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The Effectiveness of Using Instructional Modules Based on the Divergent Learning Model in Design and Interactive Thinking and in Learning Selected Skills on the Floor Exercise Mat in Women's Artistic Gymnastics

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Abstract

The research problem lies in the fluctuation in the performance level of certain artistic gymnastics skills among second-year students, despite the considerable efforts exerted by course instructors. In addition, insufficient attention has been given to various types of thinking, including design thinking and interactive thinking, despite their effective role in learning motor skills. The researcher also sought to experiment with a model that, to the best of her knowledge, has not previously been applied in the field of sports in general and artistic gymnastics in particular. This prompted the adoption of this model as a supportive element in learning certain artistic gymnastics skills and in overcoming the problems students face in motor performance. This is achieved by encouraging thinking in multiple situations and alternatives through integrating their prior knowledge with current information to construct new and accurate understanding of the correct performance of the skill, thereby enabling them to reach optimal performance.

The research aimed to design instructional modules based on the Divergent Learning Model, as well as to develop scales for design thinking and interactive thinking, and to identify the effect of the Divergent Learning Model on design thinking and interactive thinking.

The researcher employed the experimental method due to its suitability to the nature of the problem. The research population consisted of second-year female students at the College of Physical Education and Sports Sciences, University of Kirkuk, for the academic year (2024–2025), totaling (64) students. The research sample was selected randomly by lottery and divided into two groups: a control group and an experimental group, with (14) students in each group representing the main research sample.

The sample for adapting the design and interactive thinking scales consisted of (32) students, while the exploratory experiment sample included (4) students. Thus, the research sample represented (43.75%) of the original research population. The researcher then conducted the adaptation of the design and interactive thinking scales and determined the skill tests for selected artistic gymnastics skills.

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Subsequently, the instructional units based on the Divergent Learning Model were applied to the experimental research sample, totaling (10) instructional units, implemented at a rate of instructional units per week, each lasting (90) minutes. After completing the instructional units, post-tests were conducted for both the control and experimental groups. The data were statistically processed using the Statistical Package for the Social Sciences (SPSS).

After analyzing and discussing the results, the researcher reached several conclusions, the most important of which is that the model achieved significant improvement in certain artistic gymnastics skills, as well as in design thinking and interactive thinking among the experimental group. The Divergent Learning Model also helped the experimental group students perform the skills more accurately than the control group and broadened their cognitive capacities, encouraging better thinking, particularly in terms of design and interactive thinking. Accordingly, the researcher recommends employing the Divergent Learning Model in other sports and with different samples, as well as emphasizing the development and regular practice of interactive, thought-provoking exercises so that they become a habitual cognitive practice.

Keywords: *Divergent Learning Model; Design Thinking; Floor Exercise Mat; Women's Artistic Gymnastics*

1. Introduction to the Research

1.1. Introduction and Significance of the Research:

Modern trends in learning have devoted considerable attention to methods, models, and strategies, viewing them as the cornerstone of the educational process due to their crucial role in achieving objectives. Through them, the educational process is organized and learner behavior is modified. Therefore, it has become necessary for the teacher to select contemporary instructional models that provide genuine opportunities for the development of learners' abilities and interests, address learning difficulties and students' problems, ensure positive learner participation, facilitate the efficient delivery of academic content, and enable learners to acquire information in the shortest time and with the least effort.

The Divergent Learning Model is considered one of the models that emerged as a translation of post-constructivist principles. It offers modern approaches based on the idea of filling the gaps in learners' knowledge by searching for information, obtaining it, extracting it, analyzing it, interpreting it, evaluating it, and employing it in new situations. Through this process, learners acquire mental skills that prepare them to initiate thinking processes, develop their attitudes, and enhance their cognitive growth. Thinking, in turn, is reflected in both the educational environment and society.

Design thinking and interactive thinking constitute important types of thinking, as they enhance learners' ability to solve problems and develop their skills in alignment with the demands of technological advancement and global competition. Design thinking is regarded as an innovative approach to solving educational problems; it promotes the development of diverse ideas, improves learners' ability to acquire skills, enhances social skills, and encourages metacognitive thinking. It works toward constructing integrated ideas about the problem at hand, making it meaningful and beneficial. It encompasses all forms of cognitive activities, including remembering, understanding, applying, analyzing, and evaluating. Design thinking leads learners to think beyond conventional boundaries and generate innovative and creative solutions that are grounded in their needs and interests.

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Interactive thinking, on the other hand, helps individuals organize their knowledge, achieve success, and facilitate information processing to reach solutions to their problems. It contributes to deepening and expanding thinking and supports the achievement of goals. Interactive thinking is one of the fundamental elements for success in both learning and life, as it enables individuals to engage in discussion and dialogue with others and to work collaboratively within groups to develop solutions to problems related to motor performance.

