International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 4s, 2025
https://www.theaspd.com/ijes.php

The Impact Of The Generative Model Supported By Artificial Intelligence As An Advanced Organizer On High-Order Thinking Skills Among Middle School Students In Mathematics

[1]Tahreer Mohammed Kadhim, [2] Ilham Jabar Fares
[1,2]University of Baghdad / College of Education for Pure Sciences- Ibn Al-Haitham/ Department of Mathematics, Iraq.
[1]tahreer.kadhum2203@ihcoedu.uobaghdad.edu.iq;
[2]ilham.j.f@ihcoedu.uobaghdad.edu.iq

Abstract
The current research aims to know the impact of the generative model supported by artificial intelligence as an advanced organizer in developing higher-order thinking skills among middle school students in mathematics, and the researchers adopted the experimental method, where the study sample included (78) students distributed into two groups: the experimental group of (38) students studied using the generative model supported by artificial intelligence as an advanced organizer, and the control group of (40) students studied using the traditional method: The experimental group, which includes (38) students studied using the generative model supported by artificial intelligence as an advanced organizer, and the control group, which includes (40) students studied in the traditional way. The school was randomly selected, which is the Martyr Muhammad Baqer al-Sadr Middle School for Boys in Karbala Holy Education, the two groups were equalized based on four variables: Chronological age in months, intelligence, previous achievement in mathematics, and parental achievement, a test was prepared for higher order thinking skills according to Goodson's classification, which includes skills such as creative thinking, critical thinking, problem solving, and decision making, the experiment was conducted during the second semester of the academic year 2024-2025, where three chapters of the mathematics book scheduled for the second intermediate grade T6 for the year 2024 were studied, the higher order thinking test was applied on 22/4/2025, where the results proved that the experimental group outperformed the control group in the higher order thinking test.

Keywords: *Generative model, artificial intelligence, an advanced organizer, higher-order thinking.*

INTRODUCTION

Teaching methods commonly used in the field of education typically focus on memorization and indoctrination through linguistic-verbal education, as most of what students encounter in their school life consists of words and phrases. Rarely is there an emphasis on practicing mental processes by students, which is reflected in their overall thinking and achievement levels, as well as in the higher-order thinking skills in mathematics in particular. Mathematics is considered one of the most difficult subjects, characterized by abstract concepts, logical sequences, and mathematical relationships. Students face challenges in identifying its components and selecting the appropriate method to solve its problems. This weakness in higher-order thinking skills has been confirmed by the results of previous studies and research in mathematics, such as in the studies [1,2]. Therefore, learners need effective strategies that work to enhance their achievement and thinking through modern strategies and methods [3,4]. To achieve this, those interested in teaching must move away from traditional indoctrination methods and apply the principle that "competence in education is acquired through training and reflection, not inherited." Based on the above, the research problem can be defined by answering the following question:

What is the effect of an artificial intelligence-powered generative model as an advanced organizer on the higher-order thinking skills of middle school students in mathematics?

1.1. The Importance of Research:

1. The importance of mathematics in all fields, and the importance of teaching it at various educational levels, requires more attention and focused care in selecting strategies that make the student an effective and fundamental focus of the educational process [5,6].

2. The current research targets middle school students, which represents a transitional stage between childhood and adulthood, between the concrete and the abstract, and the accompanying physical and psychological changes in students. Therefore, this stage requires more comprehensive care to overcome the problems associated with this stage [7,8].

3. It may lead to a deeper, better, and longer-lasting understanding of the cognitive content by shifting from traditional teaching to teaching that selects information at a time of information overload, and also works to ensure that the student is active and engaged in the educational process [9].

4. To the researcher's knowledge, there is no previous study that has addressed the generative model supported by artificial intelligence as an advanced organizer at the local level.

1.2. The Aim of Research: The current research aims to determine the effect of the generative model supported by artificial intelligence as an advanced organizer on higher-order thinking among middle school students in mathematics.

1.3. Hypothesis of Research: There are no statistically significant differences at the level of (0.05) between the average scores of the experimental group students who will study according to the generative model supported by artificial intelligence as an advanced organizer and the average scores of the students who will study according to the traditional method in the high-order thinking skills test.

1.4. Limits of Research:

1. Successful students from the first to the second intermediate grades in intermediate and secondary day schools affiliated with the General Directorate in the Holy Karbala Governorate.

