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The Effectiveness of the Numbered Heads Together (NHT) Strategy on Scientific Concepts Acquisition for Eighth Grade Students

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Abstract

The study focused on investigating the effectiveness of the Numbered Heads Together (NHT) strategy on scientific concepts acquisition by eighth-grade students. The design of the experiment was a post-test one with two equivalent groups. The sample consisted of seventy-two eighth-grade female students from Parwa Girls' School randomly assigned to the experimental group (35) taught using NHT, and control group (37) taught conventionally. An established 28-item Scientific Concepts Acquisition Test was used to assess the outcomes, which were ensured for reliability using the Kuder-Richardson (0.77) and Parallel-Forms (0.85) methods. The experiment spanned over 32 lesson plans for seven weeks. Results showed a significant difference ($p \leq 0.05$) in favor of the experimental group. This finding evidently supports the cooperative learning strategies, such as NHT, in improving the understanding of concepts, engagement, and interest in science. Future studies may establish the long-term effects and use of the NHT across other subjects and levels.

1. Introduction

1.1: Statement of the Problem

The current era, marked by information acceleration, knowledge expansion, and technological advancement-poses significant challenges for educators in education and teaching. To response, many countries have undertaken educational reforms aimed at developing learners who are capable of critical thinking and who can keep pace with these global changes (Lestari et al,2020, p. 2). Education has long served as the cornerstone national development, and its importance extends beyond student enrollment. It plays a vital role in enhancing society's well-being in both terms living standards and the development of human resources (Herrera et al, 2006, p. 109). A solid understanding of scientific concepts is fundamental in science education, as all advanced scientific reasoning and application are grounded in these foundational concepts. This study reviews the concept of learning in science education and highlights the associated challenges in teaching and learning, supported by examples of effective pedagogical strategies for developing conceptual understanding (Wiseman et al, 2014, p. 20).

To develop future students who are self-sufficient learners and capable of problem solving, the researchers emphasize the significance of cultivating thinking skills. The accelerating pace of knowledge generation necessitates a re-evaluation of educational processes with a particular focus on active teaching strategies such as Numbered Heads Together (NHT) strategy that allow students to engage positively and participate actively while keeping up with contemporary advancements and individual differences.

The researchers propose that effective science instruction should prioritize the development of students' thinking skills and motivation through innovative models and strategies. They argue that the traditional teaching methods often fail to transform students' thinking styles, thereby necessitating the integration of constructive and thinking- based learning principles. This approach seeks to combine integrating cognitive, skill- oriented, and psychological aspects of teaching science to foster-creativity and higher-order thinking.

Based on their experiences as science educators. The researchers observe that students often struggle to grasp scientific concepts due to reliance on traditional teaching an overemphasis on rote memorization, and limited student-centered engagement.

Accordingly, the study aims to address the following research problem:

What is The Effectiveness of Numbered Heads Together (NHT) Strategy on Scientific Concepts Acquisition for Eighth Grade Students?

1.2: Significance of the Research

Science education is vital for improvement in society because it develops critical thinking and encourages innovation and development. Today, education broadly refers to any process that molds cognitive and emotional potential within individuals in developing skills that will help them grow personally and socially (Seidl et al, 2013, p. 7). When teaching science at a secondary school level, teaching procedure should no longer be limited to merely transacting knowledge but more importantly, developing the critical and analytical thinking abilities of students. A possible modern teaching strategy for encouraging active participation, cooperation, and critical thinking in promoting acquisition and cognitive motivation in science is the Numbered Heads Together (NHT)strategy (Eilks et al, 2013, p. 2). The NHT is a cooperative learning strategy that primarily promotes student engagement in interpreting, sharing ideas, as well as solving problems. It allows students to connect novel biology topics with previously acquired knowledge, thus establishing deeper understanding while clearing up misconceptions. Such activities foster cognitive behavior conducive to learning instead of pure memorization. It is beneficial to students since it helps them become motivated and develops critical thinking in their study of biological sciences.

This study further underscores the need for new pedagogies such as the NHT to enhance science education: deeper understanding, increased motivation, and the developing the critical perspective within students. It would also add value to an overall educational reform geared toward bridging the gap between the traditional methods and more constructivist approaches that

enhance active learning and student engagement. Further, the current study also proposes that teachers and supervisors understand and implement NHT strategies to carry out effective science instruction.