Artistic gymnastics is one of the sports that has witnessed remarkable progress and increasing attention in recent years by specialists, as a result of their work guided by a clear vision in its applied aspects. This reflects a level of maturity and advancement, enabling it to assume a leading position in many countries. Although it involves diverse motor situations and lacks fixed conditions for performance, it encompasses numerous characteristics that have a direct impact on learners. Cooperation, teamwork, selflessness, perseverance, fair competition, creativity, and thinking are relatively stable dispositions toward certain types of behavior that contribute to instilling such qualities in learners across various technical and educational levels.

From this standpoint, the necessity emerges to search for a modern model capable of addressing the changes and complexities within the educational process and to move toward models that are more aligned with the spirit of the age and scientific progress, namely the Divergent Learning Model. This model is based on preparing a series of conditions within the learning environment that stimulate learning processes and decode the mental processes within the learner's mind related to various types of thinking, including design thinking and interactive thinking. Consequently, its role in the educational process becomes evident. Since this model has not been applied in the field of sports, the importance of the present research lies in identifying the extent of the impact of instructional units based on design and interactive thinking and the need for such an approach. This research represents a serious scientific attempt by the researcher to apply it at the university level and in the sports field in order to enable learners to achieve optimal levels in less time and with less effort, in addition to encouraging learners to think, utilize their mental processes, invest them in the educational process, employ multiple types of thinking including design and interactive thinking and identify their role in the educational process.

1.2. Research Problem:

In reality, attention to studying motor performance in various sports activities is increasing day by day, as there are numerous factors that influence the improvement and development of motor performance to achieve the highest level of proficiency. It is observed that a learner cannot effectively learn without understanding the subject being taught. If the learner fails to grasp the subtleties of the skill explained by the instructor during the learning process, they will consequently be unable to perform it.

The research problem lies in the fluctuation in the learning levels of certain artistic gymnastics skills among second-year students. Through the researcher's observation of some practical lessons, it was noted that students face difficulties in performing certain gymnastics skills despite the attempts and efforts made by the instructors to help them achieve better learning outcomes. The researcher attributes this issue not to a lack of intelligence or insufficient cognitive abilities, but rather to the students' inadequate practice of proper thinking skills and the absence of strategies for effective thinking, as well as their limited exposure to modern educational models.

Therefore, the researcher decided to experiment with a modern model in learning selected artistic gymnastics skills, aiming to identify a model that could contribute to advancing the educational process and enabling learners to achieve optimal performance. This highlights the need to adopt a contemporary model, such as the Divergent Learning Model, which may positively influence students' design and interactive thinking and enhance their performance of artistic gymnastics skills.

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1.3. Research Objectives:

- To develop instructional units based on the Divergent Learning Model for learning selected artistic gymnastics skills among the research sample.
- To identify the effect of the Divergent Learning Model on interactive and design thinking and on learning selected types of artistic gymnastics skills for the research sample.
- To determine the superiority between the two groups (Divergent Learning Model vs. the conventional method) in interactive and design thinking and in learning selected artistic gymnastics skills.
- To construct a scale for design and interactive thinking for the research sample in artistic gymnastics.

1.4. Research Hypotheses:

- There are statistically significant differences between the pre-test and post-test results of the experimental and control groups in design thinking, interactive thinking, and selected artistic gymnastics skills among the research sample.
- There are statistically significant differences in the post-test results between the experimental and control groups in interactive thinking, design thinking, and selected artistic gymnastics skills among the research sample.

1.5. Research Scope

i. **Human Scope:** Second-year female students at the College of Physical Education and Sports Sciences, University of Kirkuk, for the academic year 2024–2025.
ii. **Temporal Scope:** From 27/10/2024 to 9/1/2025.
iii. **Spatial Scope:** The gymnastics hall at the College of Physical Education and Sports Sciences, University of Kirkuk.

2. Research Methodology and Field Procedures

2.1. Research Method: The researcher used the experimental method with a two-group equivalent design (control group and experimental group) with pre-test and post-test measures. Participants were randomly selected, as this design was suitable to meet the research requirements and achieve valid results.

2.2. Research Population and Sample: The research population consisted of second-year female students at the College of Physical Education and Sports Sciences, University of Kirkuk, for the academic year 2024–2025, totaling (64) students. A research sample of (28) students was randomly selected by lottery and divided into a control group and an experimental group, with (14) students in each group.

2.3. Homogeneity and Equivalence of the Research Sample: In order to determine the distribution of the research sample (control and experimental groups) across all research variables in a normal and balanced manner, the researcher, for the sake of accuracy, calculated the skewness and coefficient of variation values. Additionally, the Raven Progressive Matrices test (Al-Dabbagh et al., 1983, p. 60) was administered to assess the intelligence levels of the sample, in order to verify homogeneity and identify any extraneous factors that could affect the results, as shown in Table (1).

Table (1) presents the descriptive statistics of the sample characteristics.

Variables	Units of Measurement	Mean	Median	Standard Deviation (SD)	Skewness Coefficient	Coefficient of Variation (CV)
Total Height	**Centimeter (cm)**	**171.28**	**157.42**	**8.979**	**0.695**	**5.524**
Body Mass	**Kilogram (kg)**	**68.81**	**61.88**	**4.325**	**1.091**	**6.839**
Chronological Age	**Year (yr)**	**20.59**	**20.00**	**0.47**	**1.319**	**2.206**
Raven's Progressive Matrices Test	**Score (degree)**	**41.11**	**41.00**	**3.859**	**0.279**	**17.967**

Table (3–3) above shows that the skewness values ranged between (±2), which is less than (±3), indicating the homogeneity of the research sample.

