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Effect of Jigsaw2 strategy on the cognitive achievement of some motor learning topics for third stage students

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Abstract
The educational process is one of the most prominent human processes that play a major role in the development of the individual and society. With the development of teaching methods and the trends of the contemporary world towards achieving the best results in the educational field, the research aims to prepare an educational curriculum according to the Jigsaw2 strategy in the cognitive achievement of some motor learning topics, and to know the impact of this strategy on the cognitive achievement of some motor learning topics, the experimental approach was used according to the design of the two equivalent groups (control and experimental) to address the research problem, the research community was represented by the 186 students of the third stage in the Faculty of Physical Education and Sports Sciences at Al-Kut National University**,** After that, the researcher selected the research sample, which numbered (40) students, were randomly distributed equally to two groups, each group of (20) students, while 100 students were selected as a sample of preparation for the cognitive achievement test. The results of the research showed that the jigsaw2 strategy was effective in improving cognitive achievement in motor learning in students, which indicates that the application of cooperative learning in some learning topics contributes to improving cognitive achievement in them. The experimental group that used the jigsaw2 strategy to improve cognitive achievement for some learning subjects achieved the greatest improvement compared to the control group.

Keywords: Motor learning, jigsaw2K strategy, cognitive achievement

Introduction
The educational process is one of the most prominent human processes that play a major role in the development of the individual and society. With the development of teaching methods and the trends of the contemporary world towards achieving the best results in the educational field, many educational strategies have emerged aimed at improving learning outcomes and increasing its effectiveness (Abdeen, 2015) [8]. Among these modern strategies is the Jigsaw strategy, which relies on collaboration between students and the division of educational content into small parts, so that each student studies a piece of the educational material and then partners with his colleagues to link these parts together (Al-Sibai, 2017) [2, 9]. This strategy has shown a positive impact in many fields of study, both academic and applied. (Hassan, 2020) [10].

One of the subjects that needs to apply innovative educational methods is motor learning, which is one of the basics in physical education and sports science (Mahmoud, 2019) [11]. This course is about how to learn and develop motor skills, as well as understanding the scientific and practical foundations that contribute to improving motor performance. (Mohammed, 2018) [12].

As teaching methods evolve, it has become necessary to look for educational strategies that help students understand and apply these concepts effectively (Sibai, 2017) [2, 9]. In this context, the Jigsaw strategy stands out as an educational tool that can improve cognitive comprehension and contribute to students' achievement in motor learning by dividing information into small parts, enabling students to actively participate in the educational process, which contributes to enhancing collective understanding and helps to exchange knowledge and experiences among students.

Jigsaw's strategy is not only limited to traditional educational techniques, but also enhances communication skills and teamwork among students. These skills are vital in the field of physical education and sports science, where learning motor skills requires interaction between students and cooperation in the application and analysis of motor exercises (Mahmoud, 2019) [11]. This strategy also helps build a learning environment that encourages active and interactive learning, which contributes to improving academic performance.

Here arises the need to study the effectiveness of the Jigsaw strategy in improving the cognitive achievement of motor learning material for students of the third stage, and to identify how this strategy affects the development of understanding and comprehension effectively helps to improve performance, whether by daily preparation or tests for cognitive achievement and interaction with the curriculum for physical education subjects.

Hence the importance of research in studying the impact of Jigsaw strategy on the cognitive achievement of motor learning for third-stage students in physical education and sports sciences. The study aims to find out the effectiveness of this strategy in improving the learning of basic motor concepts among students. It also seeks to explore how to enhance theoretical understanding and practical application of these motor concepts in a systematic and organized manner that contributes to improving the level of students' performance in motor learning.

