fractions thereof. *(Refer to Figure 2 for the test setup and conditions.)*

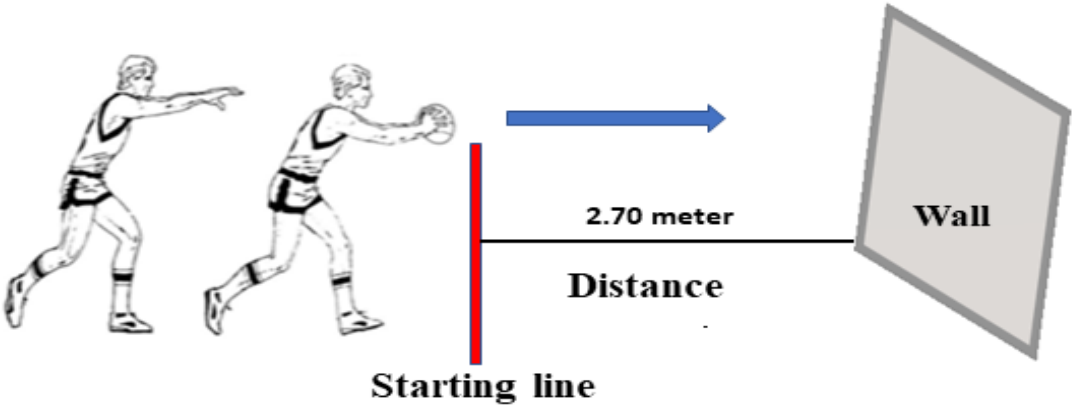

Figure 2. Requirements and conditions for performing the basketball chest pass test.

2. **Bounce Pass Test** (Katie, 2022)

- **Objective:** To measure the accuracy of the bounce pass.
- **Tools and Equipment:**

Smooth wall with a 40 cm diameter circle drawn at a height of 1 meter from the ground, basketball, whistle, and a flat surface with a 40 cm diameter circle marked on it.

- **Performance Description:**

The participant stands behind the shooting line on the ground, 270 cm from the wall and 170 cm from the circle on the floor. Upon the signal, the participant performs a bounce pass aimed at hitting the circle on the ground first, then the circle on the wall. The participant retrieves the ball after it rebounds from the wall and repeats the process until 10 accurate passes are completed.

- **Test Conditions:**
  - All passes must be executed from behind the designated line on the ground.

Proximus Journal of Sports Science and Physical Education
Volume 3, Issue 04, April, 2026
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ISSN (E): 2942-9943

- Should it happen to fall to the ground during the test, the participant must go retrieve it and continue from behind the line.
- You may attempt two times and the better of the two scores will be considered..

- **Scoring:**
  Each bounce pass that hits the circle on the ground scores 1 point, and each pass that hits the circle on the wall scores an additional 1 point. The maximum score for 10 passes is 20 points. *(Refer to Figure 3 for the test setup and evaluation criteria.)*

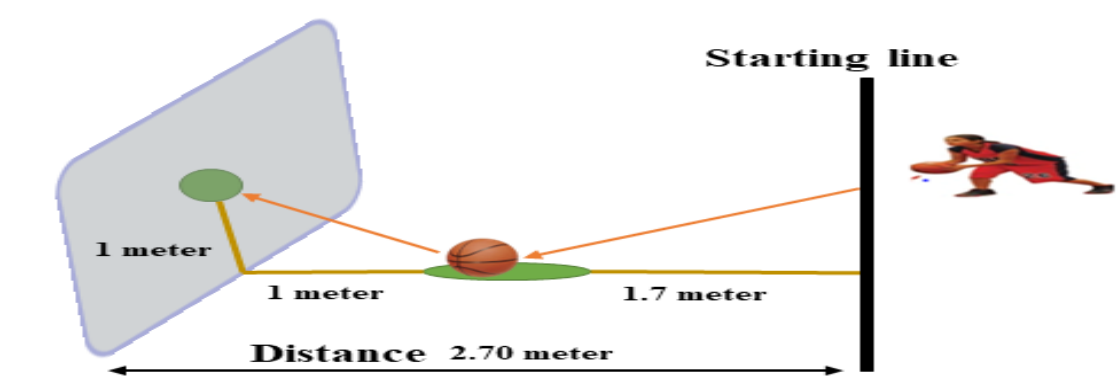

Figure 3. Instructional diagram for bounce pass testing conditions and evaluation.

Pilot Study

A pilot study was carried out on October 8th Sunday using a sample size of 10 students. The objectives of the pilot study were to:

1. Test the adequacy of the research instruments.
2. Find out the time required for the tests to be conducted.
3. Discover any problems that may arise when administering the tests.
4. Make sure that the participants understand the test procedures

This pilot study proved successful in meeting its intended goals.

