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The Effects Of Focused Training On Non-Dominant Throwing In Teenagers

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The obesity rate in children and teens in the U.S. is 17% (Brown et al,. (2016). This is in part due to physical inactivity. Other factors come into consideration such as diet and genetics, but that does not discourage the need for physical activity (Brown et al,. (2016). Lack of appropriate physical activity can lead to a less healthy lifestyle in the future (Hills & Byrne (2011). There is strong evidence supporting beneficial effects of physical activity on health, in areas such as cancer, cardiovascular health, musculoskeletal health, metabolic health, and neurocognitive health.(Miko et al,. (2020). Although ambidexterity may not always be beneficial to athletes in performance of their day to day tasks, learning a new motor skill can have other benefits. These benefits may include improvements in cognitive health and quality of life (Anderson, 2009; Mike, et al,2020).

Motor Skills

Pushing the body to learn new skills can be beneficial. Motor skills are common in almost all children and developing motor skills is essential to quality of life. (Bahar & Alif, 2020). As children motor skills are essential to quality growth. However, the importance of motor skill development does not end there.

As humans we are born with the ability to move, and we are given the brain function to learn to move skillfully. Learning plays a major role in development. Children especially are very open to learning. The continuous development of the brain allows for rapid motor skill growth as children grow and mature. In the past few decades there has been data that shows that our brains retain the neural plasticity throughout our life and not just in our childhood (Anderson (2009). Children are much more susceptible to motor skill growth. However, this does not mean adults lose the ability to develop motor skills. Skills can continually be developed throughout a

person's life the ability to develop the skill just becomes more difficult. The benefits of motor skill development are also retained throughout a person's life.

Muscle Development

As motor skills develop muscles also begin to grow and develop. Multiple repetitions varying in duration leads to muscle growth. Muscle growth is an essential part of skill development. As the skill is practiced and developed the muscles grow and strengthen. This leads to muscle memory which allows for the skill to be regularly used without difficulty. As a child grows this is an easier task that is naturally developed as the body grows and muscles build. As people age they become more habit based. Their dominant muscle uses and skills develop which causes more difficulty when trying to develop new skills. However, new skills can still be learned (Schoenfeld et al, 2015).

Throwing Mechanics

Throwing mechanics can be one of the more difficult skills to learn due to the multiple movements and muscles needed to effectively throw. However, according to a study done by Ning, Faro, Sue, and Hamilton the mechanical differences are not as difficult to transfer when switching from dominant to non-dominant. The study found that students threw with significantly more velocity and power with the dominant hand, but when the students switched hands the throwing mechanics were relatively similar. They noted the novice style of throwing shown by the individuals when using their non-dominant hand. However, the students demonstrated similar patterns of throwing when using both forms. The significant difference was when students used the non-dominant hand they had much less mechanical stability which led to a lack of acceleration which lessened velocity (Ning et al., (1999). While individuals struggle with switching the use of their dominant and non-dominant hand it may not be as difficult as

perceived. The basic mechanics are still seen even if they are less developed, but the skill can still be performed with practice.

In order to train non-dominant throwing, effective drills are needed to train. Individuals attempting to throw typically follow some sort of motion similar to pitching. An effective pitching drill is having an individual pick up their leg and stride out without a ball at first. Then the individual progresses this to using a ball but not letting go. Then the individual eventually progresses to releasing the ball. This allows the individual to gradually build familiarity with the motions and feelings of throwing the ball effectively (Whitely, 2007). Effective throwing mechanics are gradually built overtime. Allowing individuals to gradually build gives them the chance to become effective without building detrimental habits.

Conclusion

Physical activity and learning motor skills has the opportunity to improve quality of life. Most motor skill learning takes place in childhood, but neural plasticity is retained throughout life. Learning new motor skills can lead to improved physical and cognitive health. Throwing is just on of many possible motor skills to learn that can improve quality of life. The purpose of this study is to determine the effects of training on non-dominant throwing. My hypothesis are as follows: Individuals who receive training will show more growth than those who were not trained. Individuals with training will show similar growth patterns to the untrained group. Individuals with training will show less growth than those who did not receive training.

Purpose Statement

The purpose of this study was to determine whether focused training has an effect on non-dominant hand throwing of teenagers. A definition of key terms in the study is provided here.

Definition of Terms

Throwing Power. For the purpose of this study, this was defined as the farthest distance participants can successfully throw a foam ball into a fielding net target measured in yards (range of 5 to 40 yards)

Throwing Accuracy. For the purpose of this study, this was defined as the number of times (consecutive hits) participants successfully threw a foam ball to strike a fielding net. After each accurate hit, a five yard distance increment from the target was added for the next throw.