1.3: Objective of the Research

This research aims to:
Investigate the effectiveness of the NHT strategy in enhancing the acquisition of scientific concepts among eighth-grade students.

1.4: Hypotheses of the Research

- There is no statistically significant difference at the (0.05) level between the mean post-test scores of the control and experimental groups of scientific concept acquisition test.

1.5: The Scopes of the Research

This research has intensified on the following scopes:
• Humanitarian Limit: Basic Students of Eighth Grade.
• Place Limit: Basic schools were attached of Bnaslawa Education, Erbil, Kurdistan Region-Iraq (KRI).
• Time Limit: The first semester for academic year 2024-2025.
• Objective Limit: Units 1, 2, 3, 4, 5, and 6 in the science subject (Biology) for Eighth-Grade students.

1.6: Definition of Terms

1.6.1: Effectiveness

Effectiveness as the extent to which an instructional strategy can actually fulfill the intended objectives and outcomes for learning (Bedworth et al, 2010, p. 171).

Operational Definition: Assessment of enhanced students' acquisition of scientific concepts and cognitive motivation as judged by pre-test and post-test measures for experimental and control groups.

1.6.2: strategy

strategy as an art for the fulfilment of an objective. It is the application of strategies in instruction by the use of tutorials or lectures to develop the learning experiences of students concerning the concept of strategy in education (Xia et al, 2023, p. 2).

Operational Definition: An instructional system, including methods, activities, and techniques of teaching science implemented by a teacher in the classroom, that ultimately seeks the attainment of the specified learning objectives.

1.6.3: NHT strategy

According to this cooperative learning strategy, all members of a group work together to be sure that everyone will gain knowledge concerning the topic and will be able to give a correct answer when called upon (Hunter et al, 2015, p. 349).

Operational Definition: The planned application of the NHT strategy in eighth-grade science classes where students interact cooperatively in constructing scientific concepts and enhance motivation that will be measured through test scores and motivation scales.

2.Literature Review

2.1: Theoretical Background

Constructivist theory is based on the works of Jean Piaget and Lev Vygotsky and defines learning as an active, constructive process whereby individuals build knowledge through their experiences and social interactions (Piaget, 1950, p. 12; Vygotsky, 1978, p. 86). It essentially means that the learner does not passively receive knowledge but instead constructs their own understanding by relating new knowledge to what he/she already knows or has experienced (Fosnot, 2013, p. 25). Constructivism provides a powerful educational philosophy that supports student-centered learning environments that foster independent and critical thinking, collaboration, and problem-solving (Bransford et al, 2000, p. 67).

Consider the Numbered Heads Together approach: this cooperative learning method captures the constructivist essence, where students talk with peers and collaboratively search for solutions to deepen their understanding (Slavin, 2014, p. 112). In addition, constructivism fosters inquiry-based learning, where learners actively seek and investigate concepts rather than passively receiving information (Dewey, 1997, p. 34). The NHT strategy also called Numbered Heads Together is a cooperative learning technique that stresses active participation, individual responsibility and group decision making. Created by Spencer Kagan, this technique works on the concept that all students in a group should participate by giving each of them a number. Once a problem or issue gets discussed among the group, the teacher calls out a number and the student with that number presents the answer of the whole group. This system makes sure that every member of a group is ready to answer as anyone can be called up to answer and therefore encourages members to participate in the process of learning (Kagan, 2015, p 95).

The Numbered Heads Together strategy groups students together for group discussions about a topic and sharing ideas among fellow students. A number is assigned to each student, and a number is called randomly by the teacher so that a student gives the answer. This tries to make everyone participate and foster collaboration among students (Barrett et al,2019, p. 2). The Numbered Heads Together (NHT) strategy is a cooperative learning method that promotes equal student participation, accountability, and critical thinking. It encourages group discussions where all members must be prepared to share ideas and reach a consensus. This approach enhances understanding, retention, and problem-solving skills while reducing anxiety and boosting confidence. NHT also fosters communication, empathy, and teamwork (Martinez et al, 2022, p. 74). Teachers facilitate the process by guiding group dynamics, creating engaging tasks, and ensuring a supportive environment. students, in turn, engage actively, take responsibility, and benefit socially and academically from peer interaction (Sharan, 2008, p. 97).