To ensure the statistical equivalence of the experimental and control groups and to establish a baseline, the researcher used the independent samples T-test and Levene's test for homogeneity of variance between the two groups (control and experimental) for the research variables, as shown in Table (2).

Table (2) presents the mean, standard deviation, the calculated T-test and Levene's test values, and the significance of differences for the research variables in the pre-test for both research groups, along with their statistical significance.

Researched Variables	Units of Measurement	Preliminary tests				Calculated t-value	Significance level	Calculated F-value	Level of significance	Significance of differences
		Control group		Experimental group						
		M	±SD	M	±SD					
Accuracy of the Tucked Backward Roll	**Score**	**1.714**	**0.825**	**1.857**	**0.931**	**0.486**	**0.630**	**0.376**	**0.543**	Random
Forward Roll with Legs Extended	**Score**	**2.384**	**0.767**	**2.692**	**0.854**	**0.965**	**0.344**	**0.368**	**0.550**	Random
Handstand	**Score**	**2.307**	**0.751**	**2.692**	**0.751**	**1.306**	**0.204**	**0.142**	**0.710**	Random
Design Thinking	**Score**	**40.786**	**4.526**	**41.286**	**5.129**	**0.353**	**0.726**	**0.882**	**0.353**	Random
Interactive Thinking	**Score**	**41.500**	**3.777**	**42.928**	**2.934**	**1.348**	**0.185**	**1.477**	**0.231**	Random

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2.4. Research Materials, Instruments, and Tools Used:

- Arabic and foreign references and sources.
- Observation and experimentation.
- Forms for recording test results.
- Personal interviews.
- Questionnaire forms.

- Camera for photography, type **Konka**, quantity (1).
- Laptop, type **LENOVO**, quantity (2).
- Gymnastics mat.
- Laser discs, quantity (4).
- Height and weight measuring device, quantity (1).
- Educational posters.
- Design and interactive thinking scales.
- Raven's Progressive Matrices test (intelligence test).

2.5. Field Research Procedures:

2.5.1. Identification of Scales and Tests

2.5.1.1. Design Thinking Scale: After reviewing the literature, previous studies, and scientific sources related to the concept of design thinking, such as the studies by **Salem (2020)**, **Al-Sheikh (2020)**, **Latif (2021)**, **Atiya (2021)**, **Al-Sayyid et al. (2022)**, **Abdul-Zahra (2012)**, **Abdul-Hussein (2009)**, and **Jabareen (2010)**, the researcher did not find a scale specific to the field of sports. Therefore, the researcher decided to develop a scale tailored to artistic gymnastics skills, measuring learning within the framework of design thinking.

The steps for constructing the scale are as follows:

a. **Identifying the phenomenon to be studied:** In order for the researcher to achieve the study's objective, the scale must align with the nature of the study and the research sample. Therefore, the researcher proceeded to develop a scale that would be valid and acceptable for measuring design thinking among the participants.
b. **Purpose of constructing the scale:** The purpose of the test is to determine the level of design thinking among second-year students and to focus their efforts on learning motor skills, which the researcher aims to enhance through the application of the exploratory learning model.
c. **Determining the theoretical foundations of the scale:** The construction of the scale was based on constructivist theory, which works on reconstructing learners' mental schemas through specific cognitive processes. According to **Zeitoun (2007: 29)**, it is "a social process in which learners interact with objects and events through their senses, helping to link prior knowledge with their current knowledge, which includes beliefs, ideas, and images."
d. **Determining the domains of the scale:** In light of previous studies that developed design thinking tests, a list of design thinking skill dimensions was prepared: empathy, problem identification, idea generation, initial prototyping, and collaboration.
e. **Preparing the scale items and verifying validity:** The researcher prepared scale items to suit the research sample and some artistic gymnastics skills on the mat, totaling 18 items. Additionally, a second section of the scale (B) was added, comprising 20 items, following the pictorial representation system defined by **Saeed**

(2008: 39) as "the perception of the stages and components of motor skill performance resulting from observation or memory, which helps the learner achieve a better level through vision and, through practicing the movement, it is perceived and learned."

f. Scale Scoring: The researcher determined the options and weights for section (A) of the Design Thinking Scale using a five-point Likert scale: (Strongly Disagree, Disagree, Sometimes, Agree, Strongly Agree).

The main features of the Likert method are:

- It possesses high validity and reliability.
- It reduces the influence of guessing and chance.
- It is easy to understand and use, expressing a single idea.
- It is flexible due to the variety of options for each item.

Accordingly, the score for each item in section (A) of the scale ranges from 1 to 5, as shown in Table (3). Therefore, the total scores for section (A) range between 18 and 90.

Table (3) shows the scoring weights and response options for section (A) of the Design Thinking Scale.

