



Effect of Cognitive Strategy-Based Instructional Guidance on Analytical Thinking and Rhythmic Gymnastics Skills

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Abstract

Background The problem. Teaching often focuses solely on the skill and technical aspects, without paying attention to the mental and cognitive processes that accompany the learning process, which play a fundamental role in simplifying, understanding, and analyzing skills.

Objectives Design an educational guidance program based on cognitive strategies for analytical thinking and the performance of some free skills in rhythmic gymnastics for female students. Identify the impact of the guidance program based on cognitive strategies for analytical thinking and the performance of some free skills in rhythmic gymnastics for female students between the pre- and post-tests, and between the two research groups (experimental and control) in the post-tests

Methods To achieve the objectives, the experimental approach was used, with a design of two equivalent groups (control and experimental), and a descriptive approach using a survey method, as it suited the nature of the research problem. The research community was defined as (117) second-year female students in the College of Physical Education (University of Dhi Qar, Basra, and Maysan) for the academic year (2023-2024). The research population was selected from the universities of Basra and Maysan, numbering (78) students. The exploratory and application samples were from the University of Dhi Qar, numbering (39) students: (9) students for the exploratory sample and (30) for the application sample.

Results It was found that the experimental and control groups achieved their goal of a significant effect between the pre- and post-tests on learning research skills and the analytical thinking scale.

Conclusion The cognitive strategy-based educational guidance programme was proven very effective at enhancing pupils' capacity for analytical thinking. In turn, this improved pupils' capacity for analysing and comprehending the stimulus associated with freestyle elements in rhythmic gymnastics. The programme had a similar positive effect on skill performance when pupils demonstrated freestyle skills that required increased cognitive engagement.

Keywords : Instructional Guidance, Cognitive Strategies, Analytical Thinking, Rhythmic Gymnastics Skills

Introduction

Background of the Study. counseling sessions are an important part of the educational experience because they provide a way to enhance the mental skill sets of learners (Gandrapu & Rakesh, 2024). They provide a broad range of benefits, including increasing attention, decreasing fear and anxiety, and increasing confidence. As a result, mental preparedness

helps students understand and comprehend the material better and helps them to structure, retrieve and process the data more effectively than when they are not mentally prepared. One of the modern approaches to education is teaching learners cognitive skills so they can become active participants in the processing and application of knowledge. This process can speed up the educational process for students (Winn et al., 2019). This change in dynamic is evident in how a learner's behavior shifts to a more active participant in skill-development learning activities such as gymnastics because they will be more likely to want to acquire new skills (Afzal & Torralba, 2024; Bean et al., 2022).

Rhythmic gymnastics is a growing global sport that serves as an individual competitive event (Prassas et al., 2006), and provides female students with a strong base for mastering other sports. Learning technical and psychological skills in rhythmic gymnastics is a complex task. The level of technical, psychological and physical demands placed on the sport requires high levels of coordination, precision and concentration. (Abarghouejad et al., 2021; Didymus et al., 2021; Kelly et al., 2018).

Literature Review. The Modern learning theories place great emphasis on creating stimulating learning environments while encouraging the sharing of experiences and the development of analytical thinking skills. Analytical thinking, as a process of creativity, supports learners in solving educational issues through the ability to analyze, organize and apply knowledge in a way that improves their overall performance. The body of literature to date has demonstrated that by incorporating both counseling and cognitive strategies into the field of education; learners can increase attention, motivation and understanding, leading to enhanced performances in athletics and other skill-based tasks. Although these findings may substantiate the application of educational guidance programs to support analytical thinking and mastery of skills, there is a void in the literature regarding the application of educational guidance programs to rhythmic gymnastics and the application of structured cognitive strategies to enhance both analytical thinking and skill mastery.

Gap Analysis. Rhythmic gymnastics encompasses more than just performing an action; it entails both physical and mental proficiency, along with analytical capabilities. Numerous research studies indicated that the ways in which instructors commonly delivered instruction about rhythm were primarily technical in nature and failed to provide students with adequate educational or training resources when trying to acquire or improve certain free-style skills. In addition, all existing practices of instruction do not address cognitive or psychological components involved in learning such as memory retention, imagination, and problem resolution (three important areas when developing a rhythmic gymnastics ability). Thus, the absence of a coordinated program specifically designed for developing analytical thinking and performance levels associated with rhythmic gymnastics creates an apparent gap/deficiency within the current models related to educating and training rhythmic gymnastics performers.