2. The subjects were the mathematics textbook for the second intermediate grade (2024-2025), revised 6th edition, for the year 2024.

3. The researcher began the experiment in the second semester of the academic year (2024-2025).

1.5. Definitions of the Terms:

1. **Model:** a model is a set of procedures implemented by the teacher in the educational setting, including the design of the material and the methods of presenting and processing it [10].
2. **Generative Model:** it as the process of linking the learner's previous experiences with their new experiences and forming relationships between them, so that the learner constructs their knowledge through generative processes that they use to modify alternative and incorrect perceptions in light of correct scientific knowledge [11].

The operational definition of the generative model supported by artificial intelligence as an advanced organizer: An educational strategy that aims to develop students' thinking and concepts by generating two types of relationships (a relationship between the learner's previous and new experience and between the new pieces of knowledge to be learned). The learner interacts with these relationships in their daily lives when confronted with an unfamiliar problem through four basic phases: the introductory phase, the concentration phase, the conflicting phase, and the application phase. These phases enable the student to think at a higher level, leading them to solve problems and make decisions [12,13]. Artificial intelligence and its applications are helpful and supportive as an advanced organizer and use them to help students understand and retain information [14,15].

Higher-Order Thinking: Most references specializing in thinking agree on the existence of five types of thinking that fall under the umbrella of higher-order or complex thinking: (creative thinking, critical thinking, problem-solving, decision-making, and metacognition) [16]. So higher-order thinking is a type of thinking and represents a set of complex mental processes that include critical and creative thinking skills, problem-solving, and decision-making [17,18].

The researchers identified the higher-order thinking skills, whose indicators were used in the number of test items: data analysis and modeling skills, data organization skills, critical questioning skills, interpretation skills, inference skills, evaluation skills, decision-making skills, intellectual fluency skills, intellectual flexibility skills, originality skills, integration and synthesis skills, idea generation and enrichment skills, and imagination skills.

THE ORETICAL BACKGROUND

2.1. Generative Model.

The generative model is based on the assumption that the learner comes to school with a structure of prior knowledge (daily experiences) acquired during social and cultural upbringing. Therefore, the teacher should provide learners with the opportunity to generate meaningful relationships between new information in short-term memory and information in long-term memory [19]. Also as "a set of procedures and practices followed by the teacher in the educational situation, which emphasizes the essential skills for learning and the practical life in which the learner lives." [20].

Based on the above, the generative model is one of the learning models built according to constructivist theory, which relies on social participation that emerges through discussion, negotiation, and dialogue among groups of learners. Through this model, new information and concepts are generated by recalling the learners' prior experiences through collaborative workgroups formed during a class session. This process connects previous information with the new information obtained, leading to the desired learning outcome [21].

2.1.1. Stages and Phases of the Generative Model.

According to [22] and further research such as that by [23], the generative model consists of four interconnected educational phases or stages:Preparation Phase: In the preparation phase, the learner is mentally primed to receive new concepts by activating their prior knowledge related to the topic. This is achieved through posing introductory questions, recalling previous experiences, and stimulating students' everyday experiences. The teacher also presents puzzling issues, contradictory events, or various environmental situations to inspire students' thoughts and experiences related to the lesson, creating a sense of need for inquiry and exploration. It is essential that the questions and content are linked to their prior information, beliefs, and experiences to enhance interaction and highlight the importance of prior knowledge in constructing new knowledge.

1 Focus Stage: In this phase, the teacher divides students into small, heterogeneous groups to connect everyday knowledge with the targeted knowledge. This is done through activities that lead to the acquisition of the required concepts and behaviors, including the introduction of scientific terms and mental and practical inquiry activities. This allows students to observe, infer, and interpret in their own way while providing opportunities for dialogue and negotiation within the groups. Students experience the concept, and each group presents an interpretation of the activities and answers questions through its representative, preparing for a public discussion session with the

teacher. In this phase, the student's role is to actively and positively participate in group work, engaging with and sharing with peers in formulating new information, ideas, and concepts.