Scientific Basis for the Research Tests

1. **Validity of the Test:**

Validity was proved through content validation. The questionnaire was distributed among five professionals who gave a perfect score (100%).

2. **Reliability of the Test:**

The reliability of the test was determined using the test-retest approach. The test was first carried out among the pilot group on Sunday, 15th October 2023, and repeated after one week on Sunday, 22nd October 2023. Pearson's product moment correlation (r) was calculated as follows:

- Chest pass test: r=0.84r = 0.84r=0.84
- Bounce pass test: r=0.81r = 0.81r=0.81
- Both values exceeded the critical value of 0.63 at a significance level of p<0.05p < 0.05p<0.05 with 8 degrees of freedom, indicating strong reliability.

3. **Objectivity of the Test:**

Objectivity was achieved through the clarity of the tests, which were without any subjective component and easily understandable. Objectivity in the assessment was achieved by using quantifiable factors like time and scores.

Proximus Journal of Sports Science and Physical Education
Volume 3, Issue 04, April, 2026
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

Preparatory Educational Unit:

Physical education teachers try to discover a more efficient way of teaching so as to improve educational performance. Learning is not a matter of repetition but a continuous activity in which learners acquire new skills and knowledge. This leads to the improvement of learners' ability (Mohammed & Rachid, 2024).

The preparation of the instructional lesson for the experimental group was carried out before the commencement of the educational program on Sunday, 29 October 2023. The preparation involved:

1. An explanation of basketball rules.
2. Introducing students to the correct way of holding a basketball.
3. Teaching students the correct technique for executing chosen skills,

Pre-Tests

The pre-test procedure was done on Monday, 6 November 2023, at 10:00 a.m., with the assistance team working hand-in-hand with the two experimental groups on the basketball field at Al-Nobalaa Middle School. Both variables, namely the chest-pass time and bounce-pass precision, were measured during the assessment. It was found that the two groups were equal since the values of t obtained from their comparison were less than t-critical = 2.02 (P = 0.05, df = 46), as shown in Table 2.

Table 2. Equivalence between the Control and Experimental Groups

Variable	Unit of Measurement	Control Group (Mean ± SD)	Experimental Group (Mean ± SD)	t-value	Significance
Chest Pass	Time (s)	12.85 ± 1.28	13.5 ± 2.04	1.32	Not Significant
Bounce Pass	Points	9.30 ± 1.72	9.45 ± 1.51	0.32	Not Significant
* Critical t-value = 2.02 at p<0.05, 46 degrees of freedom.					

Main Experiment:

Based on their knowledge and after reviewing relevant literature, the researchers developed 12 specific tasks suited for an educational program which would meet the research goals. This was done in order to put into practice the idea of progressive increase in difficulty level, which is the essence of motor learning. While the control group followed the regular syllabus taught by the tutor, the only difference being that both groups underwent similar warm-up and cooling-off exercises, but performed different tasks during the main exercise sessions..

The experiment began on Sunday, November 12, 2023, following the prescribed academic schedule and continued for six weeks, with each week having one lesson session. In each lesson session, there were three tests conducted using the distributed practice approach. The experiment ended on Saturday, December 23, 2023.

The drill activities provided involve gradually escalating levels of difficulty regarding the performance of chest and bounce passes in basketball. More specifically, they include the following:

1. One dribble right hand pass
2. One dribble left hand pass
3. Two dribble right hand pass
4. Left hand 2 Dribble Passing
5. Left Dribble – Crossover – Right Air Pass

Proximus Journal of Sports Science and Physical Education
Volume 3, Issue 04, April, 2026
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

6. Right Dribble – Crossover – Left Air Pass
7. Scoops Passing
8. 1 Dribble Scoop Passing
9. 2 Dribble Scoop Passing
10. Crossover Air Dribble Passing
11. Switch Passing
12. Behind the Back Bounce Passing

Sample Educational Unit for the Experimental Group (Unit 1)

Educational Unit

Main Section

- **Educational Goal:** Familiarize students with system and cooperation.
- **Unit Duration:** 45 minutes.
- **Learning Goal:** Improve chest pass skills among students.
- **Behavioral Goal:** Students will execute the chest pass skill with precision.
- **Date:** November 12, 2023.
- **Number of Students:** 24.