The problem of the research was that the methods of learning must be characterized by diversification and change to keep pace with the development in various sciences, and at the same time it became characterized by learning based on deduction, thinking and analysis because traditional learning methods have become useless in some sciences, since modern educational methods depend directly on the development of the ability to understand and absorb basic theoretical topics, especially for some theoretical and scientific subjects for students of physical education and sports sciences,

Especially in the subject of motor learning because this subject is a subject on which the theoretical foundations are built in learning any mathematical skill and a basis and a strong weapon for the outputs of physical education in their ability to teach skills later and the fact that the researcher is a teacher at Al-Kut University College and is charged with teaching kinetic learning he found that there is difficulty for students to understand this material if the traditional methods are followed in it because the lecture depends mainly on the teacher and the student is just a recipient do not give him the real chance in Discovering concepts and learning it by itself and thus confusion occurs in some topics during the cognitive attainment of this subject. Due to the inability to link theoretical knowledge to general tests, which leads to poor cognitive attainment of these subjects of motor learning.

The lack of actual interaction in learning concepts and topics turns out to be one of the main reasons that lead to this problem. Therefore, it has become necessary to search for modern and innovative learning methods that help improve the level of students' comprehension and achieve a balance between the theoretical aspects of various learning topics, so the researcher found a temporary solution to his problem by employing the Jigsaw strategy in addressing this problem by encouraging cooperation between students and dividing the scientific material into small parts that are easy for them to understand and discuss interactively. This strategy also contributes to improving students' ability to link theoretical information with other practical subjects, which enhances the level of students' cognitive achievement.

The research aims to prepare an educational curriculum according to the Jigsaw2 strategy in the cognitive achievement of some motor learning topics for students of the third stage. And to know the impact of the Jigsaw2 strategy on the cognitive achievement of some motor learning topics for third stage students.

Research Methodology

The experimental method was used according to the design of the two equivalent groups (control and experimental) to address the research problem. The researcher identified the research community, which was represented by the students of the third stage of the Faculty of Physical Education and Sports Sciences at Al-Kut National University for the morning study, which numbered 186 male and female students, and then the researcher selected the research sample, represented by (40) students from the morning study students, they were randomly distributed equally to two groups, each group of (20) students, while 100 male and female students were selected as a sample preparing for the cognitive achievement test.

Determining the research tool (cognitive achievement of some motor learning topics)

The researcher prepared a cognitive achievement test for some learning topics for the topics scheduled within the special curriculum for the second course of the third stage at the Faculty of Physical Education and Sports Sciences-Al-Kut National University, which included 5 topics (learning measurement, learning theories, feedback, exercise scheduling, mental processes), as 30 questions were formulated that included the following topics (learning measurement 5 questions, learning theories 6 questions, mental processes 6 questions, feedback 5 Questions, scheduling the exercise 8 questions) distributed according to the number of hours of each learning topic that was taken according to the educational program, so that the maximum score for the test is 30 points.

Procedures for building a cognitive achievement test and achieving its scientific conditions

First: Preparing the paragraphs of the cognitive achievement test and indicating their validity: The researcher after reviewing the educational material to be taught, which was represented by motor learning between principle and application (authored by Dr. Yarub Khayoun, second edition, 2010), which is a systematic book in many faculties of physical education and sports sciences, including the University of Kut / Faculty of Physical Education and Sports Sciences, as the researcher prepared special paragraphs according to the vocabulary of motor learning And presented within a questionnaire to a group of experts and specialists in the field of motor learning to indicate the validity of the paragraphs and the researcher by relying on the use of the law of Kay Square and analysis in order to indicate the validity of the paragraphs of the test, as the researcher got full agreement on the validity of the paragraphs and was amended what is necessary to amend in terms of the wording of the paragraphs.

Table 1: Shows the extent to which the experts agree on the paragraphs of the cognitive achievement test and indicate their validity

Paragraphs	Paragraphs number	Percentage of expert opinions				Chi-square value		Sig.
		Agreed	Percentage	Disagreed	Percentage	Calculated	Tabular	
1-2-5-6-7-9-11-16-18-20-22-24-26-28-29-30	16	11	100%	0	0%	11	3.84	Sig.
4-8-10-12-13-15-23-25-27	9	10	90.90%	1	9.09%	7.36		Sig.
3-14-17-19-21	5	9	81.81%	2	18.18%	4.54		Sig.

