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The Effect of a Proposed Program Using 3D Models On The Physical Skillful Performance and The Lunge Skill in Fencing Sport

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Abstract:

The research aims to design a proposed educational training program using three-dimensional sensors and determine its impact on Some of the physical skill variables (lunge skill reaction speed, 4m advance speed, flexibility of the joints involved in the Lunge movement) for fencing among first-year female students at the faculty of Physical Education, Cairo, Helwan University and Some fencing skills (Lunge skill) for first-year female students at the faculty of Physical Education, Cairo, Helwan University.

The researcher employed the experimental methodology as it suits the nature of this research. She utilized one of the experimental designs, specifically the single-group pretest-posttest design, by applying measurements (pre-test, post-test, follow-up) due to its suitability for the research nature and objectives. The research sample was selected from first-year female students at the Faculty of Physical Education for Girls, Helwan University, for the academic year 2022/2023, using intentional random sampling. The number of students was (25), from one class after excluding (3) students for irregular attendance. In light of the research objectives, the nature of the study, within the limits of the research sample, the methodology used, and based on the collected data and the results of statistical analysis, the researcher has reached the following conclusions:

1. There are statistically significant differences between the measurements (intermediate - post) for all motor skill variables under investigation in favor of the post measurement, except for the (reaction time)

measurement where there are no statistically significant differences between the two measurements.

2. There are statistically significant differences between the measurements (intermediate - post) for the fencing skill under investigation in favor of the post measurement.

3.The use of three-dimensional models in educational units has a positive impact on the cognitive aspect of the students.

4.The use of three-dimensional models is considered an effective means to clarify different angles of skill components, contributing to an improved understanding of the concepts and skills learned by students.

5. The use of three-dimensional models has a positive impact on learning the fencing skill of Lunge.

Keywords:

- Lunge, Fencing, 3D models, physical skillful

تأثير برنامج مقترح باستخدام نماذج ثلاثية الأبعاد على الأداء المهاري البدني ومهارة الاندفاع في رياضة المبارزة

المستخلص:

يهدف البحث إلى تصميم برنامج تدريبي تعليمي مقترح باستخدام المجسمات ثلاثية الأبعاد و معرفة تأثيره على بعض المتغيرات البدنية المهارية (سرعة رد فعل مهارة الطعن، سرعة التقدم على مسافة ٤ أمتار، مرونة المفاصل العاملة في مهارة الطعن) للمبارزة بين الطالبات في السنة الأولى بكلية التربية الرياضية، جامعة حلوان، القاهرة، وبعض مهارات المبارزة (مثل مهارة الطعن) للطالبات في السنة الأولى بكلية التربية الرياضية، جامعة حلوان.

استخدمت الباحثة المنهج التجريبي لملائمته لطبيعة هذا البحث حيث استعانت باحدى التصميمات التجريبية و هو التصميم التجريبي ذو المجموعة التجريبية الواحدة ، عن طريق تطبيق القياسات (القبلية و البينية و البعدية) وذلك نظرا لملائمته لطبيعة البحث و اهدافه. تم اختيار عينة البحث من طالبات السنة الأولى في كلية التربية الرياضية للبنات بجامعة حلوان للعام الدراسي ٢٠٢٢/٢٠٢٣، باستخدام الطريقة العمدية العشوائية ، و بلغ عدد الطالبات ٢٥ طالبة، من فصل واحد بعد استبعاد ٣ طالبات بسبب الحضور غير النظامي.

وبناءً على أهداف البحث، وطبيعة الدراسة، وضمن حدود عينة البحث، والمنهج المستخدم، واستنادًا إلى البيانات المجمعة ونتائج التحليل الإحصائي، توصل الباحثة إلى الاستنتاجات التالية:

١. يوجد فروق ذات دلالة إحصائية بين القياسين (البيني – البعدي) لجميع المتغيرات البدنية المهارية قيد البحث لصالح القياس البعدى ، عدا قياس (رد الفعل) لا يوجد فروق دالة احصائيا بين القياسين .

٢. يوجد فروق ذات دلالة إحصائية بين القياسين (البيني – البعدي) للمهارة قيد البحث لصالح القياس البعدى .

٣. استخدام النماذج ثلاثية الأبعاد في الوحدات التعليمية له تأثير إيجابي على التحصيل المعرفي للطلاب.

٤ . استخدام النماذج ثلاثية الأبعاد يُعتبر وسيلة فعّالة لتوضيح زوايا مختلفة لمكونات المهارة، مما يسهم في تحسين فهم الطلاب للمفاهيم والمهارات التي تعلموها.

٥. استخدام النماذج ثلاثية الأبعاد له تأثير إيجابي على تعلم مهارة الطعن في رياضة المبارزة.

الكلمات المفتاحية: مهارة الاندفاع، المبارزة، نماذج ثلاثية الأبعاد ،المهارة البدنية

The Effect of a Proposed Program Using 3D Models On The Physical Skillful Performance and The Lunge Skill in Fencing Sport

Introduction and Research Problem

In recent technological advancements, there have been changes in many prevailing educational concepts, affecting administrative systems, curriculum development, and training programs. Some advocate for a revision of the existing form of schools, while others argue for the necessity of their existence. This comes in the context of rapid information methods, communication systems through satellites, and multimedia (programs that combine audio, visuals, drawing, and text with viewer interaction).