2 Challenge: In the presentation and discussion phase, the teacher encourages groups to present their work and engage in discussions to deepen understanding and raise challenges through contradictions in the information. The teacher creates an environment for exchanging opinions and focuses on discussions to validate new ideas and compare them with prior knowledge. The teacher facilitates the exchange of views, organizes information scientifically, and guides students to pose reflective questions to compare their achievements. The student's role is to present the group's results, correct misconceptions, and compare new information with their previous knowledge.

3 This phase provides students with the opportunity to apply what they have learned in new situations by presenting unfamiliar problems for them to solve, using the new concept to address these issues. The teacher's role focuses on designing problems and activities that can be solved according to the new concepts and information learned by the students, while creating a suitable classroom environment for problem-solving.

The student's role is limited to engaging in solving the presented problems, sharing solutions with their peers, discussing those solutions with them, and suggesting new problems [24].

METHODOLOGY

3.1. The researchers relied on the experimental approach to achieve the study's objective, which required revealing the effectiveness of the generative learning model in developing high-order thinking skills among middle school students in the Karbala Education Directorate, by revealing the significance of the difference between the scores of the experimental group that studied using the generative model supported by artificial intelligence as an advanced organizer and the scores of the control group that studied using the traditional method on the study tool [25,26].

3.1.1. Experimental design of the research: researchers adopted one of the experimental designs with partial control for two equal independent groups with a post-test, to suit the current research problem, table (1):

Table (1). Experimental Design of the Research

Group	Equivalence of Groups	Independent Variable	Dependent Variable	Type of Test
Experimental	- Intelligence Test	- Previous Achievement Scores	Generative model supported by artificial intelligence as an advanced organizer	Higher-order thinking
Control	- Parental Achievement	- Age in months	Higher-order thinking test	

3.1.2. Control Procedures; as in: [27,28]

1. Internal Safety of the Experimental Design: To verify the equivalence of the two groups concerning these variables, the researchers calculated the mean and standard deviation of the data representing these variables. Additionally, they used Levene's test for independent samples to assess the significance of the difference in the variance of each variable between the research

groups. They found that the variances were homogeneous for all mentioned variables, as the significance level for these variables was greater than (0.05). The researchers also conducted a t-test for independent samples to determine the significance of the difference between the means of each variable for the research groups. They found no statistically significant differences, as the significance level for these variables was greater than the established level of (0.05).

2. External Safety of the Experimental Design:

A- Duration of the Experiment: The duration of the experiment was consistent for both research groups, starting on Wednesday, 5/2/2025, and ending on Thursday, 17/4/2025.

B- Subject Teacher: The researchers ensured that both research groups (experimental and control) were taught by the same teacher to avoid any differences that might arise from variations in teaching styles, abilities, and skills of different teachers.

C- Subject Matter: The subject matter was represented by the mathematics textbook for the second intermediate grade (2025-2024), revised edition 6 for the year 2024.

D- Number of Scheduled Classes and Distribution Across the Week: The weekly lesson schedule for the second intermediate grade in mathematics was adopted, as approved by the school administration, with five classes per week for each section, in accordance with the Ministry of Education's guidelines that state the school week consists of five days.

E- Experimental Attrition: No student from either of the research groups (experimental and control) left the study.

F- Factors Related to the Maturity of Sample Individuals: These variables had no impact on the experiment because the duration was relatively medium. Even if changes occurred in biological or psychological maturity, these changes would be equal among students in both research groups, as they are in a similar age range. Any changes would balance out in terms of chronological age in months.

3.2. Research Community: Students from the second intermediate grade in the daytime secondary and intermediate schools under the Karbala Education Directorate were selected for the academic year (2024 – 2025).

3.3. Research Sample: A research sample was randomly selected from among the intermediate schools, with a total research community of 64,642 students distributed across 84 intermediate schools and 22 secondary schools for boys, making the total number of schools 106. After selecting the school chosen by the lottery, which is the (Martyr Mohammed Baqir al-Sadr Intermediate School for Boys) under the Karbala Education Directorate for the academic year 2024-2025, a second lottery was conducted to select the research groups. From the six classes, two sections were chosen, distributing the research sample, which consisted of 78 students. The experimental group included 38 students from section (h), while the control group included 40 students from section (d), based on data regarding the equivalence variables between the two groups (previous mathematics achievement, parental achievement, age in months, and intelligence)

3.4. Research Tool: Research Tool (Higher-Order Thinking Test):
The researchers prepared a test to measure higher-order thinking skills for students in both the experimental and control groups after completing the experiment. This test, which consists of 13 essay items, was constructed based on the following steps:

1-Define the purpose of the test.

