

The Impact of the Guided Discovery Method Combined with Sequential Learning on Selected Artistic Gymnastics Skills among University Students

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ORIGINAL STUDY

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Abstract

This study aims to examine the impact of employing the guided discovery method as the primary approach in teaching certain gymnastics skills, with the sequential method serving as a supportive tool to organize and structure the learning stages, which emphasized the combination of both methods so as to achieve both cognitive and motor objectives for the students. The importance of the current article lies on the emphasizing the duty of guided discovery to develop students' analytical skills and thinking and motivate the learners to participate actively in the process of learning. Moreover, it contributes to develop motor skill through the structured development which is provided by the successive method which adopts the growth of both cognitive as well as motor abilities. The current research involved 22 college as a samples from the Faculty of Physical Education and Sport Sciences at Al-Qadisiyah University experimental group and a control group. The students with the control may collect instruction by adopting the outmoded method, though the students with the experimental method can follow an instructional program which is planned according to sequential learning and guided discovery. Pre-tests were already done for both groups of students so as to guarantee equality, and then the program was conducted by the experimental group of students over ten educational units. As a conclusion of the present paper, post-tests were managed, and all the datasets were statistically scrutinized so as to achieve dependable findings. This paper lastly came to conclude that the guided method has a significant impact to improve students' motor acts in gymnastics and stimulate the students' thinking. Combining the guided discovery with sequential method successfully controlled the students increasingly so as to help combine the skills and accelerate the achievement.

Keywords: Guided discovery, Sequential learning, Artistic gymnastics, Motor performance, Instructional methods

1. Introduction

Gymnastics is considered one of the most important individual sports that has witnessed remarkable development in recent years, a progress largely attributed to the adoption of modern scientific methods in teaching and in developing technical and motor skills. Moreover, this sport enjoys wide international recognition for its unique blend of harmony, attractiveness, excitement, and artistry. In addition, gymnastics is characterized by the integration of agility, flexibility, and strength, which collectively add

aesthetic and creative value to performance. Guided discovery is regarded as one of the most effective teaching methods in gymnastics, as it contributes to enhancing the learning of motor skills while simultaneously developing cognitive abilities (Al-Hawamdeh & Al-Dahamsheh, 2022). Consequently, this study aims to examine the value of guided discovery as a primary instructional method in learning selected gymnastic skills. Furthermore, the sequential method is employed as a supportive tool to structure and reinforce the stages of instruction progressively. Ultimately, the instructional procedures were systematically designed to emphasize the integration of both

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Table 1. Shows homogeneity of the research sample.

Variable	Unit of Measurement	Mean	Standard Deviation	Coefficient of Variation	Significance
Height	cm	172.05	4.261	2.477	Homogeneous
Weight	kg	65.40	6.660	10.184	Homogeneous
Age	months	239.20	10.191	4.260	Homogeneous
Cartwheel	degree	31.25	10.37	33.188	Homogeneous
Headstand	degree	3.025	1.006	33.264	Homogeneous
Handstand	degree	34.50	10.63	30.798	Homogeneous

methods in order to achieve comprehensive motor and cognitive outcomes.

1.1. Research problem

The research problem lies in the fact that the teaching of gymnastics skills is predominantly based on a single instructional method, often overlooking alternative approaches—particularly those that foster critical thinking and encourage learners to actively participate in the educational process by finding solutions independently during performance. To address this gap, the researcher employed the guided discovery method in conjunction with the sequential method to enhance the teaching and learning of gymnastics skills among students.

1.2. Research objectives

The study seeks to:

1. Examine the impact of the guided discovery method on learning selected artistic gymnastics skills.
2. Identify the role of the sequential method in supporting the structured progression of learning stages when combined with guided discovery.
3. Compare the effectiveness of guided discovery combined with sequential learning against traditional teaching methods in improving learners' motor and cognitive abilities.

