

Research article

Throw and catch practice models for softball athletes

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Abstract: This study was conducted to address the lack of variation in softball training, which often relies on repetitive mechanical drills and reduces athletes' intrinsic motivation to practice. Motivation plays a crucial role in motor skill development, as highlighted in Self-Determination Theory, which emphasizes that fun, challenging, and varied training can enhance engagement and improve performance outcomes. Considering the high rate of errors due to weak mastery of throwing and catching techniques, this study aimed to develop a varied training model involving ground ball, fly ball, and driven ball exercises for novice softball athletes aged 16–19 years. The research employed a Research and Development (R&D) design following Borg and Gall's model, combining both qualitative and quantitative approaches. The participants were 60 beginner softball players. The process began with preliminary surveys, expert validation, and small group trials involving 20 athletes. At the effectiveness testing stage, a pre-test and post-test control group design was applied. The experimental group consisted of 20 athletes from Banten Province who received the newly developed training model, while the control group of 20 athletes from Lampung Province continued with regular training. The intervention was carried out over 16 sessions (three times per week), after which a post-test was administered. The instrument used was a modified softball throwing and catching skills test. The results showed that the experimental group achieved a higher mean score ($M = 17.65$, $SD = 1.72$) compared to the control group ($M = 13.90$, $SD = 1.41$). Independent sample t-test results indicated a significant difference ($t = 7.526$, $p < 0.05$) between groups, with a mean difference of 3.75. This confirms that the developed training model effectively improved athletes' throwing and catching performance. The varied training model with ground ball, fly ball, and driven ball exercises proved effective in enhancing the throwing and catching skills of novice softball athletes and can be recommended for broader application in youth softball training programs.

Keywords: Softball, Training Model, Throwing, Catching, Motor Skills, Adolescent Athletes

1. Introduction

Softball is one of the sports that is quite well known in Indonesia. However, compared to other sports, softball is said to be not so popular in the community, due to limited facilities and infrastructure. The tools used are relatively expensive and not easily accessible to the public, the field is shaped differently from other fields, gloves made of leather, softballs that are larger than tennis balls, and body protectors used for catchers and bases.[1]. As an example of a case, the Survey of Softball Learning Facilities and Infrastructure in High Schools in Jepara Regency identified that limited facilities and infrastructure are the main obstacles in softball learning in schools. Expensive equipment and a large number are the main inhibiting factors in the procurement of softball facilities. In addition, the SWOT Analysis study of Achievement Development at the Surabaya Hawks Softball Club shows that even though the equipment owned by the club is quite complete, they still have to rent a field and alternate with other clubs. This indicates the lack of adequate permanent facilities to support training and competitions. Conditions like this show that the constraints of facilities

and infrastructure are a significant factor that affects the development of softball in Indonesia.

Softball is a sport that requires its players to have good physical condition, technique, psychology, tactics, and health[2]. These five elements must be possessed to achieve maximum performance in the sport of softball itself. Physical condition can be interpreted as the state of the athlete's body to perform physical activity [3],[4], [5], [6]. Technique can be interpreted as a special way in the game of softball to carry out basic movements [7]. Psychology can be interpreted as the condition of the player to control their own emotions [8]. Tactics are the strategy and skills of the player to achieve the goals set by the team, and health means the balance between body nutrition, relationships between teammates, and rest [9], [10]. One of the five components above is basic technique. The basic techniques required in the sport of softball are Throwing, Catching, Batting, Bunting, Baserunning, and Sliding [11].

At the beginning of 2024, the Indonesian Baseball and Softball Federation or *Persatuan Baseball dan Softball Seluruh Indonesia* (Perbasasi) held the Junior National Softball Championship on January 5, 2024. It was participated in by 8 provinces including Jakarta, Banten, West Java, East Java, Yogyakarta, Lampung, South Sulawesi, and East Kalimantan. From the results of Fielding Stats data obtained, there was 34.7% ability of fielders in throwing and catching the ball during the match, indicating that fielders often made mistakes [3]. Meanwhile, in softball, throwing and catching techniques are very much needed in the defensive position. If a team is not good in the defensive position, it can be ensured that the opposing team can score points. A fielder must throw according to the target at 78.6% to obtain victory. And in catching the ball, players must have good ability. If the ball thrown from one player to another is an error, it can be ensured that the runner can be safe on base or can score points. In catching the ball from the batter's hit, a fielder has a 50:50 chance in catching ability.