S	Weights / Alternatives	Scoring weights for the responses				
		Strongly disagree	I do not agree.	Sometimes	I agree	I strongly agree
1-	**Positive paragraphs**	**1**	**2**	**3**	**4**	**5**
2-	**Negative paragraphs**	**5**	**4**	**3**	**2**	**1**

The academic English translation of your text is:

As for Section (B) of the Design Thinking Scale, the researcher conducted personal interviews with a number of experts in order to determine the scoring method. It was decided that a correct answer would receive a score of (1) and an incorrect answer a score of (0), so that the scores for Section (B) of the scale range from (0–10).

g. Linguistic Proofreading of the Scale Items: After the items were prepared in their initial form, they were presented to specialists to ensure their accuracy and to evaluate them linguistically. The feedback was taken into account, thus the items became free of linguistic errors.

h. Scale Instructions: The researcher ensured that the scale instructions were clear and specific, using short and easily memorable phrases that explain the purpose of the test and how to respond, including an example of how to answer.

i. Pilot Study of the Design Thinking Scale: The researcher conducted a pilot study of the Design Thinking Scale (Section A and Section B) on Tuesday, 29/10/2024, with a sample consisting of four second-year female students in the gymnasium. The researcher's objectives were as follows:

- To avoid potential errors that might occur in the participants' responses.
- To observe the participants' responses to the final version of the research instrument, including its strengths and weaknesses.
- To ensure the clarity of the items, questions, and response instructions.
- To calculate the time the sample takes to complete the scale.

j. The Design Thinking Scale in Its Initial Form: The Design Thinking Scale in its initial form was as follows:

Section (A): It included 18 items with both positive and negative directions, distributed across five domains and with five response options, as shown in Tables (4) and (5).

Table (4) illustrates the positive and negative direction of the items in Section (A) of the Design Thinking Scale.

S	Item Direction	Items
1-	Positive Items	1،2،3،4،5،6،7،8،10،12،13،14،15،16،17
2-	Negative Items	18 ، 11 ، 9

Table (5) shows the ordering of the domain items according to the sequence of the scale.

S	Scale Dimensions	Item Number	Item Sequence in the Final Version of the Scale
1-	Empathy	1	5
		2	10
		3	8
2-	Integrative Thinking	1	1
		2	16
		3	6
		4	12
3-	Idea Generation	1	3
		2	11
		3	2
		4	9
4-	Prototype Construction	1	15
		2	13
		3	7
5-	Collaboration	1	17
		2	4
		3	14
		4	18

Section (B): It included 10 questions representing the five domains of the modified Design Thinking Scale (Empathy, Integrative Thinking, Optimism, Experimentation, Collaboration), with two questions for each domain.

Calculation of the Total Score of the Design Thinking Scale:

The total score of the Design Thinking Scale was calculated as shown in Table (6).

Table (6) shows the method of calculating the total score of the modified Design Thinking Scale in its initial form.

S	Design Thinking Scale	Scoring Range	
		Highest Score	Lowest Score
1-	Section (A)	90	18
2-	Section (B)	10	0
Total Score of the Design Thinking Scale		18) ،100(	

k. Final Version of the Design Thinking Scale: The Design Thinking Scale in its final version was as follows:

- **Section (A):** It included 18 items with positive and negative directions, distributed across five domains, with five response options (Strongly Disagree, Disagree, Sometimes, Agree, Strongly Agree), as shown in Tables (7) and (8) below.

Table (7) illustrates the positive and negative direction of the items in the Design Thinking Scale.

S	Item Direction	Items
1-	Items	1،2،3،4،5،6،7،8،10،12،13،14،15،16،17
2-	Items	9،11،18

Table (8) shows the ordering of the domain items according to the sequence of the scale in its final version.

S	Scale Dimensions	Item Number	Item Sequence in the Final Version of the Scale
1-	Empathy	1	5
		2	10
		3	8
2-	Problem Identification	1	1
		2	16
		3	6
		4	12
3-	Idea Generation	1	3
		2	11
		3	2
		4	9
4-	Prototype Construction	1	15
		2	13
		3	7
5-	Collaboration	1	17
		2	4
		3	14
		4	18

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Accordingly, the highest possible score for Section (A) of the Design Thinking Scale is 90, the lowest score is 18, and the neutral score of the scale is 54.

As for Section (B): It included 10 questions representing the five domains of the modified Design Thinking Scale (Empathy, Problem Identification, Idea Generation, Prototype Construction, Collaboration), with two questions for each domain. The researcher established a scoring criterion, as follows:

1. **A correct answer receives a score of (1).**
2. **An incorrect answer receives a score of (0).**

To calculate the total score for Section (B), the scores obtained by the respondent are summed. Each question has a score range of 0–1, and the total score for each domain ranges from 0–2. The highest possible total score is 10, the lowest is 0, and the neutral score is 5.

2.5.1.2. Reactive Thinking Scale: According to Al-Otum (2008), citing Aidon, reactive thinking refers to an individual's ability to exchange ideas with others and interact with them in order to find appropriate solutions to problems (Al-Otum et al., 2008, p. 186).