2-Identify higher-order thinking skills.

3-Prepare the test items.

4-Prepare the test instructions.

5- Test Validity:

A. Apparent Validity: The researchers presented the test they prepared to a group of specialized judges in mathematics and its teaching methods to gather their opinions regarding the suitability of the items in measuring high-order thinking. They considered the suggested feedback and modified and revised some items based on the judges' observations, retaining the items that had an agreement rate of more than 80%.

B. Content Validity: This refers to the overall comprehensiveness of the targeted thinking skills, as well as their distribution and coordination.

6- Application on the information sample and the statistical analysis sample by the researchers, so they administered the test to two samples as follows:

A. Information Sample: To determine the time required for students to answer the test and to verify the clarity of its items and instructions, the test was administered to sample of 40 second intermediate students. It was found that the necessary time to answer all test items was 47 minutes, and no observations or inquiries regarding the items or instructions were recorded.

B. Statistical Analysis Sample: The thinking test was administered to a second sample of 150 students, excluding 5 students who failed statistically. The purpose of this test was to determine the psychometric properties. After administering the test; he following was done the both researchers:

-Corrected the students' answers.

-Ranked the data from highest to lowest score.

-Selected 27% for the upper group and 27% for the lower group. Based on this, the test items were analyzed to find the discrimination power and difficulty index.

-Statistical Analysis of the Thinking Test Items: To ensure that the test items consider individual differences among students in their ability to distinguish between them, as well as their difficulty, the researchers statistically analyzed the specific items of the thinking test as follows:

A. Difficulty Index of Items: The difficulty index for the test items was calculated, finding it to range between 31 and 59. Thus, the difficulty index for all items of the thinking test is acceptable.

B. Discrimination Power of Items: The reliability of the achievement test items was found to range between 0.33 and 0.53, where an item is considered good if its discrimination power is 0.30 or higher [29].

C. Effectiveness of Alternatives: There are no effective alternatives since the test is constructed in an essay format.

7-Test Reliability: Both researchers used the Cronbach's alpha equation to determine the reliability of the high-order thinking test, based on the suitability of the objective items that make up this test. It was found that the reliability reached 0.712, which indicates that the test is considered reliable [30].

With all the previous procedures, the high-order thinking test is now ready in its final form for implementation.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 4s, 2025
https://www.theaspd.com/ijes.php

8-Finally; the high-order thinking test was administered on Sunday, April 27, 2025. The researchers conducted the test on both the experimental and control groups simultaneously, ensuring that the students were informed of the test date one week in advance.

Results

Results Related to the **Null Hypothesis: (There is no statistically significant difference at the 0.05 level between the mean scores of the experimental group students who studied using the generative model supported by artificial intelligence as an advanced organizer and the mean scores of the control group students who studied using the traditional method in the higher-order thinking test).**

After correcting the students' answers in the higher-order thinking test, which was administered to the research groups (experimental and control), the researcher used the statistical program (SPSS) version (26) to determine the statistical description of the data related to the research groups in the thinking test. The results are shown in table (2).

Table (2). Statistical Description of the Data for the Research Groups (Experimental and Control) in the Variable of Higher-Order Thinking

Group	Section	Students no.	Mean	SD	SE of the Mean	95% Confidence Interval of the Mean	
						Maxi.	Mini.
Experimental	h	38	67.32	10.73	1.74	15.69	5.66
Control	d	40	65.50	12.02	1.90	15.95	5.68

By applying Levene's Test for two independent samples to determine the significance of the difference between the variances of the scores of the experimental and control group students, the value of (F) was (0.30) with a significance level of (0.58), which is greater than the established significance level of (0.05). This indicates that the two groups are homogeneous in this variable.

Additionally, by applying the t-test for two independent equal samples to determine the significance of the difference between the mean scores of the experimental and control group students, the t-value was (4.18) at a significance level of (0.00), which is smaller than the established significance level of (0.05) with (76) degrees of freedom. This indicates the superiority of the experimental group students, who are taught using the generative model supported by artificial intelligence as an advanced organizer, over the control group students who are taught using the traditional method in the higher-order thinking test, as shown in table (3).

