

Article

The Effect of the Balance Strategy on the Science Achievement of Fifth-Grade Female Students

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Abstract: In the present study, an effect of the balancing strategy on the science achievement of female fifth-grade students was investigated. The study was designed as an experimental study to find out whether the application of the balancing strategy could result in improvement in science achievement as compared to the conventional strategy. The total number of female students who were in 5th grade were divided into 2 groups consisting of 25 students each; experimental group and control group. The experimental group was taught the science using balancing teaching strategy, and the control group was taught the conventional method. The collected data were subjected to several statistical treatments while using various methods, namely frequency, arithmetic mean, standard deviation and effect size to determine the difference between the two groups. The results demonstrate that the experimental group had significantly better science achievement than the control group. This means that the balancing strategy has a positive impact on students' learning achievement. These findings demonstrate that using appropriate instructional strategies can improve students' understanding and achievement in science. The researcher suggests the use and testing of the balancing strategy in other subjects and educational levels to see the general effectiveness of the strategy as an instructional strategy.

Keywords: balance strategy; science; fifth grade.

1. Introduction

Research Problem

The educational process has become more complex as a result of scientific and technological advancements, the emergence of modern technologies, and the knowledge explosion; it requires effort on the part of the teacher, because he or she deals with individuals who have different inclinations and abilities, so teachers must keep pace with scientific development and progress and find appropriate solutions to the problems learners face in the educational process [1]. The major challenges in the field are the use of memorization, rote learning, listening exercises in most of the methods employed, resulting in low achievement in science at elementary level [2]. The curriculum for science education contains a number of facts, ideas and concepts, but unfortunately, it has been observed that teachers in the majority of the elementary schools have adopted traditional teaching strategies, and as a result, the teaching of science is monotonic and devoid of activities that capture student interest, which is a problem that has been observed and confirmed by a study [3].

For this purpose, the researcher designed a preliminary questionnaire for 19 science teachers of fifth grade elementary students and the results of the questionnaire were as follows:

1. 42% use the lecture and discussion method.
2. 57% apply method of five steps.
3. 100% agreed they did not know the “balance” strategy.

The nature of the science and the school curriculum are some of the reasons that cause poor achievement in science [4]. Thus, the research problem is stated as:

- Is there a gender difference in fifth grade students' success in science as a result of the balance strategy?

The Importance of the Study

Scientific achievement is a vital part of our current world, finding its place in every aspect and facet of life and activity, and becoming a hallmark of our era, progress and development. This has been seen in education, teaching methods, teacher training and teacher dispositions. Teachers' understanding of the nature of science helps them develop appropriate teaching strategies and methods [5]. The focus of all those who are interested in educational matters is now on education itself in the process of achieving balanced and integrated growth, intellectual, psychological and social for their learners, through which society develops and rests on education. Education if it should fulfill its missions cannot be effective unless curricula, pedagogy and education in general and the sciences in particular are developed in a way that is compatible with the science knowledge and developments [6]. In their different forms and kinds, teaching strategies facilitate the retention of knowledge and information for the learners by bridging familiar elements of their environment with their mental abilities and making the information meaningful and relevant to reality; teaching strategies also organize information in easy and fun manner without embarrassing the learners when they forget information [7]. Besides, active learning strategies encourage co-operation among learners, provide some excitement and break the routine and monotony [8]. Finally, the researcher believes that the “Balance” strategy creates a cooperative and assisting attitude among the students as they work in small groups and teams.

Research Hypothesis

The experimental group (teaching via the balance strategy) does not differ from the control group (teaching via the conventional method) with a mean score difference statistically significant at the 0.05 level in science.

Scope of the Study

1. Geographic Scope: Public schools in Babil Governorate/ Al-Istiqama District (Al-Istiqama Girls' school).
2. Temporal Scope: First semester 2025-2026.
3. Population Scope: A sample of 5th grade female students.
4. Content Scope: Unit 1 and Unit 2 topics.

