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فعالية نموذج كاجان في تحصيل طلاب الصف الرابع في مادة الرياضيات

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المستخلص

الهدف من هذه الدراسة هو الكشف عن مدى فاعلية نموذج كاجان للتعلم التعاوني في تحسين الأداء الأكاديمي لطلبة الصف الرابع العلمي في المدارس الثانوية بمحافظة نينوى، العراق. شارك في الدراسة عينة مختارة بعناية مكونة من ستين (٦٠) طالباً، تم توزيعهم عشوائياً بالتساوي إلى مجموعتين: مجموعة تجريبية وأخرى ضابطة، تضم كل منهما ثلاثين طالباً. وقد تم التأكد إحصائياً من تكافؤ المجموعتين في عدد من المتغيرات الأساسية مثل العمر الزمني، درجات اختبار الذكاء (IQ)، ونتائج الاختبارات القبلية التي تهدف إلى قياس المعرفة والقدرات العلمية الأساسية. اعتمدت المجموعة التجريبية على نموذج كاجان، الذي يركز على التعلم التعاوني، والمشاركة الفاعلة، والأنشطة الجماعية المنظمة التي تعزز التواصل، والتعاون، والتفكير النقدي، كأساس لإستراتيجيتهم التعليمية. بينما تلقت المجموعة الضابطة تعليماً تقليدياً يعتمد بشكل رئيس على المعلم، ويقوم على المحاضرة والعمل الفردي. وخلال الفصل الدراسي، تم إعداد اختبار تحصيلي دقيق مكون من ٢٥ سؤالاً موضوعياً من نوع الاختيار من متعدد، تم تصميمها بعناية لتقييم مجموعة متنوعة من القدرات المعرفية، من استرجاع المعلومات إلى التطبيق والتحليل. وقد خضع الاختبار لعدة خطوات صارمة لضمان الصدق والثبات، بما في ذلك مراجعات الخبراء والتجريب الأولي. وبعد انتهاء الفترة الدراسية،



تم تطبيق الاختبار على كلا المجموعتين تحت ظروف موحدة. ولاكتشاف ما إذا كان أداء المجموعتين يختلف بشكل دال إحصائيًا، تم تحليل البيانات باستعمال اختبار "ت" لعينتين مستقلتين. وأظهرت النتائج عند مستوى دلالة ٠.٠٥ ($\alpha \geq 0.05$) وجود فرق معنوي لصالح المجموعة التجريبية التي تم تعليمها باستعمال نموذج كاجان. تشير النتائج إلى دليل قوي على التأثير الإيجابي لنموذج كاجان في تحسين الأداء الأكاديمي للطلاب في مادة الرياضيات. فإلى جانب تحقيقهم أداءً أفضل من نظرائهم في المجموعة الضابطة، أظهر طلاب المجموعة التجريبية فهمًا أعمق وقدرة أكبر على استرجاع المفاهيم الرياضية. ووفقًا لذلك، فإن استراتيجيات التعلم التعاوني التي يتضمنها نموذج كاجان - مثل "فكر-شارك"، و"رؤوس مرقمة معًا"، والأدوار الجماعية المنظمة - تُعزز مهارات التواصل بين الأفراد، وتخلق بيئة تعليمية إيجابية، وتُشجع على التفاعل الفعّال مع المادة العلمية. وتُبرز هذه النتائج كيف يمكن للمقاربات التربوية المبتكرة والمتمركزة حول الطالب أن تُحدث تحولًا جذريًا في ديناميكيات التعليم داخل الصفوف الدراسية، وتساهم في رفع المعايير الأكاديمية في سياق التعليم الثانوي في العراق. وبناءً على ذلك، توصي الدراسة بتوسيع تطبيق نموذج كاجان للتعلم التعاوني في تدريس مادة الرياضيات وربما في المواد العلمية الأخرى، بهدف تعزيز التعلم العميق، والتفكير النقدي، ورفع مستوى الأداء الأكاديمي لدى الطلاب.

الكلمات المفتاحية: نموذج كاجان، طريقة التدريس، التحصيل الرياضي، الصف الرابع، التعلم التعاوني.

The Effectiveness of Kagan's Model in Mathematics Achievement of Fourth Grade Students

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Abstract

The reason for this inquiry is to discover how well the Kagan Agreeable Learning Demonstrate works in progressing the scholarly execution of fourth-grade understudies in Nineveh, Iraq's logical auxiliary school. A carefully chosen test of sixty (60) understudies took part in the ponder. They were separated into two breaks even with bunches at irregular, one for the exploratory gather and one for the control bunch, each of which had thirty understudies. Both bunches were factually affirmed to be break-even. Recently, the guidelines mediation began in some imperative ranges, such as chronological age, IQ scores, and execution on pre-tests, aiming to gauge standard scientific information and capacities. The Kagan demonstration, which stresses agreeable learning, dynamic inclusion, and arranged team-based exercises that advance communication, collaboration, and basic considering, served as the establishment for the test group's directions methodology. The control bunch, on the other hand, was teaching utilizing customary instructing methods, which are ordinarily teacher-centered and generally depend on personal work and lecture-based conveyance. Over the semester, a careful accomplishment test was made with 25 objective multiple-choice questions that were mindfully made to assess an assortment of cognitive capacities, from application and examination to data review. To ensure its legitimacy and unwavering quality, the test experienced some rigid forms, such as master assessments and pilot testing. Both bunches were given the accomplishment test beneath standardized circumstances after the course hour. To find out on the off chance that the execution of the exploratory and control bunches contrasted factually altogether, the assembled information was inspected utilizing an autonomous tests t-test. At the alpha level of 0.05 ($\alpha \geq 0.05$), the investigation appeared a critical contrast in favor of the exploratory gather that was instructed utilizing the Kagan demonstration. The results offer solid confirmation of the Kagan model's useful impacts on pupils' scholastic execution in science. In addition to doing superior, to their partners within