Throwing Limit. For the purpose of this study, this was defined as the distance in yards (range of 5 to 40 yards) at which participants could no longer accurately throw a foam ball to strike the fielding net.

Hypotheses

HA_1 - Focused training of non-dominant hand training will improve the throwing accuracy of teenagers after controlling for baseline throwing accuracy.

HA_2 - Focused training of on-dominant hand training will improve the throwing power of teenagers after controlling for baseline throwing power.

HA_3 - Focused training of non-dominant hand training will improve the throwing limit of teenagers after controlling for baseline throwing limit.

Method

Participants

Participants were a convenience sample of 33 male students in grades 9-12 enrolled in two physical education (PE) classes at a high school in central Arkansas. Both classes met three times during the week on Monday, Wednesday, Friday (45 minutes each day). Students in the morning period class (3rd Period) served as the experimental group and students in the afternoon

period class (5th Period) served as the control group. Although 21 students were enrolled in 3rd period class and 22 students were enrolled in the 5th period class, only 18 and 15 students respectively completed the study in each class. Demographics characteristics of the students are provided in Table 1.

Table 1

Demographic Characteristics of Participants

	Throwing Training	No Training	Total
Ethnicity	*n* (%)	*n* (%)	*n (%)*
White	17(61)	11(39)	28(100)
Hispanic	1(25)	3(75)	4(100)
Asian American	0(0)	1(100)	1(100)
Number of Sports			
None	12(50)	12(50)	24(100)
One Sport	4(57)	3(43)	7(100)
Two Sports	2(100)	0(0)	2(100)
Sports Played			
None	12(50)	12(50)	24(100)
Basketball/Football	1(100)	0(0)	1(100)
Football	1(50)	1(50)	2(100)
Soccer	2(67)	1(33)	3(100)

Basketball	1(50)	1(50)	2(100)
Baseball/Football	1(100)	0(1)	1(100)
Dominant Hand			
Right-handed	16(55)	13(45)	29(100)
Left-handed	2(100)	0(0)	2(100)
Ambidextrous	0(0)	2(100)	2(100)
Grade Level			
Nineth	5(83)	1(17)	6(100)
Tenth	9(53)	8(47)	17(100)
Eleventh	4(40)	6(60)	10(100)

Instrumentation

The instruments used for this study included tools to measure throwing power, throwing accuracy and throwing distance limit. A 7ft by 7ft fielding net with about 3 inches of ground clearance that was set up in an indoor football training facility served the throwing target. The fielding net was placed at the end zone of the football field (at zero yards). Throwing and throwing training were carried out using a dense foam ball 9 inches in diameter and approximately 0.3 lbs in weight. A foam ball was used for throwing to minimize injury to participants. Throwing accuracy was measured by the number of successful throws with the ball (i.e. the ball made contact with the fielding net frame anywhere excluding the part of the frame that was used to anchor the field net to the floor (legs). Throwing power and throwing limit were measured in yards (from the field net) using the yard markings on the football field.

Procedure and Experimental Protocol

This study was designed as a quasi-experimental nonequivalent sample control samples study. Before conducting the study, approval was received from the university IRB and the high school administrators. Participants were also provided informed consent and were informed that they were under no obligation to participate or complete the study protocols. The PE class that met during the 3rd period of the day (time) was assigned to the experimental condition and the class that was scheduled for the 5th period of the day (time) served as the control group. The study lasted for four weeks in the month of April.

Every day the trained group would come in and they would begin the day with about ten minutes or at least fifteen repetitions of training a day. The two primary drills used were the wall drill and throwing back and forth to a partner using only their non-dominant hand. These drills can have different names and can be used to train different areas of throwing but for our purposes it was used as progressive throwing training. These drills worked on throwing progression primarily for pitching. The wall drill works on stride length, arm motion, and body motion. Pitching motion has been described in a series of five phases. Phase one is the wind up where the leg is brought up and the arm brought back to prepare to throw. Phase two is cocking, this is where the ball is raised behind the thrower's head as they stride out. Phase three is acceleration where the arm is brought forward as the hips and torso also come around and forward. Phase four is deceleration, this is when the ball is released and the body slows down. Phase five is the follow through, this is when the momentum of the body pulls the back leg forward and the throwing arm comes across the body as it finishes its motion. These five phases were addressed in the wall drill and the partner throwing drill. One of these drills was done every day except Friday which was test day. These two classes each participated in three non-dominant

hand throwing tests over the course of the study. Participants in the control group received no throwing training during the time of the study. Participants in this group spent the 45 minute PE class period engaged in regular physical education activities (e.g. kickball, basketball, football, wiffleball, ultimate frisbee, and soccer).

