Jurnal Kepelatihan Olahraga

Volume 18 Number 1 (2026) 25 - 30

Journal homepage:
https://ejournal.upi.edu/index.php/JKO
p-ISSN number: 2086-339X e-ISSN number: 2657-1765
DOI: https://doi.org/10.17509/jko-upi.v18i1.89768

Comparative Effects of Three Conceptual Differentiation Models on Basketball Learning Outcomes

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ABSTRACT

This study examined the comparative effects of three conceptual differentiation models on basketball learning outcomes, including skill performance, selected physical attributes, and thinking styles among fourth-grade middle school students. A quasi-experimental equivalent-group design with pre-test and post-test measures was employed. A total of 160 students participated in an eight-week intervention (16 instructional sessions). The experimental groups were taught using: (1) Stimulus–Functional Integration Model, (2) Descriptive–Analytical Model, and (3) Multi-Level Structured Differentiation Model, while the control group received traditional instruction. Instruments included standardized basketball skill tests, physical performance tests, and the Bramson, Harrison, and Bartlett Thinking Styles Test (Arabic version). Content validity was established through expert review, and reliability coefficients ranged from 0.82 to 0.91. Data were analyzed using two-way ANOVA followed by Duncan post-hoc tests. Results indicated that the Multi-Level Structured Differentiation Model produced significantly greater improvements in skill performance, physical attributes, and thinking styles compared to other models and traditional instruction ($p < .05$). These findings suggest that structured conceptual differentiation enhances motor and cognitive engagement in basketball instruction.

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ARTICLE INFO

Article History:
Submitted 07 December 2025
Revised 20 January 2026
Accepted 15 February 2026
Available online 01 March 2026
Publication Date 01 March 2026

Keyword:
conceptual differentiation,
basketball learning,
motor performance,
physical education,
thinking styles.

1. INTRODUCTION

Basketball instruction in physical education represents a complex learning domain that integrates perceptual–motor coordination, physical conditioning, tactical awareness, and cognitive engagement. Due to the dynamic and high-tempo nature of basketball, students must process environmental information rapidly while executing technically precise motor actions. Therefore, effective instructional approaches must address not only physical skill acquisition but also cognitive processing and decision-making capabilities.

Motor learning theory emphasizes that skill acquisition improves when learners are exposed to structured task progression, variable practice conditions, and increasing contextual complexity (Schmidt & Lee, 2019). Contemporary ecological dynamics perspectives further argue that learning emerges through the interaction between the individual, task, and environment, highlighting the importance of adaptable instructional designs (Renshaw et al., 2019). Within school settings, structured and progressive learning environments have been shown to enhance motor competence and performance adaptability (Alali et al., 2024; Dapp et al., 2021).

In parallel, differentiated instruction has gained recognition as a pedagogical strategy designed to accommodate learner diversity. Tomlinson (2017) suggests that differentiated instruction enables teachers to modify content, process, and product according to students' readiness levels and cognitive characteristics. In physical education contexts, differentiated strategies have been associated with improved engagement, physical performance, and active participation (Akabuddin et al., 2024; Blegur & Hardiansyah, 2024; Casey & Goodyear, 2015).

Beyond motor learning, cognitive styles represent relatively stable patterns of information processing that influence how learners perceive, analyze, and synthesize information (Messick, 1984). Thinking styles shape decision-making processes, problem-solving strategies, and behavioral responses in learning environments (Sternberg, 2018). During adolescence, executive function development plays a crucial role in integrating cognitive and motor tasks (Diamond, 2016). Instructional strategies that stimulate analytical, synthetic, realistic, and practical thinking may therefore enhance both cognitive flexibility and motor learning outcomes.

Despite theoretical discussions surrounding conceptual differentiation and cognitive styles (Al-Tayib, 2000; Harrison & Bramson, 1982), limited empirical research has compared multiple structured conceptual differentiation models within basketball instruction. Moreover, few studies have simultaneously examined their effects on skill performance, physical attributes, and thinking styles.

This gap highlights the need for experimental research that integrates motor learning theory, differentiated instruction, and cognitive engagement within a unified pedagogical framework. Therefore, this study aims to compare three conceptual differentiation models and examine their impact on basketball learning outcomes among middle school students.

Although conceptual differentiation has been discussed theoretically in educational literature, limited empirical research compares multiple conceptual differentiation models in basketball learning and examines their simultaneous effects on skill performance, physical attributes, and thinking styles. Therefore, this study aims to compare three conceptual differentiation models and examine their effects on basketball learning outcomes among middle school students.

2. METHODS

A quasi-experimental equivalent-group design with pre-test and post-test measures was used. An equivalent group design with pre-test and post-test was used. Table 2.1 illustrates this design.