the control gather, understudies within the test bunch also appeared a more noteworthy comprehension and review of numerical thoughts. Concurring to this, the agreeable learning procedures included in Kagan's model think-pair-share, numbered heads together, and organized group roles enhance interpersonal communication aptitudes, empower a positive learning air, and energize more viable engagement with the fabric. These discoveries demonstrate how inventive, student-centered pedagogies can alter the elements of classroom instruction and raise scholarly guidelines within the setting of auxiliary instruction in Iraq. In arrange to advance more profound learning, basic considering, and scholarly execution among understudies, the think recommends a more extensive execution of the Kagan agreeable learning show in science preparation and maybe other logical themes.

Keywords: Kagan's model, Academic achievement, fourth grade,

1. Introduction

Global mathematicians have presented many definitions of mathematics; Paul Lockhart claimed, "Mathematics is the music of reason.". Roger Bacon defined it as "the door and key of the sciences.". At the same time, Henri Poincaré described mathematics as "the art of giving the same name to different things." Generally, mathematics is considered a scientific manner that relies on logic and logical mental thinking. So, we can present it as a science of creativity of the human mind. Moreover, its most prominent feature is that it uses spontaneity, imagination, and accuracy of observation. These features enabled it to be an approach for present and future learning in all fields of life. On the other hand, patterns, skills, laws, and concepts are the fundamentals of mathematics. These fundamentals give us a new vision of things and affect our lives (Rafiepour & Farsani, 2021). From the above, it becomes clear that mathematics is not just a science but a way of thinking and creativity beyond numbers. By teaching mathematics innovatively, individuals can use this science to develop their skills,



understand the world's ambiguity, and contribute to solving future challenges.

Be that as it may, it is getting to be more broadly recognized that progressing feasible development which intensely emphasizes instruction and learning as the foundations of societal advancement is one of the most important needs of the twenty-first century. Policymakers and other instructive partners, such as administrative teachers, non-governmental organizations, and outside accomplices, must hence donate the instructive to prepare cautious thought. Giving instructors and school administrators the help they ought to execute cutting-edge, creative, and fruitful instructing procedures that meet the changing necessities of understudies could be a significant component of this center. The educational programs, instructing strategies, understudies, and classroom environment are a few of the elemental components that must work concordantly together for the instructive preparation to be successful. The educational modules stand out as the foremost imperative of these since they give the system for mental development and the exchange of information. Arithmetic features a pivotal and essential place within educational programs. It is recognized as a fundamental instrument for creating students' expository considering, coherent thinking, and problem-solving aptitudes in expansion to being an essential scholastic point. Instructing students in arithmetic is fundamental to supplying them with the apparatuses they need to exceed expectations in an assortment of real-world scenarios. Its thoughts and strategies are utilized in numerous other fields and divisions, either specifically or by implication. Additionally, a country's advancement and capacity to compete universally are specifically related to the scientific aptitudes of its individuals, which serve as the establishment for logical investigation, building, innovative advancement, and urban improvement. Numerous countries around the world have begun major instructive framework changes, particularly within the arranging and conveyance of science educational programs, in response



to the fast progressions in science and innovation. Modernizing fabric, utilizing new educational approaches, and planning learning goals with the requests of society and the objectives of coming eras are the objectives of these changes. Since then, schools particularly in mathematics have progressed rapidly and obviously, reflecting best hones based on research and worldwide patterns. In light of this, there has been an expanding accentuation on reexamining and improving direction procedures, which are basic for proficient information improvement and teacher-student communication. Approaches that join the thoughts of constructivist learning speculations are especially useful for instructing arithmetic. These strategies put a solid accentuation on students' dynamic support within the learning handle and empower them to steadily increment their get a handle on the fabric by moving from essential ideas to more theoretical and advanced ideas. Mastering a theme like arithmetic, which needs a tall level of cognitive engagement by nature, requires these guidelines way. Scientific problem-solving as a rule begins with principal truths, hypothesizes, and adages some time recently moving on to conclusions and hypotheses utilizing methods based on deductive thinking and rationale. In this manner, it is basic to utilize direction techniques that reflect this conceptual system in arrange to assist understudies grow their scientific considering, ensure superior understanding, and develop a deep-rooted intrigue within the subject. (Chu et al., 2019).