After reviewing the literature, previous studies, and scientific sources related to the concept of reactive thinking, such as the studies by Al-Otum et al. (2008), Jabr (2023), and Al-Bahadly (2020), the researcher adopted the Reactive Thinking Scale of Al-Bahadly (2020), which included 16 items, for the following reasons:

- This scale can be applied to different educational levels, from preparatory to university.
- This scale has been used in the Arab context in numerous studies, including in Iraq, by many researchers to measure thinking habits collectively or individually.

In order for the researcher to achieve the objectives of her study, the scale had to align with the nature of the study and the research sample. Therefore, she proceeded to readapt the scale, as the process of preparing scales requires systematic and sequential planning based on scientific research principles and objective scientific foundations to ensure that it is acceptable, valid, and reliable for scientific research, while also considering ease of administration and scoring.

The steps for preparing the scale are as follows:

a. **Preparation of the scale items and their validity:** The researcher reformulated the scale items in their initial form, totaling 16 items, and presented them to a group of experts and specialists to evaluate the validity of the items in terms of their wording and their suitability for measuring reactive thinking in the research sample. The items included both positive and negative directions.
b. **Scale Scoring:** In formulating the items and determining the responses, the researcher adopted the five-point Likert method for selecting the response options in the original scale. This method was chosen because it provides weighting for participants' responses, demonstrates high validity and reliability, measures the respondent's ability to distinguish between correct and incorrect judgments, and is based on accurate perception (Reda, 2002, p. 28).

Table (9) shows the weighted scores and response options for the Reactive Thinking Scale.

S	Scores / Response Options	Weighted Scores of the Responses				
		Applies to a degree of				
		Very Low	Low	Medium	High	Very High
1-	Positive Items	1	2	3	4	5
2-	Negative Items	5	4	3	2	1

c. Scale Instructions: The researcher aimed for the test instructions to be clear and precise, asking respondents to answer with honesty, sincerity, and objectivity for the purposes of scientific research. It was also stated that there was no need to provide their name and that no one except the researcher would see their answers, in order to reassure respondents about the confidentiality of their responses.

i. Pilot Study of the Reactive Thinking Scale: The researcher conducted a pilot study of the Reactive Thinking Scale on Wednesday, 30/10/2024, with a pilot sample consisting of four female students. The researcher's objectives were as follows:

- Avoid errors that may occur during participants' responses in the laboratory.
- Ensure that the statements are appropriate for the sample's level.
- Identify the participants' responses to the research instrument in its final form.
- Determine the work obstacles and calculate the time the sample takes to complete the scale (20).

ii. The Initial Form of the Interactive Thinking Scale: The initial form of the Interactive Thinking Scale, consisting of (16) items, includes both positively and negatively worded statements with five response options, as shown in the table below:

Table (10) shows the direction of the positive and negative items of the Interactive Thinking Scale.

S	The Direction of the Items	Items
1-	Positive Items	16 ،15 ، 14 ،11 ،6،8،10 ،5 ،3،4 ،2 ، 1
2-	Negative Items	12،13، 9 ، 7

Thus, the highest score of the scale became (80), the lowest score (16), with a hypothetical mean of (48).

iii. The Final Form of the Interactive Thinking Scale: The scale, in its final form, consists of (16) items with five response options each, ranging from (Very Low, Low, Medium, High, Very High). Accordingly, the total score of the scale is (80), the lowest score is (16), and the hypothetical mean is (48).

2.5.2. Preparation of Educational Units (Using the Divergent Learning Model): After completing the preparation of all test and scale requirements, the researcher prepared the educational units using the divergent learning model to teach certain artistic gymnastics skills (tucked backward roll, forward open roll, handstand) for the experimental group. The group included (10) educational units, each lasting (90) minutes. The researcher took into consideration the following when preparing the units:

- The exercises should be appropriate for the sample's level.
- The number of exercises should match the time allocated for implementing the units.
- Exercises should progress from easy to difficult.
- The steps of the model should be implemented within the educational units.
- The educational units should align with the syllabus of the college curriculum for the second stage.

2.5.2.1. Pilot Test of the Educational Curriculum: The researcher conducted a pilot test of the educational curriculum prepared using the divergent learning model on a pilot sample of (4) female students in the gymnastics hall on 3/11/2024, prior to implementing the main experiment, in order to ensure the following:

- Appropriateness of the time allocated for each section of the educational units.
- Suitability of the exercises for the sample's level.
- The sample's understanding of the steps for implementing the model.
- Avoidance of difficulties that may occur during the implementation of the main experiment.
- Appropriate number of exercises for each unit.

2.5.3. The Main Experiment

2.5.3.1. Pre-Tests: The researcher conducted the pre-tests for the research sample during the period from 5–6/11/2024 for both the skill tests and the two scales of creative and interactive thinking. The researcher administered the pre-tests for the creative and interactive thinking scales with the assistance of a team on 5/11/2024, while the gymnastics skill tests were conducted on 6/11/2024.