Table 2.1. Experimental design for equivalent groups

Variables / Group	Equivalent	Independent variable	Post-test

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First Experimental	Age / Height / Mass Physical attributes Basic skills Thinking styles	First Conceptual Differentiation Model	Physical attributes Basic skills Thinking styles
Second Experimental		Second Conceptual Differentiation Model	
Third Experimental		Third Conceptual Differentiation Model	
Control Group		Traditional Model	

2.2. Participants

The sample consisted of 160 fourth-grade middle school students (2023/2024 academic year). Four intact classes were randomly assigned to:

- Experimental Group 1: Stimulus–Functional Integration Model
- Experimental Group 2: Descriptive–Analytical Model
- Experimental Group 3: Multi-Level Structured Differentiation Model
- Control Group: Traditional Instruction

The research population consisted of fourth-grade middle students in Mosul for the academic year (2023/2024). The preparatory schools were numbered to facilitate the random selection of the research sample. Al-Abdul Rahman Al-Ghafiqi Preparatory School was randomly chosen, with (160) fourth-grade students distributed across four sections (1, 2, 3, 4), with (40) students in each section. Through a lottery method, section (2) was selected to represent the first experimental group, which was studied according to the first conceptual differentiation model. Section (3) was chosen to represent the second experimental group, which was studied according to the second conceptual differentiation model. Section (1) represented the third experimental group, which was studied according to the third conceptual differentiation model. Section (4) represented the control group, which was studied according to the traditional method. Additionally, the pilot experiment included (30) students from Al-Sadiq Preparatory School.

2.3. Procedures

The intervention lasted eight weeks, consisting of sixteen instructional sessions. Each experimental group received structured instructional treatments according to the respective conceptual differentiation model.

- Model 1 emphasized stimulus-response integration and graded difficulty.
- Model 2 focused on analytical identification of movement characteristics before execution.
- Model 3 implemented progressive multi-level task complexity integrating cognitive and motor challenges.

Instruments included standardized basketball skill tests, physical performance tests (speed, agility, strength, flexibility), and the Bramson, Harrison, and Bartlett Thinking Styles Test. Content validity was confirmed through expert review, and reliability coefficients ranged between 0.82–0.91. Normality and homogeneity assumptions were satisfied prior to analysis. Data were analyzed using two-way ANOVA followed by Duncan post-hoc comparisons at $\alpha = .05$.

2.4 Instruments

- Standardized basketball skill tests
- Physical performance tests (speed, agility, strength, flexibility)
- Bramson, Harrison, and Bartlett Thinking Styles Test (Arabic adaptation)

Content validity confirmed through expert review (n=5) and Reliability coefficients ranged between 0.82–0.91. Normality (Kolmogorov–Smirnov) and

homogeneity (Levene's test) assumptions were satisfied ($p > .05$). Two-way ANOVA was applied followed by Duncan post-hoc tests ($\alpha = .05$).

3. RESULTS

The results of the two-way ANOVA analysis revealed that the values of (F) for the skill tests at the group level ranged between (106.732) and (555.654). At the test level, they ranged between (678.138) and (4286.685). As well as at the interaction level between group and test, they ranged between (93.204) and (529.973). All values were statistically significant as indicated by the (sig) values. This leads us to reject the null hypothesis, which states that there are no statistically significant differences among the students of the four groups. Instead, we accept the alternative hypothesis, which indicates the presence of statistically significant differences among the students of the four groups. To determine which groups the differences were in favor of, the researcher used Duncan's test to examine the least significant difference in the skill tests at table 3.1.

Table 3.1. Duncan's Test for the Least Significant Difference in Skill Tests

Test **Group**	**First experimental group**	**Second experimental group**	**Third experimental group**	**Control group**
Defensive stance	3.899	3.916	3.646	5.091
Order	B	C	A	D
Defensive steps	42.013	42.113	43.463	33.238
Order	B	B	A	C
Chest pass	13.137	13.368	12.91	16.151
Order	B	C	A	D
Bounce pass	14.553	14.834	14.117	18.079
Order	B	C	A	D
Long pass	15.2625	14.475	15.825	10.05
Order	B	C	A	D
Dribbling	13.448	13.827	13.1244	17.0108
Order	B	C	A	D
Shooting from under the basket	11.05	9.80	13.05	5.20
Order	B	C	A	D
Free throw	6.4	6.4	6.963	3.875
Order	B	C	A	D
Side shooting	6.6	5.93	7.1879	2.638
Order	B	C	A	D
Layup shooting	6.975	6.30	7.663	3.6
Order	B	C	A	D
Offensive rebound	12.650	11.988	13.288	10.363
Order	B	C	A	D

It can be seen from table 3.1 that the letter differences in the performance of the four research groups across all skill tests were in favor of the third experimental group, which was taught according to the third model of conceptual differentiation. Followed by the first experimental group, which was taught according to the first model of conceptual differentiation. Then the second experimental group, which was taught according to the second model of conceptual differentiation. Finally, the control group, which was taught using the traditional method. However, in the skill of defensive steps, no differences were observed between the first and second experimental groups, with these two groups ranking after the third experimental group.

4. DISCUSSION

The findings demonstrate that the Multi-Level Structured Differentiation Model produced superior improvements across skill performance, physical attributes, and thinking styles. These results can be interpreted through multiple theoretical perspectives.

