

The Impact of Infographic Technology on Knowledge Acquisition and Performance Level of Second-Year Female Students in Field Competitions

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Abstract:

The research aims to design an infographic technology program and to identify the impact of using this program on The level of achievement in field competitions prescribed and The performance level (skill and digital) of field competitions prescribed for second-year female students (hammer throw, javelin throw, and triple jump), The researchers utilized an experimental methodology with pre-test and post-test measurements for two groups, one control and the other experimental, to fit the research's requirements and nature, The research population comprises second-year female students at the Faculty of Physical Education for Girls at Al-Jazeera University in Cairo for the academic year 2022-2023. The research sample was randomly selected, consisting of 44 students out of a total of 270 students, representing 17% of the research population. They were equally divided into two groups: one experimental group with 22 students and the other control group with 22 students. 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:

1. There are statistically significant differences in cognitive achievement levels in the dimensional measurement between the control and experimental groups in favor of the experimental group.



2. There are statistically significant differences in performance levels (skill-digital) for field competitions prescribed for the second year (hammer throw, javelin throw, and triple jump).

Keywords: Infographic, Knowledge Acquisition, Performance Level, Field Competitions.

الملخص:

تهدف البحث إلى تصميم برنامج إنفوجرافيك وتحديد تأثير استخدام هذا البرنامج على مستوى التحصيل في مسابقات الميدان المقررة ومستوى الأداء (المهارة والرقمي) في المسابقات الميدان المحددة لطالبات السنة الثانية (رمي المطرقة، رمي الرمح، والقفز الثلاثي). استخدم الباحثون منهجية تجريبية مع قياسات قبل الاختبار وبعد الاختبار لمجموعتين، مجموعة ضابطة وأخرى تجريبية، لتناسب مع متطلبات البحث وطبيعته، ويشمل عينة البحث طالبات السنة الثانية ورمي الأمترية، ويشمل عينة البحث طالبات السنة الثانية وأخرى تجريبية، لتتناسب مع متطلبات البحث وطبيعته، ويشمل عينة البحث طالبات السنة الثانية وأخرى تجريبية، التربية البحث في القاهرة للعام الدراسي 2022-2023. تم اختيار العينة عشوائيًا، وتتكون من 44 طالبة من إجمالي 270 طالبة، ممثلة 17% من مجموعة البحث. تم عشوائيًا، وتتكون من 44 طالبة من إجمالي 270 طالبة، ممثلة 17% من مجموعة البحث. تقسيمهن بالتساوي إلى مجموعتين: مجموعة تجريبية مكونة من 22 طالبة ومجموعة نابطة المعام الدراسي 2023-2023. تم اختيار العينة عشوائيًا، وتتكون من 44 طالبة من إجمالي 270 طالبة، ممثلة 17% من مجموعة البحث. تم ملوائيًا، وتنكون من 40 طالبة من إجمالي 270 طالبة، ممثلة 17% من مجموعة البحث. تم أخرى مكونة من 22 طالبة من إجمالي 270 طالبة، ممثلة 17% من مجموعة المحث. تم أخرى مكونة من 22 طالبة ومجموعة ونابطة تقسيمهن بالتساوي إلى مجموعتين: مجموعة تجريبية مكونة من 22 طالبة ومجموعة ضابطة وسمولية الحرى مكونة من 22 طالبة. في ضوء أهداف البحث وطبيعة الدراسة، ضمن حدود عينة البحث، ولمنهجية المستخدمة، وبناءً على البيانات المجمعة ونتائج التحليل الإحصائي، توصل الباحث إلى ما يلي:

هناك فروقات ذات دلالة إحصائية في مستويات التحصيل المعرفي في القياس البعدي بين المجموعتين الضابطة والتجريبية لصالح المجموعة التجريبية.
 هناك فروقات ذات دلالة إحصائية في مستويات الأداء (المهارة-الرقمي)
 للمسابقات الميدانية المحددة للسنة الثانية (رمي المطرقة، رمي الرمح، والقفز الثلاثي.

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Introduction and Research Problem:

Life in the information age is witnessing notable advancements across various fields, which require individuals to adapt to the technological, technical, and knowledge changes of this era. Scientific research plays a crucial role in addressing many life problems. Scholars involved in the educational process strive to develop the technological variables used in education to enhance students' abilities to acquire knowledge independently from various sources.



