The effectiveness of Alexander's theory in the practice of middle school mathematics teachers for dialogic teaching

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Abstract: The current study aimed to identify the effectiveness of Alexander's theory in the practice of middle school mathematics teachers for dialogic teaching. To achieve the study's objectives, the researcher prepared a tool consisting of three axes: (Principles of Dialogic Teaching, Classifications of Dialogic Teaching, Indicators of Dialogic Teaching). The questionnaire comprised 46 items, and the sample of the study included 65 male and female teachers from the middle school level in the Al-Qunfudhah Governorate, selected randomly during the second semester (2025 AD/1446 AH). The study revealed the following results: the arithmetic averages for the first axis on the principles of dialogic teaching were rated as 'medium,' the second axis on 'Classifications of Dialogic Teaching' was rated as 'high,' and the third axis on 'Indicators of Dialogic Teaching' was rated as 'medium.' Moreover, there were statistically significant differences based on the gender variable in favor of males, and statistically significant differences based on the educational qualification variable in favor of those holding a master's degree and doctorate. There were also statistically significant differences concerning experience, favoring those with 5 to 10 years of experience. The study recommended providing an organized and safe classroom environment free from all distractions and adopting classroom designs that consider interaction with sufficient time for dialogue during lessons.

Keywords: Alexander's dialogic teaching effectiveness, Mathematics middle school, Teachers, Theory.

1. Introduction

Dialogue is fundamental for communication and understanding among individuals, and it serves as an important life approach that helps express their desires, needs, inclinations, problems, and feelings. Consequently, dialogic teaching has become a topic of significant discussion in the field of education in recent years. This approach aims to empower students to construct knowledge by activating questions and intellectual discussions. Dialogic teaching is characterized by constructive interaction, enhancing active learning, and developing students' critical thinking skills. It encourages collaboration and social interaction among them, promoting the exchange of opinions and respect for diverse viewpoints. According to Chen, et al. [1] students engaged in dialogic practices exhibit improved skills in critical thinking, authentic exploratory dialogue, and enhanced higher-order thinking skills. Therefore, dialogically rich educational strategies are a high-level educational tool for building objective knowledge and are clearly linked to critical thinking in development, productive learning, and its connection across all disciplines [2]. In mathematics teaching, research indicates that dialogically rich educational practices enable students to develop mathematical processes. Thus, it is important to understand how these practices are implemented in mathematics classrooms, specifically how they relate to skills, knowledge, and behaviors associated with thinking, explanation, communication, and processes [3]. Regarding the shift towards dialogic teaching, Alexander [4] argues that it is not limited to

enhancing one type of interaction or increasing dialogue methods in the classroom, but rather emphasizes the importance of having diverse patterns and functions of educational dialogue.

The terms that describe the concept of dialogic teaching varied, as this type of interaction has been described in the literature using terms such as dialogic teaching foundations [5] dialogic practices [3] dialogic teaching [6] or talk moves Michaels and O'Connor [7]. Vygotsky [8] posits that language is the fundamental mechanism for constructing new ways of thinking and knowledge, not merely a means of expressing ideas, and believes that learning awakens a variety of internal developmental processes that can only function when a child interacts with people in their environment and collaborates with peers, once these processes are internalized, they become part of the child's independent growth. In further developing Vygotsky's ideas, Bakhtin [9] emphasizes the importance of meaning-making and thinking within the social environment, as well as the crucial role of the teacher, who becomes the expert that must communicate with their students to create collective meaning. Bakhtin also notes that building dialogue should be considered a task for both teachers and students, as this will lead to better mutual understanding. Bakhtin [9] emphasizes that human consciousness is inherently dialogic, and the interactions we engage in contribute to its formation, it asserts that thinking and knowledge arise through dialogue and communication, where our voice intertwines with the voices of others, and the dialogue between the speaker and the audience is central, as it gives our words meaning and value. Consequently, Bakhtin [9] posits that meaning and learning emerge from the interactive act of understanding and reinterpreting the ideas of others, "Dialogic teaching" encourages interaction between the teacher and students, where they exchange ideas and opinions in an open and reciprocal manner. The speaker is guided toward achieving a responsive and effective understanding, while the listener adopts an active stance toward the dialogue. Meaning is co-constructed between the teacher and students, and diverse interactions are expected from the listener. Class dialogue enhances social and self-language skills and contributes to the development of students' exploratory and interactive learning skills [10].

1.1. Elements of Dialogic Teaching

First Element: Rationales: Education is not limited to being a moral task; it extends to being an effort of effective value. Therefore, teachers should recognize the importance of dialogue in general, and particularly the dialogue characterized by appreciation and praise, this calls for proposing rationales that better highlight this context, including being communicative, social, cultural, civic, psychological, and educational. The first four rationales take ethical stances supported by practical application, where students need to be able to communicate, build relationships, engage in their culture, appreciate collective identity, and integrate [6].

Second Element: Principles: To shift towards dialogic teaching, Alexander [6] believes that it is not limited to promoting one type of interaction or increasing dialogue methods in the classroom, but rather emphasizes the importance of having diverse patterns and functions of educational dialogue that can be distinguished by five principles as follows: (Collective, Interchangeable, Supportive, Cumulative, Purposeful).

Third Element: Classifications: Alexander classifies dialogic teaching into six classifications (Alexander, 2017) as follows:
The first classification: Organizing Interaction: There are five patterns:
- Whole class teaching (teacher - student).
- Group work (teacher - student, guided by the teacher).
- Group work (student - student, guided by students).
- Individual learning (teacher - student).
- Individual learning (pairs of students).

The second classification: Daily Dialogue: Its six categories are (interactive, explanatory, interrogative, exploratory, expressive, evaluative).

The third classification: Learning Dialogue: The quality of dialogue is linked to the learning skills acquired in the classroom (such as narration, clarification, prediction, imagination, exploration, analysis, evaluation, inquiry, justification, discussion, argument). These categories are connected to four principles according to the classification of Michaels, et al. [11] and Michaels and O'Connor [7] and Mercer and Littleton [12]. These principles clarify and facilitate the principles of collective dialogic teaching, exchange and support, listening, thinking about what they hear, giving others time to think, and respecting alternative viewpoints.

The fourth classification: Teaching Dialogue highlights the importance of interaction between teachers and students through two dialogue groups: daily dialogue and learning dialogue. In daily dialogue, the conversation is categorized into types such as (interactive, explanatory, inquiry-based, exploratory, expressive, and evaluative). In teaching dialogue, the types are expanded to eleven classifications that address the flow of learning dialogue, including (narration, analysis, and discussion), and it is important to focus on the teacher's role in modeling these patterns and emphasizing dialogic teaching as an effective approach, the comparative research in classrooms indicates a range of modern strategies associated with teaching including (repetition, memorization or indoctrination, instruction, exposition, discussion, and dialogue). Indoctrination learning may be the most commonly used type from an educational perspective, following observations of international classrooms and video analysis [13] in the field of education, the presentation and recitation are considered fundamental elements for building a strong understanding of subjects, transferring essential information, and providing a general framework for learning, the teacher can guide students and provide the fundamentals they need to grasp more complex concepts, and this underscores the importance of diversity in teaching methods and adopting a balanced approach that combines elements of rote learning, with effective communication and constructive dialogue as powerful tools to enhance student understanding and motivation, it should be emphasized that problem-solving requires more from teachers than merely transferring information or testing recall; it must be directed and inspiring to develop students' critical thinking and innovation skills, and the active learning and participation in problem-solving contribute to the holistic development of students [13].

The fifth classification: asking questions, the process of asking questions within the classroom, depending on the type of questions (Test): refers to questions that are used to test students' understanding or knowledge. (Real): Questions that aim to encourage students to think and participate more deeply.