The definitions of the research terms are given in the following order:

1. **Impact:** The Authors [9] defines it as “the result of the changes – desired or undesired – that the teaching process brings to the students” (p. 342). In the science achievement, researcher's definition is: the knowledge transferred to learners through the “balance” strategy procedure.
2. **Strategy:** According to [10], it is “a comprehensive plan that consists of a series of steps described in different theoretical frameworks, which are grouped together under the name of ‘strategy’ and are used in education. According to the researcher it is: an organized plan, tools and methods used, and assessment that the researcher will do during teaching the learners.
3. **Balance** (The scale): According to [11], “the ability of learners to identify relationships and points of reference, and to understand proportional relationships through interaction and discussion with others”. The problem-solving approach used is defined

by [12] as: “Students who will solve problems presented to them on a balance, and then weigh the solution after discussion of all the solutions” [12]. Moreover, the researcher is working it from a procedure standpoint as the learners' capacity to tell whether their answers are correct and to find the differences and similarities between the correct and the incorrect answers, as similar as the two pans of a scale.

4. **Achievement:** [13] said it as “verifying learners' ability to apply what they have learned from their experiences in the teaching and learning process”. The researcher's operational definition of it is the product of what 5th grade elementary school students learn and what they accomplish in their science class.

2. Theoretical Framework and Previous Studies

Introduction

1) **Active Learning:** The concept of active learning appeared in the end of the 20th century and became more popular in the 21st century as one of the new pedagogical, educational and psychological learning and teaching trend in the classroom carried out by the teacher with the help of interaction among all the participants involved. According to [14], active learning is an integrated technical and administrative system which includes all parties in educational system, namely the “cognitive” aspect (information and knowledge), the “affective” aspect (values and behavioral attitudes), and the “skills-based” (skills) aspect (centered on learners based on their ability and potential to develop skills to perform). From the above it is clear that active learning requires learners to do something related to the learning situation, beyond listening to the teacher explaining the situation [15] and that active learning is an environment that gives learners opportunity to speak, listen, read, write, reflect, and think about the educational content in a variety of ways, techniques, and activities [16]. The foundation of active learning is the learner's active engagement in educational situations and a classroom environment characterized by calm, reassurance, and fun-an environment that encourages enjoyable thinking and reflection, as well as the clear definition of the roles of both the learner and the teacher.

2) **The Objectives of Active Learning:** Active learning has several objectives, including [17]:

1. Promotes critical thinking.
2. It introduces students in the process of close and critical reading.
3. It provides a variety of activities to achieve educational objectives.
4. Encourages students to be confident with themselves.
5. Encouraging question and problem solving
6. Learning to focus on key issues and how learning different subjects in the school.
7. Promoting partnerships and communication with others.
8. Encouraging self-directed learning.
9. Giving learners opportunities to develop higher order thinking skills, knowledge and attitudes for their life.

3) **Benefits of Active Learning:** Active learning has many advantages, such as the following [18]:

1. To develop learners' comprehensive growth ability and skill.
2. Addressing learners' interests and needs
3. Organizing activities to support the curriculum.
4. Solving learners' behavioural and psychological problem.
5. Linking school and environment/ community.

4) Features of Active Learning: It is important that learners are afforded the opportunity to engage in activities with peers, teachers and educational materials regardless of their age so as to build the mental structure that supports their understanding of the activities. There are four elements that constitute the basis of active learning strategies, as pointed out by some teachers [19]:

1. Reading.
2. Speaking and listening.
3. Reflection and thinking.
4. Writing.

5) The role of active teacher: Active learning places emphasis on the teacher and gives him/her different roles such as: [20]

1. Teacher as facilitator, encourager, motivator, guide and catalyst in the learning process.
2. Teacher makes learning process, welcomes learners' ideas and establishes teaching atmosphere of security and playability, which helps students ask questions;
3. The teacher handles classroom situation well, and sets tasks that encourages learners to pursue knowledge.