Awad Hussein Al-Toudri (2020) indicates that the explosion of information technology in the field of educational technology has been a primary reason for the diversity of educational tools, each having a different positive impact on teaching methods. Educational technology has positively contributed to considering individual differences among learners. (13:57)

Mamdouh Mohammed Abdel-Meguid (2000) states that modern educational technologies are not an end in themselves; the availability of innovative tools and devices in educational technology is not the only determining factor in education. What is more important is how they are utilized in educational situations to achieve the desired objectives. (22:310)

Wafiqa Mustafa Hassan (2007) highlights that the relationship between physical education and educational technology is positively correlated. The use of educational technology in physical education activities achieves the principle of calculated speed. In other words, the education diminishes effectiveness of physical without proper implementation methods, accurate teaching techniques, sound intellectual and scientific foundations, efficient use of time and resources, all of which are facilitated by an educational technology system. Thus, educational technology is essential for the success of this vital type of education and for achieving its desired goals. (26:203)

One of the characteristics of our current era is that it is the "age of the image," implying the dominance and control of the visual medium as one of the most important tools in our knowledge and cultural world. The image is not a new element in human history, but it has transitioned from the periphery to the center, from partial presence to dominance over other cultural and knowledge elements. (40)

Given that infographics are a visual representation of data and information, they have emerged with diverse designs to provide a new visual form for presenting information and data attractively to the reader. Infographic designs are very important as they change the way individuals think about complex data and information. (19:25)

Hussein Mohammed Ahmed (2015) indicates that approximately 90% of the information transmitted to the brain is visual, and about 40% of



people use visual information more effectively compared to textual information. The brain processes visual information faster than textual information and prefers its use more. (7:15)

Dur (2014) points out that infographics play a strong role in the educational process as they can explain complex and difficult-tounderstand concepts in a simple way. They can also encourage student creativity by prompting them to create and design their infographics. (29:351)

Various references and studies have proven that infographics are a powerful educational medium for teachers that can be used in different curricula. They equip students with intellectual skills, moving them to the stage of analysis and synthesis, and are among the most commonly used methods that help students engage in learning and think about new information.

Field and track competitions are fundamental courses taught in physical education faculties, requiring physical and mental attributes in students to achieve the required performance level for executing basic skills. These courses are strenuous for female students, necessitating attention to teaching these skills through methods and techniques that employ modern technology. Like other sports, field and track competitions rely on technological advancements in education, training, and measurements.

Hence, the research problem arises as a scientific attempt by the researchers to use a modern technique to develop skill performance levels and increase knowledge acquisition for the field competition course for second-year students. The researchers observed that the increasing number of female students during practical and theoretical lectures, along with the number of required courses, makes it difficult for some students to understand the curriculum. This difficulty requires additional effort from the teacher to teach and simplify the skills so that students can comprehend their stages. Moreover, there is a challenge in direct communication between the instructor and the student. The researchers also noted that each student possesses an educational tablet.



Therefore, the idea of the research emerged to find a supportive method to the existing method (explanation and model performance) used in teaching field and track competitions. This necessitates exploring a new teaching approach by using educational tablets for students to facilitate comprehension and understanding. Consequently, this research aims to investigate the impact of infographic technology on knowledge acquisition and performance level in the field competition course for second-year female students in the Faculty of Physical Education for Girls in Cairo.

By reviewing the results of previous studies and research in the field of physical education, the researchers found a scarcity of studies that addressed this technology in the sports field. This motivated the researchers to explore the impact of infographic technology on knowledge acquisition and performance level in the field competition course, adding a modern aspect to the current research.

Importance of Research

1. The scientific importance lies in the scarcity of research and studies conducted in this field using this technique.

2. The practical significance is the potential use of this technique in various educational courses to enhance students' motivation to comprehend information.

Research Objectives:

The research aims to design an infographic technology program and to identify the impact of using this program on:

1. The level of achievement in field competitions prescribed for secondyear female students (hammer throw, javelin throw, and triple jump).

2. The performance level (skill and digital) of field competitions prescribed for second-year female students (hammer throw, javelin throw, and triple jump).

Research Hypotheses:

3. There are statistically significant differences in cognitive achievement levels in the dimensional measurement between the control and experimental groups in favor of the experimental group.



4. There are statistically significant differences in performance levels (skill-digital) for field competitions prescribed for the second year (hammer throw, javelin throw, and triple jump).

Terminology Used in Research:

Infographic:

"Infographic is a term used to refer to the art of transforming data, information, and concepts into clear and captivating images and drawings that can be easily understood and comprehended. This style is characterized by presenting complex and difficult information in a smooth and clear manner".

Cognitive Achievement:

"It is the set of information, knowledge, and experiences acquired by the learner through organized cognitive content."

Performance Skill:

"Teaching, developing, refining, mastering, and consolidating sports motor skills that can be used in sports competitions to achieve the highest athletic Achievements".

Previous Related Studies:

First: Arab Studies:

1. Study by Ahmed Maher et al. (2021): "Impact of an Educational Program Using Infographic Technology on the Performance Level of Some Basic Motor Skills in Track and Field for Children", which used the experimental approach and conducted a model study on (40) male and female students in the second grade of primary school at Nasiriya Experimental School. The researchers used physical and skill tests to collect data. The most important result was the effectiveness of using infographic technology in two presentation formats in demonstrating the cognitive structure of educational content about basic motor skills in track and field for children.