Various universal considerations have brought consideration to a repeating issue within the field of instruction, which is the destitute math achievement levels of kids in numerous countries. This design is additionally shown in Iraq. Particularly, Iraqi understudies at all instructive levels have persistently performed insufficiently in science, an issue that scholastic researchers, teachers, and lawmakers have continuously recognized. This stress has been backed within the Iraqi context by reports from companions who are basic of the school, dynamic instructors, and specialized administrators of arithmetic, especially within the Nineveh Governorate,



who have seen and confirmed the insufficiencies in students' numerical execution and comprehension. The analysts conducted field trips to some chosen auxiliary schools in Nineveh in an endeavor to completely look at this issue. The reason for these visits was to evaluate fourth-grade logical department pupils' execution in science, a scholarly stream that's fundamental for those who arrange to continue their instruction in logical and specialized subjects. Agreeing with the results of these school visits, pupils' scientific capability was recognizably missing, supporting past discoveries and illustrating the reality of the issue within the auxiliary school organization of instruction. Analysts and specialists within the field of science instruction habitually fault this scholastic inadequacy on the discipline's inherent structure. Since of the total structure of arithmetic, securing and comprehension of unused thoughts depend altogether on existing information. Understudies discover it more challenging to get it progressively complicated substance in later grades when they are incapable to legitimately get a handle on center concepts at an prior arrange of their academic career. This difference in past information speaks to a major deterrent to conceptual understanding and scholastic progression. The instructing methodologies utilized within the classroom have an enormous effect on students' learning resulting in the expansion of the auxiliary troubles within the subject. The conventional educating fashion is still the foremost common approach in numerous Iraqi classrooms, particularly when it comes to instructing science. This approach for the most part depends on detached data gathering, repetition memorization, and coordinated instruction. Understudies habitually need the opportunity to take an interest definitively or apply scientific thoughts in an assortment of real-world circumstances. Understudies are in this way denied the opportunity to have an intensive and comprehensive understanding of the subject, which ruins their capacity to apply what they have learned to novel problem-solving scenarios. Since each thought builds on the one sometime recently, science as a science is inherently connected. As a result, a careful



understanding of prior numerical points is vital to completely get it a show issue. Because of this reliance, instruction must move absent from memorization and toward more energetic, intuitive approaches that foster higher-order considering capacities counting deduction, coherent thinking, explanatory considering, problem-solving, revelation, and generalization. These procedures give a strong cognitive base that advances scholarly accomplishment at all instructive levels and lifetime learning. Elective instructing strategies that prioritize understudy association, conceptual understanding, and dynamic learning are becoming increasingly essential in light of these troubles and within the look for stronger ways to make strides in math learning. The Kagan Agreeable Learning Demonstrate is one such promising procedure that follows the precepts of the constructivist learning hypothesis. Through arranged, collaborative exercises, this model fosters mental engagement and highlights the learner's part as a dynamic member within the instructive handle. A few intelligent techniques, such as "Think-Pair-Share," "Numbered Heads Together," and "Team-Based Learning," are joined into Kagan's paradigm to advance participation, peer instruction, and the social creation of information. These methods not as it were make strides in cognitive improvement but also cultivate the development of communication and interpersonal abilities as well as a strong learning environment within the classroom. In arrange to progress the numerical capability of fourth-grade logical department understudies in Nineveh, Iraq, this study recommends utilizing the Kagan show as an academic intercession. The venture points to surveying how well agreeable learning hones based on the constructivist hypothesis may alter the science classroom into an energetic, student-centered setting where significant comprehension and important learning can flourish. (Kalpana, 2014). One of the relatively recent models based on the principles and assumptions of constructivist theory is the Kagan model based on cooperative learning, as it helps the student become more active and in contact with the book more than in his previous experiences (Chophel & Norbu, 2021). In this model,



the student plays an active role in learning. We always force the student to use scientific thinking to discover the gained experience and declare it whatever it is. While constructing his learning ideas, the student must manage and evaluate the learning process. In this case, the student is more active than in the previous explorations to discover appropriate solutions. The student is placed in different learning situations to be able to discuss, argue, and impose assumptions and investigations instead of receiving information. Thus, the student reaches the stage of discovery and criticism (Olusegun, 2015).

Many researchers worldwide have presented valuable research on the concept of cooperative learning based on Kagan's model. Van Dat Tran presented a paper about the effects of cooperative learning. His experimental study sample was 110, and the experiment was over eight weeks; the results confirmed the effectiveness of cooperative education (Tran, 2014). Didem Bilen et al. offered an experiment on learning vocabulary skills based on cooperative learning, and the findings explained the superiority of the new strategy over the traditional education method (Bilen & Tavit, 2015). (Akçay, 2016). Many research papers in learning and education confirm the efficacy and effectiveness of cooperative education as a proposed approach to teaching mathematics, science, and languages (McMaster & Fuchs, 2002; Shafiee & Branch, 2017). In this study, we will try to prove that our proposed approach is workable to teach mathematics.

2. Theoretical Background and Related Work

This section aims to provide a comprehensive understanding of the fundamental concepts, which revolve around the notions of research gap, rationale of the study, effectiveness, and achievement, as well as Kagan's model. We will delve into the details of these concepts, exploring their significance and implications in the context of the manuscript's subject matter, through the procedural definition of research variables.

2.1. Research Gap



When I began exploring math education in Iraq, I encountered a significant obstacle fairly quickly. There is a wealth of research available on teaching methods, but relatively little information is available about what is happening in places like Nineveh, where students are struggling with subjects such as algebra or trigonometry. Globally, people rave about cooperative learning—approaches where kids work together to figure things out—and there's solid evidence it helps. But when it comes to using something like Kagan's cooperative model for math in Iraqi secondary schools? Almost nothing. That surprised me, because math is such a critical subject, and Iraq's challenges seem like the perfect place to test new ideas.