2.5.3.2. Implementation of the Divergent Learning Model: The researcher applied the educational units based on the targeted skills following the steps of the divergent learning model (Problem, References, Mental Operations, Semantic Network, Significations) during the period from 10/11/2024 to 19/12/2024. The steps of the model were implemented by the artistic gymnastics instructor as follows:

Preparatory Section: (20 min) Includes:

- **Introduction: (5 min)** – Involving standing in formation, performing the lesson greeting, and taking attendance.
- **General Warm-up: (5 min)** – A set of exercises targeting all major muscle groups of the body.
- **Physical Exercises: (10 min)** – A set of exercises focusing on the active muscles.

Main Section: (60 min) Includes:

- **Educational Part: (15 min)** – Includes:

a. **Phase One (Problem):** The instructor begins by explaining the skill, its steps, and how to perform it in front of the students, highlighting its benefits for easy information retention in the brain. A question is then directed to the learners after the instructor signals the students to form heterogeneous cooperative groups. A leader is assigned in each group to record ideas and answers, with group members taking turns leading. For example, a flex display containing errors in performing the skill may be shown for them to identify, or an educational video related to the posed question, or a flex demonstrating the correct performance of the skill.
b. **Phase Two (References):** To enable the students to answer the instructor's questions, they begin attempting to connect their prior knowledge with the new knowledge. One minute is allocated for thinking about the task or question and recording it on a specially distributed sheet.
c. **Phase Three (Mental Operations):** Students discuss among themselves to reach a solution and represent it mentally in a schematic form. During this phase, each student engages in a set of cognitive processes to solve the question and express the relationships between new and prior knowledge. Four minutes are allocated for discussion and dialogue to answer the activity according to the sheet distributed to the groups to unify their responses.

- **Practical Part (45 min):** This includes dividing the students into groups and performing the practical exercises for the gymnastics skills.

d. **Phase Four (Semantic Network):** Practical application, during which students develop a comprehensive understanding of the performance. Exercises are then performed with peer correction and discussions within the groups about the correct execution. In this phase, the exercises are gradually made more challenging, and learners are motivated by selecting the best-performing group, in addition to providing feedback.

Final Section: (10 min) Includes:

- **Cool-down Exercises or a Small Game (5 min):** Providing feedback and correction for all students.

e. **Phase Five (Significations) – 5 min:** Discussing the groups' answers, reviewing the submitted diagrams and **illustrations** to reinforce correct responses, and correcting incorrect answers.

2.5.4. Post-Tests for the Research Sample: The post-tests were conducted during the period from 24–26/12/2024 on all members of the main experiment sample, including both the experimental and control groups. The creative and interactive thinking scales, as well as the skill tests, were administered, and the data were recorded on forms and then processed for statistical analysis.

2.6. Statistical Tools: The ready-made statistical package SPSS was used.

3. Presentation, Analysis, and Discussion of Results

3.1. Presentation of Test Results (Pre- and Post-Tests) for the Control and Experimental Groups in the Study Variables and Their Discussion

3.1.1. Presentation of the Pre- and Post-Test Results for the Control Group in the Study Variables: The results of the arithmetic means and standard deviations for the artistic gymnastics tests, creative

thinking scale, and interactive thinking scale for the control group in the pre- and post-tests are presented in the table below.

Table (11) shows the results of the arithmetic means and standard deviations of the study variables in the pre- and post-tests for the control group.

S	Variables	Units of Measurement	Pre-Test		Post-Test	
			M	±SD	M	±SD
1.	Tucked Backward Roll Skill	Score	3,384	0,650	7,461	1,391
2.	Forward Open Roll Skill		1.785	0.892	5.500	1.160
3.	Handstand Skill		1.285	0.611	5.000	1.240
4.	Creative Thinking Scale		40.786	4.526	46.214	5.000
5.	Interactive Thinking Scale		41.500	3.777	43.000	3.802

3.1.2. Presentation of the Pre- and Post-Test Results for the Experimental Group in the Study Variables: The results of the arithmetic means and standard deviations for the tests (artistic gymnastics, creative thinking, and interactive thinking) for the experimental group in the pre- and post-tests are presented and analyzed in the table below.

Table (12) shows the results of the arithmetic means and standard deviations of the study variables in the pre- and post-tests for the experimental group.

S	Variables	Units of Measurement	Pre-Test		Post-Test	
			M	±SD	M	ع±SD
1.	Tucked Backward Roll Skill	Score	3,000	0,912	7,000	0,816
2.	Forward Open Roll Skill		2,615	0,767	7,615	1,502
3.	Handstand Skill		2.615	0.869	7.615	1.894
4.	Creative Thinking Scale		41.286	5.129	53.214	3.765
5.	Interactive Thinking Scale		42.928	2.934	56.214	4.156

3.2. Presentation and Discussion of the Post-Test Results for the Control and Experimental Groups in the Study Variables: The researcher calculated the independent samples t-test values to determine the significance of the differences between the means of the post-tests for the control and experimental groups in the tests (artistic gymnastics, creative thinking, and interactive thinking).