2. Study by Amr Sayed Fahmy (2021): "Effect of Using Educational Infographic in its (Static - Animated) Form During the Corona Pandemic through Educational Platforms on Cognitive Achievement in Handball", applied the experimental method to a sample of (300) male and female



students in the third year at the College of Physical Education for Boys at Benha University. The researcher used cognitive tests to collect data, and the most important results were statistically significant differences between the pre-test and post-test measurements for the experimental group in the cognitive achievement level of handball arbitration decisions, supported by subsequent measures, and statistically significant differences between the experimental and control groups for the football team, measuring cognitive achievement levels to make the decision in favor of the experimental group.

3. Study by Samar Mahmoud Abdel Fattah (2020): "Interaction between Infographic Style and Gaming Strategy to Develop Visual Thinking Skills and Cognitive Achievement of Educational Technology Students", where the researcher used the descriptive and experimental methods with two experimental groups. The study sample consisted of (50) male and female students from the Technology Education Department at the Faculty of Specific Education, Benha University. The most important result was the statistically significant difference between the pre-test and post-test means for the two experimental groups in favor of the post-test after using infographic and gaming strategy.

4. Study by Heba Saad Eldin Mohamed (2019): "Effectiveness of Using Infographic in its (Static - Animated) Form on Cognitive and Skill Achievement of Front Handspring on Vault", which used the experimental method. The research sample consisted of (60) female students divided into three groups, each group consisting of (20) students in the third year at the College of Physical Education, Minia University. It was found that the students of the first experimental group who used static infographic outperformed the students of the control group in cognitive achievement and learning the front handspring skill on the vault. Additionally, the second experimental group and the control group students.

Second: Foreign Studies:

1. Study by Fezile Ozdamla and Hasan Ozdal (2018): Titled "The Impact of an Educational Program Designed on Infographic Programs to Understand the Opinions of Both Teachers and Students," this study aims



to determine the impact of educational programs designed using infographic programs to understand the opinions of both teachers and students. The researchers used the experimental method with a sample of teachers and primary school students. The sample size was (94), including (43) teachers and (51) students. The results obtained showed positive opinions about the use of infographics in the school learning environment.

2. **Study by Yildirm (2016):** Titled "Infographics for Educational Purposes (Their Structural Characteristics and Reader Approaches)," the researcher used the descriptive method, and the sample consisted of (64) students from the Faculty of Education at Atatürk University. One of the key findings was the benefit of using infographics in the primary learning process, which helps retain information in memory for a longer period.

3. **Study by Mohd Amin et al. (2015):** Titled "Using Infographics as a Tool to Facilitate Learning," this study aims to understand the importance of using infographics to facilitate the learning process. The researchers used the experimental method, and one of the key findings was that the attractive design of infographics, including images, symbols, and colors, encouraged learners to better understand the information presented. The study recommends considering infographics as a reliable tool to solve educational issues related to specific learner patterns.

4. **Study by Bucket, A., & Pinar, N. (2014):** Titled "A New Approach to Providing Students with Visual Literacy Skills: Using Infographics in Education," this study aims to determine the most effective design of static infographics as an educational tool when teaching and learning various courses. The researchers used the experimental method on a sample of teachers. The sample size was (64) candidate teachers. The researchers used cognitive tests to collect data, and the results showed that visual components, colors, fonts, and data organization were most important to students

Research Methodology:

The researchers utilized an experimental methodology with pre-test and post-test measurements for two groups, one control and the other experimental, to fit the research's requirements and nature.



Research Population and Sample:

The research community consists of second-year female students from the Faculty of Physical Education, Al-Jazeera University in Cairo for the academic year 2022-2023. The primary research sample was selected randomly, totaling 44 students out of 270, representing 17% of the research population. These students were equally divided into two groups: an experimental group comprising 20 students and a control group comprising 20 students.Additionally, a validation sample of 4 students was selected from both within and outside the primary sample to conduct validity and reliability tests.

Sample Selection Criteria:

- 1. Exclusion of students who failed in field competitions.
- 2. Selection of new students in the second year.
- 3. Exclusion of athlete students (any sports activity).
- 4. Exclusion of students who are not committed to attending the program.

Description	Number	Excluded Students	Basic Sample
Experimental Group	23	3	20
Control Group	24	4	20
survey sample	4	_	4
ToTal	51	7	44

Sample Description Under Research

Table (1)

Sample Homogeneity:

The researcher conducted homogeneity tests for the research groups in the selected and defined variables after referring to relevant studies, scientific references, and expert opinions. These variables include :

- anthropometric variables (age, height, weight).