Rationale of the Study. The present study seeks to rectify this shortcoming by proposing an intervention program that incorporates cognitive strategies into the training process in order to improve both analytical thinking as well as skills related to rhythmic gymnastics published by other researchers. The intended outcome of utilising this approach is

to promote active engagement in learning while reducing anxiety, increasing motivation and the creation of a positive learning atmosphere where comprehension, analysis, and problem solving is stressed rather than mere technical execution. In addition to promoting critical thinking, analysis and creativity through a cognitive strategy-based training approach, it will also integrate mental processes with physical skills to create a paradigm shift from the conventional methodologies used to teach A-level rhythmic gymnasts to a more modern methodology.

Purpose. This research serves four purposes, or objectives. The first purpose is the creation of a program of educational guidance using cognitive strategies to enhance analytical thinking and skill development and performance of specific elementary skills in rhythmic gymnastics performed by women. The second objective is developing and standardizing a scale about analytical thinking in relation to impact on skill performance among women in rhythmic gymnastics; therefore, the analytical thinking scale will measure examination, a construct that is both unique to rhythmic gymnastics and specific to the sub-skills defined in terms of performance in rhythmic gymnastics. The third objective is to determine whether the newly developed program was effective at producing results through a comparison between results obtained in the pre- and post-tests, such as how much it actually influenced the results in terms of analytical thinking and performance of skills. The final objective is to assess whether there were any significant differences between the performance outcomes and analytical thinking components of the experimental group and that of the control group on the final (post-test) assessment. Collectively, the four purposes identified above represent a holistic approach to evaluating how a program of educational guidance using cognitive strategy development relates to both the cognitive process and the development of motor skills through rhythmic gymnastics.

Hypothesis. The present study's hypotheses address the success of using an instructional guidance platform founded on cognitive strategies to facilitate improvement in analytical thought processes and selected free skills in rhythmic gymnastics. To begin with, we venture to assert that there will be a statistically significant increase in both analytical thinking and performance of selected free-skill tests (e.g., scores) between pre- and post-testing periods of the experimental group; in addition, it is anticipated that the difference will favour post-testing when every other variable is controlled for except the instructional guidance provided. To support this hypothesis, we propose that there will be no statistically significant changes from pre-testing to post-testing for the control group with regards to analytical thinking or free-skill performance; hence this supports our assertion that the incremental improvements experienced by the experimental group are a consequence of the intervention. Lastly, we have a third hypothesis regarding the differences between the two groups at test time: that the differences will favour the experimental group with respect to the improvement in analytical thinking and performance of free-skill tests. Collectively, these hypotheses serve to substantiate the importance of cognitive strategy-based instructional guidance in improving cognitive and motor skills among female students participating in rhythmic gymnastics.

Materials and Methods

Study Organization. This research utilized an experimental design that compared two equally matched groups (the experimental group and the control group), along with a descriptive approach utilizing the survey as the main data source for the research. The research was conducted through an experimental design where cognitive strategies were incorporated into the educational assistance program for the experimental group while the control group continued to participate in the normal course of studies without receiving any assistance or counseling sessions. The intervention lasted for twelve sessions, including the initiation and conclusion of the educational assistance program, held October 29, 2023, through January 7, 2024, with each session lasting approximately 15 to 20 minutes, occurring within the primary portion of the educational unit addressing free skills of rhythmic gymnastics.

Participants. The population for the study was comprised of 117 second-year students (female) at the three campuses of the College of Physical Education at Dhi Qar, Basra and Maysan universities during the academic year 2023-2024. A research sample of 78 students from Basra & Maysan universities was selected from the total population, and an exploratory sample of 39 students from Dhi Qar University was added for both pilot testing and exploratory purposes. Specifically, the exploratory sample (9 students) and application sample (30 students) were selected. Class A (15 students) was randomly assigned as an experimental group and Class B (15 students) was assigned as a control group, making up 25.64 % of the population. The sample also underwent homogeneity Testing (using the coefficient of variation) based on age/height/mass/free-skills (gazelle jump/scissors jump/step jump/front waltz/back waltz), with results showing that all samples had equivalent coefficient of variations of less than 20 %, which indicated that the samples were highly homogeneous. Equivalence between the experimental and control groups was confirmed via the results of t-tests; no significant differences existed between the pre-test scores for Free Skills and Analytical Thinking in either group.