Therefore, educational technology is a constantly evolving field that goes beyond the use and maintenance of educational devices. It is influenced by theoretical changes facing the field and its applications (11:12).

According to the United Nations Development Program, the COVID-19 pandemic has led to a different approach to education, widening the scope of inequality. Based on the Sustainable Development Goals of the United Nations, technology can either expand or narrow the existing learning gap.

And according to 'Ashlee et al.' (2020), teachers play a pivotal role in the use of technology; it is employed to support them rather than replace them. (3)

'Mohdhar Ahmed Hassan Al-Shahari' (2017) points out that the latest stage of technological evolution in our current era in education is the stage of virtual reality and artificial intelligence technology. Learners now receive their education from both reality and imagination. Imagination is manifested in the use of technology in a Virtual School, a Virtual Teacher, Virtual Reality, Virtual Lab, and Smart Classes (20:73).

According to 'Gamal Abdel Rahman Al-Sharqawi' (2003), modern educational technologies encompass the design, production, and utilization of everything new in the field of educational technology to achieve maximum effectiveness in teaching and learning situations and solve educational specialization problems (9:32).

Examples of technological innovations in the field of e-learning include mobile learning, individualized learning, virtual learning, interactive multimedia, surplus media, e-courses, educational computers, interactive videos, integrated education, and other innovations.

Mohamed Dossouqi' (2014) notes that multimedia technology is one of the most important components of virtual reality, which has become, in itself, part of multimedia elements as a virtual world used in education and training.

This involves the use of various interactive elements, as evidenced by the recent widespread 'Life Program. It relies on dealing with multimedia, demonstrating high audio capabilities and easy use of media in terms of instant messaging, chatting, as well as presenting a variety of online media content, including web pages, movies, images, documents, texts, sound, and interactive engagement (18:1).

Ann Bamford' (2020) emphasizes that the use of three-dimensional education makes the learner capable of absorbing a large amount of information compared to traditional education (6)

Three-dimensional models have significant importance as:
-They allow the correction and modification of information without damaging the original sample or increasing the financial cost.
-Three-dimensional models provide students with unlimited time to view scientific material, which can be easily shared.
-One of the essential characteristics of three-dimensional models is their physical presence, allowing for maintenance, repair, and their use in motion analysis .

The research problem is defined as a scientific attempt by the researcher to apply a new approach to the development of fencing skills using modern technological methods in education. This is in line with keeping pace with technological advancements in the sports field, rather than relying on traditional methods for teaching and training fencing.

The researcher observed that the increase in the number of female students in practical lectures for the first year leads to difficulties in concentrating for some students. Consequently, additional effort from the teacher is required to teach and simplify the skill, making it easier for the students to comprehend its stages. There is also a challenge in direct communication between the instructor and the student to convey skill stages, particularly with the increasing number of female students.

Therefore, the researcher has considered conducting this study to examine the impact of a proposed program using three-dimensional sensors on The Physical Skillful Performance, and The Lunge Skill of female fencing students using the foil. This stems from the incorporation of modern techniques in fencing education and to keep pace with the technological advancements of the era in terms of scientific progress and vast capabilities. It is expected that these technologies will assist the teacher in the teaching process.

Research Importance:

1. Academic Importance:

- This research constitutes a new scientific addition in the field of educational technology, as it addresses the impact of a proposed educational training program to enhance the physical Skillful performance and the Lunge skill of female fencing students using three-dimensional models.
- Elevating the physical fitness level contributes to the development of skill performance for female fencing students.

2. Practical Importance:

The results of this research may contribute to the development of programs aimed at enhancing both physical skill levels and the lunge skill in fencing.

Research Objective:

The research aims to design a proposed educational training program using three-dimensional sensors and determine its impact on:

-Some of the physical skill variables (lunge skill reaction speed, 4m advance speed, flexibility of the joints involved in the Lunge movement) for fencing among first-year female students at the Faculty of Physical Education, Cairo, Helwan University.

-Some fencing skills (Lunge skill) for first-year female students at the Faculty of Physical Education, Cairo, Helwan University.

Research Hypotheses:

1. There are statistically significant differences in the results between the intra-individual and inter-individual assessments for the physical motor skill variables related to fencing for the experimental research group, in favor of the inter-individual measurement.
2. There are statistically significant differences in the results between the intra-individual and inter-individual assessments in the level of skill performance for the lunge skill for the experimental research group, in favor of the inter-individual measurement.
3. There are statistically significant differences in the results between the intra-individual and inter-individual assessments in the level of cognitive achievement in the sport of fencing with the foil for first-year female students at the Faculty of Physical Education for Girls, Helwan University, in favor of the inter-individual measurement for the experimental research group.