- intelligence level.
- performance level.
- and academic achievement (represented in the cognitive test for field competitions)

The following table illustrates sample homogeneity:

Table(2)Mean, Standard Deviation, and Skewness Coefficient for DescriptiveVariables of the Research Sample (n=44)

Variables	Mean	Standard Deviation	Skewness
Age	17.523	0.549	0.347
Height	162.205	4.723	1.066
Weight	63.614	4.862	1.179
Performance level	1.30	0.23	1.40
Intelligence	82.561	1.976	-0.507

"It is clear from Table (2) that the skewness coefficient for the sample as a whole, in the descriptive variables under investigation, ranges between (+3 and -3), indicating the normality of the data."

Equivalence of the Research Groups:

After the researcher ensured that the research sample was drawn from a homogeneous population and that it falls under the normal curve, the sample was divided into two groups: an experimental group consisting of 22 students and a control group consisting of 22 students. The equivalence between the two research groups was verified, as shown in Tables (3 and 4).

Table (3)Significance of Differences between the Control and ExperimentalResearch Groups in Descriptive Variables (n=40)

Variables	Groups	Mean	SD	t	Significance
Age	Experimental	17.455	0.596	0.820	0.417
	Control	17.591	0.503		



Height	Experimental	162.136	4.873	0.095	0.925
	Control	162.273	4.682		
Weight	Experimental	63.955	5.075	0.461	0.647
-	Control	63.273	4.733		
Performance	Experimental	13.900	1.45	0.658	0.471
level	Control	14.200	1.436		
Intelligence	Experimental	82.486	1.959	0.848	0.803
	Control	82.636	2.036		

Table 3:

The significance values are less than 0.05, indicating no statistically significant differences between the two groups in the descriptive variables under research (age, height, weight, intelligence), indicating the equivalence of the two groups in these measurements.

Table (4) Mean, Standard Deviation, and Skewness Coefficient of Physical Variables in Pre-test Measurements for the Control and Experimental Research Groups

(N=40)	
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Element	Test	Unit	Measureme nt	(M)	(SD)	(T)	Significan ce
Speed	30m Sprint	Secon	Pre	5.296	0.359	0.44	0.557
		a	Post	5.250	0.319	8	0.557
Muscle	Broad Jump	Cm	Pre	108.86	14.49		
Strength				3	9	0.22	0.602
			Post	106.81	11.07	6	0.602
				8	8		
Speed- Ve	Vertical	Cm	Pre	15.546	1.920	1.00	0.065
Strength	Jump		Post	16.772	2.349	1.09	
Arm	Medicine	Aedicine M		3.866	0.408	1 /2	0.066
Strength	Dall Throw		Post	4.200	0.499	1.43	0.000
Flexibility	Sit and	Cm	Pre	591	2.719	0.45	0.274
	Reach		Post	227	2.580	5	0.274
Enduranc	30-second	Count	Pre	15.000	2.690	1 10	0.560
е	Rope Jump		Post	15.818	2.174	1.10	0.300
Abdomin	30-second	Count	Pre	12.046	2.497	0.23	0.627
Strength	Sit-up		Post	11.864	2.606	6	0.627



Leg	Dynamomet	K.g	Pre	23.091	1.849	0.48	0.617
Strength	er		Post	22.773	2.429	9	0.017
Arm	Average	Count	Pre	8.500	1.406	0.50	0.662
Strength	Pressure		Post	8.318	.9455	3	0.002
Muscle	Burpee	Count	Pre	7.636	1.329	0.44	0.512
e			Post	7.455	1.405	1	0.515
Table A.						0	

Table 4:

The p-values are greater than 0.05, indicating no statistically significant differences between the two research groups (control and experimental) in physical variables in pre-test measurements, indicating the equivalence of the two groups in these measurements.

Data Collection Tools:

To collect data, the researcher used the following tools, devices, questionnaires, and tests:

1. Tools and Devices:

- Stadiometer for measuring height in centimeters.
- Medical scale for weighing in kilograms.
- Laptop computer.
- Headphones.
- Display screen.
- Mobile phone (tablet).
- Stopwatch.

The researcher calibrated the tools and devices used in the measurements for comparison with other devices to ensure their validity.

2. Questionnaires:

- Student Data Registration Form. (2)
- Expert Opinion Survey on the Program (Duration Content).
- Expert Opinion Survey on the Most Suitable Physical Tests for Fitness Elements Relevant to the Field Competitions under Research. (5)
- Expert Opinion Survey on the Most Common Technical Errors in the Competitions under Research. (6)



- Performance levels were evaluated using the Performance Skills Assessment Form by the Scientific Department (approved by the Measurement and Evaluation Unit at the College).

3. Tests and Measurements Used in the Study:

- Ahmed Zaki Saleh Intelligence Test:

The researchers used the Ahmed Zaki Saleh Pictorial Intelligence Test (1987) (attached number), designed to assess general mental ability (perception) in individuals aged 7 to 20 years. It consists of (60) questions including (5) sets, four of which are similar or share a specific thing, and the fifth is different. Students must identify the picture. This test was used because it is a non-verbal test that does not depend on Arabic language proficiency and can be applied to a large number of students. It is suitable for the research sample in terms of mental abilities (intelligence) and has been used in many studies and scientific references with high validity and reliability. Attached (2)

The intelligence quotient is determined by the following equation: IQ = Mental age \times 100 ÷ Chronological age.