6) The active learner has the following traits [21]:

1. The learner is committed to attending classes and participating in various activities.
2. They take advantage of all opportunities to learn or participate in activities.
3. They are actively engaged in discussions and group work in the classroom.
4. They guarantee that assignment work is done and handed in properly and tidily.
5. They learn by reflecting and sharing their thoughts with others.
6. They use self-directed learning.
7. Takes suggestions and advice.
8. Trusts in self and ability to move about in educational setting
9. Uses knowledge, experiences and skills from learning in a new context in life.

7) Conditions for Using Active Learning Strategies [17]:

1. Active learning starts from an early age.
2. Learning objectives should be clear, simple and precise.
3. Activities and experiences should be suitable to the learning objectives, content and level of the learners.
4. Learners learn in various ways such as visual, auditory, kinesthetic and hands-on learning.
5. Teacher must know what the learners are doing in the class and how engaging they are in group work.
6. The teacher gives orientation to learners of their roles and responsibilities and how they can conduct their activities in a healthful environment.

8) Barriers to Active Learning: The barriers have been classified into three groups, as shown below [8]:

A.First: General Barriers

1. Traditional education is prevalent.
2. Opposition to and resistance to change.
3. Low levels of motivation to enable change.
4. Lack of privileges and authority.

B. Second: Barriers related to the implementation of active learning in the classroom:

1. Too little time in class for experiments, and in preparation and planning.
2. The large class size and the challenge
3. Lack of materials, resources, and support tools.

C. Third: Teachers' barriers:

1. Lack of interest in change and satisfaction with and dependence on traditional approaches.
2. Lack of or low skills in the context of active learning.
3. Concern with being overwhelmed with the scope of the class.

9) Teachers need a few critical skills to manage a successful classroom with active learning, which are as follows [22]:

1. Personal Skills:

- 1) Self-control.
- 2) Creativity and innovation.
- 3) Time management.
- 4) Ability to cope with the environment.

2. Technical Skills:

- 1) Knowledge and competence in subject area and skills; and experience in the application of skills.
- 2) Capable of making quick decisions in choosing alternatives.
- 3) Behaviour is appropriate and effective in all situations.
- 4) Organising classroom arrangements.

3. Interpersonal Skills:

- 1) Organizing the work within the class.
- 2) Management of the learning process.
- 3) Knowledge of various teaching methods and how to apply them to the classroom setting.
- 4) The capacity to work with students.
- 5) Promoting a team attitude and good morale of learners.
- 6) Teacher and learner's home environment are harmonious.

The issue of active and collaborative learning and its effects on learning achievement have been dealt with in several ways. The researcher selected the strategy named "balance" that is based on comparison and choosing the right answers. The teacher asks a question or problem that needs to be solved and allows the learner to identify the "right answer" and eliminate the others.

The Scales Strategy:

The strategy is based on the approach of having students generate solutions to the problem being presented with the scales (an imaginary set of scales) and then bringing a specific solution forward after discussing the various solutions. The strategy is used as needed throughout the class (see fig 1.).



Figure 1. Imaginary set of scales.

The Strategy aims to:

1. To assist the learners with their decisions.
2. To help the learners to compare answers.
3. To develop critical thinking

The researcher determines a set of characteristics, as follows:

1. The objectives are clear, definite, and simple.
2. Enabling the teacher to set up learning groups within the learners.
3. Focus on creating tasks and activities.
4. Encouraging collaboration and inclusion of students.
5. Developing the ability to compare and contrast answers.

These are the steps of the strategy [12]:

1. Determine the topic of the lesson with the problem/question in the middle of it, then locate the correct answer.
2. Teacher tells the pupils the question will be addressed using the scales strategy.
3. Learners write down their suggested answers on the scales model.
4. Teacher asks the learners what they think the answers were, on the basis of the characteristics, and chooses the "heavier" side based on the characteristics used to compare the answers.

The researcher suggests that the steps should be changed to:

1. Prior to the start of the lesson, break students into groups.
2. Select a topic.
3. In the beginning of the lesson ask short answers to find out what the students already know about the lesson.
4. Give the weighing scale sheet to the groups to record their responses on.
5. The teacher will request the leader of each group to share the group's agreed upon answer and record it on the board.
6. Discuss and compare all the responses with students and choose the right answer.