The terms used in the research:

- 3D Models:

It is the process of developing athletic representation based on coordinates for any surface (living or non-living) in three dimensions through a specialized program by processing edges, vertices, and polygons in a simulated three-dimensional space. (29) (25)

- Teaching Aids in Physical Education:

It is a set of tools and devices designed to assist learners in comprehending, understanding, and mastering educational content in the least amount of time and effort possible. It is also known as a collection of diverse and programmed resources, information, and experiences that work to help learners understand and apply theoretical and practical educational activities, thereby enhancing knowledge.(28)

- Fencing Sport:

It is a sport of attack and defense between competitors, where each one strives to score touches with a specific weapon (foil, sabre, épée). (25)

- Level of Physical performance:

It is the degree or rank that a student reaches in motor behavior resulting from the learning process to acquire and master the movements of the practiced activity. It should be performed with fluidity, precision, and a high degree of individual creativity to achieve optimal results with economy of effort. (7: 186)

- Lunge Skill:

It is the movement of extending the arm and thrusting with the purpose of delivering a touch or an attack. (15: 210)

Previous and Related Studies:

No.	Researcher's Name	Year	Type of research	Research Title	Research Objective	Research Methodology	Population and Sample	Key Findings	Reference Number
1	Asmaa Hosny Mohamed	٢٠١٧	Scientific Production	The Impact of 3D Interactive Models on Learning the Long Jump Skill	Determine the effect of the 3D educational program on cognitive achievement and learning the long jump skill	Experimental methodology	90 female students from the first year of middle school	Improved levels of students in cognitive achievement and learning the long jump skill using 3D models	3
٢	Rasha Farag Masuod	٢٠١٩	Scientific Production	The Impact of Using 3D Biomechanical Models on Learning the Technical Performance of Simple Attacks in Fencing	Investigate the impact of using 3D biomechanical models on learning simple attack techniques in fencing	Experimental methodology	*Biomechanical analysis sample: A player from Egypt's fencing national team *Research sample: 180 female students	Positive impact of 3D models on the technical performance level of simple attacks in fencing	19

٣	Samar Samy Salah	٢٠٢١	Doctorate	The Effectiveness of 3D Models on Some Ballet Skills and Cognitive Achievement for Female Students at the College of Physical Education	Determine the effectiveness of 3D models on learning ballet skills and cognitive achievement	Experimental methodology	60 female students from the College of Physical Education, Helwan University	The educational program using 3D models positively contributed to learning ballet skills and cognitive achievement	20
٤	Mohamed Gamal Alsayed	٢٠٢٢	Master's	The Impact of 3D Models in the Electronic System on Learning Some Basic Skills in Karate for Students at the College of Physical Education - City of Sadat University	Design an educational program using 3D models for learning basic skills in karate and assess its impact on learning and cognitive achievement	Experimental methodology	265 first-year female students at the College of Physical Education - City of Sadat University	Study results confirm the positive influence of using 3D models in education	15

٥	Heba Ahmed Mahmoud	٢٠١٨	Doctorate	Designing an Educational Program Using 3D Models for Some Gymnastics Skills and Its Impact on the Performance Level of Female Students at the College of Physical Education, Sadat City University	Design an educational program using 3D models and investigate its impact on gymnastics skills and cognitive achievement	Experimental methodology	80 female students from the College of Physical Education, Sadat City University	The educational program using 3D models positively contributed to gymnastics skills and cognitive achievement	12

٦	**Walaa El Moghazy**	٢٠٢١	**Scientific Production**	**The Impact of Using 3D Biomechanical Models on Learning the Piqué Turns Skill in Ballet**	**Identify the impact of using 3D biomechanical models on learning the Piqué Turns skill in ballet**	**Experimental and descriptive methodology**	***Kinematic analysis sample: Seventh-year ballet student at the Higher Institute of Ballet at the Academy of Arts and a ballet dancer at the Talent Development Center at the Egyptian Opera House *Fourth-year students, training specialization**	**Positive impact of using 3D biomechanical models in the educational process, improving skill performance levels, and cognitive achievement for learners**	**21**

Through research and reviewing scientific references and previous studies, it has not been evident within the scope of the researcher's knowledge the use of a three-dimensional educational program in relation to the level of physical skillful performance and the lunge skill in fencing.

Research Procedures:

Research Methodology: The researcher employed the experimental methodology as it suits the nature of this research. She utilized one of the experimental designs, specifically the single-group pretest-posttest design, by applying measurements (pre-test, post-test, follow-up) due to its suitability for the research nature and objectives.

Research Sample: The research sample was selected from first-year female students at the Faculty of Physical Education for Girls, Helwan University, for the academic year 2022/2023, using intentional random sampling. The number of students was (25), from one class after excluding (3) students for irregular attendance.

Reasons for Sample Selection:

- All students are in the same age group.
- No prior experience in fencing.
- Attempt to enhance the physical and skill levels of the students.

The researcher ensured homogeneity by calculating the mean, standard deviation, and skewness coefficient for the research sample in variables (age, height, weight). Additionally, an intelligence test was applied, as illustrated in Table (1).

Table (1)
Mean, Standard Deviation, and Skewness Coefficient for Descriptive Variables Under Investigation

n=25

Variables	Mean	Standard Deviation	Skewness Coefficient
Age	18.28	0.79	0.53
Height	162.76	4.37	-0.358
Weight	58.60	5.09	-0.276
Intelligence	96.60	11.94	0.502

***Table (1) demonstrates that the skewness coefficient for the descriptive variables is confined between (+3, -3), indicating the normality of the data.**

Data Collection Tools:

1. **Arabic and English References:** The researcher conducted a comprehensive literature review after reviewing numerous scientific sources in the field of fencing, educational technology in general, and three-

dimensional modeling technology in particular. This included a survey of what has been published in scientific journals.