On the Friday of each week during the study period, all students (experimental and control groups) participated in activities to measure and record their throwing distance, throwing power, and throwing distance limit. During the measurement sessions, each participant was allowed to continue throwing attempts until a total of two consecutive missed throws occurred, after which their throw limit distance was recorded. Each participant took their first thow standing five (5) yards from the fielding net. Once an accurate throw was recorded, participants were required to step backwards for five (5) yards to take their next throw. Data analysis involved a mixed factorial analysis of covariance (ANCOVA) with an alpha level set at 0.05 for testing each of the three null hypotheses. For each test, the baseline outcome measures (Throw Power, Throw Distance, and Throw Distance Limit - Week 2) were included in the model as covariates while the outcome measures for the subsequent weeks (Week 3 versus Week 4) were included as a between-subjects variable. Class period (3rd Period/Experimental and 5th Period/Control) was included in the model as a between subjects variable.

Results

To test the hypotheses in this study three mixed analyses of covariance (ANCOVA) were performed. Before conducting ANCOVA independent sample t-tests were performed to determine if there were differences between the groups before the beginning of the nondominant hand throwing training. For this analysis, the average throwing power, average throwing distance, and average throwing distance limit recorded during Week 2 of the study for the

experimental and control groups were compared. Results of this test revealed no statistically significant differences between the groups on these outcomes (see Table 2).

Table 2

Outcomes at Baseline - Experimental (Focused Throwing Training) and Control Group

Outcome	Group	*n*	Mean	SD	*t*	Probability
Throwing Accuracy	Throwing Training	18	1.78	0.81	0.85	.404
	Control	15	2.13	1.55		
Throwing Power	Throwing Training	18	13.89	4.04	0.34	.738
	Control	15	14.67	8.76		
Throwing Limit	Throwing Training	18	18.89	4.04	0.21	.834
	Control	18	19.33	7.76		

p<.05* p<.01** p<.001***

Hypothesis One

To test the null hypothesis associated with this hypothesis, a 2x2 factorial ANCOVA analysis was conducted. Before conducting the test, the test assumptions were examined (independence of observations, normal distribution, homogeneity of variances, and homogeneity of regression slopes). These assumptions were met and therefore ANCOVA was conducted. Table 3 provides a summary of the descriptive statistics as well the adjusted and unadjusted means for this analysis.

Table 3

Adjusted and Unadjusted Group Means and Variability for Throwing Accuracy (Week 3 and

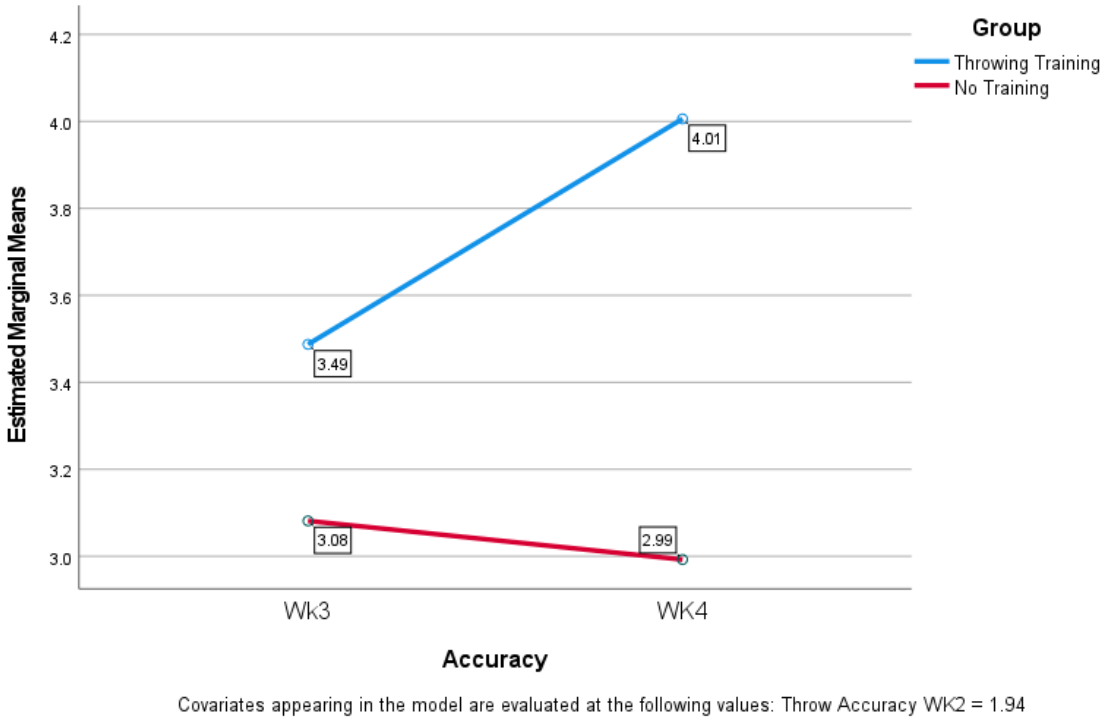
Week 4) after Controlling for Baseline Throwing Accuracy (Week 2)