The researcher points out that the balance strategy has the following benefits:

1. Promotes teamwork.
2. It enables the teacher to use a variety of teaching methods as per the needs of the lesson and the classroom ambiance.
3. Minimizing the range of differences between learners.
4. It can break the ice for students who don't have a very good sense of communication with their peers.
5. Promotes student-to-student and student-to-teacher dialogue and sharing of ideas and information.
6. It is applicable to all levels of education.

7. Develops critical thinking skills.

3. Previous Studies

1. Arabic Studies:

1)(Al-Obaidi, 2025): Al-Obaidi's research focused on the effect of the balance strategy on science achievement of the sixth grade elementary students. In this study 86 students were included in control and experimental groups. Experimental design with statistical analysis was used to check the results of the study. It was concluded that there was no difference between the experimental group, which were instructed with the balancing strategy, and the control group. The researcher suggested that teachers take into account combining the balancing strategy with other teaching methods [23].

2) (Mustafa, 2025): Mustafa's study was designed to find out the influence of the balance strategy on achievement level in biology performance of the female students in the class of grade 8. The research design was quasi-experimental and 60 female students were equally distributed between the control and experimental groups. Data analyzed with t-test for independent samples. Based on the results of the study, it was found that the control group was better than the experimental group and the researcher suggested to include the "balance" strategy in teaching science in the middle school level [3].

2. Foreign Studies: The researcher could not find the term "balance strategy" in the published foreign literature and articles but was able to find the concept of "equilibrium", which is the closest concept to the balance strategy.

1) (Vysotskaya, Lobanov, & Yanishevskaya K., 2025): The study demonstrates how the development of a preliminary idea of 'balance' influences the way of solving physics problems in primary school. The experimental group consisted of 43 students and the control group of 44 students. The study was conducted using experimental method and the statistical methods employed were percentage, chi-square test and f-test. The results indicated clearly that the experimental group outperformed the control group and thus, guided learning is important. The study suggests to encourage conceptual thinking, activities that support the transition from introductory education to school curriculum should be encouraged [24].

2) (Skytta, Lehtinen, & Hahkionemi, 2026): The current study investigates the interaction sixth grade students have with the rules of balance as shown in their fellow students. It used descriptive and inferential analysis and consisted of 61 students. The statistical methods used were frequencies and percentages. The research findings indicate that interaction with peers and group discussion are important components in building mathematical knowledge and developing the concept of balance. Finally, the study advised the encouragement and facilitation of discussion, dialogue, and positive relationship with others among learners [11].

Table 1. Studies on the Scale "Al-Mizan" Strategy

No	Researcher's Name and Year of Study	Study Objective	Level	Country	Sample	Statistical Methods	Results
1	Al-Obaidi (2025)	Identifying the Effect of the Balance Strategy on Achievement and Objective Thinking	Elementary School	Iraq	86	Statistical Package	No statistically significant difference was found between the control and experimental groups in terms of

2	Mustafa (2025)	Investigating the Effect of the Balancing Strategy on Achievement and Coordinative Thinking in Biology	Intermediat schools	Iraq	60	t-test	achievement and thinking The control group outperformed the experimental group
3	Vysotskaya, Lobanov, & Yanishevskaya, K. (2025)	xx	Elementary school	Russia	87	Percentages, F-test, and chi-square test	the experimental group outperformed the control group
4	Skytta, Lehtinen, & Hahkioniemi (2026)	xx	Elementary school	Finland	61	Repetition test, percentages	the experimental group outperformed the control group

3. **How to make the benefits of earlier studies:** These studies can be helpful in the following way?

- 1) Definition of Research Objective & Research Hypothesis.
- 2) To define the steps of the research strategy.
- 3) Choosing the right research method.
- 4) Choosing the appropriate statistics techniques.
- 5) Reviewing scientific sources.

