

The Effect of Applying the Homogeneous Groups Strategy on Academic Achievement and Motivation to Learn among Fourth-Grade Students in Basic Education in Mathematics in the Sultanate of Oman

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Abstract: This study investigated the effect of a homogeneous grouping strategy on fourth-grade students' mathematics achievement, alongside their classroom engagement and motivation, and the practical challenges of implementing the strategy from the teacher's perspective. A quasi-experimental one-group pretest–posttest design was adopted, supplemented by a qualitative component within an explanatory sequential mixed-methods framework. The sample comprised 30 fourth-grade students taught mathematics using homogeneous grouping. Three instruments were used—an achievement test, a classroom observation checklist, and a semi-structured teacher interview—whose validity and reliability were confirmed through multiple statistical procedures. Results showed statistically significant differences between pretest and posttest scores in favor of the posttest, with a very large effect size ($d = 2.96$). Students also demonstrated high levels of classroom engagement and motivation toward learning mathematics ($M = 4.21$). The interview revealed organizational challenges, primarily time management and the added workload of planning differentiated tasks. The study recommends adopting the homogeneous grouping strategy alongside targeted teacher training, and suggests future comparative studies incorporating a control group.

Keywords: homogeneous grouping, academic achievement, classroom engagement, motivation.

1. Introduction

With the advancement of modern educational technologies, traditional models based on rote instruction and lecturing are no longer capable of meeting the demands of the knowledge society or developing twenty-first-century higher-order competencies among students. These transformations have prompted educational systems worldwide to undertake a comprehensive review of their cognitive and pedagogical structures, and to redesign learning environments in ways that ensure the deployment of active learning and grant students a central role in the educational process, while accounting for individual differences in abilities, learning styles, interests, and cultural backgrounds (Bondie & Dorko, 2023). Within this context, three complementary pedagogical approaches have emerged cooperative learning,

differentiated instruction, and constructivist learning as fundamental pillars of effective teaching in contemporary classrooms (Wang et al., 2024). The Organisation for Economic Co-operation and Development (OECD), in its annual report on educational outcomes, has affirmed that the effectiveness of education systems can no longer be measured solely by school enrollment rates, but rather by these systems' capacity to cultivate higher-order thinking skills, collaboration, communication, and adaptability among students within dynamic learning environments (OECD, 2024a).

Cooperative learning is among the most extensively researched and empirically tested strategies in the contemporary educational literature. Recent experimental studies and meta-analyses have shown that the use of small cooperative groups raises students' academic achievement by an effect size ranging between 0.50 and 0.75 standard deviations compared with traditional individual instruction methods (Öztürk, 2023). This strategy also contributes to the development of social competencies, peer interaction, and a sense of belonging to the classroom learning community (Largent, 2025).

Within the framework of contemporary pedagogical approaches that respond to learner diversity within a single classroom, homogeneous grouping also known as ability grouping emerges as one of the structured instructional methods that involves classifying students within a class into small groups of comparable achievement level or learning pace, thereby enabling teachers to design learning experiences and graded assessment activities suited to each group's capabilities (Steenbergen-Hu & Cooper, 2023).

This strategy rests on the pedagogical premise that grouping learners at comparable levels enables teachers to deliver content at an appropriate pace and depth, narrows the cognitive gap within a given group, and thereby enhances students' self-confidence and intrinsic motivation to learn (Wangdi, 2025). Recent experimental studies, including that of Lou et al. (1996), have demonstrated that homogeneous grouping has a statistically significant positive effect on academic achievement, particularly in mathematics, science, and language subjects, when groups are carefully designed, periodically reviewed, and not allowed to devolve into a discriminatory tracking practice. Nevertheless, the effectiveness of this strategy is contingent upon several criteria, most notably flexibility in regrouping, diversification of within-group interaction patterns, and the provision of enrichment and remedial activities for both high-achieving and struggling groups alike (Kinder & Webel, 2025).

In the Omani educational context, since the adoption of "Oman Vision 2040," the Ministry of Education has placed particular emphasis on developing instructional practices and fostering a culture of active learning in Omani schools, in line with international trends toward improving educational quality. Basic education (Grades 1–4) constitutes one of the most critical and sensitive educational stages, as it forms the foundation upon which early cognitive skills, acquired learning habits, and attitudes toward school and knowledge are built; consequently, any pedagogical shortcoming at this stage carries cumulative effects and

repercussions for subsequent stages (Gheyssens et al., 2023). Oman's National Vision for Education 2040 emphasizes the necessity of shifting from an instructional model based on the transmission of information to one grounded in the discovery and construction of knowledge, the integration of modern technologies, and the application of active learning strategies that respond to learner diversity and activate students' role in the educational process (Hodgen et al., 2023). However, field practices documented in several recent evaluative studies conducted in the Sultanate of Oman continue to reveal a clear gap between the official directions of the reform initiative and actual classroom implementation; traditional lecture-based and rote instructional methods remain dominant, the deployment of modern strategies remains limited, and attention to individual differences among students remains inadequate—resulting in wide disparities in achievement levels and a widening gap between high-achieving and struggling students (Prast et al., 2023).