1.3. Research hypotheses

This study is guided by the following hypotheses:

1. There are statistically significant differences between pre-test and post-test results in favor of the group taught using the guided discovery method.
2. The integration of the sequential method with guided discovery is expected to result in greater improvement in motor performance compared to guided discovery alone or traditional methods.

1.4. Research sample

According to Allawi and Radwan (2000), “the objectives set by the researcher for their study and the procedures they employ are what determine the nature of the population or sample they select.” (p. 217)

The population of this study consisted of second-year students enrolled in the College of Physical Education and Sport Sciences at the University of Al-Qadisiyah during the academic year [2024–2025]. A random sample of twenty (20) students was selected and divided equally into two groups: an experimental group and a control group.

To ensure equivalence and minimize the impact of individual differences, both groups were subjected to pre-tests measuring key variables relevant to the targeted skills. Statistical analysis confirmed the homogeneity of the sample as in Table 1, thereby supporting the validity of subsequent comparisons between the two groups.

To ensure the homogeneity of the research sample and control for extraneous variables that might affect the study's results, the researcher ensured the sample's uniformity and subsequently divided the participants into two groups.

1.5. Research tools

To achieve the objectives of the study, the researcher employed a variety of tools and procedures, including standardized tests and measurements relevant to the targeted gymnastics skills, direct observation of student performance, evaluation forms to record notes and assess skill execution.

2. Gymnastics skill performance test

Student performance was recorded using two cameras:

- The first camera positioned in front of the performer
- The second camera positioned at the side
- Both cameras placed 5 meters away
- Height: 1.5 meters

The recordings were reviewed by three evaluators, and the arithmetic mean of their scores was calculated to determine each student's assessment (Mahjoub, 1988).

2.1. Exploratory experiment

An exploratory trial was conducted on 18 February 2023 with a group of 10 students outside the main sample. The purposes were to test the suitability of the instruments, identify potential implementation challenges, estimate the required time for conducting the program, verify alignment of procedures with the research plan, and assess student responsiveness to the instructional approach (Hussein et al., 1990).

2.2. Pre-tests

Following two introductory sessions, pre-tests were administered within the gymnastics hall to measure students' initial performance levels in the selected skills (handstand, headstand, cartwheel) (Kamal & Hassanein, 1997).

2.3. Instructional approach

The educational program integrated guided discovery and sequential learning in order to ensure active learner engagement and gradual skill acquisition in a way that ensures active learner engagement and a logically and systematically progressive sequence of learning stages:

1. Guided Discovery: Students were encouraged to explore motor solutions independently by engaging in problem-solving tasks. The teacher provided indirect guidance through questions and feedback rather than direct answers, fostering self-learning and analytical thinking. See Appendix 1.
2. Sequential Learning: Skills were broken down into progressive stages, from simple to complex. Mastery of each stage was required before advancing, enabling learners to consolidate motor knowledge in a structured and systematic manner.

Through this integration, the curriculum aims to achieve comprehensive development of both motor and cognitive skills, providing learners with the opportunity to acquire skills through personal experience while benefiting from the structured learning offered by gradual sequencing. See Appendix 2.

2.4. Implementation phases

1. Preparation and Planning Stag: Selection of target skills, development of a sequential training plan, preparation of the learning environment with necessary equipment and safety measures. See Appendix 3.
2. Preparation and Orientation Stag: Introducing learners to training objectives and the significance of each skill, simplified explanation of performance requirements, clarification of safety guidelines.
3. Implementation Stage:
 - **Applying the Sequential Method:** starting learning with simple steps and gradually progressing to more difficult ones, such as breaking skills into small stages.
 - **Applying Guided Discovery:** giving learners the opportunity to perform tasks themselves, while guiding them with motivating questions that encourage self-identification and correction of errors, see Appendix 1.
 - **Providing support and guidance** when needed, without undermining the discovery process.
 - **Repeating the stages** as necessary, with a focus on gradual progression and variety in exercises.
4. Feedback and Evaluation: Constructive feedback delivered to enhance performance; group discussions of performance outcomes to reinforce understanding.
5. Consolidation and Continuous Development Stage: This stage focuses on reinforcing the skills acquired through continuous practice and providing additional exercises, while encouraging learners to apply their skills in a variety of situations.