Answers: Presentation: Refers to students raising their hands to answer. Nomination: Means asking a specific question to a specific student.

Participation: Exchange: A short round of questions and answers in class. Expansion: Means longer exchanges, limited to a small number of students.

Thinking Time: Immediate: Refers to a quick response. Thoughtful: Students are given time to think and reflect before responding.

Quality of feedback: Formative: Aims to guide and improve learning. Evaluative: Performance evaluation or understanding.

Objective and formulation of questions: Objective: The goal of the inquiry can be to capture information, evoke understanding, develop thinking, explore ideas, or manage a class. Formulation of questions: The question can be closed, open, directed, narrow, or argumentative.

Nystrand, et al. [14] indicate that the teacher's guidance on these elements contributes to improving student interaction and maximizing the benefits of the learning process, despite advancements in the field of education, the teacher remains the primary individual who poses most of the questions in classrooms. Therefore, it is essential for the teacher to encourage and train students, the classification focuses on distinguishing between "test" questions that measure knowledge and "genuine" questions that promote critical thinking and active participation, it emphasizes the importance of providing students with the opportunity to ask their own questions, encouraging and training them in this regard, and the classification is divided into subcategories that comprehensively

address objectives and the structure of questions, with a focus on enhancing dialogue and motivating student participation in the educational process. Nystrand, et al. [15] proposed a set of criteria, including the use of questions that prompt students to think and express their opinions without predetermined answers, integrating previous student contributions into subsequent questions, thereby enhancing interaction, concept building, and comprehensive understanding. Additionally, they advocate for questions based on student contributions, aiming to achieve high-level assessment and promote critical thinking and deep learning.

The sixth classification: Expansion, offers steps that teachers can use to help students develop their thinking and communication skills with others. This classification includes:

1. Sharing, expanding, and clarifying ideas by giving students time to think, encouraging them to speak more broadly, and rephrasing for better understanding.
2. Listening carefully to one another through rephrasing or repeating.
3. Deepening thinking by asking students to provide evidence for their interpretations, challenging them, or providing counterexamples.
4. Thinking collectively by agreeing or disagreeing and explaining reasons, adding information, and clarifying the meaning of someone else's words. Despite the effectiveness of the expansion steps in stimulating thinking and achieving active participation, their simple use does not guarantee strong connections in classroom discussions or effective learning for students. The importance of effective planning and continuous interaction by the teacher in guiding dialogue and framing questions in a way that promotes deep thinking and ongoing discussion, along with the good integration of these linguistic moves within a framework of dialogic teaching, ensures the achievement of sustainable and comprehensive learning outcomes [7].

Both [16, 17] explain that dialogic teaching in classrooms refers to an interactive culture where students and teachers engage in discussions about shared topics. Here are some key points:

Common Topic: Dialogic teaching focuses on a common topic that serves as the center of the dialogue, where the subject is developed collaboratively. Both teachers and students contribute to the creation and negotiation of activities related to the topic.

Space for Expression and Listening: Students are given the opportunity to express their ideas freely, encouraging the expansion of thoughts and clarification when needed. It promotes active listening to others' ideas and collaboration in constructing meaning and understanding different viewpoints.

Dialogue and Culture: The dialogue is enriched by adding external information and culture that may not be present in the classroom, and this information and culture can be sourced from books, scholars, or teachers, contributing to the enrichment of the dialogue by evaluating students' ideas within a broader cultural context and supporting the development of understanding.

Fourth Element: Indicators, Alexander presents indicators that allow for the distinction between dialogic teaching and non-dialogic teaching [4]. The teacher respects students' rights to speak and engage in discussion, and the classroom is characterized by clear rules governing speaking, listening, and discussion processes, students are encouraged to prepare for participation in discussions and to connect these discussions with reading and writing skills, as well as their interaction and involvement in conversations. A variety of flexible teaching strategies are employed, and open-ended questions are posed that require in-depth and informed responses, answers are produced based on logical and inferred arguments, and ideas are exchanged in an organized manner that forms a connected chain of knowledge. There is a focus on testing and constructing arguments during discussions, and organizational models in the classroom are encouraged to foster a dialogic environment that creates a dynamic, collective, and supportive classroom culture, stimulating cooperation.

The researcher reviewed previous relevant studies, which are as follows: A study was conducted of Muhonen, et al. [18] titled "Educational Dialogue Among Teachers with Varying Levels of Self-Efficacy." The study aimed to explore the quality of educational dialogue in first-grade classrooms among teachers who possess low, medium, and high self-efficacy beliefs, and the sample included Finnish first-grade teachers, and the study concluded that the level of teachers' self-efficacy is an

important factor affecting the quality and quantity of educational dialogue in classrooms, teachers with high self-efficacy are more effective in stimulating dialogues, while the quality of dialogue is lower among teachers with low self-efficacy compared to those with medium and high self-efficacy. Lehesvuori, et al. [19] conducted a study titled "Challenges and Suggestions from Mathematics Teacher Students." The study aimed to enhance dialogue in mathematics teaching through student participation and systematically guiding the educational process, as well as improving the teaching process by adopting a dialogical approach, the study employed an experimental methodology in which mathematics teachers were trained over an intensive one-year period in teacher education departments and teacher training schools. The sample focused on a group of mathematics teacher students consisting of (13) students (5 males, 8 females) during their training period, the participants were selected based on the researchers' background in science and mathematics education research, with lessons monitored by supervisors and notes taken. The study concluded that research addressing how to effectively connect dialogical theory and practice in teacher education and professional development programs for subject teachers remains limited, especially for mathematics teachers, highlighting the importance of integrating a dialogical approach in teacher training and professional development programs.

Ramli [20] conducted a study titled "Teachers' and Students' Perceptions of Dialogue in Primary Science Classrooms." The study aimed to explore the perspectives of teachers and students regarding dialogue in science classes at the primary level, where the new integrated curriculum is implemented in Indonesia, the research focused on the teaching and learning process through classroom dialogues, specifically targeting discussion lessons in two primary schools in the Greater Jakarta area of Indonesia, interviews were conducted with teachers and a sample of students in each classroom. The study concluded that the shift in the educational process from a teacher-centered approach to a student-centered approach not only encouraged students to develop themselves but also facilitated better exchange of opinions and respect for different viewpoints.

Attard, et al. [3] conducted a study titled "Dialogic Practices in the Mathematics Classroom." The study aimed to examine the effectiveness of dialogue in enhancing students' learning experiences and developing their mathematical skills, as well as stimulating mathematical thinking and student engagement. The sample for the study consisted of six schools selected purposefully from different regions of Australia. The study concluded with several significant findings, including the need for a better understanding of how to improve the effectiveness of dialogic teaching practices to achieve a greater impact on students' mathematics learning. It emphasized focusing on developing and enhancing dialogic teaching dialogues to improve students' deep mathematical understanding, as well as to develop their skills and behaviors in the area of mathematical operations.

Vrikki, et al. [21] conducted a study titled "Dialogic Practices in Primary School Classrooms." The study aimed to identify dialogic teaching practices in English primary schools and to verify whether dialogic practices contribute to enhancing student learning. The study employed a descriptive methodology by analyzing video recordings of mathematics, English, and science lessons in (36) classrooms. The sample consisted of (36) teachers from (28) primary schools in various regions of England. The study found, among other results, the importance of professional development for teachers in promoting the use of dialogic practices in the classroom.