In light of these considerations, there is a pressing need to implement instructional strategies grounded in empirically validated cognitive theories, foremost among them the homogeneous grouping strategy, which has proven effective in improving academic achievement, developing higher-order thinking skills, enhancing classroom interaction, and reducing behavioral problems associated with boredom or frustration among struggling students (Steenbergen-Hu et al., 2016). The researchers hope that implementing this strategy within the Omani context—following a rigorous experimental design that accounts for the particularities of the Omani school and cultural environment—will contribute to narrowing the achievement gap among students, achieving the principle of educational equity, and supporting the Sustainable Development Goals related to quality, inclusive education for all (UNESCO, 2024).

2. Methodology Research Objectives and Questions

2.1 Statement of the Problem

Individual differences among students constitute one of the most pressing educational issues in contemporary teaching practices, as teachers at the basic education stage face pronounced variation in cognitive abilities and achievement levels within a single classroom a variation that poses fundamental challenges to the effectiveness of the educational process when it is not translated into differentiated instructional practices responsive to students' diverse needs. This challenge is further compounded in the Omani context by the relatively high student density, with enrollment in basic education exceeding 780,000 students, at an average of approximately 25 students per classroom a factor that limits teachers' capacity to provide effective individualized instruction and compounds the difficulty of managing cognitive diversity within classrooms.

Recent educational literature confirms that the Omani classroom environment is characterized by marked variation in student abilities, which calls for the adoption of

instructional strategies grounded in the principle of differentiation. Recent studies, however, reveal a clear gap between this theoretical orientation and actual classroom practice; findings from Al-Mahdy et al. (2023) indicated that teachers continue to rely on traditional instructional methods that do not accommodate variation in student levels, which negatively affects their academic achievement. Similarly, Dierendonck et al. (2024) found that the implementation of recommended instructional practices depends not merely on teachers' adoption of them, but is shaped by a range of factors related to their attitudes, the norms of the educational environment, and their perceived self-efficacy in applying them—factors that may hinder the transition of certain modern instructional practices from the level of theoretical recommendation to actual classroom practice.

On the other hand, numerous recent studies converge in confirming that organizing students into homogeneous learning groups based on their achievement levels produces a direct and positive effect on improving academic achievement and the quality of classroom interaction. Alam and Mohanty (2023) demonstrated that ability grouping is among the most effective strategies for teaching mathematics, particularly at the basic education stages. Similarly, Velasquez (2024) found that organizing students into groups of comparable achievement levels contributes tangibly to raising academic performance, an effect that is even more pronounced among low-achieving students. In the same vein, Kurniadi et al. (2023) confirmed that grouping strategies contribute to improving the quality of classroom interaction and increasing students' motivation to learn.

Despite this accumulating body of positive findings in the international literature, the deployment of the homogeneous grouping strategy within the Omani classroom environment particularly in public schools—remains limited and unsystematic, revealing a clear implementation gap between what contemporary educational literature recommends and what is actually practiced in classrooms. This gap is further reinforced by the absence of local empirical studies that experimentally verify the effectiveness of this strategy within the specific Omani context, with its distinctive demographic and educational characteristics. Accordingly, there is a pressing need to conduct empirical research investigating the effect of implementing the homogeneous grouping strategy on improving the academic achievement of basic education students in the Sultanate of Oman, thereby addressing this research gap and providing local empirical evidence to support educational decision-making. In light of the foregoing, the present study sought to achieve the following objectives:

1.2 Study Objectives

1. To statistically verify the significance of the differences between students' mean performance on the pretest and posttest following the implementation of the strategy, thereby providing quantitative evidence of its effectiveness.
2. To describe and analyze the level of classroom interaction and student motivation during

the implementation of the homogeneous grouping strategy, in order to understand its effect on the non-cognitive dimensions of learning.

3. To identify the practical challenges associated with implementing the strategy within the Omani context, and to formulate actionable procedural recommendations that benefit teachers and educational decision-makers in scaling up the strategy or improving its implementation.

1.3 Research Questions

1. Building on the study problem, the present research sought to answer the following main questions:
2. Are there statistically significant differences at the ($\alpha \leq 0.05$) level between the mean scores of fourth-grade students on the pretest and posttest in mathematics attributable to the use of the homogeneous grouping strategy?
3. What is the level of fourth-grade students' interaction and motivation toward learning mathematics when implementing the homogeneous grouping strategy, from the perspective of the teacher-researcher?
4. What are the most prominent practical challenges and obstacles facing the implementation of the homogeneous grouping strategy in the classroom, and what are the means of overcoming them?

2.4 Significance of the Study

The significance of this study lies in two dimensions:

Theoretical Significance

1. Contributing to bridging a local research gap: This study is among the few action research studies, to the researcher's knowledge, that address the effect of the homogeneous grouping strategy on mathematics achievement among Cycle One (Grades 1–4) students specifically within the Omani educational context, thereby contributing to enriching the Arabic literature with local empirical evidence rather than merely generalizing findings from studies conducted in culturally and organizationally different educational environments.
2. Linking the theoretical framework to classroom practice: The study offers a direct field-based test of the principle of differentiated instruction, which is frequently addressed in the educational literature at the theoretical level without documented empirical application measuring its actual effect within Omani classrooms.
3. Providing a knowledge base for future studies: The findings of this study open the way for broader future research (such as quasi-experimental studies with control groups, or longitudinal studies) addressing the homogeneous grouping strategy in other subject areas or at different educational stages.