Table (13) shows the post-test results for the control and experimental groups in the study variables.

Variables	Units of Measurement	Group	M	±SD	Independent T. Test		Statistical Significance
					T Value	Value Sig	
Tucked Backward Roll Skill	Score	Control	5.769	1.786	3.350	0.003	Significant
		Experimental	7.615	0.869			
Forward Open Roll Skill		Control	5.461	0.967	7.256	0.000	Significant
		Experimental	8.307	1.031			
Handstand Skill		Control	5.230	0.926	7.668	0.000	Significant
		Experimental	7.923	0.862			
Creative Thinking Scale		Control	46.214	5.000	4.033	0.019	Significant
		Experimental	53.214	3.765			
Interactive Thinking Scale		Control	43.000	3.802	8.458	0.000	Significant
		Experimental	56.214	4.156			

Significant at the significance level ≤ 0.05.

Table (4-6) presents the post-test results for the study variables (artistic gymnastics tests, creative thinking, and interactive thinking) for the control and experimental groups. It shows the superiority of the experimental group over the control group in the post-tests of the study variables.

The researcher attributes this to the use of the divergent learning model, which includes procedures that differ from the traditional curriculum. This model requires the preparation of motivational educational activities through which students are taught cognitive flexibility and avoiding rigidity in thinking. This, in turn, enhanced their self-efficacy, which subsequently improved their skill and cognitive performance, as observed by the researcher during the implementation of the experiment.

The researcher attributes this improvement to the exercises, questions, and the method of implementation she used according to the divergent learning model, which is characterized by a gradual progression in terms of understanding, perception, and difficulty. This approach created a suitable environment for engaging the learner's cognitive processes, enabling full comprehension of the skill. The increase in the level of the targeted skills results from the variety of questions and the responses obtained by the student during the educational units, which allows her to learn the skill technique correctly alongside the applied exercises. Additionally, the varied exercises and instructional tools in each educational unit contributed to learning the studied skills. This aligns with what Al-Omari (2000) indicated: *"Placing the student in learning situations or environments that are utilized to achieve optimal performance comes through assisting them in processing information and experiences in a scientifically planned and correctly organized manner"* (Al-Omari, 2000, p. 312).

The researcher believes that the reason for the experimental group's superiority over the control group at this level is that the educational units prepared according to the divergent learning model were more effective than the units for the control group. Furthermore, the learning environment provided by these units, through the five stages of the model starting with the Problem Phase, aimed to encourage students to acquire knowledge and apply it in the learned skill by searching for, analyzing, and connecting information. This included using printed posters, videos, and internet resources, through which the student obtains information while taking responsibility for her own learning, ultimately enhancing her self-confidence.

The researcher attributes the progress in creative thinking to the role of the divergent learning model through its application stages, which stimulate learners and develop their thinking abilities. This contributed to the advancement of creative thinking across its five stages, as the model presents educational content in the form of problems that challenge students' thinking and their ability to provide creative solutions. These problems create cognitive conflicts regarding the learned skills, prompting students to use their prior knowledge and reconstruct it mentally to form a clear understanding of correct performance. This process requires organizing ideas in the student's mind, thereby increasing their motivation to learn and enhancing their creative thinking.

The divergent learning model encourages cooperative work among students during inquiry by forming small groups, providing them with specific problems, and guiding them to find appropriate solutions. This approach develops students' creative thinking by having them mentally enact the skill to solve the presented problem, generating a set of ideas and constructing the initial model. As Lokwood Bapqi (2018) stated, *"Design thinking allows freedom of expression, resulting in brainstorming and idea generation without constraints, and facilitates expressing ideas and feelings in a more innovative and effective way."*

The stages of the model align with the stages of creative thinking. The questions presented by the researcher according to the divergent learning model go beyond simple recall and extend to analytical and creative questions, avoiding reliance on a single type of question. This is supported by Lzam et al. (2005), who emphasized that variety and novelty in using exercises, methods, and strategies when teaching sports skills are most suitable for creating an engaging, stimulating, and enjoyable learning environment, contributing to the rapid acquisition of movements and sports activities (Lzam, 2005, p. 60).

Moreover, the engagement and motivation of students in the divergent learning model, preventing feelings of boredom, were utilized to train them in creative thinking skills. This was achieved by having students empathize with the presented problem, identify and define it, and generate as many ideas as possible to solve it through collaborative learning groups. They then designed a model and, finally, received feedback on their solutions, which played an effective role in improving performance.

This aligns with what Al-Kaabi and Abboud (2021) stated: *"Many learning situations cannot be properly evaluated by the learner without the assistance of others, which is reflected in the information they receive. During the learning of a skill or acquisition of a behavioral pattern, the learner can evaluate their performance either internally or externally. Feedback is linked to an important aspect of learning, which is the assessment of performance and behavior"* (Al-Kaabi & Abboud, 2021, p. 148).