Bansal [22] conducted a study titled "A Framework for Teaching Dialogic Practice in High School Science Classes." The study aimed to understand the various practices of teachers in organizing dialogic teaching in high school science classrooms, it involved classroom observations and interviews with teachers, with the sample consisting of science teachers in India. The findings indicated that teachers' practices in high school science classes aim to develop a culture of dialogue, stimulate students' perspectives, and encourage active exchange of ideas, teachers employed specific methods to achieve these goals, facilitating their roles as guides for dialogue and thinking in the classroom.

Kumpulainen and Rajala [23] conducted a study titled "Dialogic Teaching and Students' Dialogic Identities in Science Learning." The study aimed to explore the significance of dialogic teaching and its role in encouraging students to engage in dialogue as science learners in the classroom, analyzing its

impact on their participation in science learning, the sample consisted of elementary school students involved in recorded classroom interactions as part of a science learning project, with a specific analytical focus on four students, and the study utilized video data from classroom interactions collected from the elementary science learning project. The findings revealed that dialogic teaching enhances students' participation and interaction with one another, leading to the development of their skills and understanding of scientific topics, the diversity of students' identities in dialogic teaching reflects the social context, and understanding students' identities is essential for effectively promoting scientific learning and achieving equity. Additionally, teaching methods play a role in shaping dialogue in the classroom.

Jay, et al. [24] conducted a study titled "Evaluating Dialogic Teaching: Enhancing Talk in the Classroom." The study aimed to identify the impact of dialogic teaching on improving the academic achievement of primary school students in English and mathematics after two years. The study population consisted of (80) primary schools in the local authorities of Leeds/Bradford and Birmingham, where the schools designated for the intervention group received teacher training, along with ongoing monitoring and support within the school. Data were collected using surveys and interviews with a sample of teachers, facilitators, and heads. The study found that the dialogic teaching approach had positive effects on students' confidence and engagement. Most participating teachers felt that implementation required more than two academic terms to fully adopt the dialogic teaching approach in their classrooms, and it also necessitated a change in the way teachers communicated in the classroom.

It has been shown that most studies agree on the importance of the study topic, while differing from previous studies in the study community, as all previous studies were conducted outside the Kingdom of Saudi Arabia. This study aims to examine the reality of dialogic teaching practices in mathematics in Saudi schools. The researcher benefited from previous studies in highlighting the study problem, constructing the theoretical framework, developing the current study tool, discussing its results, and linking them to the findings of those studies.

Study Problem: The researcher found that teaching mathematics relies on dialogue as one of the educational dialogic practices to enrich mathematical topics. However, teachers do not have accurate models for organizing more dialogic interactions, even though they recognize that such interactions would have a positive impact on student learning or any preliminary readiness for reforms and curricula focused on students, as a language of thought and a point of local and global interest, various strategies are employed in teaching mathematics that allow students the opportunity to participate, interact, and build and modify ideas as a result of their engagement with the surrounding environment, the National Council of Teachers of Mathematics in the United States has called for the use of modern methods in teaching mathematics that help prepare students. A study of Attard, et al. [3] indicates an urgent need to focus on developing and enhancing the dialogic teaching style to improve students' deep mathematical understanding and to develop their skills and behaviors in the area of mathematical operations. This means that emphasizing interactive dialogues and effective participation in classrooms can significantly contribute to improving students' understanding of mathematical topics and developing their skills, it is essential to train teachers to employ dialogic teaching and encourage them to participate in the learning process, making their stance more positive than that of a bystander or listener, where students arrive at ideas and information on their own rather than having them provided by the teacher, it allows students to address the problems they encounter in learning mathematics, this approach encourages critical thinking and systematic, logical problem-solving, it also enables learning through the exchange of opinions and discussions among students, given the researcher's observations in the educational field, there is a noticeable weakness in teachers' use of dialogic teaching, in response to vision (2030), efforts have begun to develop educational curricula and establish mechanisms to achieve this by introducing new methods that rely on student participation, making them the focal point of the educational process, this includes developing their skills, building their character, and enhancing higher-order skills such as critical thinking and problem-solving, as well as improving the school learning environment to make it more engaging for students. Consequently, the research problem has

crystallized into "What is the effectiveness of Alexander's theory in the practice of middle school mathematics teachers in dialogic teaching?"

Study Questions: The current study aimed to answer the following main question: "What is the effectiveness of Alexander's theory in the practice of middle school mathematics teachers in dialogic teaching?" The main question branches into the following sub-questions:

First question: What is the effectiveness of Alexander's theory in the practice of middle school mathematics teachers in dialogic teaching according to the principles of Alexander's theory?

Second question: What is the effectiveness of Alexander's theory in the practice of middle school mathematics teachers in dialogic teaching according to the classifications of Alexander's theory?

Third question: What is the effectiveness of Alexander's theory in the practice of middle school mathematics teachers in dialogic teaching according to the indicators of Alexander's theory?

Fourth question: Are there statistically significant differences in the effectiveness of Alexander's theory in the practice of middle school mathematics teachers in dialogic teaching based on variables (gender, educational qualification, and years of experience)?

1.2. Study Objectives

- To identify the effectiveness of Alexander's theory in the practice of middle school mathematics teachers in dialogic teaching according to the principles of Alexander's theory, the classifications of Alexander's theory, and the indicators of Alexander's theory.
- To demonstrate the existence of statistically significant differences in the effectiveness of Alexander's theory in the practice of middle school mathematics teachers in dialogic teaching based on variables (gender, educational qualification, and years of experience).

1.3. Study Boundaries

Human, Spatial, and Temporal Boundaries: The current study was limited to mathematics teachers in public middle schools affiliated with the Ministry of Education during the second semester of the academic year (1446 AH) in Al-Qunfudhah Governorate.

Objective (Procedural) Boundaries: The current study focused on identifying the effectiveness of Alexander's theory in the practice of middle school mathematics teachers in dialogic teaching. The study tool consisted of three axes: (principles of dialogic teaching, classifications of dialogic teaching, indicators of dialogic teaching), and the questionnaire comprised (46) items.

Terminological and Procedural Definitions

Effectiveness: It is the ability to achieve specified goals and is manifested in the practice of dialogic teaching principles, classifications of dialogic teaching, and indicators of dialogic teaching. It focuses on both the quantity and quality of outcomes, not just their quantity. Effectiveness is measured by the level of satisfaction among teachers in their practice of dialogic teaching at the middle school level.

Mathematics Teachers: They are specialists in teaching mathematics to students, possessing scientific knowledge and the ability to simplify complex concepts, making them accessible for all students. They are responsible for guiding students to understand the fundamentals (such as algebra, geometry, statistics, and calculus) and act as mentors who encourage scientific curiosity and motivate students to persevere and work hard to solve challenging mathematical problems. They play a crucial role in building the intellectual foundation of students and developing their future in engineering, sciences, economics, and technology.

Middle School: This is the stage that prepares students for a more specialized phase, with students' ages ranging from 12 to 15 years. Its objectives include preparing students for secondary education, developing critical thinking skills, enhancing self-discipline, and encouraging students to take responsibility and maintain discipline in their performance.

Dialogic Teaching: Alexander [25] defines it as an educational approach that focuses on using dialogue as a primary tool for developing thinking, learning, understanding knowledge, enhancing

communication and social interaction, learning how to handle situations, adapting to challenges, and fostering a culture of discussion among teachers. Dialogic teaching requires a deeper understanding of students' needs and the challenges they face. The researcher defines it operationally as teaching that centers on building understanding through intentional dialogue between the teacher and students to enhance effective learning.