Second: Preparing instructions for answering the cognitive achievement test: The researcher prepared instructions for the cognitive achievement test, which explains how to answer its paragraphs, as the researcher took into account some instructions that included that the paragraphs are clear, easy and understandable, as well as by increasing clarity on how to answer by presenting an explanatory paragraph outside the test paragraphs and how to answer them, as well as the need to answer all paragraphs in proportion to the laboratory's understanding and awareness.

Third: The exploratory experiment for the cognitive achievement test: The researcher conducted his exploratory experiment on the cognitive achievement test for some motor learning topics 10 days before the post-test in order to avoid the inequality of the construction sample in terms of knowledge of the theoretical aspect of the topics under study, as well as to avoid the impact of the answers members of the sample and accompanied by the assistant work team and the number (6) students, and the researcher carried out his exploratory experiment for the purpose of identifying some of the difficulties that the researcher may face when applying the test to the construction sample And the application, identifying and knowing the time spent in answering the test paragraphs, as well as identifying the extent to which students can understand the test paragraphs and their clarity, as well as the integrity of their language and the way they are formulated, and finally to ensure the efficiency of the assistant team and research tools.

Fourth: The application of the cognitive test on the construction sample: After completing all the initial steps in preparing the cognitive achievement test to become ready in its initial form for application to the construction sample, the researcher applied the defined achievement test for a week to a group of students of the third stage from outside the research sample, which numbered 100 male and female students, and after checking and examination, (8) forms for the cognitive achievement test were excluded for not conforming to the conditions and instructions of the test.

Fifth: Statistical analysis of the paragraphs of the cognitive achievement test:

1. Ease and difficulty coefficient: The researcher found the coefficient of difficulty and ease for each paragraph of the cognitive achievement test in order to show the extent to which the test vocabulary fits the research sample, and to find the coefficient of ease or difficulty of the paragraphs of the cognitive achievement test, the researcher extracted the coefficient of difficulty for each paragraph of the test by subtracting the coefficient of ease extracted from the number (1), because the sum of the ratios of correct and wrong answers for each of the paragraphs of the scale is equal to the number (1) This is what the researcher adopted, which "recommends the designers of tests and measures to exclude questions or paragraphs whose difficulty coefficients are less than (0.10) or more than (0.90)(), and after the researcher has processed the scores that belong to the members of the sample statistically, it became clear from that that no paragraph was excluded from the achievement test paragraphs, which numbered (20) paragraphs because the coefficient of difficulty is normal as recommended by the designers of the tests and the specialist. Table (2) shows the coefficients of ease and difficulty of the paragraphs of the cognitive achievement test for students prepared by the researcher.

2. Paragraph discrimination coefficient:

First: The two terminal groups: There are scientific steps followed by the researcher in order to be able to reach the extraction of the discrimination coefficient by comparing the discriminatory ability of the distinctive paragraphs from other non-discriminating paragraphs by the criteria set by (Ebol) and the table (2) below shows that.

Table 2: Shows the criteria set by IBEL for the discriminatory power of paragraphs

Discrimination Criterion	Paragraph Evaluation
0.40 and up	Very good paragraphs
0.30-0.39	Paragraphs to an acceptable extent but may be subject to improvement
0.29-0.20	Borderline vertebrae that need improvement
0.19 and less	Weak paragraphs to be deleted or improved

After the researcher applied the above steps, he found that the coefficient of discrimination for all its paragraphs of the cognitive achievement test ranges between (0.31-0.72) and the researcher adopted the paragraphs that had a discrimination coefficient (0.30-and higher) and on this basis, all paragraphs of the cognitive test were adopted all according to the standards of Ebel.

Second: The internal consistency of the paragraphs (correlation of the degree of the paragraph with the total degree of the test) The researcher calculated the simple correlation coefficient (Pearson) between the degree of one paragraph and the total degree of the test and the members of the construction sample as a whole, and to find out the significance of the correlation the researcher used the test (T.R) to ensure the significance of the differences and after processing the data found that all paragraphs got calculated values greater than the tabular value of (0.264) at the degree of freedom (91) and under the level of significance (0.05), which indicates the acceptance of all paragraphs and not excluding any paragraph of it.