- Special Physical Tests:

- The researchers selected physical tests that have been proven for their validity, reliability, and objectivity on a sample from the same population as the research sample. Attached (5).

Cognitive Test:

The researcher used the end-of-year written test for second-year students in track competitions to assess their knowledge level. This choice was made because it aligns with the course description for second-year track competitions for the academic year 2022/2023, as specified by the committee according to examination paper specifications. Attached(8)

Program Implementation Procedures:

Pre-Application Procedures:

- A questionnaire was conducted to select the most suitable physical tests that align with the fitness elements specific to the field competitions



under research (hammer throw, javelin throw, triple jump, and 400m race).

- A questionnaire was conducted to identify the most common technical errors in the competitions under research (hammer throw, javelin throw, and triple jump).
- The program was designed using infographics on the topics prescribed for the second year.

- The program was presented to experts to determine program steps and select the most suitable times for its implementation.

- A survey study was conducted on a sample of students from the research community and outside the primary research sample, totaling 4 students, during the period from Saturday, 18th February 2023, to Thursday, 23rd February 2023. This aimed to apply the variables under study and establish the scientific foundations for these variables.

Pre-test Measurement:

- The researchers conducted pre-assessments for the research groups on Tuesday, 14th February 2023, and Wednesday, 15th February 2023. The following measurements were taken

- Anthropometric pre-assessment and intelligence quotient measurement were conducted on Tuesday, 14th February 2023, for both the control and experimental groups.

- Performance level assessment was conducted on Wednesday, 15th February 2023, for both the control and experimental groups.

Implementation of the Proposed Program:

The researcher applied the proposed program for field competitions under research (hammer throw, javelin throw, triple jump) using infographics on the experimental group. Following a review of the syllabus for second-year field competitions and in accordance with the scheduled teaching time, the researcher implemented the program starting from the third week of the study. The application was completed in the seventh week of the study, lasting five weeks, with one session per week (Tuesday) for both the experimental and control groups. Each session lasted (45) minutes, with a total program time of (3:45) hours. The lecture was divided into (30)



minutes of faculty explanation and (15) minutes of presenting the program using infographic technology. The researcher ensured consistency during the implementation process for both groups in terms of conditions and timing, despite differences in teaching methods, applying the standard teaching method for the control group.

Teaching Method (Infographics):

- Infographics were designed for course topics during instructional units.

Observations During Implementation:

- Observing the extent of students' responsiveness to the infographic technique in the lecture through some oral questions.
- The speed at which the information reaches the student and the quality of comprehension.
- The interaction of the researcher with the students in light of the exchange of dialogue about the curriculum, leading to a sense of enjoyment during the lecture.
- Improvement in the students' numerical level during practical lectures as an indicator of improved performance.
- The student's understanding of her mistakes and how to correct them.
- A reduction in technical errors among the students.

Post-test Measurement:

- The researcher conducted post-test measurements for both research groups on Wednesday and Thursday, April 6-7, 2023, measuring the following:
- Post-test measurement of cognitive tests for both groups (control and experimental) in the final theoretical exam.
- Performance level measurement (numeric-skills) for both groups (control and experimental) by the appointed committee from the department to measure the competitions under research (hammer throw, javelin throw, triple jump) according to the standard chart and the performance level from the measurement and evaluation unit.



Statistical Analyses Used:

- The researcher used the SPSS program to calculate the following statistical processes:
- Mean.
- Standard deviation (SD).
- Skewness coefficient ().
- Normal distribution test Kolmogorov-Smirnov (Z).
- Randomness test (Z) Runs Test.
- Homogeneity test (F test).
- Significance test (t-test).
- Improvement ratios.

Presentation Of Results:

Table (5)Differences between Pre and Post Measurements in Physical VariablesUnder Study for the Control Group(n=20)