Alexander's Theory: This theory belongs to the mathematician Alexander Grothendieck, who is credited with establishing modern algebraic geometry, it includes essential elements of commutative algebra and comparative algebra for similar structures, the theory of sheaves, and classification theory in its foundation, his theory of schemes has become the globally accepted language for all other technical work. Grothendieck's generalization of the classical Riemann-Roch theorem initiated the study of algebraic geometry and topological K-theory, and his new homology theories had profound effects on algebraic number theory, algebraic topology, and representation theory, and his establishment of the topos theory also influenced set theory and logic.

Methodology and Procedures: This chapter presents an overview of the study's methodology, its community, and sample, the study tool, design procedures, validity, stability, its variables, and the applied procedures and statistical methods used.

Study Methodology: The researcher employed a descriptive survey method.

Study Population: The study population consists of all mathematics teachers teaching at the middle school level in Al-Qunfudhah Governorate, totaling (293), of which (189) are male teachers and (104) are female teachers, within the scope of the Education Department of Al-Qunfudhah for the academic year (2024-2025).

Study Sample: The study sample included (65) male and female mathematics teachers from middle schools in the public education sector under the Education Department of Al-Qunfudhah, selected through simple random sampling during the second semester of the academic year (2024-2025). Table 1 shows the distribution of the number of sample members according to the study variables:

Table 1.
Distribution of the Number of Sample Members according to the Study Variables.

Variable	Variable Levels	Sample	Percentage (%)
Gender	Male	30	46.2%
	Female	35	53.8%
Academic Qualification	Bachelor's Degree	42	64.6%
	Master's and Doctorate	23	35.4%
Experience	Less than 5 years	20	30.8%
	5 to 10 years	22	33.8%
	More than 10 years	23	35.4%
Total		**65**	**100%**

Study Tool and Preparation Procedures: The researcher chose the questionnaire as the data collection tool. After reviewing the theoretical literature and studies related to the topic of the study, the researcher developed the study tool, which was initially formulated based on the theoretical framework. It consisted of:

First Section: Included general information about the respondent, representing the demographic variables of the study.

Second Section: Comprised three axes as follows:

First axis: Relates to the principles of dialogic teaching, consisting of (11) items.

Second axis: Relates to the classifications of dialogic teaching, consisting of (28) items.

Third axis: Relates to the indicators of dialogic teaching, consisting of (8) items. The questionnaire items were presented according to a five-point Likert scale (high, medium, low, rare, nonexistent).

The tool was presented to a number of faculty members and specialists, totaling (10), who were asked to provide their opinions on the phrasing of the statements, their clarity, and their relevance to the axes. They provided their feedback, and after making the necessary adjustments to the study tool, the questionnaire was finalized as follows:

- The first axis: Relates to the principles of dialogic teaching, consisting of (11) items.
- The second axis: Relates to the classifications of dialogic teaching, consisting of (28) items.
- The third axis: Relates to the indicators of dialogic teaching, consisting of (7) items.

Validity and Stability of the Study Tool: Validity is one of the essential elements that must be present in the tool to measure the extent to which each statement can assess what it was designed for. To ensure the validity and stability of the tool and its suitability for measuring the extent of middle school mathematics teachers' practice of dialogic teaching according to Alexander's theory, the validity and stability of the tool were verified using two methods:

A) Apparent Validity of the Tool (Content Validity): To ensure the content validity of the questionnaire and its appropriateness for accurately measuring the phenomenon under study, the researcher presented the questionnaire to a group of experienced and specialized academic referees, where ten referees were selected. The referees were asked to provide their opinions on the tool regarding: the phrasing of the statements, their clarity, and their relevance to the axes, in addition to providing any comments or suggestions (such as deleting or adding statements). Subsequently, the researcher studied the referees' comments and suggestions, resulting in the deletion and rephrasing of some statements to enhance clarity. After the revisions, the number of statements in the final version of the questionnaire was established.

B) Internal Consistency Validity (Construct Validity): The questionnaire was applied to an exploratory sample consisting of (30) male and female teachers outside the study population, representing mathematics teachers across all educational stages (elementary, middle, and high school), to ensure the clarity of the scale's statements. To verify the validity of the tool, the internal consistency validity of the questionnaire was calculated using Pearson Correlation, where the correlation coefficient between each statement and the total score was calculated. The following tables (Numbers 2 and 3) illustrate the results of the correlation coefficient calculations.

Table 2.
Values of correlation coefficients between each axis and the total degree.

Field	Statement	Correlation Coefficient	Significance Level
First Axis	Principles of Dialogic Teaching	.748**	Statistically Significant
Second Axis	Classifications of Dialogic Teaching	.794**	Statistically Significant
Third Axis	Indicators of Dialogic Teaching	.736**	Statistically Significant

Table 2 illustrates the correlation coefficients between the degree of each axis and the total degree for all items. All correlation coefficients between each axis and the total degree showed positive values that are statistically significant at the level of (0.01).

Table 3.
Values of correlation coefficients between paragraphs and the total score.

Statement	Total Degree
1- Teachers involve all students in dialogue during classroom situations.	0.815**
2- Teachers encourage the exchange of opinions and ideas among students.	0.900**
3- Teachers encourage students to express their ideas freely without fear or hesitation.	0.897**
4- Teachers set clear goals for effective dialogue.	0.761**
5- Teachers demonstrate subject mastery during dialogue and discussions.	0.847**
6- Teachers engage students in identifying problems related to the dialogue topic.	0.743**
7- Teachers revisit dialogue and discussion to achieve the main objectives.	0.841**
8- Teachers summarize main findings aligned with the defined educational goals after the dialogue.	0.734**
9- Teachers encourage interaction among students to build knowledge through logical, coherent dialogue.	0.769**
10- Teachers direct classroom dialogue to enhance students' knowledge and understanding.	0.781**
11- Teachers promote flexible dialogue to adapt to students' evolving understanding.	.739**
12- Teachers encourage students in a way that fosters positive dialogue among them.	0.766**
13- Teachers facilitate the generation of ideas and arguments clearly and smoothly during dialogue.	0.855**
14- Teachers ask diverse and intelligent questions during discussions with students.	0.938**
15- Teachers explore different dimensions of ideas and topics during dialogue and discussions.	0.786**
16- Teachers encourage students to express themselves clearly during dialogues.	0.816**
17- Teachers evaluate students' opinions objectively and logically during dialogues.	0.815**
18- Teachers appropriately correct information presented in the dialogue.	0.834**
19- Teachers develop their students' level in the skills of (narration - clarification - prediction - imagination - exploration - analysis - evaluation - inquiry - justification - discussion - argument) in the learning dialogue.	0.784**
20- Teachers listen to their students and motivate them to improve the educational process.	0.979**
21- Teachers provide students sufficient opportunities to think and express their opinions during lessons.	0.833**
22- Teachers encourage students to respect each other's viewpoints.	1.000**
23- Teachers use various types of dialogue in the classroom to achieve learning goals effectively.	0.810**
24- Teachers assist students in dialogic teaching to promote critical thinking and deepen understanding of concepts.	0.798**
25- Teachers interact with students in dialogic teaching situations.	0.817**
26- Teachers regularly use dialogic teaching in their instructional practices.	0.815**
27- Teachers employ strategies to enhance dialogic teaching during lessons.	0.900**
28- Teachers ask questions that enrich mutual interaction between them and students.	0.897**
29- Teachers give students enough time to answer questions.	0.761**
30- Teachers vary between open-ended and closed-ended questions during classroom interactions.	0.838**
31- Teachers provide immediate feedback to improve the quality of students' answers.	0.743**
32- Teachers allocate enough time for students to think before engaging in dialogue.	0.841**
33- Teachers encourage students to speak fluently and creatively when presenting ideas.	0.734**
34- Teachers ensure they listen to students' ideas during dialogues.	0.769**
35- Teachers reformulate or repeat students' ideas to ensure proper understanding.	0.781**
36- Teachers encourage students to provide evidence to support their interpretations and analyses of discussed topics.	0.739**
37- Teachers guide students to provide counterexamples to deepen their understanding.	0.766**
38- Teachers encourage collective interaction and discussion during dialogues.	0.855**
39- Teachers help students express their opinions and recognize agreements or disagreements.	0.938**
40- Teachers respect students' right to speak and engage in dialogue in the classroom.	0.786**
41- Teachers set clear rules governing dialogue and discussions in the classroom.	0.816**
42- Teachers encourage students to prepare for participation in dialogue, linking it to reading and writing skills.	0.815**
43- Teachers use diverse and flexible teaching strategies in the classroom.	0.834**
44- Teachers ensure that classroom culture is dynamic, supportive, and promotes collaboration.	0.784**
45- Teachers encourage the use of organizational models in the classroom to foster a dialogic environment.	0.979**
46- Teachers encourage the exchange of ideas and the formation of a continuous chain of knowledge.	0.833**

Note: * Function at the level of (0.05).
** Function at the level of (0.01).