Test Stability

The researcher used the method of half fragmentation, as this method is one of the most common stability methods because of the avoidance of the defects of some other methods in stability, such as not ensuring the same conditions when re-testing for the second time or the familiarity of the testers for that repeated test, as well as enjoying the most important advantages: abbreviation in time and effort, and the researcher then calculated the simple correlation coefficient (Pearson) between the two halves of the test, which amounted to (0.796)

and since this coefficient does not measure the stability of the whole test, Because it is a stability for half of it, so it was necessary to modify this coefficient in order to obtain the value of the stability coefficient of the test in full, and the researcher used this amendment (Spearman-Brown). Thus, the value of the stability coefficient for the test is (0.732), which is a good value.

Table 3: Shows the coefficients of ease and difficulty of the items of the cognitive achievement test and the coefficient of discrimination for them for the construction sample

Paragraph	Ease Coefficient	Coefficient of Difficulty	Discrimination Coefficient	Paragraph Evaluation
1	0.65	0.34	0.52	Valid
2	0.36	0.63	0.57	Valid
3	0.4	0.59	0.57	Valid
4	0.75	0.24	0.62	Valid
5	0.46	0.53	0.45	Valid
6	0.43	0.56	0.32	Valid
7	0.44	0.55	0.42	Valid
8	0.51	0.48	0.65	Valid
9	0.67	0.32	0.50	Valid
10	0.38	0.61	0.42	Valid
11	0.55	0.44	0.52	Valid
12	0.48	0.51	0.59	Valid
13	0.75	0.24	0.61	Valid
14	0.58	0.41	0.45	Valid
15	0.72	0.27	0.41	Valid
16	0.57	0.42	0.42	Valid
17	0.46	0.53	0.42	Valid
18	0.67	0.32	0.42	Valid
19	0.36	0.63	0.47	Valid
20	0.39	0.6	0.35	Valid
21	0.67	0.32	0.48	Valid
22	0.45	0.54	0.74	Valid
23	0.41	0.58	0.66	Valid
24	0.48	0.51	0.66	Valid
25	0.62	0.37	0.58	Valid
26	0.71	0.28	0.42	Valid
27	0.65	0.34	0.50	Valid
28	0.52	0.47	0.32	Valid
29	0.44	0.55	0.42	Valid
30	0.58	0.41	0.48	Valid

Table 4: Shows the value of the correlation coefficient of the paragraph grade with the total grade and the value of (T.R) and its significance

No.	Correlation coefficient	Significance level	Statistical significance	No.	Correlation coefficient	Significance level	Statistical significance
1	0.531	0.001	Sig.	16	0.559	0.000	Sig.
2	0.516	0.000	Sig.	17	0.477	0.034	Sig.
3	0.623	0.032	Sig.	18	0.508	0.018	Sig.
4	0.491	0.000	Sig.	19	0.498	0.001	Sig.
5	0.518	0.001	Sig.	20	0.504	0.000	Sig.
6	0.468	0.081	Sig.	21	0.583	0.000	Sig.
7	0.518	0.004	Sig.	22	0.384	0.004	Sig.
8	0.489	0.003	Sig.	23	0.582	0.000	Sig.
9	0.563	0.019	Sig.	24	0.675	0.000	Sig.
10	0.591	0.016	Sig.	25	0.702	0.000	Sig.
11	0.562	0.000	Sig.	26	0.486	0.001	Sig.
12	0.549	0.000	Sig.	27	0.589	0.000	Sig.
13	0.478	0.048	Sig.	28	0.437	0.002	Sig.
14	0.462	0.044	Sig.	29	0.458	0.002	Sig.
15	0.494	0.002	Sig.	30	0.587	0.000	Sig.

The main experience

The researcher used the forms of cognitive achievement test (for some motor learning topics) on the sample members of (40) male and female students for both groups after the completion of the application of the Jigsaw2 strategy during (12) weeks by an educational unit each week has been using the test and answering the cognitive questions that include concepts for learning topics has been using educational methods that enhance and deepen the areas of academic and horizontal content, which works to provide students with new concepts suitable for the content of the course.