The researcher's experience in the field, for beginner athletes there are difficulties in mastering throwing and catching techniques, namely: (1) athletes are not yet skilled in holding the ball when going to throw, because when gripping the ball, usually beginner athletes still experience slippage of the ball. (2) the hand movement when throwing the ball is still not in accordance with the target and direction of the throw. (3) the body position when throwing is still not optimal. (4) as well as the final position when throwing is still not optimal. Meanwhile, when catching: (1) athletes are still unable to predict the direction of the ball. (2) the body position when catching is not yet optimal. (3) the position of the glove when catching is still often rotated, causing the ball to often fall. To obtain maximum throwing and catching ability, training must be done continuously and with discipline. From the results of the analysis, muscle performance when catching and throwing has an average percentage of 71% during the acceleration phase.

From the results of interviews with several coaches, practitioners, and softball athletes, it was found that throwing and catching training tends to be boring so that beginner athletes become bored because there is no training variation. In addition, the limited references for throwing and catching training models for beginner athletes become an obstacle for a coach to provide the right and varied training model so that the athletes can follow the training session with enthusiasm and enjoyment to achieve the purpose of the training [12]. Training with certain frequency, intensity, time, and type can increase optimal athlete ability if made in a structured manner according to the expected goals according to the training program target. The types of throws and catches greatly depend about the ball hit by the batter. However, in the field, it is still seen that only a few variations are trained. Training helps improve player ability, but to achieve good skills, training should be done sufficiently often so that players get used to performing a technique under any conditions, considering that in a match there will be many unexpected situations [1].

In a match, many situations and incidents make defensive players perform techniques that are not usually performed, for example in throwing, in certain incidents the fielder is required to be able to throw the ball well in any situation or position. A

player does not always throw overhand like in training, but often sidearm throws and underhand throws must be performed by the fielder. This means mastering all throwing techniques is important. All players must be able to throw well and accurately. And when catching the ball, sometimes the ball bounces in an unpredictable direction, so the defensive player must quickly position themselves to catch the ball and throw it to the base to prevent the runner from scoring or being safe on base [13].

Beginner athletes in this study have a strategic role in producing high-achieving athletes in the sport of softball. In this research, beginner athletes are made the subject of the study, whose throwing and catching movements are measured from throwing and catching techniques. For throwing technique indicators are overhand throw, sidearm throw, and underhand throw. And for catching technique indicators are catching straight balls, ground balls, and catching fly balls.

Based on the problems, analysis, and field observations, a throwing and catching training model is needed for beginner athletes in the sport of softball to help increase understanding and technique of softball play in the defensive position for coaches, athletes, and athletes' parents. Therefore, the researcher intends to study the throwing and catching training model for beginner softball athletes. By creating a throwing and catching training model in the sport of softball for athletes aged 16–19 years. Later this model will be digitized to make it easier for users to access.

2. Materials and methods

The study involved 60 novice softball players aged 16–19 years. Participants were recruited from registered softball clubs in Banten and Lampung Provinces based on inclusion criteria: (1) aged 16–19 years, (2) classified as beginner athletes with less than two years of training experience, and (3) actively participating in regular club training. Athletes with injuries or medical conditions affecting upper limb performance were excluded.

From the total population, 40 athletes who met the criteria and were willing to participate in the effectiveness test were selected using purposive sampling. They were then assigned into two groups based on their province of origin: 20 athletes from Banten Province as the experimental group and 20 athletes from Lampung Province as the control group. Because the groups were drawn from different provincial clubs, individual randomization was not conducted; however, both groups had comparable training backgrounds and competitive levels.

Before the intervention, all participants completed a pre-test measuring throwing and catching skills. An independent samples t-test was conducted to examine baseline equivalence between the Banten and Lampung groups. The results showed no significant difference in initial skill levels ($p > 0.05$), indicating that both groups had comparable starting abilities prior to treatment.

This study employed a mixed-method approach (qualitative and quantitative) using the Research & Development (R&D) model from Borg and Gall to produce a structured throwing and catching training model for beginner softball athletes. The research stages included:

- preliminary research through surveys and interviews in several softball clubs to identify problems and training needs;
- planning and designing the training model;
- development of the initial product draft;
- expert validation by three softball and coaching experts followed by revision;
- small-group trials involving 15–20 athletes with pre-skill testing;
- large-group field trials for refinement; and
- implementation of the finalized model to test effectiveness.

The effectiveness test applied a pre-test–post-test control group design. The experimental group (Banten athletes) received the developed training model, while the control group (Lampung athletes) continued with conventional training provided by their regular coaches.

Structure of the Training Sessions

The intervention was conducted over 16 meetings (three sessions per week for approximately five to six weeks). Each training session lasted approximately 90 minutes and followed a structured format:

1. **Warm-up (15 minutes):** Dynamic stretching, mobility exercises, and light throwing drills to prepare the upper and lower body.
2. **Core Training Session (60 minutes):**
 - Fundamental catching drills (stationary and moving targets)
 - Progressive throwing accuracy drills toward wall targets
 - Partner-based reaction and coordination exercises
 - Gradual increase in task complexity (distance, speed, movement variation)

The training progression was designed from simple to complex tasks, emphasizing repetition, accuracy, reaction time, and coordination.