4. Research Procedures includes: -

- 1) **Research Methodology:** This is an experimental method which was deemed fit for the current study.
- 2) **Experimental Design:** The study has an independent variable (balancing strategy) and a dependent variable (academic achievement). So a partially controlled experimental design was selected where the experimental and control groups consisted of equal sample sizes as shown in Table (2).

Table 2. Experimental Design for the Two Research Groups

Group	Equivalence	Independent Variable	Dependent Variable
Expermintal	1. Prior Knowledge 2. Prior Achievement	Scales Strategy method Ordinary method	Outcome assessment
Control	3. Intelligence Test		

- 3) **Research Population and Sample:** The research population includes all female fifth-grade students at Al-Istiqama Girls' School (affiliated with Babylon/Al-Mahawil Education Directorate) in the 2025–2026 school year. School was purposively selected because it was in close vicinity to researcher's place of work. The subjects for the research were 53 students with only two classes remaining because students who failed the grade had been exposed to the academic subjects included in the experiment before, which would have affected the results. The final number was 50 students, 25 students in each experimental and control group. There are two classes: Class A (experimental) and Class B (control) as shown below:

Table 3. Distribution of Female Students in the Research Sample Between the Experimental and Control Groups

Division	Group	Number of Female Students Before Exclusion	Number of Female Students Excluded	Number of Female Students After Exclusion
A	Experimental	26	1	25
B	Control	27	2	25

4) **Equivalence of the two research groups:** was established from the first week by giving a prior knowledge test, prior achievement test, and intelligence test that might have some effect on the independent variable. The prior knowledge test was made up of 20 multiple-choice questions, prior achievement was based on previous school records and the intelligence test was the Raven's test. As presented in Table (4) at the 0.05 level of significance, it is indicated whether the two groups are statistically equivalent or not.

Table 4. Statistical Significance of the Equality of the Two Groups

Variable	Group	N.	Mean	Standard Deviation	Var.	Degrees of Freedom	T-value		Significance Level
							Calculated Value	Table Value	
Previous Information	Exp.	25	12.93	2.40	5.75	48	0.95	2.011	Not Significant
	Cont.	25	11.43	2.5	6.52				
Previous outcomes	Exp.	25	3.5	8.98	80.56	48	0.56	2.011	Not Significant
	Cont.	25	33.58	8.84	78.11				
IQ Test	Exp.	25	59.33	28.98	839.892	48	0.923	2.00	Not Significant
	Cont.	25	52.65	29.28	857.479				

5) **Research Materials: includes these steps: -**

A. Identification of the Material: The researcher identified the material studied by the experimentals and the control groups which were Units 1 and 2 of the 5th grade science text book of the 8th edition 2024-2025 school year.

B. Formulation of Behavioral Objectives: The topics of Units 1 and 2 were analyzed according to Bloom's taxonomy of knowledge (recall, comprehension, application) which are then 126 in number, and the distribution was (69%) recall, (43%) comprehension, and (11%) application, respectively. The behavioral objectives were discussed with a group of experts in the science field.

C. The researcher made 18 lesson plans for the control group and 18 for the experimental group for 9 weeks for the course (Appendix 1) based on the curriculum for the science course and the behavioral objectives. 80% agreement between experts.

6) **The research tool** was a science achievement test with 26 items that are formulated from a specification table. The test was constructed in a multiple choice format, there was only one correct answer per item and 3 choices per item. The test was used to assess the academic performance of female students and the material assessed was specific to the fifth grade elementary school science textbook: -

1. Specification Table (Test Map) preparation: This was to distribute test items throughout the entire science curriculum and all behavioral objectives, using Bloom's taxonomy of cognitive levels (recall, comprehension, and application).

Table 5. shows the test blueprint with the sections of the achievement test

Chapter	Topics	Content			Behavioral Objectives			Total
		N. of Classes	N. of Pages	Content Weight	Recall 55%	Comprehension 34%	Application 11%	
					Number of Paragraphs			
First	Flowering and Non-flowering Plants	4	18	24%	4	2	1	7
Second	Vertebrates and Invertebrates	5	19	28%	4	2	1	7
Third	Circulatory and Respiratory Systems	5	16	26%	3	2	1	6
Fourth	Digestive and Urinary Systems	4	15	22%	3	2	1	6
	Total	18	68	100	14	8	4	26

2. **Test Validity:** Face, Instructions clarity, Content validity of the test is evaluated to find out how appropriate the test is for female students, how clear the instructions are and the content validity of the test. This has been confirmed through the use of the test blueprint.