The third phase of the divergent learning model (Mental Operations) focuses on the use of this type of thinking, as it engages all cognitive processes, including brainstorming, which the students perform while participating in solving the educational problem. In this phase, the relationships between new knowledge and prior knowledge are expressed through diagrams, posters, pictorial representations, or answers on the answer sheets designated for each group. This encourages creativity and innovation, which Saud et al. (2017) defined as the ability to produce something new in its formulation (Saud et al., 2017, p. 113). This phase contributed to enhancing their creative thinking. Scheer (2017)

noted that the success of design thinking depends on three elements: learner engagement, the learning environment, and the balance between instruction and construction (Scheer, 2017, p. 11).

Regarding the effect of the experimental group on interactive thinking, the researcher attributes this to the effectiveness of the model. The divergent learning model transformed students from passively receiving information to actively researching it themselves through direct interaction with the posed questions (Problem Phase). This opens the horizons of their interactive thinking by prompting them to seek solutions and generate ideas. The model is characterized by interactive activities between teacher and student, student and student, and student and environment, which enhances their ability to perform the skill correctly and develops their interactive thinking.

The model incorporates diverse teaching methods such as cooperative learning, brainstorming, discussion, and dialogue, encouraging students to utilize their different cognitive skills, explore independently, exchange knowledge, and infer the correct method of performance. Costa and Kallick (2005) emphasized that interactive thinking is part of higher-order cognitive abilities that enable individuals to act intelligently when they do not know the answer to a question or face a problem. These abilities help the individual perform in a smart way, leading to productive actions that benefit both the learner and others in their community (Costa & Kallick, 2005, p. 4).

Moreover, the educational units prepared according to the divergent learning model were more effective than the units used for the control group due to the sequential presentation of topics and the inclusion of activities and events suited to the students' level of understanding. This design made the students more motivated and receptive to receiving information. The units also contained a set of instructional aids that helped form a comprehensive mental image of correct performance, in addition to capturing the learners' attention and preventing distraction while performing physical exercises and motor skills, thereby reducing boredom, which is a critical factor as motivation is an essential condition for learning.

Furthermore, the divergent learning model facilitated dialogues and discussions among the students, enabling them to generate new ideas and acquire a cognitive habit known as interactive thinking when solving their peers' problems. They developed skills such as avoiding hasty responses, engaging in peer discussion, expressing opinions, and thinking outside the box, which fostered creativity and innovation in problem-solving. This contributed to the development of their interactive thinking, aligning with the definition by Costa and Kallick (2003, p. 96): *"The increased ability of a person to think with others and work in groups requires the capacity to justify ideas, develop readiness, and openness that helps accept feedback from a critical friend."*

The researcher believes that the educational process is a blend of the teacher's expertise in formulating varied questions, presentation methods, and visual communication strategies with the student's abilities and cognitive and motor skills. This interaction reflects on the student's skill performance through interactions between (student and teacher), (student and student), and (student and learning environment). Giordan (2012) emphasized this, stating: *"All the previous interactions should convince the learner that the concepts they possess cannot solve the problem, and they should guide them to gather new information. They also lead to a change in attitudes from their prior conceptions about the problem and help them reformulate the problem"* (Giordan, 2012, p. 6).

It is also important to note a key factor that contributed, directly or indirectly, to the experimental group's superiority over the control group: the students performed many of the exercises included in the educational units, repeated them, received feedback, and corrected their performance during execution. Working within groups increased competition and excitement among the groups and encouraged integrative thinking for each group member. Their adherence to all instructions and consistent attendance were also effective factors in improving skill performance, ultimately achieving the objectives of the educational units. Al-Zarkani (2021) noted that the learning process develops through engaging students actively and through cognitive interactions among students, as they respond to their peers' questions and

inferences, which often differ from their own. This transforms students from passive recipients of information into active researchers, making them the center of the educational process (Al-Zarkani, 2021, p. 86).

4. Conclusions And Recommendations

4.1. Conclusions

i. There was improvement in creative and interactive thinking, as well as in some artistic gymnastics skills, for both the experimental and control groups, but at varying rates.
ii. The model provided the experimental group students with the opportunity to connect their prior knowledge and experiences with new information to acquire new knowledge, thereby contributing to the development of their creative thinking more effectively than the control group.
iii. The divergent learning model contributed to the development of interactive thinking because it gave students opportunities to engage in cognitive processes more effectively compared to the control group.
iv. The effect size of the divergent learning model was large for the tucked backward roll, the forward open roll, creative thinking, and interactive thinking, and moderate for the handstand.
v. The effect size of the applied method was large for the skills of tucked backward roll, forward open roll, and creative thinking, and moderate for interactive thinking and the handstand.

4.2. Recommendations

i. Employ the divergent learning model in other sports and with different samples.
ii. Encourage students to engage in collaborative and cooperative work and provide them with opportunities to express their ideas.
iii. Incorporate visual presentation tools in other sports to observe and analyze movement components, as this is important for linking auditory and visual senses, which in turn accelerates the learning process.
iv. Work on developing students' higher-order cognitive abilities to enable greater success in society.
v. Conduct studies to compare males and females in the divergent learning model regarding creative and interactive thinking.
vi. Utilize the creative and interactive thinking scales in other sports activities.

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