During a few school visits in Nineveh, I saw the issue up close. Fourth-grade scientific stream students were struggling—not just with tough concepts, but with staying interested. Teachers told me the usual method—stand up, explain, assign homework—isn't working. Kids memorize but don't understand, and since math builds on itself, that's a recipe for trouble. Most studies I found either talk about traditional teaching in Iraq or cooperative learning elsewhere, like in Europe or Asia, and they don't tackle the specific mix of outdated curricula and passive classrooms we have here. There's a real opportunity to try something like Kagan's model, where students collaborate and think actively, but no one's really tested it for math in this setting. That's what this study wants to explore, it can bridge that gap and help students get better at math.

2.2. Rationale

This entire venture began with an address: how can we make math press for understudies in Nineveh? I've seen as well numerous kids in fourth-grade logical classes as well as bored or misplaced amid math lessons, and it's not their blame. The way math is instructed in a part of Iraqi schools' teacher talks, understudies duplicate, and everybody memorizes' feels like it's stuck in the past. Math isn't close to getting the proper reply; it's almost perplexing through issues, making associations, and feeling like you've broken a code. That's why I'm energized almost attempting Kagan's agreeable learning



demonstration. It's all almost getting understudies to group up, conversation through thoughts, and illuminate issues together, which appears like an idealize fit for a subject that flourishes on thinking. I'm inclining on constructivist thoughts here the idea that individuals learn best when they are building information themselves, not fair gulping realities. Math is particularly extreme since on the off chance that you miss something early, like how divisions work, afterward stuff like conditions gets muddled. When I chatted with instructors in Nineveh, they kept saying the same thing: kids are slipping through the splits since they are not locked in. Kagan's approach, with its gathering exercises and shared tasks, seems to alter that. Envision understudies debating how to illuminate a geometry issue rather than fair tuning into a lecture' that's the kind of start I think seems to make a distinction. Also, in a world that values cooperation and problem-solving, this strategy feels right for planning understudies past the classroom. My trust is to test this demonstration and see in the event that it can deliver instructors and policymakers something down to earth to work with.

2.3. Effectiveness

In educational papers, the effectiveness of educational models is considered independent, while academic achievements depend on it (Lockheed & Hanushek, 1994). So, we measure how significant this effect is because the practical model is not necessarily the most efficient. In this paper, the effectiveness of Kagan's model was considered an independent variable, while the students' achievement was a dependent variable. In simple terms, it is the amount of influence of the variable (Kagan model) on the dependent variable (academic achievement).

2.4. Achievement

UNESCO defined achievement tests as "the performance in examinations that measure scientific knowledge of a specific knowledge field". In simple terms, academic achievement was defined procedurally as the amount of information and knowledge acquired by students and the ability to apply it in new situations. Its degree is measured through a test



prepared for this purpose. In this work, the achievement test for students was prepared based on the specification table (Anderson, 1972; Ing et al., 2015). The specifications table was built after determining curriculum contents and behavioral objectives based on the cognitive field of Bloom's classification. The achievement test was offered to a sample of mathematics teachers and supervisors to consult them about the test. It was prepared to reflect the educational outcomes and situations planned during his teaching. In this study, the results for both the control and experiment groups were based on the prepared objective test for students that consisted of 25 multiple-choice items with four alternatives. The marks of the test are as follows: each item has (4 M.), the marks range from [0- 100], and the hypothetical mean is (50 M.).

2.5. Kagan's Model

Cooperative Kagan learning has three dimensions: social dependence dimension, cognitive (cognitive) development dimension, and behavioral dimension. These features tempted researchers to adopt this model. Kagan's model is a contemporary approach to cooperative learning, which focuses on restructuring students' thinking patterns, enhancing their skills, providing a realistic perspective on things, fostering self-esteem and confidence, promoting creativity, and cultivating teamwork (Davoudi & Mahinpo, 2012; Goulart, 2022; Singay, 2020). In this work, Kagan's model was defined procedurally as a set of strategies that deal with the individual differences of fourth-grade secondary school students and that represent the basic structure of each lesson through the interaction between the strategy and the lesson content represented by the chapters of the mathematics book.

3. Proposed Approach

Our instructing technique, which is based on Kagan's Agreeable Learning Show, has been carefully created to comply with the basic thoughts of agreeable learning. These thoughts shape the foundation of a guidelines approach that advances cooperation, individual obligation, and reasonable participation all of which lead to more critical and long-lasting



learning comes about. The basic columns of our usage are spoken to by the following elements:

1. Positive Interdependence: This central rule of agreeable learning emphasizes the thought that understudies perform way better when they offer assistance to one another than when they work alone. This thought places understudies in a collaborative environment where each student's accomplishment is closely connected to that of their peers. In this collaborative learning environment, each student's scholastic improvement gets to be a collective accomplishment. The classroom energy is implied to take after an agreeable "trench," where understudies must offer assistance to one another, endeavor toward shared objectives, and get it that no one can succeed until the bunch as an entirety does. This advances cooperation and collective obligation.

2. Individual Responsibility: Indeed when gathering errands is a portion of agreeable learning, each participant must take individual responsibility. When we put it into hone, typically accomplished by relegating characterized parts to each understudy inside the gather. These parts are not discretionary; each understudy is committed to contributing effectively and genuinely to the learning handle. This guarantees that each understudy is held responsible for their learning and disheartens detached interest or social loafing. Through this instrument, understudies learn the significance of duty, self-management, and the part they play in contributing to collective results.

3. Equal Participation Through Structured Interaction: In arrange to guarantee decency and avoid prevailing voices from eclipsing others, our approach carefully plans and controls understudy interaction. The conveyance of parts is think and impartial, making openings for each understudy to take an interest. This technique not as it were fortifies decency but also makes a difference create a wide extend of interpersonal and communication abilities, as understudies must take turns, tune in effectively, and contribute thoughts in a collaborative environment. By leveling the



playing field, each understudy is enabled to lock in with the substance, express their consideration, and learn from others.