		Unadjusted		Adjusted	
	N	*M*	*SD*	*M*	*SE*
Throwing Training (WK3)	18	3.33	0.91	3.49	0.16
Control (WK3)	15	3.27	1.71	3.08	0.18
Throwing Training (WK4)	18	3.83	1.25	4.01	0.20
Control (WK4)	15	3.20	1.54	2.99	0.22

The results indicated that throwing accuracy at Week 2 was a statistically significant covariate $F(1, 30) = 87.90$, $p < .001$. Furthermore, there was a statistically significant main effect for training $F(1, 30) = 7.72$, $p = .009$; but not for weeks $F(1, 30) = .002$, $p = .969$. However, this was qualified by a statistically significant interaction between training and weeks $F(1, 30) = 10.01$, $p = .004$. Because of this interaction, the simple effects of training were examined for the two time periods (Week 3) and (Week 4). These results revealed that although the difference in throwing accuracy between the groups were not statistically at Week 3 $F(1, 30) = 2.81$, $p = .104$, partial eta squared = .09, by Week 4, throwing accuracy for the trained group had improved significantly over that of the no training group $F(1, 30) = 11.37$, $p = .002$, partial eta squared = .283 (See Table 3 and Figure 1) . On the basis of these results the null hypothesis was rejected and H_A1 was supported. Figure 1 provides a visual summary of the differences in throwing accuracy between the experimental group that received focused training and the control group at week3 and at week 4.

Figure 1

Throwing Accuracy by Training (Week 3 and Week 4 - Controlling for Baseline - Week 2)



Hypothesis Two

To test the null hypothesis associated with hypothesis two, a 2x2 factorial ANCOVA analysis was also conducted. Before conducting the test, assumptions were examined and met. Table 4 provides a summary of the descriptive statistics as well the adjusted and unadjusted means for this analysis.

Table 4

Adjusted and Unadjusted Group Means and Variability for Throwing Power (Week 3 and Week 4) after Controlling for Baseline Throwing Power (Week 2)

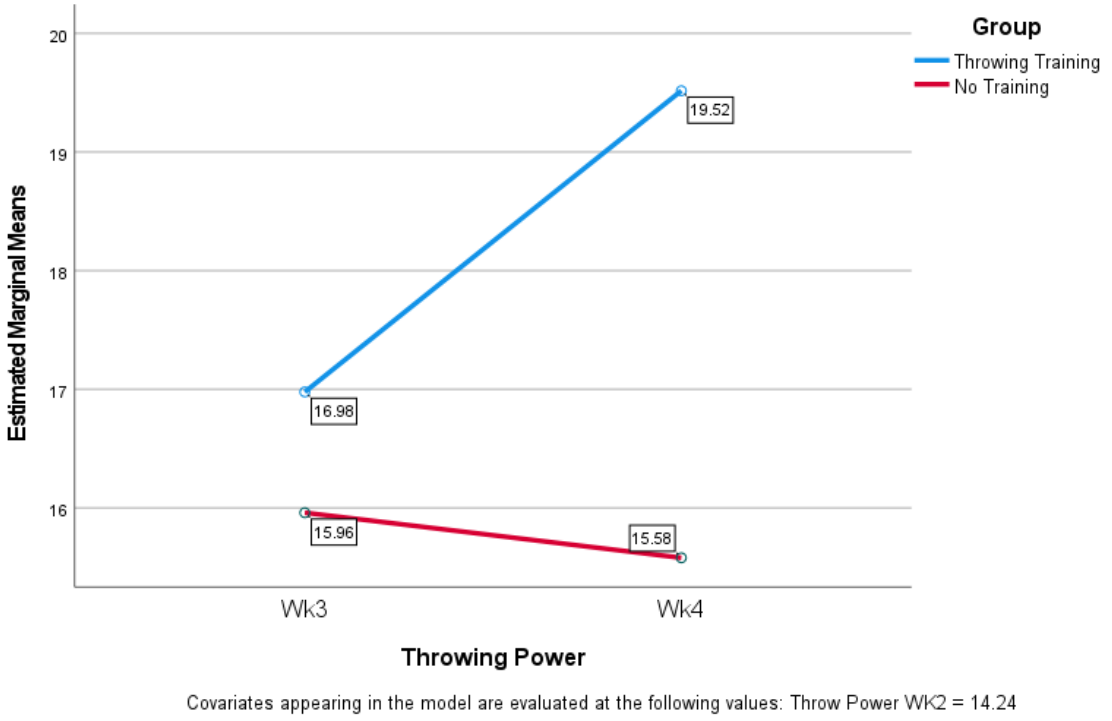
		Unadjusted		Adjusted	
	N	*M*	*SD*	*M*	*SE*
Throwing Training (WK3)	18	16.67	4.54	16.98	0.78