Instruments. Instruments utilized in this research project included: A Sony Digital Video Camera, a Television, a Computer, an Electronic Scientific Calculator, a Height-Measurement Device, a Medical Scale, Compact Discs (CDs), Gymnastics Mats and a Whistle. The Counseling Program was structured based on Five Selected Cognitive Strategies (Reformulation Stimulus, Educational Questions, Physical Sensory Image, Mental Images and Imagination and Memory Support Tools) allowed by an Expert Review. The Analytical Thinking Scale, designed by Abdul Zahra (2019), was additionally employed to measure student's Analytical Thought. The Analytical Thinking Scale was composed of 40 validated

items divided into four domains (Focus of Attention, Perception, Decision Making and Interpretation) measured through a five-point Likert scoring model of Always to Never, which was subjected to Pilot Testing with Nine Students who found the Scale to be Very Clear with Average Time Responses of 15-20 Minutes. The scale demonstrated Validity via Expert Review, Construct Validity and Internal Consistency, and Reliability was demonstrated by Split-Half Reliability ($r = .856$), and Spearman-Brown Formulae ($r = .891$), along with Objectivity via clear instruction and a predetermined scoring scheme.

Statistical Analysis. The data from the pre- and post-test measurements for analytic thinking and the performance levels of the free skills involved with rhythmic gymnastics was processed using SPSS (Statistical Package for the Social Sciences). The data collection included descriptive statistics including a mean, standard deviation, and coefficient of variation for each of the study's dependent variable categories (i.e. Pre-Test and Post-Test results). Independent t-tests were then utilized to determine if there was a significant difference between the two treatment groups at baseline and to determine if there was a significant difference between the two treatment groups based upon the post-test results. Paired t-tests were utilized to compare within each treatment group the differences between pre-test and post-test results. The level of significance to evaluate the effectiveness of the coaching program based on cognitive strategies was set at 0.05.

Results

Results of the Experimental Group. The data in table 1 presents a clear picture of how the results from both the pre-test and post-test assessments on "Skills" and the Analytical Thinking Scale differ between the two groups that were assessed during the study.

Table 1. Results of the pre- and post-tests for the experimental group

Skills	Pre-test (x ± s)	Post-test (x ± s)	Calculated value	T	Sig.	Statistical significance
Gazelle's leap	1.467 ± 0.481	5.400 ± 1.121	16.165		0.000	Significant
Scissors jump	1.367 ± 0.399	5.267 ± 1.100	14.932		0.000	Significant
Step leap	1.292 ± 1.010	7.500 ± 0.477	7.184		0.000	Significant
Forward waltz step	1.563 ± 0.854	7.375 ± 0.678	14.611		0.000	Significant
Back waltz step	2.208	7.417 ± 0.469	16.375		0.000	Significant

			0.982			
Analytical Thinking Scale		73.86 ± 3.35	93.20 ± 2.455	16.034	0.000	Significant

The data shows that both groups had made statistically significant gains in all of the skills measured as well as their analytical thinking abilities; the t-scores for all of the tests used exceeded the critical values that were determined to be the cutoff for each of the ten tests (2.145, $p < .05$) to be statistically significant. Therefore, we can conclude that the cognitive strategy-based guidance program had a positive and significant impact on both skill acquisition and analytical skill development. The improvements seen in both groups can be attributed to the positive impact on reducing anxiety and fear, increasing self-confidence and resulting in an increased ability to acquire new skills through participation in the cognitive strategy-based guidance program. The findings of this research are consistent with those of Fakher (1876), who stated that ineffective study techniques and a lack of knowledge about cognitive strategies impede one's ability to retain knowledge. Similarly, Droza Afnan (2004) indicated that well-sequenced strategies enhance comprehension and improve performance. The cognitive strategy-based guidance program was also able to create an environment that emphasised reflective thought, which supports Qandil's assertion (2008) that democratic learning strategies help to promote the use of both creative and analytical thinking.

Results of the Control Group. As seen in Table 2, the control group was provided with the same standard education curriculum as the experimental group but did not receive any counseling sessions.

Table 2. Results of the pre- and post-tests for the control group

Skills	Pre-test (x ± s)	Post-test (x ± s)	Calculated value	T	Sig.	Statistical significance
Gazelle's leap	1.233 ± 0.320	4.467 ± 0.990	12.784		0.000	Significant
Scissors jump	1.233 ± 0.320	4.533 ± 0.743	13.485		0.000	Significant
Step leap	1.792 ± 1.033	5.458 ± 0.450	10.094		0.000	Significant
Forward waltz step	1.542 ± 0.831	5.208 ± 0.450	12.537		0.000	Significant
Back waltz step	2.188 ± 0.806	5.250 ± 0.584	8.016		0.000	Significant
Analytical Thinking Scale	74.73 ± 3.10	77.26 ± 3.11	2.489		0.022	Significant

While the control group showed improvement in skill performance and analytical thinking skills, it did not show as much improvement as the experimental group. Therefore, the control group was able to show that standard education curricula are an effective way to provide improvement opportunities for students. Saleh Jwaid (2009) stated that students who are taught with sound educational curricula using scientifically selected exercises at the appropriate levels for their students will improve. Dhafer (2002) also noted that effective learning can occur when the right teaching steps are utilized.