Table 3 shows the correlation coefficients between the degree of each statement and the total degree for all items. All correlation coefficients between the degree of each item and the total degree were positive, strong, and statistically significant at the levels of (0.05) and (0.01).

Stability: To calculate the stability of the questionnaire assessing the effectiveness of Alexander's theory in the dialogic teaching practices of middle school mathematics teachers, the researcher used Cronbach's Alpha coefficient.

Table 4.
Cronbach's Alpha Coefficient to Calculate the Stability of the Study Tool the Basic Sample.

Cronbach Alpha Coefficient	Number
0.997	46

It is evident from Table 4 that there is a high level of stability, as the Cronbach's alpha coefficient is (0.997), which is greater than (70%). Based on this result, the level of stability of the tool's content is considered appropriate from a scientific research perspective.

Standard Criterion: For the purposes of interpreting the results and reaching final conclusions regarding this study, which aimed to identify the effectiveness of Alexander's theory in the dialogic teaching practices of mathematics teachers in the middle school stage, the researcher adopted the following standard criterion: To determine the length of the cells of the five-point Likert scale (the minimum and maximum limits), the range was calculated (5-1=4), and then it was divided by the highest value on the scale to obtain the length of the cell, which is (4÷5=0.80). After that, this value was added to the lowest value on the scale (the starting point of the scale, which is one) to determine the upper limit of this cell. Thus, the length of the cells became "distribution of categories according to the scale used in the study tool" as follows:

Table 5.
Distribution of Categories According to the Scale Used in the Study Tool.

Cell Length (Arithmetic Average)	Approval Level
From 1 to less than 1.80	Nonexistent
From 1.80 to less than 2.60	Rare
From 2.60 to less than 3.40	Low
From 3.40 to less than 4.20	Medium
From 4.20 to 5	High

Statistical Methods Used in the Study: Various statistical methods were employed using the Statistical Package for the Social Sciences (SPSS), as follows: the use of arithmetic average and standard deviations, Cronbach's Alpha coefficient to verify the stability of the questionnaire, Pearson correlation coefficient, independent samples T-test, and one-way ANOVA to assess the effectiveness of Alexander's theory.

Study Results and Discussion: The results of the study indicated the "Effectiveness of Alexander's Theory in the Practice of Middle School Mathematics Teachers for Dialogic Teaching." To answer the study questions, arithmetic average and standard deviations were calculated for all items in each dimension or axis of the questionnaire, and the results for each dimension or axis were presented separately.

Results of the First Question and Discussion and Interpretation: To answer the first question, "What is the effectiveness of Alexander's Theory in the practice of middle school mathematics teachers for dialogic teaching according to the principles of Alexander's Theory?" the researcher calculated the means and standard deviations of the responses from the study sample regarding the extent to which middle school mathematics teachers practice dialogic teaching according to Alexander's theory. These were arranged in descending order based on their means from their perspective, to clarify the extent of middle school mathematics teachers' practice of dialogic teaching according to the principles of Alexander's Theory. Table 6 illustrates this:

Table 6.
Arithmetic Averages and Standard Deviations of the Responses of the Sample Members Regarding the Degree to Which Middle School Mathematics Teachers Practice Dialogic Teaching According to the Principles of Alexander's Theory

- **The first axis**

Statement	Arithmetic Average	Standard Deviation	Approval Level	Rank
3. Teachers encourage students to express their ideas freely without fear or hesitation	4.63	.993	High	1
2. Teachers encourage the exchange of opinions and ideas among students	4.26	1.302	High	2
4. Teachers set goals for effective dialogue	4.26	1.302	High	2
5. Teachers are scientifically proficient in the topics discussed and debated	4.26	1.302	High	2
1. Teachers engage all students in dialogue during classroom situations	4.17	1.353	Medium	3
7. Teachers consistently work to bring dialogue and discussion back to the main goal when it strays	3.31	.846	Low	4
9. Teachers contribute to encouraging interaction among students to build knowledge through verbal answers to logically and cohesively guide dialogue	3.25	.708	Low	5
10. Teachers direct dialogue in the classroom to help increase students' knowledge and understanding effectively	3.25	.685	Low	5
11. Teachers encourage dialogue flexibly to keep up with the development of students' understanding	3.25	.708	Low	5
6. Teachers involve students in identifying problems related to the topic of dialogue	3.22	.838	Low	6
8. At the end of the dialogue, teachers seek to extract the main conclusions related to the specific educational objectives	3.22	.875	Low	7
First Axis: Related to the principles of dialogic teaching	3.73	0.513	Medium	

Table 6 shows that the overall result for the first axis "Principles of Dialogic Teaching" received a "Medium" rating, with an arithmetic average of (3.73). The arithmetic averages for all statements within the first axis ranged between (3.22 - 4.63), falling into the categories of "Low," "Medium," and "High." The highest arithmetic average (4.63) was for statement (3), which encourages teachers to allow students to express their thoughts freely without fear or hesitation, with a standard deviation of (0.993), rated as "High." The standard deviations ranged between (0.685 - 1.353), indicating low values that reflect the homogeneity of the responses from the study sample regarding the first axis. The lowest standard deviation (0.685) was for statement (10): "Teachers guide the dialogue in the classroom to help increase students' knowledge and understanding better," indicating that this statement had the most consensus among the study sample's opinions. In contrast, the highest standard deviation (1.353) was for statement (1): "Teachers involve all students in dialogue during classroom situations," suggesting that this statement had the most variation in the opinions of the study sample. The results of this question indicate that the extent of mathematics teachers in middle school practicing dialogic teaching according to Alexander's theoretical principles was rated as medium, with an arithmetic average of (0.513). The researcher attributes these results to the medium nature of the first axis, which is the principles of dialogic teaching, indicating that some teachers lack training or a deep understanding of the principles of dialogic teaching, particularly the skills that require flexible guidance of dialogue or encouraging knowledge accumulation among students. Additionally, the students' lack of enthusiasm or limited willingness to participate freely poses a significant challenge for teachers, who tend to focus on using and employing traditional teaching methods, which restricts the pace of transition to dialogic teaching. This result agreed with the results of the study of Jay, et al. [24] as well as with the results of the study of Vrikki, et al. [21] the study of Muhonen, et al. [18] and the study of Ramli [20].