A. A sample of 30 fifth grade elementary students was tested, the first pilot, to clarify the items on the test and to determine the time required to complete the test. Sunday October 19, 2025 was chosen as the test date. Answering time to test items and instructions clarity & understanding were measured.

B.Second pilot sample administration: The test was administered on Wednesday October 22, 2025 for a statistical analysis of the test items. The top group was those with the highest scores and the bottom group were those with the lowest scores. The scores were ordered from highest to lowest ranging from 26 to 8 to decide the psychometric attributes of the achievement test:

1. **The difficulty coefficient for each** item was between 0.32 and 0.68 indicating that all the items were acceptable as per the difficulties.

2. **Discrimination power (item discrimination coefficient):** The items in the test ranged in discrimination power from 0.51, which were accepted as good.

3. **Effectiveness of Alternatives:** Using the mathematical equations, the researcher obtained negative values for all test items ranging from (-0.09) to (-0.23) which show that all the test items are effective.

7) All Test items were Multiple choice and the reliability coefficient was calculated as 0.82 (equation of Cokewder & Richard) and thus it is considered as a good reliability coefficient.

8) The final version of the Achievement Test was given to the experimental and control groups. It comprised 26 objective multiplechoice questions, each of which had three options, one of which was right, and the other two wrong.

9) The Research Tool was given to both groups after instruction on the material was given, and the results of the tests were then scored to get results.

10) Data were statistically analyzed in SPSS Version 24 to get reliable data.

5. Results

5.1. **Presentation and Interpretation of the results:** After administering the achievement test to the research sample, the arithmetic mean and standard deviation were calculated. The mean scores for the female students in the experimental and control groups were (18.32) and (9.80) respectively with standard deviations (5.94) and (5.21) respectively as shown below in table (6).

Table 6. Arithmetic Mean and Standard Deviation of the Achievement Test for the Research Sample

Group	Number	Mean	Standard Deviation	T-value		Statistical Significance
				Experimental	Control	
Control	25	9.80	5.21			Statistically
Experimental	25	18.32	5.94	5.39	2.01	Significant

From the table above it is observed that $t > t_c$ and the experimental group is better than the control group at a 0.05 level of significance with 48 degrees of freedom. This means that there was a statistically significant difference between the experimental group's results (which were studied with the balance strategy) and the control group's results. Based on the results of the above calculations, the hypothesis that there is no difference between the independent and dependent variables is rejected and the alternative hypothesis is accepted, as indicated in Table (7) shows the effect size between the independent variable and dependent variable.

Table 7. Impact Value

Independent variable	Dependent variable	Value of effect size	Value of effect size
Scale strategy	Outcome test	0.38	large

When calculating the effect size, it was found that the teaching strategy resulted in an effect size of (0.38) for the academic achievement of the female students in the experimental group, indicating that the strategy has an impact on improving the performance of the experimental group.

6. Conclusions

In light of the research findings, we conclude the balance strategy is effective in raising the academic achievement level of fifth-grade female students compared to the conventional method. The teaching strategy encouraged increased participation, motivation, and learning among the female students. In light of the findings, the researcher recommends that education directorates must ensure that science teachers-both male and female-are familiar with modern teaching methods. Students in the College of Education and the Department of Elementary Education should be taught modern teaching strategies, as these strategies create engagement, which in turn raises academic achievement. A study should be conducted on the impact of the "Balance" strategy on other academic subjects. Finally, the suggestions of our findings are to complement this research, the researcher suggests conducting studies and research to identify the impact of the "balance / scale" strategy in science classes by incorporating variables such as thinking, attitudes, and motivation. In last view is conducting similar studies in other subjects and at other educational levels.

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