Table 3. Model of an educational unit for the main section of the experimental group

Exercise	Execution Time (s)	Repetitions	Sets	Rest Between Reps (s)	Rest Between Sets (s)	Exercise Time (min
Passing Right hand 1 Dribble	5	6	3	20	60	9.5
Passing Left hand 1 Dribble	5	6	3	20	60	9.5
Passing Right hand 2 Dribble	5	6	3	20	60	9.5
Total Exercise Time: 28.5 minutes						

Subsequent sessions maintained the same instructional design but gradually progressed to more complex and realistic tasks. For instance, the first few sessions emphasized single-hand dribbling passes. However, later sessions incorporated dynamic dribbling passes using crossover dribbling techniques and behind-the-back passes in a game-like setting. This reflects the concept of progression, which helps players adapt to new task constraints and develop their skills. An example of this unit design is illustrated in Table 3.

Post-Tests

The post-tests were conducted under the same conditions and procedures as the pre-tests, in terms of timing and location, on **Sunday, December 26, 2023**.

Statistical Methods (Hardwick et al., 2013):

- Arithmetic mean
- Standard deviation
- Coefficient of variation (C.V.)
- Pearson correlation coefficient (RRR)
- Independent t-test for unpaired samples
- Paired t-test for dependent samples

Proximus Journal of Sports Science and Physical Education
Volume 3, Issue 04, April, 2026
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

- Improvement percentage formula.

Results

This study produced a detailed analysis of the effects of this program on basketball chest pass and bounce pass skill development. The findings are based on the comparison of performance outcomes between the experimental group, which followed the skill focused program, and the control group, which followed the traditional curriculum. Below are presented detailed statistical analyses of pre and post test results for both groups, demonstrating effectiveness

***Pre- and Post-Test Results for the Experimental Group*:**

As shown in Table 4, there are statistically significant differences between the pre- and post-test results for the experimental group in both chest pass and bounce pass tests, favoring the post-test. The calculated t-values (7.65 and 9.28) exceeded the critical t-value of 2.06 at a significance level of 0.05 with 23 degrees of freedom. Figures 2 and 3 illustrate the means of the pre- and post-test results for the experimental group.

Table 4. Experimental Group Pre- and Post-Test Results

Test	Unit	Pre-Test (Mean ± SD)	Post-Test (Mean ± SD)	Mean Difference	Std. Error	Calculated T-Value	Significance	Effect Size (Cohen's d)
Chest Pass	Time (s)	13.5 ± 2.04	10.13 ± 1.18	3.37	2.17	7.65	Significant	1.87
Bounce Pass	Points	9.45 ± 1.51	13.72 ± 1.21	4.27	2.28	9.28	Significant	3.20
* Critical t-value = 2.06 at $p<0.05$, 23 degrees of freedom.								

To add to the information from the t-test and estimate the size of the change, Cohen's d was computed. Cohen's d shows the effect size by converting the difference between two means to standard deviation units. Following Cohen's criteria, a d value of 0.2 is little, 0.5 is intermediate and 0.8 or above is large. Calculating effect sizes makes it easier to judge the practical effects of a study, not just the statistical ones. In the experimental group, the improvement in chest pass speed (Cohen's d = 1.87) showed a large and important impact resulting from the intervention. The effect size for bounce pass accuracy was also very large (Cohen's d = 3.20), demonstrating a major improvement in skill. The program appeared to make participants pass the course materials faster and more accurately.

Pre- and Post-Test Results for the Control Group:

Table 5 indicates statistically significant differences between the pre- and post-test results for the control group in both chest pass and bounce pass tests, also favoring the post-test. The calculated t-values (3.43 and 5.95) exceeded the critical t-value of 2.06 at a significance level of 0.05 with 23 degrees of freedom. Figures 4 and 5 illustrate the means of the pre- and post-test results for the control group.

Table 5. Control Group Pre- and Post-Test Results

Test	Unit	Pre-Test (Mean ± SD)	Post-Test (Mean ± SD)	Mean Difference	Std. Error	Calculated T-Value	Significance	Effect Size

Proximus Journal of Sports Science and Physical Education
Volume 3, Issue 04, April, 2026
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

								(Cohen's d)
Chest Pass	Time (s)	12.85 ± 1.28	12.08 ± 0.98	0.77	1.13	3.43	Significant	0.68
Bounce Pass	Points	9.30 ± 1.72	11.98 ± 0.13	2.68	2.23	5.95	Significant	2.20

* Critical t-value = 2.06 at $p<0.05$, 23 degrees of freedom.

A moderate effect size (d = 0.68) in the control group points to an improvement that can be noticed, but it is still moderately small. The big effect size for bounce pass accuracy (d = 2.20) means that the method used in the traditional curriculum has a strong real-life influence on performance

Post-Test Results Between Experimental and Control Groups:

Table 6 demonstrates statistically significant differences in the post-test results between the experimental and control groups in both chest pass and bounce pass tests, favoring the experimental group. The calculated t-values (6.29 and 7.25) exceeded the critical t-value of 2.02 at a significance level of 0.05 with 46 degrees of freedom.