Control (WK3)	15	16.33	8.55	15.96	0.85
Throwing Training (WK4)	18	19.17	6.24	19.52	0.96
Control (WK4)	15	16.00	9.10	15.58	1.05

The results indicated that throwing power at Week 2 was a statistically significant covariate $F(1, 30) = 99.64$, $p < .001$. Furthermore, there was a statistically significant main effect for training $F(1, 30) = 4.22$, $p = .049$; but not for weeks $F(1, 30) = .177$, $p = .677$. However, there was a statistically significant interaction between training and weeks $F(1, 30) = 34.72$, $p = .004$. Because of this interaction, the simple effects of training were examined for the two time periods (Week 3) and (Week 4). These results revealed that although the difference in throwing accuracy between the groups were not statistically at Week 3 $F(1, 30) = 0.78$, $p = .384$, partial eta squared = .03, by Week 4, throwing accuracy for the trained group had improved significantly over that of the no training group $F(1, 30) = 7.63$, $p = .010$, partial eta squared = .20 (See Table 4 and Figure 2). On the basis of these results the null hypothesis was rejected and H_A1 was supported. Figure 2 provides a visual summary of the differences in throwing accuracy between the experimental group that received focused training during weeks 3 and 4.

Figure 2

Throwing Power by Training (Week 3 and Week 4 - Controlling for Baseline - Week 2)



Hypothesis Three

Finally, to test the null hypothesis associated with hypothesis three, a 2x2 factorial ANCOVA analysis was conducted. For this analysis, the test assumptions were examined and considered met as with the other hypotheses. Table 5 provides a summary of the descriptive statistics as well the adjusted and unadjusted means for this analysis.

Table 5

Adjusted and Unadjusted Group Means and Variability for Throwing Limit (Week 3 and Week 4) after Controlling for Baseline Throwing Limit (Week 2)