2. **Devices and Tools:**
   - Medical scale for measuring weight in kilograms.
   - Measuring tape for height and distance in centimeters.
   - Stopwatch for measuring time.
   - Colored pens for marking.
   - Ruler graduated in centimeters.
   - Legal foil weapon with a length of 110 cm and a weight of 500 grams.
   - Recording board.
   - Camera for recording.
   - iPad for content display.
   - Laptop.

3. **Data Recording Forms:** The researcher designed forms for recording the measurements related to the research and the data of the research sample for data collection and subsequent statistical analysis. These include:
   -Registration Form for Measurements for Female Students in Variables (Age, Height, Weight). Attached (٢).
   - Form for Recording Measurements for Female Students in Physical Skill Tests. Attached (٣).
   - Form for Recording Measurements for Female Students in Skill Test (Under Research). Attached (٤).

4. **Tests:**
   First, Physical Skill Tests:
   1. **Reaction Speed Test for Lunge Movement:** Measures reaction speed.
   2. **Advance Speed Test:** Measures motor speed.
   3. **Flexibility of Joints Involved in the Lunge Movement Test:** Measures flexibility. (attached ٥)

Second, Skill Test:
- Lunge Skill Test. (attached ٤)

Scientific Properties of Physical Tests:
Evaluating the accuracy of physical skill assessments

The researcher measured the accuracy of physical skill assessments by comparing the performance between the higher and lower proficiency groups

within a survey sample drawn from the research community and beyond the core sample. The sample consisted of 20 female students, and the assessment took place on February 5, 2023. The results are presented in (Table 2).

Table (2)
The differences between the lower spring and upper spring groups in the physical skill assessments

N=20

Variables	Lower Spring (n=5)		Upper Spring (n=5)		t-value	Significance
	mean	Standard deviation	mean	Standard deviation		
Advance Test (m)	٤.٨٠	١.١٢	٤.٠٠	١.٠٣	٥.٩١*	٠.٠٠١
Reaction Test	٠.٣٤٥	٠.١١١	٠.٢١٥	٠.١٧٨	٤.٩١*	٠.٠٠٠
Flexibility Test	٢.٩٩	٠.٤٩٠	٢.١١	٠.٤١٠	٦.٣٤*	٠.٠٢٠

***Significance is less than 0.05**

From Table (2), it is evident that there are statistically significant differences between the two groups in favor of the higher spring group. This indicates the tests' ability to distinguish between the two groups and the validity of the physical skill assessments.

The stability of the physical skill assessments

The researcher assessed the stability of the physical skill assessments through test-retest methodology. The tests were initially administered to a survey sample drawn from the research community and outside the core research sample on Sunday, February 5, 2023. Subsequently, the researcher re-administered the tests on Sunday, February 12, 2023, with a seven-day interval between the first and second applications. The details of this process are outlined in Table (3).

Table (3)
The correlation coefficient between the two applications in the physical skill assessments

N=20

Variables	First Application		Second Application		r - value	Significance
	mean	Standard deviation	mean	Standard deviation		
Advance Test (m)	5.12	1.65	5.76	1.98	*0.678	0.000
Reaction Test	0.345	0.114	0.400	0.118	*0.593	0.000

Flexibility Test	**50.53**	**11.05**	**50.98**	**11.98**	***0.634**	**0.000**

***Statistically significant at the 0.05 level.**

Scientific Properties of Skill Test:

The accuracy of the skill assessments

The researcher measured the validity of the skill assessments by comparing the higher and lower spring groups within a survey sample taken from the research community and beyond the core sample. The sample consisted of (20) female students, and the assessments were conducted on February 6, 2023. The results are detailed in (Table 4).

Table (4)
The differences between the lower spring and upper spring groups in the skill assessments
N=20

Variables	Lower Spring (n=5)		Upper Spring (n=5)		T - value	Significance
	mean	Standard deviation	mean	Standard deviation		
Lunge	2.06	0.700	3.98	0.803	*4.91	0.007

***Statistically significant at the 0.05 level.**

From Table (4), it is evident that there are statistically significant differences between the two groups in favor of the upper spring group. This suggests the validity of the skill assessments and their ability to distinguish between the two groups.

The stability of the skill assessments

The researcher calculated the reliability of the skill assessments through test-retest methodology. The tests were initially administered to a survey sample drawn from the research community and beyond the core research sample on Monday, February 6, 2023. Subsequently, the researcher re-administered the tests on Monday, February 13, 2023, with a seven-day interval between the first and second applications. The details of this process are outlined in Table (5).

Table (5)
The correlation coefficient between the two applications in the skill assessments
N=20

Variables	First Appilcation		Second Application		r - value	Significance
	Mean	Standard deviation	mean	Standard deviation		
Lunge	2.81	0.477	3.03	0.499	*0.591	0.000

***Statistically significant at the 0.05 level.**

Table (5) reveals a statistically significant correlation between the two applications in the skill assessments under investigation. This indicates the reliability and stability of the skill assessments.