Practical Significance

1. **Supporting teachers with applicable instructional methods:** The study provides teachers, particularly basic-stage female teachers, with a clear procedural model for organizing students into homogeneous groups, thereby helping to move beyond reliance on traditional methods that do not accommodate individual differences, and offering a practical, direct instructional alternative that can be implemented without the need for complex additional resources.
2. **Contributing to improved academic achievement:** The study's findings are expected to provide teachers and educational decision-makers with actionable evidence regarding the effectiveness of the strategy in raising achievement levels in mathematics a subject that has witnessed a notable decline in student outcomes, as indicated by international assessments.
3. **Responding to reform directions in Omani education:** The study aligns with the directions of Oman's Ministry of Education toward developing instructional practices and improving learning quality, consistent with the goals of the "Oman Vision 2040" in the field of education, as it offers a practical tool that could be scaled up across a wider range of public schools should its effectiveness be established.
4. **Enhancing classroom interaction and motivation:** The study contributes an in-depth perspective on the effect of homogeneous grouping on the non-cognitive dimensions of learning, such as inter-student interaction and motivation toward the subject a dimension frequently overlooked in studies that focus solely on quantitative achievement.

2.5 Delimitations of the Study

Temporal Delimitation: The second semester of the 2025/2026 academic year (implementation duration: one full semester).

Spatial Delimitation: Darb Al-Ula School for Basic Education.

Human Delimitation: One section of fourth-grade students, and a single teacher implementing the strategy.

Content Delimitation: The homogeneous grouping strategy and its effect on mathematics achievement, motivation, and classroom interaction.

Methodological Delimitation: A one-group (pretest–posttest) design without a control group.

2.6 Definitions of Terms

Homogeneous Grouping Strategy

The homogeneous grouping strategy is defined as an instructional method based on dividing students into small groups of comparable ability or achievement level, with the aim of delivering targeted instruction that accommodates the characteristics of each group and enhances the quality of learning and classroom interaction (Alsalihi et al., 2025).

Homogeneous grouping is operationally defined in this study as the instructional method whereby the teacher divides fourth-grade students into groups of comparable achievement level in mathematics and delivers targeted learning activities to each group, with the aim of improving their academic achievement and classroom interaction.

Academic Achievement

Academic achievement is defined as the level of performance a learner attains in a given academic domain, as inferred from the results obtained on achievement measurement instruments that reflect the extent to which the targeted knowledge and skills have been acquired (Hattie, 2023). It is operationally defined in this study as the score obtained by fourth-grade students on the mathematics achievement test, which was administered as a pretest and a posttest to measure the effect of the homogeneous grouping strategy.

Teaching Practices

Teaching practices refer to the set of procedures and methods that a teacher employs in planning, implementing, and evaluating the instructional process; these practices are associated with the effectiveness of educational leadership and the institutional support provided to the teacher within the school environment (Al-Mahdy et al., 2024). They are operationally defined in this study as the activities and methods employed by the teacher in the classroom to teach mathematics to fourth-grade students such as organizing groups, delivering targeted activities, managing time, and providing feedback as documented through the classroom observation checklist.

Classroom Management

Classroom management is defined as the set of organizational and behavioral procedures a teacher adopts to regulate the classroom environment and guide student behavior, thereby ensuring an effective and learning-supportive educational environment (Chow et al., 2024). It is operationally defined in this study as the teacher's ability to organize students within homogeneous groups, regulate their behavior, allocate time and tasks, and manage classroom activities during the implementation of the strategy.

Classroom Interaction

Yao and Shao (2024) defined successful classroom interaction as that which comprises three sequential and interrelated elements: initiation, followed by a response from the other party, and then evaluation or feedback from the teacher; when this three-part sequence is completed, the interaction is considered successful and complete, whereas if it stops at the response stage without evaluation or feedback, it is considered a low-quality, incomplete interaction. Classroom interaction is operationally defined in this study as the sum of the verbal and non-verbal behaviors exhibited by fourth-grade students while working within the homogeneous grouping strategy—represented by participation and initiative in posing questions, responsiveness to the teacher's and group members' directions, and cooperation in accomplishing shared mathematical tasks—as measured by the total score a student

obtains on the classroom observation checklist developed for the purposes of this study.

Motivation

Adhikari, Budhathoki, and Adhikari (2025) defined motivation as the physiological and psychological processes that initiate, sustain, and terminate behavior, in addition to the perceived positive or negative value an individual attribute to the activity in which they are engaged. The study noted that a motivated student is more inclined to participate actively in class, demonstrate greater persistence, and achieve better academic performance, while acknowledging that sustaining this motivation poses a challenge due to variation in students' backgrounds, interests, and learning styles. Student motivation is operationally defined in this study as the internal state that drives a fourth-grade student toward emotional engagement and enthusiasm, and persistence in solving mathematical problems despite their difficulty, while working within the homogeneous grouping strategy; it is quantitatively determined by the total score a student obtains on the "emotional engagement" and "persistence" domains of the classroom observation checklist and the performance record developed for the purposes of this study.