Simultaneous Interaction: One of the one-of-a-kind highlights of Kagan's is its accentuation on maximizing engagement through concurrent interaction. Instead of depending on successive, teacher-led addressing that includes as it were one understudy at a time, this show empowers respective and group-based trades.

4. Through structures like pair-share exercises or little bunch talks, understudies lock-in in dynamic support concurrently. This duplicates the volume of understudy engagement, viably multiplying or tripling the number of dynamic members at any given minute, in this manner expanding cognitive movement and developing understanding.

A. The Changing Role of Instructors and Understudies:

Both teachers' and students' roles changed on a very basic level changed in this concept. Rather than serving as the elite source of information, the teacher's work shifts to that of a direct facilitator. The teachers closely watch how students associate with one another, give incite comments, and help with the learning preparation by helping understudies create exact comprehension and logical thinking. Instructors must so obtain and show an extent of direction capacities, such as:

- The skill of making provocative, open-ended requests.
- The ability to effectively control bunch elements and discussions.
- And the creation of curious and noteworthy learning settings that empower collaboration, problem-solving, and higher-order considering.

At the same time, understudies got to be more included and able in their claim instruction. They are presently active creators of understanding instead of detached buyers of data, participating to fathom issues, investigate scientific thoughts, and express their suppositions.

B. Educational Impact



Our instructing methodology points to making a more energetic, student-centered, and locks-in learning environment by joining Kagan's agreeable learning strategies. This cultivates the advancement of arithmetic information whereas moreover progressing vital life abilities like expository considering, communication, cooperation, and responsibility. In science instruction, where conceptual understanding and problem-solving require both personal understandings and gathered thinking, these come about are particularly vital. To whole up, Kagan's show gives a careful and adaptable establishment for improving math instruction. By bridging the hole between hypothesis and hone, it gives an implication of restoring ordinary classrooms and setting up the social and cognitive underpinnings required for both scholastic and personal success. (Pfänder & Couper-Kuhlen, 2019).

The students have different roles like team leader, team rapporteur, maintenance official, supporter or encourager, and timer. The team leader is responsible for directing individuals toward achieving the desired goal or task, preventing them from wasting time. The team rapporteur is responsible for writing, recording, presenting, and summarizing the discussions and decisions reached by the team. The maintenance official is responsible for receiving and returning the materials and tools from the teacher and arranging the place after the teams finish their work. Supporter or encourager has an essential social role in the team; it serves as reinforcement for students. The timer has an elementary role, but it is essential for the team as it helps them control the work speed by recording the time taken and the rest.

Our proposed approach relies on some of Kagan's (class-building / Team-building) structures, which are (Line-Ups, Find Someone, Who, Mix-Pair-Share, Corners, RoundRobin, Fan-n-Pick, Team Charades, Placemat Consensus) according to the nature of the material and the ability and abilities of the students. Kagan structures allow the learner to express his opinion by participating in classroom activities and solving problems. It puts the content in an attractive and exciting framework that contributes to



investing time and motivation to work and achieving success for the team to which he belongs.

Finally, our approach was built to be concerned with students' differences. The model is an interaction between the teaching method and the academic content based on the cooperative concept to form an attractive activity (Davidson, 2021; Murphy et al., 2005; Simpson, 2011).

3.1.Study Objective

In this paper, we tried to discover the effect of the independent variable (Kagan's model) as a method for teaching mathematics, on the dependent variable (achievement in mathematics of scientific branch fourth grade-grade students). The idea was born after extrapolating the results of the students as well as listening to school-critical friends' testimonies and specialist mathematics supervisors' observations about the disorder in mathematics results. To determine the effectiveness of using Kagan's model as an approach to teaching mathematics, we proposed the following statistical hypothesis: There is no statistically significant difference at the 0.05 level between the mean scores of the experimental group students who will study mathematics according to the Kagan model and the mean scores of the control group students who will study the same subject using the traditional method of achievement.

As appeared in Figure 1, our study's plan was established on a controlled test strategy. Sometime recently the educating procedures were utilized, it was fundamental to set up equivalency between the exploratory or experimental and control bunches in terms of critical variables in arrange to ensure the legitimacy of the about. These variables included pre-test math aptitudes, age, and IQ test comes about (see Table 1). A one-way Examination of Change (ANOVA) was utilized to survey the groups' homogeneity concerning these characteristics. The ANOVA's discoveries, which are shown in Table 2, illustrated that there were no measurably noteworthy contrasts between the bunches since the p-values for each variable beneath examination were higher than the centrality level of 0.05.