Comparison Between Experimental and Control Groups. According to Table 3, the results of the Post-test for the Experimental Group and the Control Group indicate a statistically significant difference between both, favouring the Experimental Group.

Table 3. Post-test results for the control and experimental groups

Skill	Group	Mean ($\bar{x} \pm s$)	Calculated value	T	Sig.	Statistical significance
Gazelle's leap	Control	4.467 ± 0.990	2.416		0.022	Significant
	Experimental	5.400 ± 1.121				
Scissors jump	Control	4.533 ± 0.743	2.140		0.041	Significant
	Experimental	5.267 ± 1.100				
Step leap	Control	5.458 ± 0.450	10.800		0.001	Significant
	Experimental	7.500 ± 0.477				
Forward waltz step	Control	5.208 ± 0.450	9.229		0.042	Significant
	Experimental	7.375 ± 0.678				
Back waltz step	Control	5.250 ± 0.584	10.032		0.000	Significant
	Experimental	7.417 ± 0.469				
Analytical Thinking Scale	Control	77.26 ± 3.11	10.868		0.000	Significant
	Experimental	93.20 ± 2.455				

Although, both groups had similar levels of improvement, there was a statistically significant difference between the amount of improvement that occurred within each group. This means the inclusion of cognitive strategies during the Guidance sessions was a better way to teach than the Traditional Curriculum alone. The majority of these findings corroborate what Nasha'a (2000) stated, i.e. that lack of knowledge about cognitive strategies was one of the major barriers for Iraqi students; Cross (2011) further stated Analytical Thinking is an iterative-reflective process that promotes creativity and adaptability when approaching problems.

Discussion

The findings of this research indicate that the experimental group had significantly greater improvements from pre-test to post-test with respect to the other realm of the skills studied (analytical reasoning). The magnitude of change for the experimental group, as a result of the cognitive strategy-based instruction, exceeded that of the control group. The analytic results for each group demonstrated that the experimental group demonstrated greater success than the control group in all areas of testing, thereby serving as an affirmation of the enhanced effectiveness of the cognitive strategy-based intervention compared to the control.

The results of this study provide evidence that cognitive strategy-based instructional guidance can improve both performance in gymnastics as well as the mental processes involved in skill execution. The effectiveness of the intervention appears to have been related to the use of specific cognitive strategies to promote active reflection, internalization, and application of mental processing as the learner conducts the physical movement of executing a task.

The theoretical interpretation of the data indicates positive customer satisfaction (i.e., performance exceeds customer expectations). However, within the educational context, positive disconfirmation refers to the expectations and results of the learner. This aligns also with the principles underpinning metacognitive and cognitive strategy instruction, which posit that learners who are guided to engage higher-order thinking, reflection, and self-monitoring will show superior learning gains (e.g., studies on metacognitive strategy use in education) (Adewale et al., 2024; Alamäki et al., 2024; Huang & Lajoie, 2023). The utilization of cognitive strategies to create a more stable and consistent method of learning reduces the effects of the diversity of learning methods used by students upon their performance on test/class average outcomes (Bf et al., 2020)

Furthermore, this finding supports the premise that a student's anxiety will greatly affect his/her performance and a student's confidence can be improved with structured cognitive assistance, providing a better opportunity for student success. This correlates with previous studies indicating that anxiety will often limit a student's ability to acquire a specific skill and cognitive and psychological assistance provided through scaffolding will alleviate this barrier to skill acquisition. The improvements demonstrated above the standard curriculum within the control group, indicates that the successful completion of the educational program cannot solely be attributed to the students' knowledge of the material covered. The increase in cognitive strategy assistance enhances the effectiveness of the curriculum. Therefore, it is necessary to combine cognitive strategies with physical and technical training, particularly in areas of rhythmic gymnastics where developing numerous skills is highly complex.

There are limitations to the study. These include a short intervention period and a small sample size; therefore, the findings may not be applicable to all populations. Additional studies will be necessary to determine how long cognitive strategy-based guidance programs would be beneficial for developing both technical and analytical abilities. Overall, the results of this research indicate that the integration of cognitive strategy-based guidance programs into the training of rhythmic gymnasts has promise. It is recommended that coaches, educators, and curriculum designers implement the use of cognitive strategies in conjunction with technical drills to increase both performance and cognitive skills.