2 Theoretical Framework

The homogeneous grouping strategy represents a contemporary application of differentiated instruction, whereby students are organized into small groups according to the comparability of their achievement levels or cognitive abilities, with the aim of delivering targeted instruction that responds to their actual needs rather than applying a single uniform instructional approach to all students regardless of their variation. This strategy has received growing attention in the recent educational literature as a practical tool that enables teachers to adapt content and learning activities to the characteristics of each group of students, which is positively reflected in teaching efficiency within classrooms characterized by marked variation in ability levels (Al salhi et al., 2025).

In a study conducted by Al salhi et al. (2025) in Jordan on the effect of the homogeneous grouping method, compared with the traditional method, on the science achievement of basic-stage students—employing a quasi-experimental design the findings confirmed the superiority of the homogeneous grouping method over the traditional method in improving academic achievement, and the study recommended adopting it within cooperative learning environments in classrooms. Similarly, Tomasik and Trudell (2024) provided a comprehensive literature review of methods for grouping students according to their abilities, noting that high-quality studies in this area remain limited in number, but that the available studies demonstrate a positive effect of homogeneous grouping methods (such as classification by achievement level), with this effect varying according to age group and subject area. At the level of the Sultanate, and despite the limited number of local studies

addressing the homogeneous grouping strategy specifically, Al-Mahdy et al. (2024), in a study conducted on a sample of teachers in Omani schools, confirmed that the successful adoption of modern instructional strategies such as differentiation and grouping is closely linked to the quality of leadership and training support provided to the teacher within their school—highlighting that the primary obstacle to scaling up these strategies in the Omani environment is not theoretical, but rather implementation and institutional.

3.1 Significance of the Homogeneous Grouping Strategy

The significance of this strategy lies in its capacity to provide a learning environment that allows students to learn at their own pace without experiencing the frustration resulting from wide disparities in levels within a single group. Recent literature, however, indicates that the effectiveness of this strategy is not absolute but is rather contingent upon precise implementation factors; the review by Tomasik and Trudell (2024) showed that grouping students according to their achievement abilities may not achieve the intended effect unless designed with sufficient flexibility to allow for the periodic redistribution of students among groups, thereby avoiding the entrenchment of a fixed classification that could limit some students' opportunities for advancement. Studies further confirm that the success of the strategy depends to a considerable extent on the teacher's skill in designing targeted activities that accommodate the characteristics of each group.

3.2 Academic Achievement

Academic achievement is one of the fundamental indicators reflecting the success of the educational process, inferred through the level of performance students attain on achievement measurement instruments. This concept has received growing attention in the recent educational literature, particularly with respect to the factors explaining variation in achievement among students. In this regard, teaching quality is one of the most important such factors; the study conducted by Hattie (2023) showed that instructional strategies grounded in effective feedback and direct, guided instruction are among the most influential classroom practices for improving students' achievement levels, compared with traditional lecture-based methods. Recent studies further indicate that interactive and cooperative learning methods contribute, in turn, to improving academic achievement by fostering deep understanding of concepts and knowledge. Simesso et al. (2024), in a study applied to secondary-stage students in chemistry, found that the use of cooperative learning methods led to a statistically significant improvement in students' achievement and information retention, compared with the group taught using the conventional lecture-based method. Accordingly, improving academic achievement requires the adoption of instructional strategies that accommodate the variation in students' levels and provide an interactive, supportive learning environment—consistent with what the present study seeks to verify empirically.

3.3 Classroom Interaction

Classroom interaction constitutes the pulse of the teaching–learning process and its vital axis, as it reflects the sum of the verbal and non-verbal actions and behaviors exchanged between the teacher and students, or among students themselves, within the classroom, with the aim of achieving a state of adaptation and harmony that allows teaching and learning to be practiced effectively. Hall (2002), as cited in Ismail and Mohammed (2023), defined classroom interaction as that interaction which occurs between the teacher and students together within the classroom to stimulate intellectual and practical activities and achieve development in the educational process, whereas Abu Jado (2015) defined it as the opinions, activities, and dialogues that occur in the classroom in an organized and purposeful manner to increase learner motivation and develop genuine willingness to learn, for the purpose of communication and the exchange of ideas and information. The significance of classroom interaction lies in its contribution to transforming the teacher's role from a transmitter of knowledge into a facilitator, encourager, and supervisor of the educational process, and in transforming the student from a passive recipient into an active, effective participant with a positive and influential role in their classroom environment. In a recent Arab field study conducted on university students, Ismail and Mohammed (2023) found that the participatory interaction pattern between teacher and student was the preferred pattern among the vast majority of the sample, and that this pattern was positively correlated with students' level of analytical thinking, as it affords students the opportunity to exchange dialogue and discussion, express opinions, and respect the views of others—thereby reducing the teacher's dominance over the course of the instructional situation and granting students greater scope for active participation. In light of the foregoing, it is evident that the quality of classroom interaction is related not only to its quantity but also to its type and pattern; hence the importance of employing instructional strategies such as the homogeneous grouping strategy adopted by the present study, which is expected to enhance the participatory interaction pattern among members of a single group of comparable level, and to create a safer and more dynamic classroom environment that encourages students to take initiative and participate without hesitation.