Pre-tests

The pre-tests were conducted before the start of the exercise

application according to the Jigsaw2 strategy on Monday, 28-9-2024 at 3:00 pm in the outdoor playgrounds of the University of Kut in Essaouira.

Implementation of the educational strategy

The Jigsaw2 strategy was applied during the main section of the lectures over a period of six weeks, where four topics of motor learning (feedback, exercise scheduling, mental processes, learning theories) were selected as the focus of the practical application of the strategy. The experimental group students were divided into small groups (5 students in each group), so that each topic was distributed in the form of different "jigsaws" for each student within the group.

For example, in the topic of "Scheduling Exercise", the themes (sequential and random training, fixed and variable training, intensive and distributed training, total and partial training, mental training and mastery learning) were distributed to students within the same group, and each student became an "expert" in the part he studied. Then "expert groups" were formed from students with the same part, where they discussed and delved in, and then each student returned to their original group to explain the part in which they majored to the rest of their classmates. This mechanism was replicated on all four subjects.

This method contributed to activating the principle of cooperative learning and distributing cognitive responsibility, as it provided each student with the opportunity to be a learner and a teacher at the same time, which enhanced a deep understanding of the scientific material. Multimedia such as presentations, class discussions, and concept-related hands-on activities were used to support the learning process.

The content of the topics was also linked to the cognitive tests prepared by the researcher in advance, which facilitated the process of accurately measuring the impact of the strategy on cognitive achievement. The results of the dimensional achievement of the experimental group showed a clear superiority compared to the control group, which confirms the effectiveness of the Jigsaw2 strategy in teaching motor learning topics in a scientific and systematic manner. The strategy was implemented during the main part of the lecture for a period of 6 weeks, and the application of the exercises began on 1/10/2024 and ended on 16/11/2024.

An applied model of the Jigsaw2 strategy in teaching the subject of "exercise scheduling" 1-Dividing the sample:

- The 40 students were distributed into 8 groups, with 5 students in each group. This division was consistent throughout the teaching period to ensure harmony among the members of the same group.
- Dividing the topic of "Scheduling Exercise" into five main axes: The teacher relied on dividing the topic of "Scheduling Exercise" according to the lecture on the following axes:
  - Sequential and random training
  - Fixed and variable training
  - Intensive and distributed training
  - Total and partial training
  - Mental training and mastery learning

Each student within the group is assigned one part to become an "expert" in it.

Stages of implementation of the lesson:

Phase I: Formation of expert groups (15 minutes) Each student met with colleagues from other groups who have the same axis (e.g. all "sequential and random training" students) to form an "expert group". This group is moderated by guided discussion using investigative questions and supporting media (such as slideshows or short videos).

Second Stage: Return to the original group (20 minutes) each student returned to their original group and explained their "Exercise Scheduling" axis to the rest of their classmates. The explanation was supported by mini-demonstrations, illustrations, and practical examples from real-life sports or coaching.

Third Stage: Group Activity (15 minutes) each production group was asked to produce a visual summary (concept map or comparison table) that combines the five parts of the exercise scheduling, providing an applied example from the game of volleyball.

Fourth Stage: Quick Assessment (10 minutes) Use a short test containing 5 objective questions covering the five axes, in order to measure the extent to which each student understands the overall content of the lesson, not only the axis in which he specialized.

Post-exams

The post-exams were conducted in the same place for the pre-tests and with the same procedures on 17/11/2024.

Statistical means: The researcher used the SPSS statistical bag to find and process the results.

Results

Table 5: Shows the values of differences in the arithmetic circles before and after and the calculated and tabular values of the control group in the cognitive achievement test.

Test	Pre-test		Post-test		Calculated T-Value	Sig. value	Sig. level
	Mean	St.d	Mean	St.d			
Cognitive Achievement	13.554	1.155	16.113	2.068	4.495	0.001	Sig.

Table 6: Shows the values of the differences in the arithmetic means before and after and the calculated and tabular values of the experimental group in the cognitive achievement test

Test	Pre-test		Post-test		Calculated T-Value	Sig. value	Sig. level
	Mean	St.d	Mean	St.d			
Cognitive Achievement	13.048	1.482	20.395	2.697	7.495	0.000	Sig.