Variable	Test	Measurem ent Unit	Pre- Measurem ent	Post- Measurem ent	Mean Differen ce	Significan ce	Percenta ge	%
Speed	30m Sprint	Seconds	Pre	5.250	.319	*5 75	0.000	10.
			Post	5.794	.341	*3./3	0.000	2
Muscle	Broad Jump	Cm	Pre	106.818	11.078	*14.05	0.000	22.
Strength			Post	131.364	12.069	-14.93	0.000	9
Speed-	Vertical	Cm	Pre	16.773	2.349	*18 /1	0.000	50.
Strength	Jump		Post	25.318	3.630	10.41	0.000	9
Arm	Medicine Boll Throw	М	Pre	4.200	.499	*12.00	0.000	6.6
Strength	Dall THOW		Post	4.489	.460	13.09	0.000	0.0
Flexibility	Sit and	Cm	Pre	227	2.581	*11 40	0.000	3.9
	Reach		Post	1.773	2.045	*11.48		2
Enduran	30-second	Count	Pre	15.818	2.174	*01.60	0.000	31.
ce	Rope Jump		Post	20.727	2.292	*21.02	0.000	0
Abdomin	30-second	Count	Pre	11.864	2.606			29
Muscle Strength	Sit-up		Post	15.318	2.697	*21.93	0.000	0
Leg Muscle Strength	Dynamomet er	K.g	Pre	22.773	2.429			
Gronger			Post	24.773	2.181	*17.55	0.000	8.7
Arm Strength	Average Pressure	Count	Pre	8.318	.945	*14.81	0.000	35. 0



			Post	11.227	1.152			
Muscle Enduran ce	Burpee	Count	Pre	7.455	1.405	*12.64	0.000	67.
			Post	12.455	1.299	*13.04	0.000	1

*Significance < 0.05

From Table (5), it is evident that there are statistically significant differences between the pre and post measurements in all physical variables in favor of the post-measurement for the control group. Except for the speed endurance measurement, there were no differences between the two measurements. The percentage of sample responses varied across variables.

Table (6)Mean, Standard Deviation, and Significance of Differences between Pre and Post
Measurements for the Experimental Group (n=22)

Variable	Test	Measurement Unit	Pre- Measurement	Post- Measurement	(M)	(sD)	Percentage	%
Speed	30m Sprint	Second	Pre	5.2959	.35970			
			Post	5.0295	.26786	*3.98	0.000	5.1
Muscle Strength	Broad Jump	Cm	Pre	108.8636	14.49892			
			Post	159.8636	18.01929	*9.17	0.000	46.9
Speed-Strength	Vertical Jump	Cm	Pre	15.5455	1.92050			55.2
			Post	24.1364	8.62607	*4.76	0.000	
Arm Strength	Medicine Ball Throw	M	Pre	3.8659	.40778		0.000	
			Post	5.0618	.55953	*12.09		31.0
Flexibility	Sit and Reach	Cm	Pre	5909	2.71958	+15 40	0.000	0 101
			Post	3.5909	2.06234	15.13	0.000	8.191
Endurance	30-second Rope Jump	Count	Pre	15.0000	2.69037	*22.62	0.002	103.9
			Post	30.5909	2.19651			
Abdominal Muscle Strength	30-second Sit-up	Count	Pre	12.0455	2.49718	*26 55	0.000	00 7
			Post	22.7273	3.23937	20.00	0.000	00.7
Leg Muscle Strength	Dynamometer	Kg	Pre	23.0909	1.84930	*10.14	0.000	16.1



			Post	26.8182	1.65145			
Arm Strength	AveragePressure	Count	Pre	8.5000	1.40577	*04.07		
			Post	14.5909	2.10801	*21.87	0.000	71.6
Muscle Endurance	Burpee	Count	Pre	7.6364	1.32900			
			Post	17.5455	2.34475	*28.01	0.000	129.8

Significance < 0.05

From Table (6), it is evident that there are statistically significant differences between the pre and post measurements for all physical variables in favor of the post-measurement for the experimental group. The percentage of sample responses varied across variables.

Table (7)The arithmetic mean and standard deviation for the control and experimentalgroups in the post-test measurement of cognitive achievement and performancelevel (skill-based - numeric)(n=40)

Variables	Unit	Group	Mean	Std. Dev.	t	Significance	
Written	Score	Experimental	50.0909	3.46285	*16.50	0.000	
		Control	32.7727	3.49056	*16.52	0.000	
Triple jump	М	Experimental	7.8705	.172280	*10.44	0.000	
		Control	6.3932	.529440	*12.44	0.000	
	Grade	Experimental	8.7955	.367070	*20.44	0.000	
		Control	5.7386	.60983	20.44		
Hammer	М	Experimental	27.6636	1.88580	*10 50	0.000	
		Control	15.8523	3.63405	*13.33		
	Grade	Experimental	8.6477	.39081	*17 57	0.000	
		Control	5.6705	.69173	*17.37	0.000	
Javelin	М	Experimental	17.8559	.94003	*7.05	0.000	
		Control	14.8659	1.75067	* 7.05	0.000	
	Grade	Experimental	8.4205	.38873	*13.01	0.000	
		Control	5.6364	.92494	13.01	0.000	

Significance < 0.05



From Table (7), it is evident that there are statistically significant differences between the two groups in the post-test measurement for all skill-based research variables in favor of the experimental group.