3.4 Motivation

Motivation to learn is one of the psychological and educational concepts that has received wide attention in the contemporary literature, being the internal force that drives student behavior and directs it toward the achievement of specific educational goals, such that its effect extends beyond merely stimulating educational activity to encompass its continuity and direction toward a clear objective until the desired goal is attained. Shaheen (2025), in an analytical study, confirmed that learning motivation is a behavior directed toward the achievement of specific educational goals, influenced by an interwoven system of biological, emotional, cognitive, and social factors that interact with one another to shape the learner's

overall motivational profile; the teacher, through their instructional methods, the classroom environment with its social relationships, the family through its supportive role, alongside the student's sense of self-efficacy and personal interest in the subject, all contribute to shaping the student's level of motivation to learn. The effect of motivation is not confined to improving academic performance alone but extends to modifying undesirable behavioral patterns among learners; Al-Abdallat and Al-Hadid (2023) revealed the effectiveness of a remedial program based on a behavioral support model in reducing impulsive behavior and increasing learning motivation among basic-stage students with learning difficulties, which confirms that motivation is not a fixed attribute of the learner but rather a variable susceptible to development and modification through carefully designed and planned educational interventions. In light of the foregoing, it is evident that learning motivation represents a fundamental axis of the teaching-learning process, and that stimulating and sustaining it requires the deployment of effective instructional strategies that accommodate individual differences among learners, such as the homogeneous grouping strategy adopted by the present study, which is expected to contribute to creating a psychologically safer and more motivating learning environment, positively reflected in students' level of motivation and interaction in the classroom.

3 Methodology

4.1 Study Methodology

The present study adopted the action research method, considered the most appropriate approach for the nature of the research problem, as it enables the teacher-researcher to diagnose a real problem within her own classroom environment, design a direct educational intervention represented by the homogeneous grouping strategy, and measure its effect through a systematic methodological approach that serves the improvement of teaching practice from within (Kemmis, 2023). Within this method, a one-group quasi-experimental design with pretest and posttest measures was employed, whereby the study group underwent a pretest achievement test, followed by the implementation of the strategy, and then a posttest achievement test to measure the effect of the implementation.

4.2 Study Population and Sample

The study population consisted of all fourth-grade students at Darb Al-Ula School for Basic Education, while the study sample consisted of the students of one section of fourth grade at the same school, selected purposively given the nature of action research, which targets addressing a real problem within a specific classroom context. The mathematics teacher in the classroom undertook the implementation of the strategy.

4.3 Study Instruments

The present study relied on four integrated instruments for data collection, combining quantitative and qualitative approaches consistent with the nature of action research:

First: The Achievement Test

The achievement test is the principal instrument in quasi-experimental research for measuring the effect of the experimental treatment on student achievement, as it is administered before and after treatment to detect, with objective precision, the change resulting from the educational intervention. The test for the present study was developed in accordance with the mathematics content for fourth-grade students and included graduated cognitive levels (recall, comprehension, application). Its validity was verified by presenting it to a panel of specialized reviewers and making adjustments in light of their feedback, and its reliability was verified by re-administering it to a pilot sample outside the main study sample—a procedure adopted in similar recent educational studies, both in the Arab context (Al-Shuaili, 2024) and internationally (Simesso et al., 2024). The achievement test was developed to measure fourth-grade students' achievement in mathematics, comprising 20 multiple-choice questions covering the levels of knowledge, comprehension, and application according to Bloom's taxonomy. Its psychometric properties were verified by establishing face and content validity, achieved by presenting it in its initial form to a panel of reviewers specialized in curricula, teaching methods, and measurement and evaluation, to comment on the clarity of the items, their appropriateness for the age level, their alignment with the content and instructional objectives, and their linguistic accuracy; it achieved an agreement rate of 85% among the reviewers, and items that did not meet the required rate were revised or deleted. Internal consistency validity was also confirmed by calculating the correlation coefficient between each question's score and the test's total score using the Pearson correlation coefficient. To derive the difficulty and discrimination coefficients for each question, the test was administered to a pilot sample of 12 students, and test items with difficulty coefficients ranging between 0.20 and 0.80 and discrimination coefficients of 0.30 or higher were accepted as appropriate items in terms of difficulty level and ability to discriminate among students (Abu Labda, 1982).

Second: The Classroom Observation Checklist

The observation checklist was used as a complementary qualitative instrument, documenting students' behavior and interaction during the implementation of the homogeneous grouping strategy through specific indicators such as participation, cooperation, and level of engagement in learning. The use of this instrument is consistent with what a recent methodological review confirmed—namely, that structured observation instruments constitute a reliable means of measuring behavioral and interactional dimensions that are difficult to capture through quantitative tests alone (Chow et al., 2024). The classroom observation checklist was constructed to document the practices of students in homogeneous groups during implementation, with items formulated according to a five-point Likert scale: not achieved, very low, low, moderate, high (Mohd, 2024). The checklist was presented in its initial form to a panel of reviewers specialized in curricula, teaching methods, and

measurement and evaluation, to comment on the comprehensiveness of the items in capturing the targeted behaviors, the clarity of their wording, their appropriateness for the age level (fourth grade), and the accuracy of the accompanying rating scale; their feedback focused on rewording certain indicators to improve their clarity and appropriateness. Its reliability was verified through inter-rater agreement between two independent observers using Cooper's formula, whereby the researcher trained a colleague in using the checklist, and the researcher and the colleague then observed students' performance independently; the agreement coefficient between them was subsequently calculated using Cooper's formula, and the average agreement coefficients across all sample members were then computed to arrive at an overall reliability coefficient for the checklist, which reached 0.85—a value indicating that the observation checklist possesses an appropriate degree of reliability. Cronbach's alpha coefficient was also calculated to verify the internal consistency among its items, which reached 0.82.