2.5. Post-tests

Final tests were administered at the end of the program; data were analysed using SPSS software, employing paired-sample t-tests and group comparisons to identify significant differences.

2.6. Results analysis

A paired-sample t-test was applied to analyze the differences within the experimental group, in addition to comparing the post-test results of both groups, as shown in Table 2.

Table 2. Differences between the experimental and control groups in the Post-test.

Variable	Unit of Measurement	Control Group (Mean $\pm$ SD)	Experimental Group (Mean $\pm$ SD)	t-value	p-value
Handstand	degree	5.125 $\pm$ 1.217	7.250 $\pm$ 1.165	3.479	0.003
Headstand	degree	5.375 $\pm$ 0.916	8.313 $\pm$ 0.704	6.754	0.000
Cartwheel	degree	4.944 $\pm$ 0.808	7.375 $\pm$ 0.694	4.198	0.001

Note: t-critical value at 0.05 significance level with $df = 18$.

3. Results and discussion

The statistical results indicate a clear superiority of the experimental group over the control group across all measured variables. This advantage reflects the effectiveness of the brainstorming strategy in enhancing skill performance and promoting students' psychological stability.

The data presented in Table 2 illustrate the differences between the two groups in the post-test, showing higher results for the experimental group in the technical performance of the studied skills. This highlights the positive impact of teaching using guided discovery and sequential learning compared to the traditional method applied to the control group. The improvement in the experimental group's mean scores can be attributed to several factors resulting from the implementation of the strategy, including the development of a well-organized, sequential training curriculum based on guided discovery. This approach provided students with opportunities for critical thinking, exploration, problem-solving, and situational management, which contributed to skill acquisition and enriched students' feedback resources, enabling all individuals to reach high performance levels. Moreover, structured repetition reinforced motor information, as noted by Wang Arnov, cited by Mostafa in (2003), who stated that repeated practice activates motor learning (Al-Far, 2003).

The guided discovery method also created a flexible learning environment that allowed immediate feedback to correct errors as they occurred and adapt exercises according to students' abilities, while organizing performance through exploratory questions. This aligns with Atiya (2009), emphasis on the importance of time management and the use of worksheets to track exercises and is consistent with Najah's findings in (2000), regarding the role of repetition and regular practice in improving motor control and execution accuracy (Shalsh & Sobhi, 2000).

Additionally, the applied method facilitated learners' reflection on their knowledge to generate appropriate answers, enhancing their feedback and increasing their internal knowledge resources. Consequently, this positively affected the learning process, positioning the student as the central agent while the teacher assumes a guiding role. One of the studies noted that in guided discovery, the teacher directs learners' thinking toward the intended discovery, providing

guidance sufficient for the learners to achieve the expected outcome (Zaghloul et al., 2001).

The sequential method also enabled learners to focus on a single skill without distraction, allowing continuous repetition until the skill became familiar and performance stabilized. With frequent repetition, responses become nearly automatic, meaning the learner can perform movements smoothly without significant cognitive effort. This is particularly important in the early learning stages, where the player needs to consolidate the fundamentals before progressing to new skills or integrating them into complex game situations. Nahda Al-Dulaimi (2016) explained that this method relies on learning a skill in sequential parts until the entire skill is mastered, then moving to another skill. The learner focuses exclusively on the skill from all aspects until reaching a good performance level before proceeding. This view is further supported by Ya'rab Khayoun (2002), who stated that learners benefit from sequential training by establishing the foundational elements of the intended movement before implementing the complete program.