This recommends that in terms of age, IQ, and past arithmetic skills, the two bunches were comparative and homogeneous. To back these up, a free tests t-test assuming rise to changes was performed. Moreover, the t-test discoveries appeared that all p-values were higher than 0.05, affirming that there were no factually noteworthy changes between the test and control bunches earlier to the intercession. We found from this examination that the test bunches were adjusted and factually rose. This equivalency recommends that the educating procedure was the as it was testing variable included to think about, empowering an authentic examination of its effect on understudy execution. Appropriately, the strategy of instruction (Kagan agreeable learning show vs. conventional instructing strategy) was taken care of as the free variable in this test set, whereas understudy achievement in science was the subordinate variable. This kind of test control ensures that any varieties in accomplishment scores that are taken note of can as it were be connected to the kind of educating technique utilized. Fourth-grade logic department students registered in auxiliary schools within the Nineveh Governorate, Iraq, made up the study population. The students who went to Rashida Tall School within the 2022-2023 school year made up the examining outline. The vital of school provided significant data about the understudies, and the school organization chose the test arbitrarily. The substance of the arithmetic educational programs was carefully inspected and altered to fit the proposed instructing strategy in arrange to ensure that the instructing methods coordinated the course materials. The chosen subject ranges were trigonometry, examples and roots, conditions and imbalances, and numerical logical of which are fundamental components of the fourth-grade logical educational modules. Comprehensive lesson plans and behavioral destinations were created for the test and control bunches based on this data. The whole test was to begin with part into two bunches at irregular: 31 students within the test gather, who were teaching utilizing the Kagan agreeable learning show, and 32 understudies within the control group, who were educating utilizing customary lecture-based procedures.



To ensure the exactness and consistency of the discoveries, three understudies who had fizzled were not included in the factual investigation amid the consideration. As a result, 60 understudies made up the ultimate test measure, which was part similarly between two break-even and comparable bunches of 30 understudies each. To coordinate the preparation handle, 164 behavioral targets were created in agreement with the best guidelines in instructional design. These objectives, which tended to cognitive levels of counting information, understanding, application, investigation, blend, and appraisal, were systematically organized in understanding with Bloom's Scientific classification. A solid system for assessing how well the Kagan show progresses students' numerical achievement is given by the fastidious arrangement of curricular fabric, instructing approach, and directions goal.

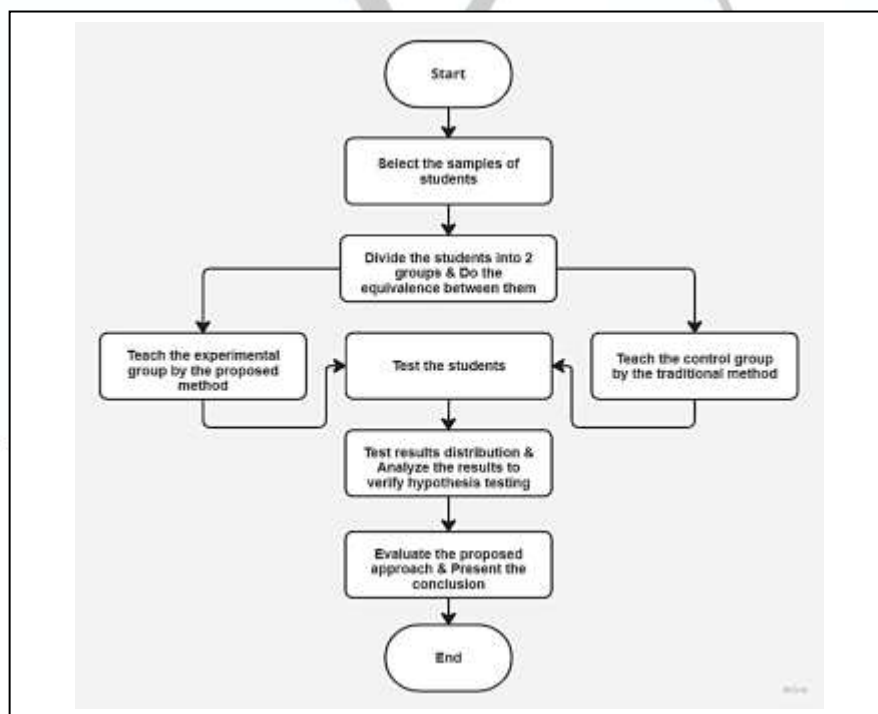




Chart 1. The Experiment Flowchart

Table 1. Samples Data Details

Variables	Control			Experimental		
	Average $\pm$ STD	Min	Max	Average $\pm$ STD	Min	Max
Age in Months	199.733 $\pm$ 3.855	191	204	199.366 $\pm$ 3.478	193	204
Pre-test	65.800 $\pm$ 9.910	51	91	66.066 $\pm$ 10.151	50	95
IQ test	87.8 $\pm$ 4.928	81	102	88.5 $\pm$ 4.104	81	98

Table 2. Details Equivalence of Samples Data

Variables	Anova (p-Value)	T-test (p-Value)
Age in Months	0.901514	0.705128
Pre-test	0.496526	0.919726
IQ test	0.970975	0.559023

4. Results and Discussion

This area gives an intensive clarification and abstract of the exploratory comes about, with specific consideration to the exploratory or experimental group and the control, group that comes about on the scientific accomplishment test (see Table 3 and Figure 2). These come about, come from the body of our thinking about, and constitute the premise for surveying how well the Kagan agreeable learning show works to raise students' scholastic accomplishment in science. The achievement test comes about for both bunches that were subjected to the Kolmogorov-Smirnov Test for Typicality in arrange to start the measurable investigation. In arrange to continue with parametric measurable tests, it was essential to find out whether the dispersion of the information that was accumulated complied with the suspicions of commonality. The exploratory or experimental group's p-value for the Kolmogorov-Smirnov test was



0.40918, whereas the control group was 0.32819. We induce that the information from both bunches takes after dissemination that does not altogether shift from typicality since both values are more prominent than the noteworthiness level of 0.05. This disclosure bolsters the utilization of parametric quantifiable strategies to fortify and investigate. The theory of the ponder was tried by organizing and analyzing the information obtained from the understudies in both groups' science and mathematics accomplishment tests comes about. "There's no quantifiably essential separate at the 0.05 level between the pitiless accomplishment scores of the understudy's interiors the exploratory bunch who assessed science utilizing the Kagan wonderful learning illustrate and those interiors the control bunch who reviewed the same surface through schedule instructing strategies," they concluded.