Knowledge Acquisition Test:

The researcher developed a cognitive test for the students in the research sample, following several steps, including:

1. Setting the Test Objective:

This test aims to measure the level of cognitive knowledge among individuals in the research sample regarding the fundamentals of fencing with the foil.

2. Identification of Test Axes:

Based on the test's objective, the researcher identified several main axes that the test could include after conducting a reference survey of previous research and studies in the same field, in addition to the fencing curriculum for first-year students. Three axes were extracted and placed in the questionnaire:

a. Historical Axis.
b. Skill Performance Axis.
c. Fencing Tools and Tasks Axis.

These axes were presented to experts to express their opinion on the relative importance of each axis in alignment with the nature of the research and the sample.

3. Determining the Relative Importance of Test Axes:

The researcher prepared a table of the relative importance of the cognitive test axes and presented it to experts to understand the relative importance of each axis in the cognitive test. This is evident in Table (6), (attached ٦).

Table (6)
The Relative Importance of Cognitive Test Axes According to Expert Opinions
N=10

Axis	The Relative Importance
Historical Axis	10%
Skill Performance Axis	60%
Fencing Tools and Tasks Axis	30%
Total	100%

Table (6) indicates that the experts assigned the highest relative importance to the Skill Performance Axis, followed by the Fencing Tools and Tasks Axis, and lastly, the Historical Axis.

4. Writing Cognitive Test Items:

The researcher took into consideration the relative importance of each axis in the cognitive test according to the opinions of the experts. The aim was to ensure that the test items are clear, carry a single meaning, and avoid ambiguity. The statements were formulated in an engaging manner for the students. The test comprised 50 items, and these statements were presented to the experts to ensure their appropriateness, clarity, and formulation

.

5. Cognitive Test Instructions:

The researcher wrote introductory remarks for the test, explaining how to answer the questions in a clear manner suitable for the students. Each question was assigned one point during the correction process.

6. Test Administration:

The test was administered to a sample of (20) female students on March 25, 2023, from the first year at the Faculty of Physical Education, Helwan University. This sample included participants from both the research community and beyond the core research sample. The aim was to ensure the clarity of the cognitive test questions and to calculate the statistical indicators for the test. (Attachment ٧).

Table (7)
the cognitive test axes and the corresponding statement numbers for each axis

Test Axes	The total number of statements	Statements Numbers
History Axis	٦	(٣٣-٢٥-٢١-١٣-٤-١)
Skill Performance Axis	٢٥	(٣-٢-٦-٧-٨-٩-١١-١٢-١٤-١٥- ١٦-١٧-١٨-١٩-٢٠-٢٦-٢٨-٢٩- ٣٠-٣٢-٣٤-٣٥-٤٢-٤٨-٥٠)
Tools and Tasks Axis	١٩	(٥-١٠-٢٢-٢٣-٢٤-٢٧-٢٨-٢٩-٣٠- ٣١-٣٦-٣٧-٣٨-٣٩-٤٠-٤١-٤٣- ٤٤-٤٩)
Total		٥٠

Calculation of Ease, Difficulty, and Discrimination Coefficients for the Cognitive Test

Table (8)
Coefficients of Ease, Difficulty, and Discrimination for Cognitive Test Items
N=20

n	History Axis		Skill Performance Axis		Tools and Tasks Axis	
	DR	DI	DR	DI	DR	DI
١	٠.٦٥*	٠.٨٠*	٠.١٢	٠.٢٠	٠.٤٥*	٠.٧٤*
٢	0.15	٠.٥٥	٠.٤١*	٠.٦٩*	٠.٥٨*	٠.٦٨*
٣	٠.٢٠	٠.٤٠	٠.٥٨*	٠.٧٠*	٠.٢٢	٠.٧٣*
٤	٠.٦٧*	٠.٧٥*	٠.٤٣*	٠.٦٨*	٠.٦٠*	٠.٨٣*
٥	٠.٤٢*	٠.٧٢*	٠.٥٧*	٠.٨٦*	٠.١٠	٠.٨٠*
٦	٠.٥٠*	٠.٦٧*	٠.٥٩*	٠.٧٠*	٠.٢٤	٠.٦٩*
٧			٠.٣٥*	٠.٨٧*	٠.٤٢*	٠.٧٢*
٨			٠.٤٢*	٠.٧٤*	٠.١١	٠.٧٥*
٩			٠.٣٧*	٠.٧٨*	٠.٥٢*	٠.٧٠*
١٠			٠.٦١*	٠.٧١*	٠.٤٣*	٠.٨٢*
١١			٠.١٣	٠.٨٨*	٠.٠٥	٠.٧١*
١٢			٠.٠٩	٠.٢٨	٠.٦٥*	٠.٧٦*
١٣			٠.٠١	٠.٨٢*	٠.١٤	٠.٨٠*
١٤			٠.٥٤*	٠.٧٣*	٠.٦٧*	٠.٨١
١٥			٠.٤٨*	٠.٧٤*		
١٦			٠.٦٢*	٠.٧٢*		
١٧			٠.٦٣*	٠.٧٩*		
١٨			٠.٤٤*	٠.٨٥*		
١٩			٠.٥٦*	٠.٧٤*		
٢٠			٠.٥٢*	٠.٦٩*		
٢١			٠.٦١*	٠.٨٨*		