4. Conclusions

1. The guided discovery method contributed noticeably to improving students' motor performance in gymnastics skills by involving them in the learning process and encouraging deeper thinking and analysis.
2. Combining the sequential method with guided discovery helped to structure the learning stages step by step, which supported skill retention and led to faster mastery.
3. The integration of both methods proved more effective in addressing learners' individual differences compared with relying only on one method or on traditional teaching.
4. This instructional model shows strong potential for application in other sports that require precision and gradual skill development.

5. Recommendations

1. Encourage the use of modern teaching strategies that promote student interaction, engagement, and active participation throughout the learning process.

2. When designing instructional programs, integrate the sequential method with guided discovery to provide structured, step-by-step learning that matches individual levels and supports faster, more effective skill acquisition.
3. Organize training courses and workshops for coaches that highlight both the theoretical concepts and the practical applications of guided discovery, while also demonstrating how to incorporate the sequential method.
4. Ensure that learning programs allocate enough time for the stages of guided discovery, giving students the chance to experiment, explore, and reflect on their learning rather than relying only on direct instruction.

Conflicts of interest

None.

We confirm that all tables and figures in this article are ours and written by the researchers themselves.

Author's contributions

All contributions to this study were carried out by the researcher (Ali Shaker Naama), who developed the main idea, wrote the manuscript, and drew the conclusions, with additional contributions from Asst. Prof. Dr. Ismail Hasan Obeid, English language specialist at the University of Al-Qadisiyah, College of Fine Arts, in reviewing and translating the manuscript.

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Data availability

The authors confirm that the data supporting the findings of this study are available within the article [and/or] its supplementary materials.

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Appendices

Appendix 1

Practical Examples of Implementing the Curriculum for Specific Gymnastics Skills

Handstand

Sequential approach:

- a) Practice balancing in a kneeling position on the hands with wall or partner support.
- b) Progress to pushing the body into a handstand with minimal support.
- c) Hold the handstand independently for short periods.

Guided discovery: Learners are encouraged to experiment with hand placement and body angles. Questions include: How does weight distribution affect stability? What changes when the body angle is adjusted?

Headstand

Sequential approach:

- a) Train students to correctly place head and hands on the floor with teacher support.
- b) Gradually push the body upward while maintaining balance.
- c) Hold the headstand without support for short periods.

Guided discovery: Students experiment with distributing pressure between head and hands. Questions: How can arm positioning improve balance? How does body tension affect stability?

Cartwheel

Sequential approach:

- a) Practice placing one hand on the floor with feet stationary.
- b) Progress to full movement of both hands maintaining alignment.
- c) Perform the full cartwheel emphasizing smoothness and control.

Guided discovery: Learners are asked: How does the body's tilt affect the cartwheel's flow? Which movement keeps the body aligned during rotation?

Appendix 2

Examples of Guided Discovery Questions

Objective: Encourage learners to find motor solutions independently through open-ended questions.

Skill	Guided Question	Observation / Expected Answer
Jumping and Ground Push	Does bending your knees more or less help you jump higher?	Greater bend = stronger push
Jumping and Ground Push	What happens if you use your arms while jumping?	Increased height and improved balance
Jumping and Ground Push	How can you land without losing balance?	Bend the knees upon landing to absorb impact
Inverted Movements	How can you maintain a handstand for the longest possible time?	Tighten the body, fix gaze, push through shoulders
Inverted Movements	What is the effect of tightening your abdomen during a handstand?	Improved stability and prevention of back arching
Inverted Movements	How do you feel if you push the ground harder at the start of the movement?	Faster rise and better stability
Fluidity and Coordination	How can you transition from one movement to another without stopping?	Pre-plan movements and link them smoothly
Fluidity and Coordination	What happens if you start slowly and then gradually increase speed?	Greater control and smoother performance
Fluidity and Coordination	How can you synchronize the movements of your arms and legs at the same time?	Practice motor rhythm
Overcoming Fear	What small step can you try before performing the full movement?	Break the movement into smaller parts
Overcoming Fear	How can you feel safe while trying the movement?	Use a safety mat or coach assistance
Overcoming Fear	What happens if you repeat the movement several times quickly?	Increased confidence and reduced fear of the movement