Results of the Second Question, Discussion, and Interpretation: To answer the second question, "What is the effectiveness of Alexander's theory in the practice of middle school mathematics teachers in

teaching dialogue according to the classifications of Alexander's theory?" the researcher calculated the arithmetic averages and standard deviations of the responses from the study sample regarding the extent to which middle school mathematics teachers practice teaching dialogue according to Alexander's theory. These were arranged in descending order based on their arithmetic averages from their perspective, to clarify the extent of middle school mathematics teachers' practice in teaching dialogue according to the classifications of Alexander's theory. Table 7 illustrates this:

Table 7.
Arithmetic Averages and Standard Deviations of the Responses of the Sample Members Regarding the Degree to Which Middle School Mathematics Teachers Practice Dialogic Teaching According to the Principles of Alexander's Theory

- **The second axis**

Statement	Arithmetic Average	Standard Deviation	Approval Level	Rank
29. Teachers give students enough time to answer questions	4.86	.634	High	1
36. Teachers encourage students to provide evidence to explain and analyze the discussed topics	4.86	.634	High	1
37. Teachers guide students to provide counterexamples to deepen their understanding	4.82	.727	High	2
31. Teachers use immediate feedback to improve the quality of student responses	4.80	.565	High	3
32. Teachers allocate sufficient time for students to think before participating in dialogue	4.74	.619	High	4
27. Teachers use strategies to enhance dialogic teaching during lessons	4.72	.875	High	5
23. Teachers use various forms of dialogue in the classroom to significantly achieve learning objectives	4.68	.773	High	6
28. Teachers ask questions that enrich mutual interaction	4.68	.937	High	6
20. Teachers listen to their students and motivate them to improve the learning process	4.65	.909	High	7
26. Teachers regularly use dialogic teaching in their educational practices	4.63	.993	High	8
19. Teachers develop students' skills (narration, explanation, prediction, imagination, exploration, analysis, evaluation, inquiry, justification, discussion, argument) in the dialogic learning	4.60	.862	High	9
24. Teachers help students in dialogic teaching to encourage critical thinking and deepen understanding of concepts	4.57	.883	High	10
14. Teachers ask diverse and smart questions during discussions	4.48	.752	High	11
25. Teachers interact with students during dialogic teaching	4.45	1.173	High	12
22. Teachers encourage students to respect each other's perspectives	4.43	.984	High	13
38. Teachers encourage group interaction and discussion during dialogue	4.35	1.243	High	14
15. Teachers discover their ability to explore different dimensions of ideas and topics during discussions	4.22	.927	High	15
35. Teachers reformulate or repeat students' ideas to ensure correct understanding	4.11	.921	Medium	16
13. Teachers facilitate the generation of ideas and arguments in a smooth and clear manner during discussions	4.03	1.000	Medium	17
33. Teachers encourage students to speak fluently and creatively in presenting ideas	4.02	1.038	Medium	18
18. Teachers appropriately correct the information presented during dialogue	4.00	1.118	Medium	19
17. Teachers objectively and logically evaluate students' opinions during dialogue	3.95	1.067	Medium	20
30. Teachers vary between open and closed questions during classroom situations	3.94	.950	Medium	21
21. Teachers give students sufficient opportunities to think and express their opinions during lessons	3.89	1.252	Medium	22
16. Teachers encourage students to express themselves clearly during discussions	3.86	.966	Medium	23
34. Teachers are keen to listen to students' ideas during dialogue	3.85	.972	Medium	24
12. Teachers strive to encourage students to positively engage in dialogue with each other	3.54	.831	Medium	25
39. Teachers assist students in expressing their opinions and agreeing or disagreeing with each other	2.77	.425	Low	27
Second Axis: Classifications of Dialogic Teaching	4.25	0.309	High	

Table 7 shows that the overall result for the second axis, "Classifications of Dialogic Teaching," received a "High" rating, with an arithmetic average of (4.25). The arithmetic averages for all statements in the second axis ranged between (2.77 - 4.86) within the categories of "High," "Medium," and "Low." The highest arithmetic average (4.86) was for statements (29 and 36): "Teachers provide enough time for students to answer questions," and "Teachers encourage students to provide evidence to support their interpretations and analyses of the topics presented," with a standard deviation of (0.634) and rated as "High." The standard deviations ranged between (0.425 - 1.252), which indicates low values suggesting homogeneity in the responses of the study sample regarding the extent to which middle school mathematics teachers practice dialogic teaching according to Alexander's theory for the second axis. The lowest standard deviation (0.425) was for statement (39) - "Teachers help students express their opinions and the differences or agreements among them," indicating that this was the statement around which the opinions of the study sample were most closely aligned. The highest standard deviation value (1.252) was for statement (21) - "Teachers give their students ample opportunities to think and express their opinions during the lesson," indicating that this was the statement around which the opinions of the study sample varied the most. The results of this question indicate that the extent to which middle school mathematics teachers practice dialogic teaching according to Alexander's classifications was rated high, with an arithmetic average of (4.25).

The researcher attributes this result to a decrease in self-efficacy, which leads to a reduction in teachers' confidence in their abilities. This negatively impacts the quality of interaction and dialogue with students. Additionally, poor classroom organization is considered a major barrier to fostering positive dialogue, as an unstructured or distracting classroom environment weakens the quality and effectiveness of discussions. Furthermore, a lack of motivation and weak effective listening skills diminish student engagement in the classroom, the limited time allocated for dialogue restricts opportunities for students to express their opinions clearly and deeply, while also reducing the possibility of discussing and respecting different viewpoints, and this result agreed with the results of the study of Ramli [20] as well as those of Attard, et al. [3]; Jay, et al. [24] and Kumpulainen and Rajala [23].

Results of Third Question and its Discussion and Interpretation: To answer the third question: "What is the effectiveness of Alexander's theory in the practice of middle school mathematics teachers in dialogic teaching according to the indicators of Alexander's theory?" The researcher calculated the arithmetic averages and standard deviations of the responses from the study sample regarding the extent to which middle school mathematics teachers engage in dialogic teaching according to the indicators of Alexander's theory. These were arranged in descending order based on their arithmetic averages from their perspective, to illustrate the extent of middle school mathematics teachers' practice of dialogic teaching according to the indicators of Alexander's theory. Table 8 illustrates this:

Table 8.
Using Arithmetic Averages and Standard Deviations for the Answers of the Study Sample Members Regarding the Degree of Practice of Middle School Mathematics Teachers in Dialogic Teaching According to the Indicators of Alexander's Theory.

- **The third axis**

Statement	Arithmetic Average	Standard Deviation	Approval Level	Rank
42. Teachers encourage students to prepare for participation in dialogue and connect discussions to reading and writing skills	4.15	1.064	Medium	1
41. Teachers establish clear rules governing dialogue and discussions in the classroom	3.60	1.087	Medium	2
40. Teachers respect students' right to speak and engage in dialogue in the classroom	3.55	1.132	Medium	3
46. Teachers encourage the exchange of ideas and the formation of a continuous chain of knowledge	3.52	.850	Medium	4
43. Teachers use diverse and flexible teaching strategies in the classroom	3.35	1.052	Low	5
44. Teachers ensure that classroom culture is dynamic, collaborative, and supportive, fostering cooperation	3.29	1.100	Low	6
45. Teachers encourage the provision of organizational models in the classroom that contribute to a dialogic environment	2.89	.312	Low	7
Third Axis: Indicators of Dialogic Teaching	3.48	0.621	Medium	

Table 8 indicates that the overall result for the third axis, "Indicators of Dialogic Teaching," received a "Medium" rating with an arithmetic average of (3.48). The arithmetic averages for all statements in the third axis ranged between (2.89 - 4.15), falling within the "Low" and "Medium" categories. The highest arithmetic average (4.15) was for statement (42), "Teachers encourage students to prepare for participation in dialogue and connect discussions to reading and writing skills," with a standard deviation of (1.064), rated as "Medium." The lowest arithmetic average (2.89) was for statement (45), "Teachers encourage providing organizational models in the classroom that contribute to achieving a dialogic environment," with a standard deviation of (0.312), rated as "Low."