Table (3). (F) & (t) values for the two research groups in the mathematics achievement test

Groups	No.	Levene's test for equality of variances		(t-test) for equality of means		DF	Statistical significance at the 0.05 level
Exp.	38	value	Significance	t value	Significance		
Con.	40	.30	0.58	18ز4	0.00	76	significant

Thus, the first null hypothesis was rejected, and the alternative hypothesis was accepted in favor of the experimental group students.

CONCLUSIONS

1. The generative model supported by artificial intelligence as an advanced organizer has a clear positive effect on higher-order thinking compared to the traditional method among second-grade middle school students.
2. The use of the independent variable in teaching provided an opportunity for all students in the experimental group to participate in the lesson and work on connecting ideas.
3. The teaching procedures using the generative model supported by artificial intelligence as an advanced organizer align with modern educational trends by making students the focus of the educational process using the model's steps: introduction, focus, challenge, and application.
4. The interaction and cooperation of students who were taught using the generative model were better than those of students taught using the traditional method.
5. The use of the generative model supported by artificial intelligence as an advanced organizer in teaching helped foster desirable behaviors among students, such as attention during the lesson, interest in the information, thoughtful engagement, and increased motivation to follow and engage with the material.

RECOMMENDATIONS

1. Encourage and urge teachers to use the generative model supported by artificial intelligence as an advanced organizer when teaching mathematics at the middle school level, due to its positive impact on thinking.
2. Urge education and training directorates to conduct training courses for mathematics teachers on implementing the generative model supported by artificial intelligence as an advanced organizer and how to utilize it in teaching mathematics through theoretical and practical training.
3. Invite colleges of education in Iraqi universities to include the generative model supported by artificial intelligence as an advanced organizer in the curriculum of mathematics teaching methods taught to education students, outlining the main steps for its implementation according to the study.

REFERENCES:

1. Handarini, O. I., & Wulandari, S. S. (2020). Pembelajaran daring sebagai upaya study from home (SFH) selama pandemi covid 19. Jurnal pendidikan administrasi perkantoran (JPAP), 8(3), 496-503.
2. Jawad, L. F. (2021). “Tactical thinking and its relationship with solving mathematical problems among mathematics department students”, International Journal of Emerging Technologies in Learning (iJET), 16(09), pp.247-262.
3. Ali Khazal Jabr Al-Aqabi, & Hiam Mahdi Jawad Al-Kazemi. (2023). The effect of a proposed strategy based on the theory of realistic mathematics on achievement and mathematical coherence among third-grade intermediate female students. Journal of Educational and Psychological Researches, 20(77), 391-415.
4. Ahmed, B. Sh., and Faris, I. J., (2025).” THE EFFECT OF USING INQUIRY LEARNING SUPPORTED BY INTERACTIVE VIDEO IN MATHEMATICS AMONG HIGH-

ACHIEVING SCHOOL STUDENTS AND THEIR STRATEGIC THINKING", Mathematics for Applications, 14(1), pp. 88–104.