Conclusion

The educational guidance program that provided cognitive strategy suggestions was clearly successful in creating an environment where students were able to think analytically. As a result, students were better able than before to examine and ultimately master the technical elements associated with free-skill movement. The fixed nature of the educational guidance sessions not only supported the cognitive involvement of each student; however, by using higher-level functional cognition and activating reflective processes, it also enhanced the motivation of each student. The improved level of motivation aided students in decreasing their level of anxiety during periods of performance when they were executing complex motor skills due to the introduction of cognitive stimulants that were included as part of the program. By providing an environment where cognitive skills were given added focus, students progressed more rapidly and with greater accuracy when developing the correct skill performance. Additionally, the combination of an educational guidance program with a skills training program produced outstanding improvements in student learning outcomes. This

success is especially notable in sports (e.g., Rhythmic Gymnastics), that require performers to have a strong link between mental preparation and technical ability to succeed.

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References

- Abarghoueinejad, M., Barreira, D., Dias, C., Guimarães, E., Baxter-Jones, A. D. G., & Maia, J. (2021). Body Physique, Body Composition, Physical Performance, Technical and Tactical Skills, Psychological Development, and Club Characteristics of Young Male Portuguese Soccer Players: The INEX Study. *International Journal of Environmental Research and Public Health*, 18(7), 3560. <https://doi.org/10.3390/ijerph18073560>
- Adewale, M. D., Azeta, A., Abayomi-Alli, A., & Sambo-Magaji, A. (2024). Impact of artificial intelligence adoption on students' academic performance in open and distance learning: A systematic literature review. *Heliyon*, 10(22), e40025. <https://doi.org/10.1016/j.heliyon.2024.e40025>
- Afzal, I., & Torralba, A. (2024). *Cognitive Skills Development through AI Tools: Critical Thinking and Pedagogics Design in Modern Education*. Unpublished. <https://doi.org/10.13140/RG.2.2.34811.53281>
- Alamäki, A., Khan, U. A., Kauttonen, J., & Schlögl, S. (2024). An Experiment of AI-Based Assessment: Perspectives of Learning Preferences, Benefits, Intention, Technology Affinity, and Trust. *Education Sciences*, 14(12), 1386. <https://doi.org/10.3390/educsci14121386>
- Bean, C., Kramers, S., & Harlow, M. (2022). Exploring life skills transfer processes in youth hockey and volleyball. *International Journal of Sport and Exercise Psychology*, 20(1), 263–282. <https://doi.org/10.1080/1612197X.2020.1819369>
- Bf, H., R, W., K, V., H, van E., J, O., & E, H. (2020). Effects of physical activity interventions on cognitive outcomes and academic performance in adolescents and young adults: A meta-analysis. *Journal of Sports Sciences*, 38(23), Article 23. <https://doi.org/10.1080/02640414.2020.1794763>
- Didymus, F., Norris, L., Potts, A., & Staff, H. (2021). Psychological stress and performance. In Z. Zenko & L. Jones (Eds.), *Essentials of exercise and sport psychology: An open access textbook* (pp. 683–709). Society for Transparency, Openness, and Replication in Kinesiology. <https://doi.org/10.51224/B1029>

Gandrapu, A., & Rakesh, K. R. (2024). Sports Psychology: Mental Skills Training and Performance Enhancement Strategies for Athletes. *Innovations in Sports Science*, 1(3), 1–4. <https://doi.org/10.36676/iss.v1.i3.13>

Huang, X., & Lajoie, S. P. (2023). Social emotional interaction in collaborative learning: Why it matters and how can we measure it? *Social Sciences & Humanities Open*, 7(1), 100447. <https://doi.org/10.1016/j.ssaho.2023.100447>

Kelly, S., Thelwell, R., Barker, J. B., & Harwood, C. G. (2018). Psychological support for sport coaches: An exploration of practitioner psychologist perspectives. *Journal of Sports Sciences*, 36(16), 1852–1859. <https://doi.org/10.1080/02640414.2018.1423854>

Prassas, S., Kwon, Y., & Sands, W. A. (2006). Biomechanical research in artistic gymnastics: A review. *Sports Biomechanics*, 5(2), 261–291. <https://doi.org/10.1080/14763140608522878>

Winn, A. S., DelSignore, L., Marcus, C., Chiel, L., Freiman, E., Stafford, D., & Newman, L. (2019). Applying Cognitive Learning Strategies to Enhance Learning and Retention in Clinical Teaching Settings. *MedEdPORTAL*, 10850. https://doi.org/10.15766/mep_2374-8265.10850