Discussion of Results:

Based on the research problem and objectives, theoretical framework, related Arab and foreign studies, experimental methodology, characteristics of the research sample, and data collection tools, statistical processing was conducted. The researchers discussed the results as follows:

From Table (7), it is clear that there are statistically significant differences between the control and experimental groups in the post-test measurement of cognitive achievement, in favor of the experimental group. The average score of the experimental group in the cognitive test was 50.0909, equating to 83.5%, while the control group scored an average of 32.7727, equating to 54.7%, with a difference of 28.8%.

These results align with the findings of Shaltout (2016), who indicated that infographics change the way of thinking about complex data and information and help educators present curricula in an engaging manner. This necessitates exploring new ways to apply this technology in educational processes and integrate it into academic decisions. Mansour (2015) also confirmed that the educational value of infographics surpasses that of mind maps, as they not only enhance cognitive achievements but also teach students visual communication skills, equipping them with high-level skills for new thinking methods, thus fostering productive mental habits.

Additionally, Darwish emphasized the importance of using infographics in preparing educational projects for various curricula. Kibarpinar and Akkoyunlu (2014) recommended using infographic technology for students in different educational specializations, demonstrating ways to use infographics in educational processes and offering studies on training teachers to design and use infographics to clarify scientific terms and visual-statistical data. Krauss (2012) provided many scientific concepts that can be taught through infographics in education. Foss (2014) highlighted the relationship between visual



representation strategies and the development of critical thinking skills. Matrix and Hodson (2014) noted that infographics simplify scientific facts, present them visually, condense explanatory texts and illustrations into simple symbols and images, and are easy to implement without costly software or advanced programming skills. They are also more widely spread than other electronic media through educational and recreational social networks. Mohammed (2019) found that infographics significantly simplify information, sequence it, and organize its presentation, which aids in retaining learning outcomes and understanding information and knowledge, combining images, drawings, and video clips, enriching both teaching and learning processes by considering individual differences.

The studies by Jassim (2021), Saleh (2020), and Abdul-Salam (2020) found that educational programs based on infographics positively impacted all research variables in favor of the experimental group, indicating that the effects of using infographics in the experimental group remain educationally beneficial, engaging, and motivating.

The researchers attributed the superiority of the experimental group over the control group in cognitive achievement to the infographics' focus on cognitive structures and processes, presenting a sequence of ideas, information, and concepts for easy memory retention. Infographics use hierarchical organization of general concepts under which specific concepts are linked, providing learners with a concentrated schematic summary of what they have learned. This led to increased comprehension and understanding of the curriculum, creating an educational environment that enhanced learning effectiveness and fixed the scientific material in memory, which is not available through traditional methods.

Furthermore, the researchers believe that using educational infographics in presenting the curriculum helped overcome difficulties encountered by students in learning skills. Infographics proved highly successful in overcoming learning difficulties and capturing students' attention, increasing their focus, and preventing boredom through engaging skill presentation methods, thus maintaining students' interest and enthusiasm and enhancing their positivity, leading to the retention of learned material.



From the above, it is evident that the first research hypothesis is fully realized, stating:

There are statistically significant differences in cognitive achievement between pre-test and post-test measurements of the control and experimental groups in favor of the post-test of the experimental group.

Table (5) also shows statistically significant differences between pretest and post-test measurements in all physical variables in favor of the post-test for the control group, with varying percentage responses. Flexibility recorded the highest improvement of 679.7% in the forward bend test, followed by muscular endurance with a 67.1% improvement in the Burpee test, and speed-strength with a 50.9% improvement in the vertical jump test. Arm strength came fourth with a 35% improvement in the modified push-up test, followed by coordination with a 31% improvement in the 30-second rope skipping test. Abdominal muscle strength showed a 29% improvement in the sit-up test, muscle strength a 22.9% improvement in the broad jump test, speed a 10.2% improvement in the 30-meter sprint test, leg muscle strength an 8.7% improvement, and arm strength with a 6.6% improvement in the final rank.

From Table (6), it is clear that there are statistically significant differences between the pre-test and post-test measurements in all physical variables in favor of the post-test in the experimental group. The percentages of improvement varied across the variables under study, with flexibility ranking first with a 508.4% improvement in the forward bend test. Muscular endurance came in second with a 129.8% improvement in the Burpee test. Coordination ranked third with a 103.9% improvement in the 30-second rope skipping test. Abdominal muscle strength was fourth with an 88.7% improvement in the sit-up test, followed by arm strength at fifth with a 71.6% improvement in the modified push-up test. Speed-strength ranked sixth with a 55.2% improvement in the vertical jump test. Muscular strength came seventh with a 46.9% improvement in the broad jump test. Arm strength ranked eighth with a 31% improvement in the medicine ball throw test. Leg muscle strength was ninth with a 16.1%



improvement, and speed ranked last with a 5.1% improvement in the 30meter sprint test.