Appendix 3

Sample Teaching Unit

Grade Level: 2nd

Duration: 90 minutes

Learning Objective: Learn the handstand skill

Unit Section	Time	Activities and Skills	Notes
Organizational Aspect	4 min	Recording student attendance	
I. Preparatory Section	16 min	– Walking – jogging with alternating arm rotations forward and backward – lifting knees forward and backward, etc.	– Emphasize organization
A – General Preparatory	8 min	– (Standing) Jump upward while pulling knees to chest (1–2)	– Students move in warm-up formation
B – Specific Preparatory	8 min	– (Standing, legs apart, waist) Rotate head in all directions sequentially (1–4)	– Warm-up should cover all body parts
		– (Standing, legs apart, arms up) Bend trunk forward and back down (1–4)	– Emphasize major muscle groups involved in performance
II. Main Section	60 min	Teacher asks students guiding questions	Questions are asked and clarified until the correct answer is reached
1 – Educational Part		– Student performs the skill	Students identify errors themselves, evaluate, and correct mistakes independently
2 – Practical Part		– Student evaluates performance and identifies errors by comparing execution with answers to questions	
		– Skill is repeated with corrections	
III. Concluding Section	10 min	Body cooldown exercises and games, then dismissal	Review key points given during the lesson

تأثير أسلوب الاكتشاف الموجه بالتعلم المتسلسل في بعض مهارات الجمناستك الفني للطلاب

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المستخلص

تهدف هذه الدراسة إلى بيان أثر توظيف أسلوب الاكتشاف الموجه كأسلوب رئيسي في تعليم بعض مهارات الجمباز، مع اعتماد الأسلوب المتسلسل كأداة مساندة لتنظيم وتدرج مراحل التعلم، مع التأكيد على الجمع بين كلا الأسلوبين لتحقيق الأهداف المعرفية والحركية للطلاب. تكمن أهمية هذه الدراسة في إبراز دور الاكتشاف الموجه في تطوير مهارات التحليل والتفكير لدى الطلاب وتحفيزهم على المشاركة الفعالة في عملية التعلم. كما يسهم الأسلوب المتسلسل في تطوير المهارات الحركية من خلال تنظيم عملية التعلم بشكل متدرج، ما يتيح تنمية القدرات المعرفية والحركية معاً، شارك في الدراسة 22 طالباً من كلية التربية الرياضية وعلوم الرياضة بجامعة القادسية، مقسمين إلى مجموعة تجريبية وأخرى ضابطة. تلقى طلاب المجموعة الضابطة التعليم بالأسلوب التقليدي، في حين اتبع طلاب المجموعة التجريبية برنامجاً تعليمياً مخططاً وفقاً للأسلوبين المتسلسل والاكتشاف الموجه. أجريت الاختبارات القبلية لكلا المجموعتين لضمان المساواة، ثم تم تنفيذ البرنامج على المجموعة التجريبية خلال عشر وحدات تعليمية، في ختام الدراسة، أجريت الاختبارات البعدية وتم تحليل جميع البيانات إحصائياً للوصول إلى نتائج موثوقة. وتوصلت الدراسة إلى أن أسلوب الاكتشاف الموجه له أثر كبير في تحسين الأفعال الحركية للطلاب في الجمباز وتنمية التفكير لديهم. كما أن الجمع بين الاكتشاف الموجه والأسلوب المتسلسل ساهم بشكل فعال في تنظيم أداء الطلاب تدريجياً، مما ساعد على دمج المهارات وتسريع تحقيق الأهداف التعليمية.

الكلمات المفتاحية: الاكتشاف الموجه، التعلم المتسلسل، الجمناستك الفني