Table 7: Shows the values of the arithmetic and dimensional means and the calculated and tabular values of (t) between the control and experimental groups in the cognitive achievement test

Test	Experimental Group		Control group		Calculated T value	Sig. value	Sig. level
	Mean	St.d	Mean	St.d			
Cognitive Achievement	20.395	2.697	16.113	2.068	4.157	0.002	Sig.

Discussion

Table (7) shows the results of the post-test of the special cognitive achievement of some motor learning topics (feedback-exercise scheduling mental processes-learning theories) and for the experimental and control groups and it appeared that there are differences between the results of the post-test for both groups and in favor of the experimental group, where the researcher attributes that this development came as a result of the use of a strategy, which is the Jigsaw strategy, which is considered one of the effective cooperative methods that contribute significantly to improving the cognitive achievement of students in motor learning, where the results of the study showed A positive impact of this strategy on students' cognitive achievement in motor learning, which indicates its effectiveness in enhancing students' understanding of cognitive concepts and their application in tests or in measurements.

The researcher believes that the development in the topics of motor learning (feedback-exercise scheduling-mental processes-learning theories) is the result of the use of strategy, which led to improving the effectiveness of understanding this topic accurately through continuous cooperation within the groups, as this enhanced their performance better through the continuous exchange of observations and reviews, which contributed to correcting errors faster and more accurately, as this work led to enhancing cognitive achievement, and this is what he stated (Okebukola, 1989) [14] that cooperative learning increases participation effective in students and reduces their fatigue.

The researcher also believes that this superiority of the experimental group over the control group is also due to the different role of the teacher or teacher in the cooperative groups, where his role becomes as a guide, supervisor and promoter of the learning process during the lesson, meaning that it has become a participation of students in the various educational situations that occur during the lessons, but in the control group, the teacher performs all the activities of the educational process, which is often limited to once you give and supply information to students, regardless of the amount of what has been acquired and understood. Indicates that "the educational process should focus on providing the learner with a set of knowledge, facts and concepts only, but go beyond that to guide students in their behavior and psychological and social components within the lesson".

Here we note that the study strengthened showed that the use in cooperative learning of the use of the jigsaw strategy led to a significant improvement in students' cognitive achievement in motor learning topics by enhancing group interaction, stimulating critical thinking and systematically organizing study times, as this strategy contributes to improving students' comprehension of cognitive concepts and their application in practical life.

The results also showed that the study using the jigsaw strategy helps in promoting and applying cooperative and social theories among students through teamwork, where (Zhou Y, Li W & Zhang X, 2017) [13] believes that students become able to understand and absorb the scientific material through participation and discussion, where discussion and cooperation contribute to increasing group interaction and stimulating thinking and reading ideas among students, which contributes to achieving students' comprehension to the highest possible extent, and this is what was pointed out by (Nader *et al*., 1999) as "Group interaction enhances the application of these theories in various practical situations, which contributes to enhancing students' understanding of scientific concepts accurately".

Where the arrangement of exercises according to the strategy and their distribution according to the specified time has an impact on obtaining positive results in the dimensional results and for the benefit of the experimental group, and this is what the results showed in the above tables.

Conclusions

- The jigsaw2 strategy has been effective in improving cognitive achievement in motor learning in students, which indicates that the application of cooperative learning in some learning subjects contributes to improving cognitive achievement in them.
- The experimental group that used the jigsaw strategy to improve cognitive attainment for some learning subjects achieved the greatest improvement compared to the control group.

Recommendations

- Use the jigsaw2 strategy in all other learning topics as well as in the rest of the subjects due to its effectiveness in improving students' cognitive achievement, as well as enhancing cooperation and interaction between them for team games because it helps improve motor performance and facilitate the acquisition of new skills.
- Emphasizing the application of the jigsaw2 strategy to other academic levels, which contributes to enhancing learning outcomes and achieving greater benefit for students in various educational situations.

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