٢٢			٠.٤٥*	٠.٨١*		
٢٣			٠.٦٣*	٠.٧٢*		
٢٤			٠.٦٧*	٠.٧٣*		
٢٥			٠.١١	٠.٥٥		
٢٦			٠.٤٦*	٠.٧٤*		
٢٧			٠.٤٨*	٠.٦٧*		
٢٨			٠.٦١*	٠.٨٢*		
٢٩			٠.٥٣*	٠.٧١*		
٣٠			٠.٦٠*	٠.٦٨*		

-DR is The coefficients of ease and difficulty (the coefficient accepts values between 0.33 – 0.67)
-DI is The discrimination coefficient (the coefficient accepts values of 0.67 or more)
**** is the accepted statements.**

It is evident from Table (8) that (13) statements have been removed from the cognitive test due to the non-acceptance of coefficients of difficulty, ease, and discrimination. Thus, the test, in its revised form, consists of (37) statements. (attached ٨)

Calculating the reliability coefficient for the cognitive test

Table (9)
The correlation value between the score of each axis and the total score of the test

N=20

Axis	Statement Number	(r)
History Axis	٤	٠.٨١١*
Skill Performance Axis	٢٥	٠.٩٠١*
Tools and Tasks Axis	٨	٠.٧٩٢*

The tabular correlation value (r) is 0.738.

It is evident from Table (9) that there is a statistically significant correlation between the score of each axis and the total score of the test.

Calculating the Cognitive Test Reliability Coefficient

Table (10)
Correlation Values between the First and Second Applications for the Cognitive Test Axes
N=20

Axes	First Application		Second Application		(r)	Statistical Significance
	mean	Standard deviation	mean	Standard deviation		
History Axis	١.٥٠	١.٢٣	٢.٠	١.٢٥	٠.٧٨٠*	Function
Skill Performance Axis	١٣.٦٠	٢.٥٠	١٤.١٠	٢.٦٥	٠.٧٧١*	Function
Tools and Tasks Axis	٥.٠	١.١٠	٦.١١	١.٥٥	٠.٨٠٠*	Function
Total	٢٠.١	٣.١٧	٢٢.٢١	٣.٢٠	٠.٧٧٥*	Function

The tabulated value (r) = (0.738).

It is evident from Table (10) that there is a statistically significant correlation between the initial application and the re-application on the cognitive test axes. Therefore, it is valid for application.

The proposed educational program using 3D models

The construction of the educational program using 3D models is the fundamental focus of this research. The researcher conducted a thorough search and review of numerous scientific references and previous studies, both Arab and foreign, that revolve around the use of 3D models in educational and training programs. Based on this, she established the objectives, principles, and content for the educational program under investigation.

1.Suggested Educational Program Goals
Educational Goal

- To enhance the physical performance of first-year female students.
- To capture the attention and enthusiasm of the students.
- The program model presented to the students should be realistic, executable, and of a high standard.
- To instill in the students a new learning method, namely, self-directed learning.

The content of the program (academic material)

The researcher has determined the content of the program to align and harmonize with the research goal, which is to impart some skills of fencing to the students. (attached ٩)

Students Level

The research was conducted on first-year students who were beginners in the sport of fencing with the foil, possessing zero proficiency in the fundamental skills of this discipline.

The principles considered when developing the proposed program include:

- Considering Individual Differences: The program aims to accommodate and address individual variations among students.
- Age-Appropriate: Ensuring that the program is suitable for the specific age group of the students.

Educational Units for the Proposed Program:

The educational program consists of 12 weeks, with two sessions per week, and each unit has a duration of 60 minutes. (attached 10)

Modern Technology Used in the Proposed Program:

- 3D Sensors.
- Motion Analysis Software.
- 3D Models.

Resources Used in the Proposed Program:

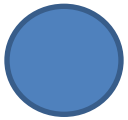
- Fencing Hall.
- Foil Weapons.

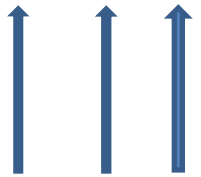
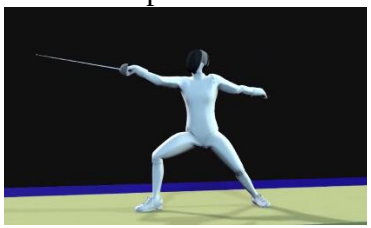
Considerations for Program Implementation:

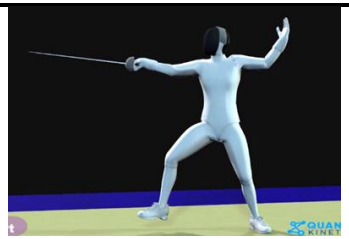
- The researcher recorded a high-level fencer and connected her to a three-dimensional sensor device while performing the skills under investigation at the College of Physical Education for Girls, Helwan University.
- The researcher then processed the data from the sensor device and input it into a motion analysis program, resulting in three-dimensional models in their final form, with specific technical points on the models for each part of the investigated skills.
- The videos of the recorded skills were sent to the students using the WhatsApp application.