5. Majeed, B. H. (2022). "Impact of a Proposed Strategy According to Luria's Model in Realistic Thinking and Achievement in Mathematics", International Journal of Emerging Technologies in Learning (iJET), 17(24), pp. pp. 208–218. doi: 10.3991/ijet.v17i24.35979.
6. Qaeed, N.S. and Faris, I.J., (2021)." Knowledge Economy Skills and their Relationship to Mathematical Culture among Secondary School Mathematics Teachers", International Journal of Early Childhood Special Education, 13(2).
7. Jawad, L. F., Raheem, M. K. (2021). "The Effectiveness of Educational Pillars Based on Vygotsky's Theory in Achievement and Information Processing Among First Intermediate Class Students", International Journal of Emerging Technologies in Learning (IJET), 16(12), pp. 246-262.
8. Suhail, A.H., Faris, E.J., (2024). "The effectiveness of a proposed strategy in light of anchored instruetion learning on achievement among middle school students", Edelweiss Applied Science and Technology< 4(80), pp. 1252–1260.
9. Assan, A. K. (2017). The effective of the suggested instructional design that based on the teaching strategy for understanding in achievement for students of mathematics in the fifth grads. Journal Of Educational and Psychological Researches, 14, pp. 1-22McLeod, S. (2008). Bruner's Three Modes of Representation. Simply Psychology.
10. Fiorella, L. Making Sense of Generative Learning. Educ Psychol Rev 35, 50 (2023). https://doi.org/10.1007/s10648-023-09769-7
11. El Fathi, T., Saad, A., Larhzil, H. et al. Integrating generative AI into STEM education: enhancing conceptual understanding, addressing misconceptions, and assessing student acceptance. Discip Interdscip Sci Educ Res 7, 6 (2025). https://doi.org/10.1186/s43031-025-00125-z
12. Resnick (1987). Education and Learning to Think, Washington, DC: National Academy Press.
13. Michalko, M. (1998). "Thinking like a genius: Eight strategies used by the supercreative, from Aristotle and Leonardo to Einstein and Edison." The Futurist 32(4): 21.
14. Ameen, L. T., Yousif, M. R. (2024). "The Impact of Artificial Intelligence on Computational Thinking in Education at University", International Journal of Engineering Pedagogy (iJEP), 14(5), pp. pp. 192–203. doi: 10.3991/ijep.v14i5.49995
15. Abdulsalam, W. H. (2025). "Digital Intelligence for University Students Using Artificial Intelligence Techniques", International Journal of Computing and Digital Systems, 17(1), pp.1-10.
16. Goodson, L. A. (2000). Teaching and Learning Strategies for Complex Thinking Skills. ERIC ED455772
17. Crogman, H., & Trebeau Crogman, M. (2016). Generated questions learning model (GQLM): Beyond learning styles. Cogent Education, 3(1). https://doi.org/10.1080/2331186X.2016.1202460
18. Fengchun, M. & Wayne, H. (2023). Guidance for generative AI in education and research.Book.
19. Wheatley, G.H. (1991) Constructivist Perspectives on Science and Mathematics Leaming. Science Education, 75(1) 9-21.

20. Ameen, L. T., Yousif, M. R. (2024). "The Impact of Artificial Intelligence on Computational Thinking in Education at University", International Journal of Engineering Pedagogy (iJEP), 14(5), pp. pp. 192–203. doi: 10.3991/ijep.v14i5.49995
21. Romdhon, J., Masrifah, M., Shiyama, N., & Suharyati, H. (2024). International Journal of Sustainable Development & Future Society, International Journal of Sustainable Development & Future Society, 2 (2), November 2024, pp.62-69.
22. Wittrock, M. C. (1990). Generative Processes of Comprehension. Educational Psychologist, 24, 345-376.
23. Fiorella, L., & Mayer, R. (2016), Learning as a Generative Activity: Eight Learning Strategies that Promote Understanding, DOI:10.1017/CBO9781107707085
24. Hetmanenko, L. (2024). The role of interactive learning in mathematics education: fostering student engagement and interest. Multidisciplinary Science Journal, 6, 2024ss0733.
25. Jassim, B. M. (2024). "The Impact of Two Proposed Strategies Based on Active Learning on Students' Achievement at the Computer and Their Social Intelligence", International Journal of Engineering Pedagogy (iJEP), 14(1), pp. 39–49. doi: 10.3991/ijep.v14i1.47085
26. Majeed, B. H. (2022). "Effect of Augmented Reality Technology on Spatial Intelligence among High School Students", International Journal of Emerging Technologies in Learning (iJET), 17(24), pp. pp. 131–143. doi: 10.3991/ijet.v17i24.35977.
27. Al-Yassiri, S. J., Al-Kanaani, A. M., & Al-Kanaani, H. K. (2013). The strategy of guided discovery and its effect on mathematical communication skills. Journal of Educational and Psychological Researches, 10(36), 269-288.
28. Ghawi, N. Y. & Al-Mayouf. R. B. (2011). The effect of the laboratory model in correcting common mathematical concepts among middle school first-grade students. Journal of Educational and Psychological Researches, 8(29), 311-341.
29. Ebel, R. L. (1972). Essentials of Educational Measurement (1st ed.). Upper Saddle River, NJ: Prentice Hall.
30. Hasan, I.F. and Faris, E.J., (2019). "The of Effect Instructional Design based on Kagan Structure In Generating Information Skills for First Intermediate Student's In Mathematics", Journal Of Educational and Psychological Researches, 16(62), pp. 301-322.