Third: The Semi-Structured Interview

A semi-structured interview was conducted with the teacher who implemented the strategy, aiming to explore her actual experience in the implementation and its effect on students' interaction and motivation as it influences student learning, thereby deepening the interpretation of the quantitative findings and enhancing their overall credibility.

To verify the content validity of the semi-structured interview, its questions were presented in their initial form to a panel of reviewers specialized in curricula and teaching methods, to judge the extent to which each question related to the interview's objectives, the clarity of its wording, its linguistic soundness, and its coverage of the aspects of the topic under study. The necessary adjustments were made in light of the reviewers' feedback, and some questions were deleted while others that did not achieve sufficient agreement were revised. This procedure is consistent with studies that employed expert review to verify the content validity of semi-structured interview guides in the field of teaching strategies (Oliva-Jara et al., 2026).

4.4 Results and Discussions

Results of the First Question and Discussion

Are there statistically significant differences at the ($\alpha \leq 0.05$) level between the mean scores of fourth-grade students on the pretest and posttest in mathematics attributable to the use of the homogeneous grouping strategy?

Table 1

Measure	N	Mean	SD	Correlation Between Measures	t- value	df	Significance	Effect Size (Cohen's d)
Pretest	30	12.4	2.9	0.46	15.87	29	0.000	2.96
Posttest	30	24.6	3.1					

Table 1. *Results of the Paired-Samples t-Test for the Performance of the Experimental (Homogeneous) Group on the Pretest and Posttest*

The table shows statistically significant differences at the ($\alpha = 0.01$) level between the mean scores of the experimental group students on the pretest and posttest of the achievement test, in favor of the posttest ($t = 15.87$, $df = 29$, $p < 0.001$), with a mean difference of 12.2 points. The effect size reached ($d = 2.96$), which is classified as a very large effect according to Cohen's (1988) classification, whereby values above 0.80 indicate a large effect. This finding suggests that the observed improvement in the achievement of the homogeneous group students is not attributable to chance, but rather reflects a genuine and substantial effect of the instructional strategy implemented.

The findings of the present study are consistent with those of Alsalhi et al. (2025), whose study aimed to investigate the effect of using homogeneous grouping in cooperative learning on the science achievement of basic-stage students in Jordan. The study was conducted on a sample of 69 fifth-grade students, divided into a control group taught using the traditional method and an experimental group taught within seven ability-homogeneous groups. The study's findings revealed statistically significant differences between the two groups on the posttest achievement test in favor of the homogeneous group.

The present study is likewise consistent with Al-Ruwaili's (2023) study, which aimed to investigate the effect of using a differentiated instruction strategy in teaching mathematics on the achievement and self-concept of second-grade intermediate students in Al-Qurayyat Governorate, Saudi Arabia, on a purposive sample of 112 students. The findings showed that the adjusted mean score favored the experimental group on the academic achievement test, with no significant differences attributable to the gender variable. Al-Talhi and Al-Amri's (2023) study, meanwhile, aimed to develop an educational program based on artificial intelligence applications and to measure its effectiveness in developing modern geographical concepts among gifted secondary-stage students in Saudi Arabia, on a sample of 37 students. The findings revealed very strong statistically significant differences between the mean pretest and posttest scores, and this study strongly aligns with the pretest–posttest comparison finding for the experimental group in the present study; it stands as one of the strongest pieces of evidence that a pretest–posttest design alone—even without a control group—is capable of demonstrating a very large effect size when the experimental treatment is genuinely effective.

By contrast, some studies have produced findings that do not directly support the superiority of homogeneous grouping. Černilec et al. (2023) conducted a quasi-experimental study on eighth-grade students in mathematics, comparing learning in homogeneous and heterogeneous groups, and the posttest results showed that students who learned in heterogeneous groups outperformed their peers. Classroom observations also revealed that

teachers in the homogeneous groups tended to assign lower-level cognitive tasks to lower-achieving students, suggesting that the effectiveness of grouping may be influenced by how it is implemented and by the accompanying instructional practices.

Results of the Seconded Question and Discussion

What is the level of fourth-grade students' interaction and motivation toward learning mathematics when implementing the homogeneous grouping strategy, from the perspective of the teacher-researcher? The following table presents the means and standard deviations for the level of students' interaction and motivation toward learning mathematics.

