EFFICACY OF LORSBACH CONSTRUCTIVIST MODEL TO IMPROV SPECIFIC PHYSICAL ABILITIES AND NUMERICAL ACHIEVEMENT LEVEL OF HAMMER THROW EVENT OF PHYSICAL EDUCATION STUDENTS

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ABSTRACT

Background Hammer throw is one of the most technically challenging athletics events, requiring a precise combination of explosive power, rotational speed, and control of centrifugal force. Literature indicates that relying on traditional teaching methods, which make the student a passive recipient, leads to a weak understanding of the technical phases and a low level of performance. **Objectives.** This study aims to develop educational sessions based on Lorsbach model and evaluate their impact on developing physical variables maximum and explosive power and performance levels in hammer throw. An experimental approach with two equivalent groups was used. Sample consisted of 40 students from Wasit University, randomly divided into an experimental group Lorsbach model and a control group traditional method, with 20 students in each group. Approach lasted four weeks, with two sessions per week. **Method**. Lorsbach model, through its exploration and explanation phases, enabled students to understand mechanical relationship between leg strength and hammer release speed, leading to better organization and optimal utilization of physical effort in skill performance. The research concludes that Lorsbach model contributes to stimulating self-inquiry and linking prior experiences to complex motor skills required for hammer throw, thus enhancing students' motivation to achiev**. Result**. Results showed a significant advantage for experimental group in all physical variables and performance levels ($p < 0.05$) compared to control group, this advantage is attributed to nature of learning sessions, which linked physical variables to hammer's motion, in hammer throw, explosive power and velocity are primary drivers of hammer's spin. **Conclusion.** The researcher recommended to adopt of educational sessions designed according to Lorsbach model in teaching hammer throw activity in physical education colleges, teachers should be urged to instructors to shift from traditional roles to facilitator and guide roles, in accordance with constructivist theory.

Keywords; lorsbach model, hammer throw, physical abilities, numerical achievement, constructivist theory.

A. INTRODUCTION

Hammer throw is one of the most technically challenging athletics events, requiring a precise combination of explosive power, rotational speed, and control of centrifugal force (Castaldi et al., 2022; Wang et al., 2023). Literature indicates that relying on traditional teaching methods, which make the student a passive recipient, leads to a weak understanding of the technical phases and a low level of performance (Al Ardha et al., 2024; Liu et al., 2025; Pavlović, 2020; Tiedemann et al., 2022). Need arose to adopt the constructivist Lorsbach model, which is based on five phases attention, inquiry, explanation, extension, and evaluation aimed at making the student focus of learning process and the discoverer of the skill (Agustina et al., 2024; Nubatonis et al., 2024; Yogi et al., 2023). The research problem lies in the inadequacy of using modern strategies that take into account the specific physical requirements of hammer throw, which necessitated the design of educational sessions that link specific physical conditioning with constructivist skill learning.

B. METHOD

Research Methodology

Experimental research method and experimental and control group design with pre- and post-testing were used to control for variables. Research population was defined as first-year students at College of Physical Education and Sports Sciences at Wasit University for the academic year 2024-2025, totaling (60) students. A sample of (40) students was selected randomly by lottery, representing (66.6%) of the original population. Grouping: The sample was randomly divided into two equal groups, each group containing (20) students: The experimental group: which underwent educational sessions according to the "Lorsbach model". The control group: which was subjected to the traditional curriculum followed by the subject teacher.

To ensure the equivalence of the starting point between the two research groups (experimental and control), the necessary statistical treatments were carried out to verify homogeneity of the sample and the equivalence of the groups in the variables (anthropometric, physical, and achievement) as follows: First: Homogeneity of the research sample anthropometric variables: Distribution of sample 60 students was checked in terms of variables age, height, and mass to ensure normality of distribution, using skewness coefficient:

Table 1. Sample homogeneity in some anthropometric variables

Variables	Mean	Standard deviation	Mediator	Torsion coefficient
Age (years)	19.60	0.26	19	0.022
Height (meter)	1.71	0.67	1.71	0.607
Mass (kg.)	71.31	10.81	69	0.484

We note that all values of skewness coefficient were within (±1), which indicates that the sample members fall under the normal curve, which is an indicator of homogeneity of sample members in these variables. Second: Equivalence of the two research groups physical variables and achievement: To ensure that both groups experimental and control started from the same level before implementing the educational program, a t-test was used. For independent samples and Levene's homogeneity test:

Table 2. Equivalence of two groups in pre-tests physical fitness and hammer throw performance

Variables	Control group		Experimental group		Calculated (t) value	Sig. level	Sig. type
	M.	St.d	M.	St.d			
Maximum strength (legs and back)	2.75	0.55	2.54	0.83	0.114	0.78	Sig.
Maximum strength (arms)	3.40	0.76	3.21	0.80	0.623	0.92	Sig.
Explosive force (arms)	11.03	0.61	10.57	0.77	0.887	0.70	Sig.
Explosive force (legs)	1224.66	60.41	1217.12	63.34	0.556	0.55	Sig.
Speed-strength (arms)	11.66	1.03	11.45	1.43	0.447	0.60	Sig.
Speed-strength (legs)	1015.00	74.16	1001.23	76.19	0.381	0.63	Sig.
Hammer throw achievement (M.)	12.62	0.43	12.07	0.69	0.301	0.78	Sig.

The table above shows that all T values are Less than the significance level (0.05), which indicates that there are no statistically significant differences between the two groups in the pre-tests. This confirms the equivalence of the two groups and the validity of the starting point for the experiment.

Equivalence is a fundamental requirement in the experimental method to ensure that any differences appearing in post-tests are due to the influence of the independent variable (Lorsbach's model units) and not to any pre-existing differences between the students . The similarity of the results in ultimate and explosive forces confirms that the sample of first-year students possess very similar physical characteristics, making the research findings more accurate and objective when generalized.

In this way, the neutrality of the starting point is ensured statistically and in the field, paving the way for measuring the true impact of the proposed educational program.

A range of specialized instruments were used to ensure the accuracy of measurements in the hammer throw event, namely: Measuring tools: A rigid measuring tape (50m) long, and an electronic timer of the (Casio) type, made in Japan. Canon video cameras for documenting and analyzing performance, and a handheld calculator. Physical and skill-based equipment: Legal hammers of varying weights, medicine balls, boxes of varying heights, and plastic barriers for developing specific physical abilities.

Conducting physical and performance tests

Physical tests were identified that reflect the strength and speed requirements for hammer throwing:

1. Maximum strength tests: These include a maximum strength test for the legs and back, and a maximum strength test for the arms.
2. Explosive force tests: Measuring the explosive power of the arms and legs, which is crucial at the moment of firing the hammer.
3. Speed-strength test: for the arms and legs to ensure rotation efficiency.
4. Achievement test: Measuring the longest numerical distance achieved by the student in hammer throwing according to legal requirements.

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Research timeline

1. Pre-tests: They were conducted at 9:00 am on October 8th and 9th, 2024 at Wasit University stadiums.
2. Implementation of program (educational sessions): Start date: October 20, 2024. Expiry date: November 22, 2024. System: The program lasted for (4) weeks with two educational sessions per week (a total of 8 units).
3. Post-tests: Conducted under same conditions as pre-tests on November 23, 2024.

Mechanism for implementing educational program (Lorsbach)

Educational sessions for experimental group were implemented according to five interconnected stages aimed at deepening motor understanding: Attention phase (7 min): Stimulating curiosity by showing videos of correct performance. Investigation phase (8 min): Working in cooperative groups to explore the mechanics of hammer throwing using pictures. Explanation phase (15 min): Discussing the discovered concepts with the teacher and correcting the motor paths. Extension phase (25 min): Applying intensive physical and skill exercises to link the rotation phases with the throwing. Evaluation phase (15 min): Final performance assessment and error diagnosis to ensure skill comprehension.

Approved physical tests for hammer throw: Validity and reliable tests were selected:

Maximum strength (legs and back): due to its importance in base of support during rotation. Explosive force (arms and legs): to accelerate hammer during launch phase. Power characterized by speed: to ensure the continuity of rotational speed. Digital achievement test: Measuring the distance of the hammer throw according to international law.

Tutorial program (Lorsbach model steps)

Attention (7 min): Showcasing videos of global hammer throw performances to raise curiosity. Inquiry (8 min): Divide the students into groups (5 students) to explore the skill and use illustrative pictures. Explanation (15 min): Students discuss the concepts they have discovered with the teacher. Extension (25 min): Applying exercises linking technical phases (turning and launching). Assessment (15 min): Teacher performance evaluation and student self-assessment.