The standard deviations ranged between (0.312 - 1.132), which are low values indicating the homogeneity of the responses of the study sample regarding the extent to which secondary school mathematics teachers practice dialogic teaching according to Alexander's theory for the third axis. The lowest standard deviation (0.312) was for the statement (45 - encourages teachers to provide organizational models in the classroom that contribute to achieving a dialogic environment), indicating that this was the statement around which the opinions of the study sample were most closely aligned. The highest standard deviation (1.132) was for the statement (40 - teachers respect students' right to speak and engage in dialogue in class), suggesting that this was the statement around which the opinions of the study sample varied the most. The results of this question indicate that the extent to which middle school mathematics teachers practice indicators of dialogic teaching according to Alexander's theory was low, with an arithmetic average of (3.48). The researcher attributes these results to the lack of clear organizational models among teachers that contribute to creating a dialogic environment that encourages interaction among students. Educational strategies may be limited to a single style or be inflexible, which restricts the diversity of dialogue and negatively impacts student interaction. The lack of encouragement from teachers for organized idea exchange may lead to a weakness in the flow of knowledge among students. Additionally, the lack of clear dialogue rules creates a chaotic situation that affects the quality of discussion, revealing students' insufficient readiness for effective participation in dialogue and the absence of prior preparation. This result agreed with the results of the study of Lehesvuori, et al. [19] and differs from the results of the study of Kumpulainen and Rajala [23].

Results of the answer to fourth question: which states: "Are there statistically significant differences in the application of Alexander's theory in the practices of middle school mathematics teachers for dialogic teaching in middle school according to the variables (gender, educational

qualification, number of years of experience)?" This question was answered for each variable separately as follows:

First: Gender Variable: The arithmetic averages and standard deviations were calculated, and an independent samples T-test was conducted to assess the effectiveness of Alexander's theory in the practices of middle school mathematics teachers for dialogic teaching based on the gender variable. The results are as follows:

Table 9.
Arithmetic Averages, Standard Deviations, and the Independent Samples T-Test for the Effectiveness of Alexander's Theory in the Practice of Middle School Mathematics Teachers for Dialogic Teaching According to the Gender Variable

Axes	Gender	Number	Arithmetic Average	Standard Deviation	T Value	df	Significance Level	Decision
Principles of Dialogic Teaching	Male	30	4.03	0.394	5.029	63	0.000	Significant
	Female	35	3.48	0.471				
Classifications of Dialogic Teaching	Male	30	4.38	0.157	3.413	63	0.001	Significant
	Female	35	4.14	0.361				
Indicators of Dialogic Teaching	Male	30	3.75	0.500	3.462	63	0.001	Significant
	Female	35	3.25	0.630				

Table 9 shows that all significance level values for all dimensions of Alexander [4] theory of effectiveness in the dialogic teaching practices of middle school mathematics teachers, according to the gender variable, are statistically significant. This leads to the conclusion that there are statistically significant differences for all dimensions of Alexander's theory of effectiveness in the dialogic teaching practices of middle school mathematics teachers based on the gender variable, with all differences favoring males. The researcher attributes this result in favor of male teachers to their ability to engage students during the teaching process, reduce the monotonous and repetitive routine typically experienced daily, activate students' prior and subsequent knowledge and experiences, deepen and solidify the concept of dialogue among students, involve them in directing lesson activities, encourage students to prepare in advance for lessons, and foster a competitive spirit among them to showcase each student's experiences, abilities, and uniqueness, they employ various teaching methods and strategies, promote humility in dialogic relationships based on mutual respect, believe in the humanity of individuals, and ensure that their dialogue is grounded in the principle of mutual respect, they enhance trust in others' awareness and their capacity to effect change and encourage critical thinking. This result agrees with the results of the study of Attard, et al. [3].

Second: Variable of Educational Qualification: The arithmetic averages and standard deviations were calculated, and an independent samples T-test was conducted to evaluate the effectiveness of Alexander's theory in the dialogic teaching practice of middle school mathematics teachers based on the variable of educational qualification. The following is a summary of the results:

Table 10.
Arithmetic Averages, Standard Deviations, and the Independent Samples T-Test for the Effectiveness of Alexander's Theory in the Practice of Middle School Mathematics Teachers for Dialogic Teaching According to the Variable of Educational Qualification.

Axes	Educational Qualification	Number	Arithmetic Average	Standard Deviation	T Value	df	Significance Level	Decision
Principles of Dialogic Teaching	Bachelor's	42	3.62	0.502	-2.462	63	0.017	Significant
	Master's and Doctorate	23	3.94	0.479				
Classifications of Dialogic Teaching	Bachelor's	42	4.17	0.348	-2.974	63	0.004	Significant
	Master's and Doctorate	23	4.40	0.133				
Indicators of Dialogic Teaching	Bachelor's	42	3.34	0.627	-2.582	63	0.012	Significant
	Master's and Doctorate	23	3.74	0.532				

Table 10 shows that all significance level values across all dimensions of Alexander's Theory effectiveness in the dialogic teaching practices of middle school mathematics teachers, according to the variable of educational qualification, are statistically significant. This leads to the conclusion that there are statistically significant differences for all dimensions of Alexander's Theory effectiveness in the dialogic teaching practices of middle school mathematics teachers based on the variable of educational qualification, with all differences favoring those holding master's and doctoral degrees. The researcher attributes this result to the intention of the discussants in the dialogue to reveal the truth, distancing themselves from self-promotion and personal biases, there are some who engage in dialogue for reputation and debate, being recognized as good discussants while supporting falsehoods despite being aware of it, teachers with higher academic qualifications tend to ensure that all parties in the discussion are knowledgeable about the topic, unlike those who claim it is unnecessary to be familiar with the subject of the dialogue, these discussants exhibit courage and bravery in acknowledging mistakes, driven by a desire to achieve the truth and to maintain calm and moderation until the discussion concludes. They demonstrate flexibility in dialogue and the ability to express themselves, considering dialogue a good means to resolve many problems, and play a role in building a common ground for coexistence and cooperation among all members of society, they also strengthen individuals' feelings of satisfaction and acceptance of decisions made with an open heart, free from skepticism, while preserving individuals' rights and interests at all levels and in all fields, and this result agrees with the results of the study of Lehesvuori, et al. [19].

Third: Variable of Years of Experience: To answer this question, arithmetic averages and standard deviations were calculated, and a one-way ANOVA was conducted to assess the effectiveness of Alexander's theory in the practice of middle school mathematics teachers for dialogic teaching, according to the variable of years of experience. The following is a clarification of the results.

Table 11.
Arithmetic Averages, Standard Deviations, and One-Way ANOVA for the Effectiveness of Alexander's Theory in the Practice of Middle School Mathematics Teachers for Dialogic Teaching According to the Variable of Years of Experience.