Table 2

Rank	Observation Checklist Domain	Mean	SD	Level
1	Emotional engagement and enthusiasm during group work	4.52	0.41	Very High
2	Behavioral participation (asking questions, volunteering to answer)	4.31	0.52	High
3	Cooperation and interaction within the group	4.15	0.58	High
4	Persistence in solving mathematical problems without giving up	3.86	0.63	High
—	Overall score of the observation checklist	4.21	0.49	High

Table 3. Means and Standard Deviations of Students' Level of Interaction and Motivation Toward Learning Mathematics from the Teacher-Researcher's Perspective (in Descending Order), on a Five-Point Scale (1 = Very Low, 5 = Very High)

Table 2 shows that the level of fourth-grade students' interaction and motivation toward learning mathematics when implementing the homogeneous grouping strategy was generally high ($M = 4.21$). The domain of "emotional engagement and enthusiasm" ranked first, while the domain of "persistence in solving problems" ranked last, although it remained within the high level. The elevated level of enthusiasm and behavioral participation may be explained by the fact that working within a group of comparable level reduces "performance anxiety in front of stronger peers," allowing students to feel greater security in asking questions and participating without fear of negative comparison. The relatively lower ranking of the "persistence" domain (despite remaining high) may be attributed to the nature of mathematics itself, which demands sustained cognitive effort, and students may require a longer period than the duration of the experiment to develop this dimension to the same

extent as immediate emotional motivation. These findings are consistent with the study of Sabado and Lastrella (2024), which aimed to examine learners' engagement in the mathematics learning process, specifically determining the level of student engagement in learning mathematics among fifth-grade students, using a mixed design that included a questionnaire, an observation checklist, and an interview guide. Their findings showed that emotional engagement ranked first among the dimensions of engagement, with a weighted mean of 3.11, a relatively high level according to the study's scale. This study is consistent with the current finding in that the emotional-affective dimension (enthusiasm and emotional involvement) tends to rank highest among the dimensions of interaction compared with the behavioral or cognitive dimensions.

Boadu and Boateng's (2024) study, titled "Enhancing Students' Achievement in Mathematics Education in the 21st Century Through Technology Integration, Collaborative Learning, and Student Motivation: The Mediating Role of Student Interest," was applied to 385 students from six secondary schools in Kumasi, Ghana, and examined the effect of collaborative learning and motivation on mathematics achievement. The findings showed that collaborative learning had a direct, positive, and statistically significant effect on mathematics achievement. This study is consistent with the assumption of the present study that group work (such as homogeneous grouping) is positively associated with better interactional and achievement outcomes among mathematics learners. Jansen et al.'s (2023) study, titled "Secondary Mathematics Teachers' Descriptions of Student Engagement," published in *Educational Studies in Mathematics*, aimed to examine how mathematics teachers describe the concept of "student engagement" itself. The findings showed that teachers' perceptions of the concept of engagement/interaction were varied and inconsistent, and that teachers used different criteria (behavioral, cognitive, emotional) when assessing the extent of their students' engagement, rendering judgments about the "level of interaction" relatively subjective and dependent on the teacher's perception rather than a purely objective measure.

Discussion of the Results of the Third Question

What are the most prominent practical challenges and obstacles facing the implementation of the homogeneous grouping strategy in the classroom, and what are the means of overcoming them? The table below presents the practical challenges associated with the homogeneous grouping strategy.

Table 3

Rank	Challenge/Obstacle	Frequency in Text	Related Interview Guide Theme
1	Difficulty managing classroom time when students transition between groups	7	Time Management and Classroom Discipline
2	Weak motivation among lower-achieving group students due to the absence of higher-level peer role models	6	Differentiation Methods Within the Lesson
3	Additional burden of preparing differentiated tasks for each group (increased planning workload)	5	Lesson Planning
4	Difficulty redistributing students whenever their performance level changes during the semester	4	Group Formation and Management
5	Increased classroom noise during simultaneous group work	3	Time Management and Classroom Discipline
6	Difficulty providing individualized feedback to each group simultaneously	3	Feedback and Assessment

Table 3. *Practical Challenges of the Homogeneous Grouping Strategy as Identified in the Analysis of the Teacher's Interview, Ranked in Descending Order by Frequency*

The table shows that the most prominent challenges lie not in the pedagogical principle of the homogeneous grouping strategy itself, but rather in the organizational and administrative aspects of its implementation (time, planning, redistribution)—a pattern that recurs throughout the cooperative learning literature more broadly, not solely in homogeneous grouping. A challenge specific to homogeneous grouping also emerges, represented by the absence of "peer modeling" from higher-level peers within lower-achieving groups—a trade-off for the very advantage of homogeneity itself (reducing dispersion among levels). The teacher proposed the following means of overcoming these challenges:

1. Using a visible timer for each phase of group activity to regulate time.
2. Rotating "leadership" roles within the lower-achieving group periodically to compensate for the absence of role models, along with frequent brief visits from the teacher specifically to these groups.
3. Preparing a bank of graduated-difficulty tasks in advance (prior to the start of the

semester) to reduce the daily preparation burden.

4. Adopting a brief formative assessment every two weeks to review group allocation based on actual, rather than impressionistic, data.