3. **Cool-down (15 minutes):** Static stretching, reflection, and feedback on performance.

Training intensity and task complexity were progressively increased every four sessions to ensure adaptation and skill development.

Research Instruments

The instruments used included interviews, observations, questionnaires, and a modified softball throwing and catching skills test. Qualitative data from interviews and observations were used to identify training needs and obstacles. Questionnaires were distributed to experts and coaches to evaluate the feasibility and clarity of the training model. The modified throwing and catching test used a wall as a target. A circle with a diameter of 1.52 meters was mounted on the wall, with the bottom of the circle positioned 1.22 meters above the ground. The starting line was set 9.14 meters from the wall. A pitching machine was placed at the same distance and delivered 10 consecutive balls at a constant speed of 45 mph toward each participant.

Participants stood at the starting line holding a glove in their dominant hand. After the "go" signal, they attempted to catch and throw the ball toward the circular target. Each successful catch was awarded one point, and an additional point was given if the throw hit the circular target. The maximum score was 20 points.

Post-test results were compared with pre-test data to determine skill improvement between the experimental and control groups

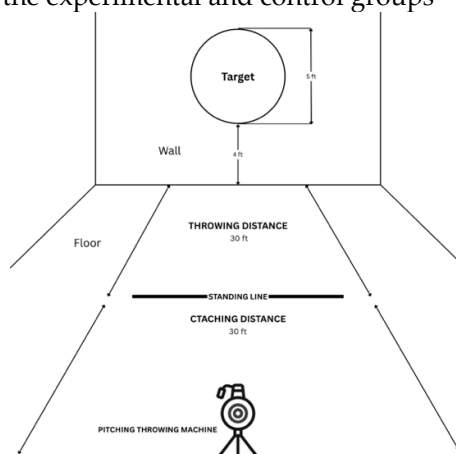


Figure 1. Modified softball catching instrument.

3. Results

Before diving into the specific training models, it's important to understand the structure and objectives behind the various drills. These training models are designed to improve key skills such as throwing, catching, and team coordination. The following sections outline the different training methods implemented, followed by the results that demonstrate their effectiveness.

a. Throwing Training Model

The throwing training model focuses on various throwing techniques and distances, designed to enhance accuracy and distance control. It includes multiple variations of throws, such as overhand, underhand, and sidearm, at different distances and directions. For example, the training progresses from a basic 6-meter throw to more challenging 18-meter throws, and even includes specialized training where targets are positioned to the left and right of the thrower. This progression is aimed at increasing the thrower's precision, distance, and overall skill.

b. Catching Training Model

The catching training model is structured around different types of catches, such as catching line drives, fly balls, and ground balls. Each type of catch is practiced from various directions, including the front, right, and left. These variations ensure that the athlete develops versatility in handling different kinds of balls that may come from multiple angles during a game. This type of training sharpens reaction times and improves hand-eye coordination, both of which are crucial for successful gameplay.

c. Group Throw-and-Catch Training Model

The group throw-and-catch training model focuses on team-based skills, specifically designed to simulate game scenarios where multiple players are involved in throwing and catching to put out runners at various bases. These drills are designed to enhance teamwork, communication, and execution under game-like pressure. The exercises progress from individual base scenarios to more complex ones involving multiple bases, thereby improving the team's overall defensive performance.

The statistical results in Table 1 compare the performance of the experimental group and the control group in long-service ability after completing the training. The experimental group demonstrated superior results, with a mean score of 17.65, compared to the control group's mean score of 13.90. Additionally, the experimental group exhibited a smaller standard deviation, suggesting more consistent performance across participants.

Table 1. Statistical table of throw results from the two groups

Long Service Ability		
Data Description	Experimental Group	Control Group
N	20	20
Mean	17.6500	13.9000
Std. Deviation	1.72520	1.41049
Std. Error Mean	0.38677	0.31539

The differential test results Table 2 offer a statistical comparison of the two groups using an independent samples t-test. The results show a significant difference between the experimental group and the control group in terms of long-service ability, with a mean difference of 3.75. The t-test results demonstrate that this difference is statistically significant, with a p-value of 0.000 (both assuming and not

assuming equal variances). This confirms that the experimental group's performance was significantly better than the control group's after the training periode.