Table 6. Post-Test Results Comparison Between Experimental and Control Groups

Test	Unit	Control Group (Mean ± SD)	Experimental Group (Mean ± SD)	Calculated T-Value	Significance	Effect Size (Cohen's d)
Chest Pass	Time (s)	12.08 ± 0.98	10.13 ± 1.18	6.29	Significant	1.80
Bounce Pass	Points	11.98 ± 0.13	13.72 ± 1.21	7.25	Significant	2.02

* Critical t-value = 2.02 at $p<0.05$, 46 degrees of freedom.

The result proved that the experiment group showed considerable effects when compared to the other groups. According to Cohen's d of 1.80 on the chest pass speed and 2.02 on the bounce pass accuracy, the new program surpassed the old one..

Improvement Percentages:

The results shown in Table 6 demonstrate the percentages of improvements, showing that the experimental group was superior to the control group in terms of the velocity of chest pass and accuracy of bounce pass skills.

Discussion

The enhancement witnessed in terms of speed and accuracy in execution of the chosen variables is attributed to the suggested exercises, which were taken directly from real life situations and skills in the games. Basketball players do not necessarily have to do chest passes when standing stationary but may also do them while dribbling and making other motions. These diversifications among the students' motor programs resulted in reduction of execution time and increased accuracy. These findings support the research findings by

Proximus Journal of Sports Science and Physical Education
Volume 3, Issue 04, April, 2026
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ISSN (E): 2942-9943

Koryahin et al. (2019), who highlight the effectiveness of learning through games by improving basketball skills as a result of conducting certain actions in competitions using effective training programs.

There are many achievements associated with the project, including using the motor learning concept by gradually increasing exercise difficulties with passing basketball exercises. In addition, this research supports the findings by Karhoot and Mohammed (2020), who found out that some sports skills require an organized instructional strategy to achieve two key objectives: execution precision and accuracy. The use of right techniques and devices can minimize efforts and time needed for acquiring motor skills, thus producing useful results. To support the findings, the improvement percentages highlight the superiority of the experimental group (see Table 7). The improvement in chest pass speed was 14.26% for the experimental group, significantly higher than the control group's 3.08%. Similarly, the improvement in bounce pass accuracy for the experimental group was 18.42%, surpassing the control group's 12.59%.

Table 7. Improvement Percentages in Chest Pass Speed and Bounce Pass Accuracy

Test	Group	Pre-Test	Post-Test	Improvement (%)
Chest Pass Speed	Experimental Group	13.5	10.13	14.26
	Control Group	12.85	12.08	3.08
BouncePass Accuracy	Experimental Group	9.45	13.72	18.42
	Control Group	9.30	11.98	12.59

The results align with the views of Ecological Dynamics which emphasize the significance of body-task-environment relationships in movement control (Chow et al., 2011). The order of tasks was arranged in a progressive manner which is reminiscent of Nonlinear Pedagogy ensuring deeper learning and easier transfer of learning in other contexts. Similar findings were reported by (Moy et al. 2020), who showed that a constraint-led physical education lesson enhanced motor skill performance in a complex technical sport task. The substantial changes observed in this study, with Cohen's d values indicating a strong effect size for both the chest pass (1.87) and bounce pass (3.20), shows both the statistical significance and educational impact of the intervention as the students were able to perform better. Through the use of true-to-life training situations and the principles of motor learning, participants were successfully taught and made able to transfer skills across a range of situations.

Conclusions:

1. The educational program consisting of exercises with increasing levels of difficulty used in the experiment can be successful and useful for improving the speed of the chest pass and the accuracy of the bounce pass in middle school athletes in the experimental group.
2. The traditional curriculum was positively related to performance gains in the control group, albeit the size of the gain was not as significant as that of the experimental group.
3. Post-test comparisons between the groups suggested that the experimental program based on progressive difficulty and representative practice was more effective than a traditional curriculum in improving basketball passing skill.
4. The performance improvement of the experimental group may have come from the distributed practice method's effectiveness on the utilization of the suitable rest period consistent with motor learning and fatigue principles.

And recommendations are:

Proximus Journal of Sports Science and Physical Education
Volume 3, Issue 04, April, 2026
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

1. Teachers and coaches should implement the educational program and exercise model used in the study group to develop technical skills through basketball instruction.
2. The guideline is to make a task more complex only after the learner has already shown sufficient capacity through their previous successes.
3. Further research should apply progressive task-based intervention to other basketball skills such as shooting, dribbling and defensive movements.
4. The researcher recommends that the program be validated in a wider variety of populations, which includes female students, to judge the responses of performance based on gender and create a more inclusive educational design for students.

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