The analysts computed the number-crunching cruel and standard deviation of the test comes about for the exploratory and control bunches in arrange to evaluate the reasonability of this theory. These measurements were calculated to empower coordinate comparison and to characterize the execution changeability and central inclinations inside each bunch. Table 4, which shows the numerical aberrations in accomplishment scores between the two educating approaches, is the result of a systematic organization and introduction of the factual comes about. In arrange to discover if the watched varieties in cruel scores are critical or may have happened by mischance, this investigation serves as the establishment for advanced factual testing. In differentiation to the comes about of the conventional instructing strategy, we trust to survey whether the application of the Kagan show comes about in a quantifiable and factually noteworthy increment in students' numerical accomplishment by comparing the performance metrics of the two bunches. The comes about of inferential factual tests, just like the autonomous tests t-test, will appear and be clarified within the following subsections in arrange to bolster or negate the most preface. These come about will include a bigger discussion on the adequacy of agreeable learning



procedures and how they might move forward the standard of science instruction in auxiliary schools in Iraq.

Table 3. Achievement Test Score Details

Groups	Average	±	Mi	M	Medi
	STD	n	ax	an	
Control	68.466±	13.200	40	10	64
Experiment	80.533±		36	10	80
al	12.6483		0		

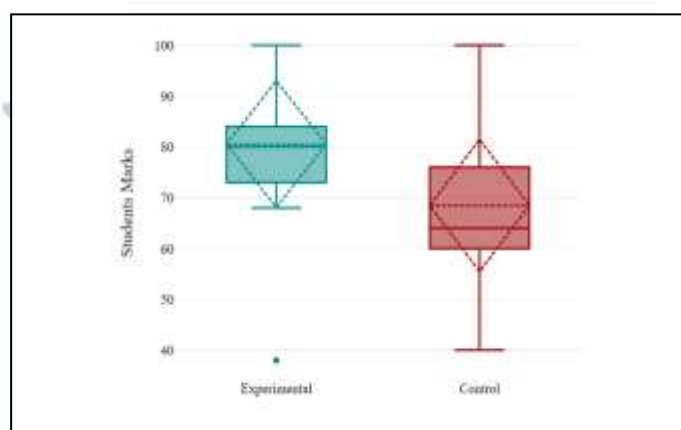


Figure 2. The Graph of the Distribution of Student Scores

Table 4. t-test result

t-Statistical	D	T-tabular	p-value
F			
3.615091793	58	2.001717484	0.000629537

The factual investigation delivered solid proof supporting the viability of the recommended instructing methodology based on Kagan's agreeable learning show, as appeared by the information displayed in Table 4. In specific, the t-test yielded a p-value of 0.000629537, which is significantly lower than the standard alpha limit of 0.05. The invalid speculation is emphatically rejected in light of this finding and the



computed t-statistic esteem of 3.615091793, which is higher than the vital t-tabular esteem of 2.001717484. As a result, the elective speculation is acknowledged, demonstrating that there's a factually critical distinction between the test and control bunches. This distinction is assist highlighted by looking at the cruel and middle execution scores, which show that understudies within the exploratory gather performed almost 12.07 and 16 focuses superior to those within the control bunch, separately. The interesting instructing approach based on Kagan's agreeable learning systems is directly capable of this critical increment. Understudies who took portion in the exploratory intercession appeared more profound engagement and conceptual understanding, as proven by the watched scholastic picks up, which are not fair factually noteworthy but moreover instructively noteworthy. The analysts see these come about as compelling proof that students' approaches to, intuition with, and inevitable internalization of scientific concepts were significantly modified by the agreeable learning environment that Kagan's show advanced. Understudies were energized to precise their suppositions, have academic discussions, and work together to illuminate issues by effectively taking an interest in organized ventures. On the side of cognitive improvement, this approach cultivated individual development by cultivating the advancement of interpersonal abilities and self-confidence. In this setting, arithmetic was now not seen as a single or threatening subject but maybe as an energetic, intuitive encounter. The understudies were not detached beneficiaries of data; instead, they were co-constructors of information. Through instruments such as thought sorting, data preparation, collaborative meaning-making, and relevant application inside a social gathering, learners created a more significant and enduring understanding of the fabric. These hones adjust with the standards of the constructivist instructional method, emphasizing that significant learning happens when learners are effectively involved in constructing their possess understanding. Moreover, Kagan's paradigm's social component significantly upgraded a feeling of community and Kagan's paradigm's