Table 2. Differential test results of experimental group and control group

F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95 % Confidence Interval of the Difference	
							Lower	Upper
1.377	0.248	7.526	38	0.000	3.75000	0.49829	2.74127	4.757873
		7.526	36.556	0.000	3.75000	0.49829	2.73996	4.76004

4. Discussion

Based on the results of interviews and observations at various softball clubs, it was found that basic throwing and catching skills are still in the low category. This can be seen from the fact that there are still frequent mistakes in making accurate throws and clean catches, especially in game situations that demand quick reaction and team coordination. One of the main factors that causes such low basic skills is the monotonous and boring model of training [14], [15]. Based on the results of interviews with coaches and athletes, most training sessions focus only on mechanical repetition of less variety. This condition reduces the intrinsic motivation of athletes to train, so their concentration and involvement in the training process becomes lo. In fact, motivation is an important aspect in improving motor skills, as explained by the theory of Self-Determination that fun, challenging, and varied exercises will increase engagement and achievement of learning outcomes. Initial skills before treatment have an average score of 79, while after treatment it increases to 88.61 or an increase of 12.16%.

Mastering the basic techniques of throwing and catching in the game of softball is crucial because it is the foundation for the course of the game. Accurate throws and good catches allow teams to carry out defensive and offensive strategies effectively. Mistakes in performing these two basic techniques not only have an impact on the loss of scoring opportunities but can also give the opponent a huge advantage [16], [17]. An improper throw can trigger the runner to advance further, not just one base, but even two. So as to increase the risk of the opposing team scoring points.

By seeing the high error rate due to the weak mastery of throwing and catching techniques, it is necessary to develop a more effective training model that is in accordance with the needs of athletes. This becomes even more important in the age group of 16–19 years, because in this age range athletes are in the developmental phase towards peak performance. The late adolescence period is a critical period in the formation of specific skills, muscle strength, and mental readiness to face the demands of higher competition. Therefore, the training model given should not simply repeat techniques mechanically, but must be designed in a varied, progressive way, and be able to combine physical aspects and techniques, both individually and in groups. At this stage, athletes are required to integrate the basic skills that have been mastered with complex game situations

Taking into account the specific needs of athletes at the age of 16–19 years, the development of a training model is carried out that is adapted to the characteristics of their physical and technical development. This development focuses not only on improving individual skills such as throwing and catching, but also on the ability to work together in game situations. For this reason, the training model that has been designed then goes through the feasibility test stage to ensure that the form of training offered is really relevant, practical, and effective for improving athlete performance.

Based on the results of the feasibility test, 43 training models were obtained that were declared feasible and validated by experts. The training model consists of 27 throwing exercises, 9 catching exercises, and 7 group exercises (table 4–6). These exercises include a variety of game situations such as throwing – catching ground

balls, line drives, and fly balls. Expert validation confirms that this exercise model is relevant to the needs of basic softball skills, particularly in the aspects of precision, strength, and coordination of movement.

Furthermore, the effectiveness test was carried out through the application of an exercise model to the experimental group and compared with the control group. The measurement results showed that the experimental group experienced a higher performance improvement than the control group. Based on the Group Statistics table, the experimental group ($N = 20$) achieved a mean score of 17.65 ($SD = 1.72$) in the throwing test, whereas the control group ($N = 20$) obtained a lower mean score of 13.90 ($SD = 1.41$). This indicates a clear difference between the two groups, with the experimental group performing better in throwing performance. The Independent Samples Test shows that the significance value (Sig. 2-tailed) is $0.000 < 0.05$, suggesting that there is a statistically significant difference between the experimental and control groups in throwing ability. The obtained t -value was 7.526, with a mean difference of 3.75, confirming that the training model applied to the experimental group had a positive and significant effect on improving throwing performance.

In the game of softball, mastery of the technique of handling three variations of the ball, line drive, fly ball, and ground ball is a fundamental aspect that determines the quality of the team's defence. Line drive requires a high speed of visual and motor reaction. Balls that go straight at high speed provide a very narrow time space for the fielder to anticipate, so failure to make a catch can result in the opponent's chances of scoring quickly. The fly ball requires consistent mastery of eye-hand coordination and the ability to read the trajectory of the ball in the air. Mistakes in estimating the direction of the ball fall often lead to miss-catches that are detrimental to the team. Meanwhile, ground balls are often perceived as the most error-prone situations. This is because the ball moves quickly on the ground and often bounces unexpectedly, so it requires the right hand and foot reaction from the infielder.

5. Conclusions

The development of a throw–catch training model for athletes aged 16–19 years has been declared feasible, validated by experts through 43 training models consisting of 27 throwing, 9 catching, and the rest group exercises. The effectiveness test demonstrated that the experimental group achieved significantly better results than the control group. In the throwing test, the experimental group obtained a mean score of 17.65, compared to 13.90 in the control group, with the independent samples t -test showing a significant difference ($p = 0.000 < 0.05$). These results indicate that ground ball, line drive, and fly ball handling skills require intensive training, particularly ground balls, as they most often result in errors during games. Furthermore, group exercises proved essential in enhancing coordination, communication, and players' understanding of team play. Overall, the developed training model is effective, practical, and can be applied as a reference in coaching adolescent softball athletes.

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