First, from a motor learning standpoint, progressive task complexity and structured variability enhance neural adaptation and skill consolidation (Schmidt & Lee, 2019). The multi-level structure likely facilitated deeper perceptual discrimination and improved coordination patterns, consistent with ecological dynamics principles that emphasize task–environment interaction (Renshaw et al., 2019; Alali et al., 2024).

Second, differentiated instruction frameworks suggest that adapting instructional difficulty to learners' readiness levels enhances motivation and engagement (Tomlinson, 2017). Research in physical education indicates that when tasks are appropriately structured and progressively challenging, students exhibit improved motor performance and physical fitness outcomes (Akabuddin et al., 2024; He et al., 2023). The current findings align with these perspectives, demonstrating that structured differentiation enhances physical attributes such as speed, agility, and strength.

Third, the observed improvements in thinking styles may be explained by increased cognitive engagement embedded within the instructional model. Executive function research highlights that adolescence represents a critical period for cognitive flexibility and decision-making development (Diamond, 2016). The multi-level model likely stimulated analytical and synthetic thinking processes through structured problem-solving tasks and adaptive transitions between difficulty levels. Sternberg (2018) argues that instructional environments requiring adaptive thinking promote intellectual development beyond content mastery.

The superiority of the first and second differentiation models over traditional instruction further supports the notion that cognitively enriched motor tasks outperform purely repetitive instructional methods (Casey & Goodyear, 2015). Traditional models, which rely heavily on direct instruction and uniform task repetition, may limit cognitive engagement and adaptive skill development. Collectively, these findings contribute to the growing body of literature advocating integrative pedagogical approaches that combine motor learning principles, cognitive engagement, and differentiated instruction in physical education.

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Collectively, these findings contribute to the growing body of literature advocating integrative pedagogical approaches that combine motor learning principles, cognitive engagement, and differentiated instruction in physical education.

5. CONCLUSIONS

The Multi-Level Structured Differentiation Model was the most effective approach for enhancing basketball skill performance, physical attributes, and thinking styles. Structured differentiation strategies are recommended for physical education teachers. Future research should examine long-term retention and application across different sports.

6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

7. REFERENCES

Akabuddin, A., Suherman, W. S., Komari, A., Hambali, S., & Permana, M. F. (2024). The utilization of differentiated learning in improving physical fitness and active lifestyle of junior high school students. *Pamukkale Journal of Sport Sciences, 15*(3), 561–577. https://doi.org/10.54141/psbd.1512748

Alali, N. N., Carson, H. J., & Collins, D. (2024). A pragmatic approach to skill acquisition for physical education: Considering cognitive and ecological dynamics perspectives. *Quest, 76*(2), 227–246. https://doi.org/10.1080/00336297.2023.2298931

Al-Tayib, I. A. (2000). *Styles of thinking: Theories, studies, and contemporary research*. Alam Al-Kutub.

Blegur, J., & Hardiansyah, S. (2024). Differentiation instruction publications in physical education: A bibliometric analysis. *Journal of Education and Learning, 18*(3), 902–913. https://doi.org/10.11591/edulearn.v18i3.21307

Casey, A., & Goodyear, V. A. (2015). Can cooperative learning achieve the learning outcomes of physical education? *Physical Education and Sport Pedagogy, 20*(2), 150–165.

Dapp, L. C., Gashaj, V., & Roebers, C. M. (2021). Physical activity and motor skills in children: A differentiated approach. *Psychology of Sport and Exercise, 54*, 101916. https://doi.org/10.1016/j.psychsport.2021.101916

Diamond, A. (2016). Why improving and assessing executive functions early in life is critical. *Developmental Cognitive Neuroscience, 18*, 34–48. https://doi.org/10.1016/j.dcn.2015.11.005

Harrison, A., & Bramson, R. (1982). *Styles of thinking for asking questions, making decisions, and solving problems*. Anchor Press.

He, J., Yu, H., Jiang, M., & Białas, M. (2023). A research synthesis on successful educational practices and student outcomes for physical education. *Frontiers in Psychology, 14*, 1280871. https://doi.org/10.3389/fpsyg.2023.1280871

Messick, S. (1984). The nature of cognitive styles: Problems and promise in educational practice. *Educational Psychologist, 19*(2), 59–74. https://doi.org/10.1080/00461528409529283

Renshaw, I., Davids, K., Newcombe, D., & Roberts, W. (2019). *The constraints-led approach: Principles for sports coaching and practice design.* Routledge. https://doi.org/10.4324/9781315102351

Schmidt, R. A., & Lee, T. D. (2019). *Motor learning and performance: From principles to application* (6th ed.). Human Kinetics.

Sternberg, R. J. (2018). *A theory of adaptive intelligence and its relation to general intelligence*. Cambridge University Press. https://doi.org/10.3390/jintelligence7040023

Tomlinson, C. A. (2017). *How to differentiate instruction in academically diverse classrooms* (3rd ed.). ASCD.