social component too significantly upgraded a feeling of shared accountability responsibility. Understudies have to perform certain assignments while working in groups in arrange to support the group's learning. Each student's continued support and responsibility were ensured by this structure. By raising your voice, their basic considering and passionate insights by talking up, tuning in to others, and tending to scholastic issues. These capacities are vital for victory within the classroom and the genuine world. Our responsibility. Understudies ought to perform certain errands while working in bunches in arrange to bolster the group's learning. Each student's proceeded support and responsibility were ensured by this structure. Through talking up, tuning in to others, and settling scholarly issues, understudies created their basic considering and passionate insights. These abilities are fundamental for both real-world and scholastic accomplishment. Moreover, the agreeable learning setting cultivated an environment within the classroom that was stamped by scholastic intrigue, regard for one another, and support. Since they saw examining as a shared enterprise instead of a chore, understudies detailed feeling more motivated and energetic to lock in lessons. This inside drive comes about in expanded problem-solving perseverance, expanded discussion engagement, and availability to require mental risk actions that are habitually related to moving forward with scholarly execution. The findings also recommend that this strategy upgraded different cognitive measurements past fundamental memorization or procedural information. It cultivated explanatory thinking, conceptual understanding, and the capacity to exchange learned abilities to novel circumstances. Students were seen to lock in in metacognitive hones, reflecting on their problem-solving methodologies and adapting them in real time in reaction to peer input or bunch discourses. In conclusion, the test group's pupils' academic execution essentially moved forward as a result of these combined circumstances. The control gathers, on the other hand, which got customary, lecture-based preparation, did not show comparable levels of participation, association, or



achievement. The discoveries highlight how Kagan's agreeable learning approach can upgrade the instructive handle by making learning more participatory, comprehensive, and student-centered, in expansion to raising test scores. Given these outcomes, the ponder advocates for broader usage of agreeable learning techniques in arithmetic classrooms and the past. The victory watched in this limited test setting warrants advanced investigation, replication, and potential scaling over diverse review levels and subject zones. Teachers and policymakers ought to genuinely consider joining such innovative models into standard educational modules to better prepare understudies for the collaborative and problem-solving requests of the cutting-edge world.

5. Conclusion

Students' intelligence with science was altogether changed by the proposed strategy. The strategy not as it was made science more receptive but also more curious by advancing understudy associations and a collaborative demeanor. Understudies have begun to effectively take an interest in the learning preparation instead of being inactive customers of information. This alter gave understudies the certainty and clarity to voice their logical perspectives, which made a difference in forming a classroom environment where talk, examination, and back among peers were esteemed exceedingly. Moreover, the strategy empowered more profound cognitive engagement and made it less demanding to organize contemplations. Students were encouraged to apply basic considering aptitudes, make associations between thoughts, and handle issues from a few viewpoints. These experiences improved their cognitive capacities and advanced a more profound comprehension of arithmetic. Concepts, which in turn drive quantifiable advancements in scholastic accomplishment. The development in self-confidence upgraded communication abilities, and the capacity to collaborate successfully all reflected a positive alter in their generally instructive encounter. Given these promising results, we emphatically prescribe embracing Kagan's agreeable learning show not as it were as a



direction technique for arithmetic but as a comprehensive system for educating all subjects over tall school educational program. Its benefits expand past scholastic execution; it develops social and passionate abilities that are fundamental for victory in both scholarly and real-life settings. To back this move, it would be advantageous for instructive specialists to create and distribute a point-by-point education particularly custom-fitted to the application of Kagan's demonstration of completely different subjects. Furthermore, organizing and preparing workshops and proficient improvement courses for instructors would guarantee that the show is executed viably and reliably. Preparing instructors with the instruments, methods, and certainty to apply agreeable learning methodologies can maximize the potential effect on understudy learning results. Besides, we propose investigating the utilization of Kagan's show to upgrade not as it were scholastic accomplishment but moreover higher-order considering abilities, such as deductive thinking and inventive problem-solving. These cognitive capacities are crucial in planning understudies for the challenges of higher instruction and the advanced workforce. By coordinating Kagan's demonstration over the tall school educational modules, teachers can cultivate an era of learners who are not as they were learned but moreover inventive, expository, and collaborative. In conclusion, the usage of Kagan's agreeable learning show holds an extraordinary guarantee for changing instruction. It adjusts well to advanced educational standards, bolsters constructivist learning situations, and meets the advancing needs of 21st-century learners. With mindful arranging and organization back, this demonstration can serve as an effective catalyst for instructive change in tall schools.

6. Future Work

Building on the discussions and results, a few bearings for future investigation and advancement are proposed. It would be profitable to conduct longitudinal studies to look at the long-term impacts of Kagan's agreeable learning demonstration on students' scholastic execution,



maintenance of numerical concepts, and advancement of basic considering aptitudes. Such ponders seem to give more profound bits of knowledge into how supported execution impacts learning directions over numerous scholarly a long time. Also, future inquiries might investigate how Kagan's demonstration impacts understudies with differing learning needs, including those with learning troubles or skilled understudies. Fitting cooperative learning structures to suit distinctive cognitive profiles may encourage an upgrade to the inclusivity and adequacy of the show. Another region worth exploring is the integration of innovation with agreeable learning. Investigating how advanced stages and intuitive devices can be utilized to bolster or amplify the standards of Kagan's structures' particularly in mixed or inaccessible learning environments could make the approach more versatile to modern instructive settings. It is additionally suggested to extend the application of Kagan's demonstrated past arithmetic, looking at its impact on other subjects such as science, dialect expressions, and social ponders. Comparing its adequacy over disciplines may offer assistance to teachers and policymakers make educated choices approximately educational programs plan and direction techniques. In conclusion, participation with services of instruction and educator preparing education can offer assistance spread the utilization of agreeable learning strategies. Future ventures can concentrate on giving intensive preparation educational programs, guidelines materials, and checking instruments to ensure application devotion and progressing improvement. By seeking these future bearings, teachers and analysts can proceed to refine and extend the effect of agreeable learning, contributing to more energetic, student-centered classrooms over various instructive settings.

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