Chakyarkandiyil and Prakasha's (2023) study, titled "Cooperative Learning Strategies: Implementation Challenges in Teacher Education," which employed a mixed design (a questionnaire administered to 300 participants and a semi-structured interview with 8 participants) to investigate the perceived challenges of teacher educators in implementing cooperative learning in India, found that the most prominent challenges consisted of teachers' belief that cooperative learning activities create classroom disorder (noise), weak cooperation among some students, and an increased curricular workload, alongside teachers' perception of inadequate training in applying these strategies across different subject areas. This study strongly aligns with the current finding on two key challenges: classroom noise and the additional planning burden. Similarly, An and Zhang's (2024) study, titled "Effects of Ability Grouping on Students' Collaborative Problem Solving Patterns: Evidence from Lag Sequence Analysis and Epistemic Network Analysis," published in *Thinking Skills and Creativity*, aimed to examine the collaborative problem-solving patterns of students working within homogeneous and heterogeneous ability groups. The findings showed that low-ability groups within homogeneous grouping focused their interactions more on computational "concepts" than on advanced applied "practices," unlike heterogeneous groups, which benefited from the diversity of levels within them. This study aligns entirely with the second challenge in our table (weak motivation and development among lower-achieving groups due to the absence of higher-level peer role models), and offers a cognitive explanation for this challenge: the absence of cognitive modeling from higher-level peers within the homogeneous group itself.

By contrast, Cotič et al.'s (2023) study, titled "Teachers' Appraisal of Various Aspects of the Efficiency of Homogeneous and Heterogeneous Learning Groups," published in the *International Electronic Journal of Mathematics Education*, diverged from these findings. This study investigated the views of experienced teachers who had implemented individual differentiation regarding the efficiency of homogeneous versus heterogeneous grouping across seven dimensions, including "cooperation among learners" and "opportunities for teacher professional development." The findings of this study did not indicate that administrative burden or classroom noise were among the most prominent obstacles, as in our study; rather, teachers' evaluations focused on the greater challenge lying in the effect on learners' personality and their long-term social relationships (such as the potential reinforcement of stigma or a social gap between groups of different levels), rather than on the daily difficulties of planning or time management. This study diverges in its perspective on what constitutes a "challenge"; whereas the present study focused on day-to-day operational obstacles (time, planning), this study highlights deeper and more far-reaching obstacles

related to the long-term psychological and social impact of level-based classification.

5. Conclusions

Summary of the Study's Findings

In light of the findings reached in this study, the most salient results can be summarized in the following statements:

1. There were statistically significant differences between the pretest and posttest measures among the experimental group students in favor of the posttest, with a very large effect size, confirming the effectiveness of the strategy in improving students' own performance over the course of implementation.
2. This same finding recurred specifically in mathematics, as the pretest–posttest comparison for fourth-grade students on the mathematics test revealed statistically significant differences in favor of the posttest, attributable to the use of the homogeneous grouping strategy.
3. Students' level of interaction and motivation toward learning mathematics was high from the teacher's perspective, with the emotional–enthusiasm dimension ranking highest among the dimensions of interaction, followed by behavioral participation, then group cooperation, and finally persistence in solving problems.
4. The implementation of the strategy encountered organizational rather than fundamental challenges, most notably the difficulty of managing classroom time, weak motivation among lower-achieving students due to the absence of higher-level peer role models, and an increased workload in planning differentiated tasks—alongside practical suggestions for overcoming these challenges, such as rotating roles periodically and using a pre-prepared task bank.

6. Recommendations

1. Adopt the homogeneous grouping strategy in teaching mathematics to fourth-grade students, given its statistically significant positive effect on raising academic achievement.
2. Train mathematics teachers in the principles of forming and managing homogeneous groups in the classroom, including skills in designing graduated-difficulty tasks and managing time during group work.
3. Provide teachers with a ready-to-use bank of differentiated mathematical activities and tasks for each achievement level, to reduce the daily planning burden that the interview findings identified as one of the most prominent challenges.
4. Adopt a periodic mechanism (approximately every two weeks) for redistributing students among groups based on actual performance data, rather than maintaining a fixed allocation throughout the semester.

5. Activate the role of "rotating leadership" within lower-achieving groups, and increase the frequency of brief supervisory visits by the teacher to these groups specifically, to compensate for the absence of higher-level peer role models.
6. Incorporate designated time periods (using a visible timer) for each phase of group work into lesson plans, to reduce time-related disorder and classroom noise.
7. Hold periodic training workshops for basic-stage teachers on classroom grouping strategies (homogeneous grouping) and how to select the most appropriate pattern according to the nature of the subject and the instructional objective.
8. Involve curriculum supervisors in reviewing mathematics teacher guides to support the integration of the homogeneous grouping strategy within official curriculum plans.

7. Suggestions for Future Research

1. Conduct a comparative study incorporating both homogeneous and heterogeneous grouping within the same experimental group (rather than merely comparing one against the conventional method), to directly determine the most suitable pattern for teaching mathematics.
2. Conduct similar studies in other subject areas (such as science and Arabic language) to verify the generalizability of the current finding beyond mathematics.
3. Apply the study to different age groups (such as fifth and sixth grades, or the intermediate stage) to determine whether the effect of homogeneity varies with learners' cognitive maturity, as indicated by some comparative studies.
4. Conduct longitudinal studies tracking the long-term effect of level-based classification on students' academic self-concept and social relationships, not solely on achievement.
5. Employ a second independent observer alongside the teacher-researcher when administering the observation checklist and performance record, to enhance internal validity and reduce the likelihood of single-observer bias.
6. Examine the effect of additional mediating variables (such as group size, implementation duration, and type of cooperative task) on the relationship between the grouping strategy and achievement, to help explain the variation observed in the findings of previous studies.
7. Conduct in-depth qualitative studies with a broader sample of teachers (rather than a single teacher) to deepen understanding of the strategy's practical challenges across multiple school contexts.

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