Table (11)

Educational Unit Model from the Proposed Educational Program
Total Time for the Unit: 60 minutes
Educational Objective: Teach the skill of "Lunge" (Le Developpement)
Cognitive Objective: Acquire knowledge and information related to the skill.
Physical Objective: Develop physical attributes associated with the skill.
Educational Objective: Foster collaboration and leadership.

Components of load	Time	Content	Aim of training	Load levels	Formations
Warming up	5 min	- running - arms exercises - trunk exercises - legs exercises	- Stimulating the Circulatory System - Preparing the Muscles Before Performance	Simple	Circle 
General Physical Preparation Biceps Stregnth Trunk Flexibility Respiratory Endurance	١٠ min	- Weightlifting and Arm Extension Forward - Spreading the Legs and Attempting to Place the Head on the Knee - Jogging in Place for 1 Minute	Enhancing the Physical Fitness of the Player to Achieve Optimal Performance	Moderate	Spreading 
		- Standing in the on guarde Position, then Returning to	- Development of Neuromuscular Coordination	Maximum 95 %	Lines

Specific Physical Preparation	10 min	Attention position 4 Times -Standing in the on guarde Position and Jumping 4 Times - Standing on a bench and Jumping 4 Times on on guarde position	- Development of Spatial Awareness and Sense of Void - Strengthening the Leg Muscles		
Main Part	30 min	Progressing in the skill of advancement through watching videos on a laptop, iPad, or phone  Performance Method: 1. The skill begins from the on guarde position , then extending the armed arm. 2. Taking a step forward with the front foot and keeping the back foot stable.	Skill understanding	moderate	

		 3. Not lifting the back foot off the ground without tension in the movement, and lowering the free (non-armed) arm downward in parallel extension to the back leg. 4. The gradual descent of the front foot onto the heel until the ball of the foot touches the ground, ensuring that the knee is vertical over the foot. 			
Cool down	٥ min	Cool down exercises	Muscles Cool down		circle

Attached (10)

Implementation of the Proposed Program Using 3D Models:

The researcher initiated the implementation of the proposed program from February 18, 2023, until May 6, 2023, with one training unit per week.

Survey Studies:

First Survey Study:

During the period from February 4, 2023, to February 6, 2023, the researcher conducted a survey study on a total of (20) female students from the first year, including both the research community and outside the primary research sample.

The purpose of this study was to calculate the scientific coefficients for the tests and aimed to:

- Ensure the validity and suitability of the tests used for the research sample.
- Confirm the validity of the tools and devices used.

Second Survey Study:

During the period from February 11, 2023, to February 13, 2023, the researcher conducted a second survey study involving (20) female students from the first year at the Faculty of Physical Education. This study targeted both the research community and those outside the primary research sample. The aim was to ensure the extent to which the students understood and comprehended the proposed program using three-dimensional models.

Implementation Procedures:

Main Study Implementation:

The researcher implemented the educational program using three-dimensional models on the research sample, utilizing various technological tools such as laptops, iPads, and mobile phones. This took place from February 18, 2023, to May 6, 2023, with two training units per week for a total of 12 weeks, and each unit lasted for 60 minutes, totaling 720 minutes overall.

Intermediate Measurements:

The researcher conducted intermediate physical-skill measurements for the basic research group from April 1, 2023, to April 3, 2023, to monitor the progress in the variables under study.

Post-measurements:

After completing the implementation of the basic educational program, the researcher conducted post- physical-skill measurements from May 4, 2023, to May 6, 2023. The data was then processed statistically after being collected and organized.

Statistical Procedures:

After collecting and organizing the data, and recording measurements for the variables used in the research, the researcher performed appropriate statistical procedures to achieve the research objectives and verify its hypotheses. The following statistical methods were used:

Statistical Procedures Used:

1. Descriptive Statistics
2. T-test for Significance
3. Spearman's Correlation Coefficient
4. One-Way Analysis of Variance
5. Least Significant Difference (LSD) for Mean Differences
6. Improvement Percentage Calculation

Results Summary

Table (12)
The disparities between the two assessment methods (intra-individual and inter-individual) in physical motor skills variables and the corresponding improvement rates

N=25

Variables		Mean	Standard Deviation	T - value	p- value	%
Advance speed test	**Itntra**	5.8240	1.16164	٥.٢٦*	0.000	22.1
	Inter	4.5320	٠.66503			
Reaction Test	**Intra**	٠.3064	٠.14815	0.179	0.859	7.2
	Inter	٠.3288	٠.59011			
Flexibility Test	**Intra**	50.4400	14.04481	٣.٩٨*	0.001	3.2
	Inter	48.8000	13.64734			

***Significance level less than 0.05 indicates statistically significant differences**.

Table (12) reveals statistically significant differences between the two

assessment methods for all investigated physical motor skill variables in favor of the inter-individual measurement, except for the variable of 'Reaction Time,' where no statistically significant differences are observed.