Axes	Experience	N	Arithmetic Average	Standard Deviation	F Value	Significance Level	Decision
Principles of dialogic teaching	Less than 5 years	20	3.45	.553	8.435	.001	Significant
	5–10 years	22	4.03	.366			
	More than 10 years	23	3.70	.458			
Classifications of dialogic teaching	Less than 5 years	20	4.33	.218	12.726	.000	Significant
	5–10 years	22	4.41	.161			
	More than 10 years	23	4.03	.362			
Indicators of dialogic teaching	Less than 5 years	20	3.15	.631	5.829	.005	Significant
	5–10 years	22	3.76	.457			
	More than 10 years	23	3.50	.634			

Table 11 shows that all significance level values across all dimensions of the effectiveness of Alexander's Theory in the practice of mathematics teachers in the middle school for dialogic teaching, according to the variable of years of experience, are statistically significant, this leads to the conclusion that there are statistically significant differences for all dimensions of the effectiveness of Alexander's Theory in the practice of mathematics teachers in the middle school for dialogic teaching according to the variable of years of experience, to determine the source of these differences, a Scheffé test for post-hoc comparisons was conducted. The results revealed statistically significant differences in the dimension of dialogic teaching principles between those with (less than 5 years) of experience and those with (5 to 10 years) of experience, favoring those with (5 to 10 years) of experience, there are no differences found in the remaining levels of experience. Additionally, there were statistically significant differences in the dimension of dialogic teaching classifications between those with (less than 5 years) of experience and those with (more than 10 years) of experience, favoring those with (more than 10 years) of experience. There were also differences between those with (5 to 10 years) of experience and those with (more than 10 years) of experience, favoring those with (5 to 10 years) of experience. There are statistically significant differences in the dimension of dialogue teaching indicators between those with less than 5 years of experience and those with (5 to 10 years) of experience, favoring those with (5 to 10 years) of experience. However, there are no differences among the other levels of experience. The researcher attributes this result to the fact that dialogue is an important skill that everyone should master and practice, as it enables effective communication with others, many individuals may fail to engage in successful and effective dialogues with their counterparts due to their inability to speak fluently or due to excessive nervousness, the role of experienced teachers in encouraging dialogue with students allows them to communicate comfortably, convey their thoughts, accept others' opinions, and guide them towards improvement, this fosters the development of an open generation capable of facing various challenges and embracing all cultures. Additionally, it benefits the participants by providing information that they previously lacked, these teachers have become trainers who conduct workshops that allow interested individuals to enhance their skills and knowledge in various areas, including emotional intelligence courses, social communication, and teaching the fundamentals of dialogue, particularly for those who struggle with speech and have low self-confidence. This result agrees with the results of the study of Ramli [20].

Recommendations: Based on the results obtained from the study, the researcher recommends the following:
- The necessity of providing specialized training programs for mathematics teachers, aimed at enhancing their understanding of dialogic teaching principles according to Alexander's theory.
- The need to provide practical models and hands-on practices that boost teachers' confidence in using dialogic teaching.
- The researcher recommends creating an organized classroom environment that is free from distractions by adopting a classroom design that promotes interaction and participation.
- The necessity of organizing regular meetings with parents to raise awareness about the importance of dialogue and their role in enhancing students' readiness for active participation in discussions and dialogues.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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References

[1]   P. Chen, A. K. Tolmie, and H. Wang, "Growing the critical thinking of schoolchildren in Taiwan using the Analects of Confucius," *International Journal of Educational Research*, vol. 84, pp. 43-54, 2017. https://doi.org/10.1016/j.ijer.2017.02.002

[2]   T. Kazepides, *Education as dialogue: Its prerequisites and its enemies*. Montreal and Kingston: McGill-Queen's University Press, 2010.

[3]   C. Attard, C. Edwards-Groves, and P. Grootenboer, "Dialogic practices in the mathematics classroom," in *41st Mathematics Education Research Group of Australasia (MERGA) Conference 2018*, 2018: The Mathematics Education Research Group of Australasia Inc, pp. 122-129.

[4]   R. Alexander, *A dialogic teaching companion*. London: Routledge, 2020.

[5]   N. Mercer, "The social brain, language, and goal-directed collective thinking: A social conception of cognition and its implications for understanding how we think, teach, and learn," *Educational Psychologist*, vol. 48, no. 3, pp. 148–168, 2013. https://doi.org/10.1080/00461520.2013.804394

[6]   R. J. Alexander, *Towards dialogic teaching: Rethinking classroom talk*, 5th ed. York, UK: Dialogos, 2017.

[7]   S. Michaels and C. O'Connor, *Conceptualizing talk moves as tools: Professional development approaches for academically productive discussions. In L. B. Resnick, C. S. C. Asterhan, & S. N. Clarke (Eds.), Socializing intelligence through talk and dialogue*. New York: Routledge, 2015, pp. 347-362.

[8]   L. S. Vygotsky, *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press, 1978.

[9]   M. Bakhtin, *The dialogic imagination*. Austin: University of Texas Press, 1981.

[10]   M. M. Bakhtin, *Speech genres and other late essays*. Austin, TX: University of Texas Press, 1986.

[11]   S. Michaels, C. O'Connor, and L. B. Resnick, "Deliberative discourse idealized and realized: Accountable talk in the classroom and in civic life," *Studies in Philosophy and Education*, vol. 27, pp. 283-297, 2008.

[12]   N. Mercer and K. Littleton, *Dialogue and the development of children's thinking: A sociocultural approach*. London, UK: Routledge, 2007.

[13]   R. J. Alexander, *Essays on pedagogy*. London: Routledge, 2001.

[14]   M. Nystrand, A. Gamoran, R. Kachur, and C. Prendergast, *Opening dialogue*. New York: Teachers College Press, 1997.

[15]   M. Nystrand, L. L. Wu, A. Gamoran, S. Zeiser, and D. A. Long, "Questions in time: Investigating the structure and dynamics of unfolding classroom discourse," *Discourse Processes*, vol. 35, no. 2, pp. 135-198, 2003.

[16]   S. Michaels and C. O'Connor, *Talk science primer*. Cambridge MA: TERC, 2012.

[17]   C. Van Der Veen, F. Van der Wilt, C. Van Kruistum, B. Van Oers, and S. Michaels, "MODEL 2 TALK: An intervention to promote productive classroom talk," *The Reading Teacher*, vol. 70, no. 6, pp. 689-700, 2017. https://doi.org/10.1002/trt.1573

[18]   H. Muhonen, E. Pakarinen, H. Rasku-Puttonen, and M.-K. Lerkkanen, "Educational dialogue among teachers experiencing different levels of self-efficacy," *Learning, Culture and Social Interaction*, vol. 29, p. 100493, 2021. https://doi.org/10.1016/j.lcsi.2021.100493

[19]   S. Lehesvuori, M. Hähkiöniemi, L. Ketonen, M.-K. Lerkkanen, S. Pöysä, and E. Pakarinen, "Reflections on dialogicity: Challenges and suggestions by mathematics student teachers," *Learning, Culture and Social Interaction*, vol. 31, p. 100567, 2021. https://doi.org/10.1016/j.lcsi.2021.100567

[20]   M. Ramli, "Classroom Interaction: Teacher and Students Perception on Dialogue in Primary Science Classroom," *Edusains*, vol. 10, no. 1, pp. 127-134, 2018. https://doi.org/10.15408/es.v10i1.8092

[21]   M. Vrikki, L. Wheatley, C. Howe, S. Hennessy, and N. Mercer, "Dialogic practices in primary school classrooms," *Language and Education*, vol. 33, no. 1, pp. 85-100, 2019. https://doi.org/10.1080/09500782.2018.1509988

[22]   G. Bansal, "Teacher discursive moves: Conceptualising a schema of dialogic discourse in science classrooms," *International Journal of Science Education*, vol. 40, no. 15, pp. 1891-1912, 2018.

[23]   K. Kumpulainen and A. Rajala, "Dialogic teaching and students' discursive identity negotiation in the learning of science," *Learning and Instruction*, vol. 48, pp. 23-31, 2017.

[24]   T. Jay *et al.*, *Dialogic teaching: Evaluation report and executive summary*. Education Endowment Foundation. https://educationendowmentfoundation.org.uk, 2017.

[25]   R. J. Alexander, *Culture, dialogue and learning: Notes on an emerging pedagogy*. York, UK: Dialogos, 2007.