Table (7) shows statistically significant differences between the control and experimental groups in the post-test for all skill-related variables in favor of the experimental group. The differences in measurements were as follows: a 12.44 difference in the skill performance level of the triple jump, a 20.44 difference in the digital performance level of the same event, a 13.53 difference in the skill performance level of the hammer throw, a 17.57 difference in the digital performance level of the javelin throw, and a 13.01 difference in the digital performance level of the javelin throw.

These results are consistent with the studies of Rubaie and Amin (2010) and Tayfun et al. (2012), which indicated that the method relying on verbal explanation of the required skill, the teacher performing a model of the skill, and correcting students' mistakes during the learning process provides good learning opportunities. Darwish (2016) noted that the control group's progress could be attributed to the teaching method (explaining the skill and performing the model) used by the teacher, which includes skills that aid in developing the performance of the events under study. Other studies by Ahmed (2021), Shaala (2021), Awad (2021), and Kos and Sims (2014) agreed that units designed using infographics improve learners' skill levels and cognitive performance, enabling them to achieve proficiency in performance and overall learning improvement in various fields compared to traditional methods. This fulfills educational process goals and helps learners achieve mastery in performance.

The researchers attributed these results to the impact of educational infographics, which utilize the latest computer-based techniques and practical models of the required skills. Through infographics, students receive verbal stimuli (texts), visual stimuli (images), and videos (voiceover + performance). The interaction with educational infographics led to an increased performance level in the experimental group compared to the control group and contributed to the development of the studied variables (physical and skill-related) by attracting attention and creating



excitement and interaction between students and the teacher. Infographics, through static, dynamic, and interactive images, allow students to repeatedly view skill models, facilitating easier skill acquisition and application.

Additionally, infographics can show skills at normal speed and in slow motion, allowing students to correctly understand the motor skills, especially those executed quickly. This enables students to comprehend the sequential stages of skill performance with clear visibility and ample time. Infographics also allow students to control and actively participate in the learning process, unlike traditional methods (verbal explanations and practical demonstrations) which may leave some students unable to understand explanations or see the skill model clearly due to large class sizes.

Infographics help address these issues by using feedback to build and develop movement perception, improve performance specifications, and accelerate students' learning processes. By allowing comparison between the required performance and the actual performance, students can identify and correct errors, positively affecting the events under study (hammer throw, javelin throw, triple jump). The comprehensive use of completed performance as a basis for comparison and correction leads to improvements in the variables under study.

The researchers attribute the improvement in post-test measurements over pre-test measurements for the control group in the physical variables for the competitions under study (hammer throw, javelin throw, triple jump) to the traditional method. This method involves verbal explanations and practical demonstrations of the essential skills required for the competitions, followed by a series of gradually challenging exercises, starting from easy to difficult and simple to complex. The students practice and repeat the skills, with errors corrected and guidance provided by the teacher during the process. This approach leads to proper learning aligned with the technical performance of the skills, positively impacting skill performance efficiency.

On the other hand, the researchers attribute the improvement in posttest measurements over pre-test measurements for the experimental group



in all the studied competitions (hammer throw, javelin throw, triple jump) to the use of infographics. This technique introduced new information not previously experienced by the students in the educational process. The visual representation of skills provided a wealth of information and concepts, making the skills clearer. Infographic sequences of movement details helped convey the skill's specifics, making it easier for students to learn and understand the correct technical representations of the skills. Infographics also created an interactive space where students could connect technology and education, enhancing their understanding and performance of the skills correctly and at a high level. This significantly boosted the students' confidence and comprehension of all skill-related concepts.

From the previous discussion and results, it is clear that the second hypothesis of the research is fully confirmed, stating:

There are statistically significant differences in performance levels (skill-related and digital) for the competitions set for the second-year group (hammer throw, javelin throw, triple jump).

Conclusions:

In light of the results reached by the researchers, after analyzing, discussing, and statistically processing them, the following conclusions were drawn:

1. Using infographics in teaching led to positive results in teaching the competitions under study.

2. The educational method using infographics significantly improved the cognitive achievement of the experimental group compared to the control group.

3. Utilizing both static and animated infographics in learning resulted in the experimental group outperforming the control group in performance levels (digital and skill-related) for the competitions under study.

4. The educational program designed with infographics was more effective than the traditional learning method involving verbal explanations and practical demonstrations.



Recommendations:

Based on the findings and conclusions of the research, within the scope of its objectives and fields, the researchers recommend the following:

- 1. Provide scientific material for all field competitions included in the curriculum for all grades using infographics.
- 2. Propose new methods and techniques for using infographics in the educational process to help condense information, accelerate learning time, and ensure long-term retention.
- 3. Conduct training courses and workshops to familiarize faculty members and their assistants with infographics, and how to design and use them in teaching.
- 4. Conduct further similar studies using infographics and exploring their impact on cognitive, skill-related, and affective aspects of students in various field competitions.
- 5. Equip lecture halls with modern technological devices to employ advanced teaching methods during instruction.

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