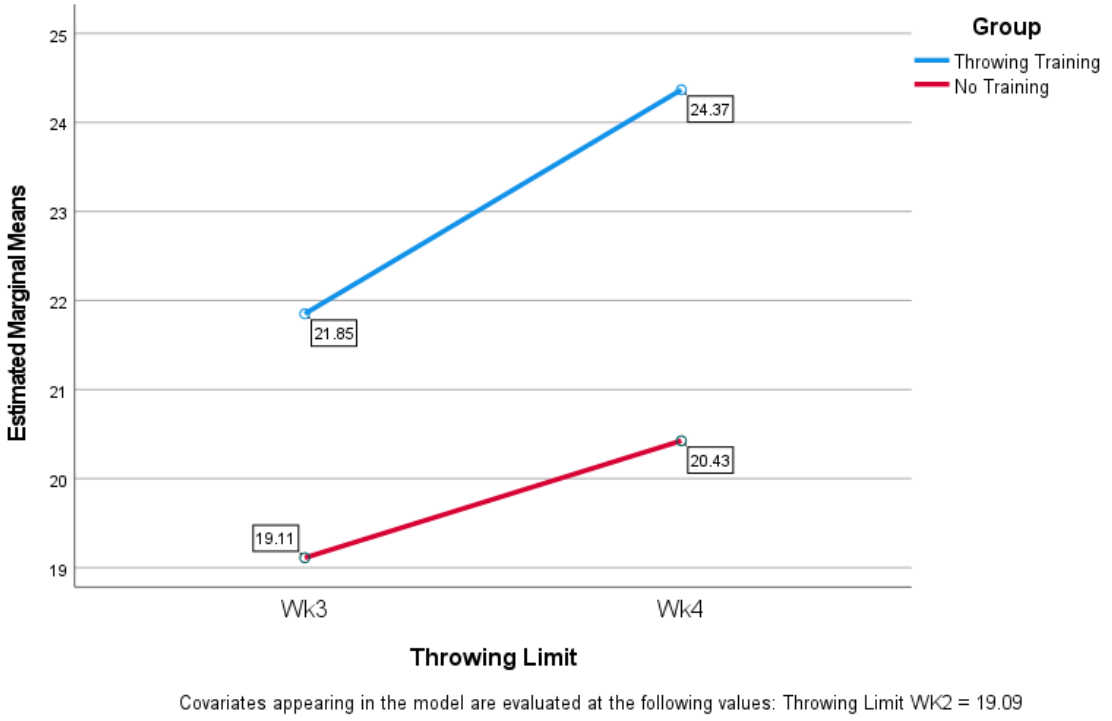
		Unadjusted		Adjusted	
	N	*M*	*SD*	*M*	*SE*
Throwing Training (WK3)	18	21.67	4.54	21.85	1.06

Control (WK3)	15	19.33	9.23	19.11	1.16
Throwing Training (WK4)	18	24.17	6.24	24.37	0.96
Control (WK4)	15	20.67	8.21	20.43	1.05

The results indicated that the throwing limit at Week 2 was a statistically significant covariate $F(1, 30) = 65.59$, $p < .001$. Furthermore, there was a statistically significant main effect for training $F(1, 30) = 5.85$, $p = .022$; but not for throwing limit over the course of the three weeks $F(1, 30) = 0.43$, $p = .837$. Similarly, the interaction between training and weeks $F(1, 30) = 1.08$, $p = .308$ was not statistically significant. These results point to the fact that over time , the difference in throwing limits were about the same; however, at both week 3 and week 4 (after controlling for baseline throwing limits), teenagers in the group that received focused training had throwing limit scores that were significantly higher than those of teenagers in the control group. Figure 3 provides a visual summary of the differences in throwing accuracy between the experimental group that received focused training and the control group in week 3 and week 4.

Figure 3

Throwing Limit by Training (Week 3 and Week 4 - Controlling for Baseline - Week 2)



Discussion

Findings

The purpose of this study was to determine whether focused training has an effect on non-dominant hand throwing of teenagers. Analysis of the data obtained for this study shows that focused training of the non-dominant hand improves the throwing accuracy, throwing power, and throwing distance of teenagers after controlling for their baseline throwing ability. These findings suggest that when focused training is incorporated into physical education classes for teenagers, it can improve their abilities. These findings are similar to those of Whitely (2007) who found that a gradual introduction of throwing in phases allows learners to establish motion familiarity over time. Similarly, the absence of a similar growth trajectory for teenagers in the control group also suggests an meaningful effect of focused training

Limitations

The findings in this study should however be considered in light of the following limitations. The sample for this study was a relatively small non-random sample of male teenagers drawn from two sections of a high school physical education class. These sample characteristics could limit the generalizability of these results to the larger population of teenagers. As a result of this, it is difficult to ascertain if similarly designed studies with a larger more diverse group of teenagers in a non PE class setting would yield the same results. Furthermore, given that this study involved only male students, it is difficult to determine if similar results could be obtained for female students.

Implications

Despite these limitations, the current study holds several implications for the practice of physical education at the K-12 level of education. For instance, the study shows that coaches and teachers can use focused-training to improve students' athletic abilities in a manner that has real world application. The connection between the ability to use a non-dominant hand for throwing has direct implications for teenagers who may engage in sports such as baseball, softball, basketball, or even tennis. Including such training activities as part of a formal physical education curriculum could serve as motivation for students to stay engaged and fully participate in the class.

Suggestions for Future Research

Future research in this area of knowledge should include female students or better yet a mixed sample of both male and female students. Such studies should also draw from larger randomized samples. Additionally, controlling for other confounding variables beyond initial throwing ability may also help to narrow down the unique effects of focused training on the non-dominant hand throwing ability of teenagers.

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