C. RESULTS AND DISCUSSION

Data were statistically processed to compare development in physical variables (maximum strength, explosive power, speed-strength) and numerical achievement level of hammer throw.

Table 3. Results of control group (traditional method) between pre-test and post-test

Variables	Pre-test		Post-test		Calculated (t) value	Sig. level	Sig. type
	M.	St.d	M.	St.d			
Maximum strength (legs and back)	2.75	0.55	4.54	0.58	3.15	0.000	Sig.
Maximum strength (arms)	11.03	0.61	13.06	0.63	2.47	0.000	Sig.
Explosive force (arms)	1015.00	74.16	1165.12	70.27	3.07	0.000	Sig.
Explosive force (legs)	12.62	0.43	14.22	0.40	2.16	0.000	Sig.

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Speed-strength (arms)	2.75	0.55	4.54	0.58	3.15	0.000	Sig.
Speed-strength (legs)	11.03	0.61	13.06	0.63	2.47	0.000	Sig.
Hammer throw achievement (M.)	1015.00	74.16	1165.12	70.27	3.07	0.000	Sig.

Table 4. Results of experimental group (Lorsbach model) between pre-test and post-test

Variables	Pre-test		Post-test		Calculated	Sig.	Sig.
	M.	St.d	M.	St.d	(t) value	level	type
Maximum strength (legs and back)	2.54	0.83	6.40	0.74	4.16	0.000	Sig.
Maximum strength (arms)	10.57	0.77	14.43	0.62	3.98	0.000	Sig.
Explosive force (arms)	1001.23	76.19	1321.55	64.87	4.10	0.000	Sig.
Explosive force (legs)	12.07	0.69	16.56	0.54	5.07	0.000	Sig.
Speed-strength (arms)	2.54	0.83	6.40	0.74	4.16	0.000	Sig.
Speed-strength (legs)	10.57	0.77	14.43	0.62	3.98	0.000	Sig.
Hammer throw achievement (M.)	1001.23	76.19	1321.55	64.87	4.10	0.000	Sig.

Discussion

Results showed a significant advantage for experimental group that used Lorsbach model in all physical variables and in numerical performance level of the hammer throw. This advantage is attributed to the nature of the learning units, which linked physical variables to the hammer's motion. In the hammer throw, explosive power and velocity are the primary drivers of the hammer's spin. The Lorsbach model, through its exploration and explanation phases, enabled students to understand the mechanical relationship between leg strength and hammer release speed, leading to better organization and optimal utilization of physical effort in skill performance.

Inquiry phase allowed students to work collaboratively in groups to independently identify balance and rotation errors. This approach reduces distractions and helps develop a sound kinesthetic understanding that transcends erroneous "alternative concepts. This aligns with (Ebrahim & Hussein, 2025; Hussein, 2025) assertion that learner motivation and interest in the skill are key to maximizing learning outcomes. Experimental group outperformed the digital achievement group due to improved neuromuscular coordination resulting from repeated performance in "expansion" situations . Providing students with continuous feedback throughout the model helped refine the learning process and correct immediate errors, leading to a greater digital achievement than the traditional method.

The researcher is attributed to effectiveness of Lorsbach model in providing a collaborative learning environment that allowed students to logically connect physical force with the hammer's trajectory. Self-inquiry enabled students to understand the importance of explosive force in increasing the hammer's peripheral velocity before release. Furthermore, fostering motivation through the stages of attention and expansion reduced the anxiety associated with learning the challenging spinning skill.

D. CONCLUSION AND RECOMMENDATIONS

Lorsbach model has had a significant positive impact on the development of the physical variables (maximum strength, explosiveness, and speed) of hammer throw effectiveness. Results proved that Lorsbach model was superior to traditional method in improving students' digital achievement levels. The model contributed to increasing students' motivation and engagement, which reduced the difficulty of learning the complex hammer-throwing skill. Adoption of educational sessions designed according to Lorsbach model in teaching hammer throw activity in physical education colleges. Teachers should be urged to instructors to shift from traditional roles to facilitator and guide roles, in accordance with constructivist theory. Conducting similar research that examines effect of this model on kinematic (biomechanical) variables of hammer throwing.

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