Table (13)
The disparities between the intra-individual and inter-individual assessments in skill variables and their respective improvement percentages

N=25

Variables		M	SD	T - Value	P - Value	%
Lunge	**Intra**	2.5600	٠.79477	١٠.٨٦*	0.000	75.0
	Inter	4.4800	٠.88365			

***Significance level less than 0.05 indicates statistically significant differences.**

Table (13) reveals statistically significant differences between the two assessment methods for all investigated skill variables in favor of the inter-individual measurement.

Table (14)
The significance of differences between intra-individual and inter-individual measurements for sample responses on cognitive test axes and their corresponding improvement percentages

N=25

Axes		M	SD	T - Value	P - Value	%
History	**Intra**	1.6000	1.22474	٩.٢٨*	0.000	95.0
	Inter	3.1200	٠.72572			
Skill Performance	**Intra**	14.1600	2.68763	٦.٠٢*	0.000	20.6
	Inter	17.0800	3.37787			
Tools and Tasks	**Intra**	5.5200	1.19443	٨.١٦*	0.003	16.0
	Inter	6.4000	1.55456			
Total Score	**Intra**	21.2800	3.76962	٨.٩٠*	0.000	25.0
	Inter	26.6000	3.79693			

***Significance level less than 0.05 indicates statistically significant differences.**

Table (14) indicates that there are statistically significant differences

between the two assessment methods for all cognitive test axes under investigation, favoring the inter-individual measurement.

Discussion of the Results

Based on the research objective, the methodology employed, the study sample, and the statistical analyses, several key conclusions can be drawn:

Table (12) illustrates the differences between intra-individual and inter-individual measurements in physical motor skill variables. Statistically significant differences were found in all skill variables, except for Reaction Time, favoring the inter-individual measurement. The improvement percentages were notable, with a 22.1% enhancement in the Progress 7M test and a 3.2% improvement in the Flexibility test. However, Reaction Time showed a non-statistically significant improvement of 7.2%."

The researcher attributed the progress in physical motor skill variables to the educational program utilizing three-dimensional models. The program introduced a novel pedagogical approach that considered individual differences among novice female students in the sport of fencing with the foil weapon.

The findings align with the studies conducted by "Rasha Farag Masoud" (2019) (21) and "Hamdi Ahmed and Toot" (2018). (12)

This suggests partial support for the first hypothesis, indicating statistically significant differences in the results between the intra-individual and inter-individual assessments for the physical motor skill variables related to fencing for the experimental research group, in favor of the inter-individual measurement.

Table (13) elucidates the differences between intra-individual and inter-individual measurements in skill variables, indicating statistically significant differences in the investigated skill variables in favor of the inter-individual measurement. The improvement percentage in the flexibility movement skill test reached 75.0%.

The researcher attributes this positive impact on skill variables to the use of three-dimensional modeling technology, which stimulates the senses of the students and creates a new educational environment that enhances learners' motivation.

This aligns with the studies conducted by "Moshira Ibrahim" and "Ahmed Talha" (2021) (19), as well as "Heba Ahmed Nassar" (2018). (13)

This confirms the validity of the second hypothesis, which states the existence of statistically significant differences in the results between the intra-individual and inter-individual assessments in the level of skill performance for the stabbing skill for the experimental research group, in favor of the inter-individual measurement.

Table (14) illustrates the significance of differences between intra-individual and inter-individual measurements for sample responses on cognitive test axes and their improvement percentages. Statistically significant differences were found in all cognitive test axes under investigation between intra-individual and inter-individual measurements, favoring the inter-individual measurement. The improvement percentages were noteworthy, with a 95.0% enhancement in the History axis, 20.6% in the Skill Performance axis, 16.0% in the Tools and Tasks axis, and 25.0% in the Total Score axis.

The researcher attributes the superiority in the level of cognitive achievement among students to the consolidation of cognitive information related to the students' curriculum through the presentation of educational models using three-dimensional models.

These results are consistent with the findings of studies conducted by "Wala El Maghazi" (2021) (24) and "Ghadeer Ezzat Abdel Salam" (2020). (10)

This confirms the validity of the third hypothesis, which suggests the existence of statistically significant differences in the results between the intra-individual and inter-individual assessments in the level of cognitive achievement for fencing for the experimental research group, in favor of the inter-individual measurement.

The conclusions

1. Statistically significant differences exist between the intra-individual and inter-individual measurements for all investigated physical motor skill variables, favoring the inter-individual measurement. However, in the measurement of Reaction Time, there are no statistically significant differences between the two measurements.

2. There are statistically significant differences between the intra-individual and inter-individual measurements for all investigated skill variables, favoring the inter-individual measurement.
3.The use of three-dimensional models in educational units has a positive impact on the cognitive aspect of the students.
4.The use of three-dimensional models is considered an effective means to clarify different angles of skill components, contributing to an improved understanding of the concepts and skills learned by students.

Recommendations

Based on the research results and findings, the researcher recommends the following:
1. Directing three-dimensional models to fencing coaches to benefit from them and their results.
2. Disseminating the culture of using modern technology, especially three-dimensional models, among female students at the College of Physical Education.
3. Emphasizing the importance of utilizing three-dimensional models in educational practices for those involved in the educational process.

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