A thorough understanding of such essential concepts needs good pedagogical delivery strategies, hands-on activity, peer learning, and usage of technology to realize interactive environments for science concepts learning (Bransford et al, 2000, p. 79). A culture in the classroom that engenders curiosity and questioning directly leads up to the cognitive motivation and internalized conceptual understanding (Vygotsky, 1978, p. 14). Scientific concepts provide frameworks for understanding natural phenomena in various ways. They include observing characteristics (descriptive), comparing similarities and differences (comparative), identifying interactions (relational), explaining causes and effects (causal), forming abstract ideas (theoretical), using measurable definitions (operational), applying numerical analysis (quantitative), and organizing based on shared traits (classification). These concept types collectively support scientific thinking, inquiry, and deeper comprehension (Tytler, 2007, p. 29).

2.2: Previous Studies

Previous research studies displayed strong correlations between the application of the Numbered Heads Together (NHT) strategy and improvements in various aspects of student learning such as learning scientific concepts.

Iman Majali Abdullatif (2019) conducted a study in Aqaba, Jordan, to evaluate how the NHT strategy affects English language achievement among seventh-grade female students. Sixty students were divided into experimental and control groups. Using achievement tests and statistical methods like ANCOVA and eta-squared, the study revealed that the group taught using NHT significantly outperformed the control group, supporting the integration of NHT into English language instruction.

N. Setyaningsih and D. P. Utami (2020) explored the impact of a discovery learning model based on NHT on students' performance in mathematics, taking cognitive learning styles into account. The research was carried out in Sragen, Indonesia, among class VIII students. Tools included a validated learning outcomes test and the Group Embedded Figures Test (GEFT) to assess cognitive styles. Using two-way ANOVA, the study found significant differences in mathematics achievement based on learning model and cognitive style, highlighting the value of combining discovery learning and cooperative strategies like NHT.

Aseel O. Ajlouni & Suhair A. Jaradat (2020, Jordan) this study explored how pedagogical hypermedia can support the development of scientific concepts among fifth-grade students. Fifty female students were involved, and the researchers used a Scientific Concept Test (SCT) along with various hypermedia tools as learning aids. The findings, analyzed using ANCOVA, showed that students who learned through hypermedia performed significantly better in understanding scientific concepts than those in the traditional setting. The study concluded that hypermedia positively influences students' conceptual understanding by making learning more engaging and interactive.

Lafta A.R. & Hasan A.O. (2024, Iraq) this research aimed to determine the effectiveness of Landa's model in helping students acquire biological concepts. A total of 61 fifth-grade students participated, divided into control and experimental groups. A 45-item biological concept test was used to measure learning outcomes. Statistical analysis conducted at the 0.05 significance level revealed that students in the experimental group, taught using Landa's model, showed notable improvements in their understanding of biological concepts. Additionally, these students exhibited greater task engagement and interest, indicating that Landa's model not only supports cognitive development but also enhances motivation in science learning.

Overall, previous studies converge in that the NHT strategy stands an effective instrument in improving performance, and understanding of scientific concepts in students. They open assesses the NHT strategy is widely applicable across various formal and nonformal educational settings and importantly a significant step in advancing science teaching methodologies.

3.Methodology

3.1: Research Design

The study adopted a quasi-experimental design with two groups: an experimental group in which the NHT strategy was applied while a control group was taught using traditional methods. The primary aim was to evaluate the acquisition of scientific concepts using post-test measures as illustrated in Figure (1)

Figure (1) Representing the Experimental Design

Groups	Intervention	Post-Tests
Experimental Group	Using NHT Strategy	Scientific Concepts Acquisition
Control Group	Using Traditional Method	Scientific Concepts Acquisitions

3.2: Participants

This research involved (72) female students from the (Parwa Basic School) in Erbil Governorate during the academic year (2024-2025). The selection criteria were purposive sampling and a matching criterion in terms of the key parameters such as age, IQ, as well as academic performance. The groups were accordingly formed so that they would be equivalent at the beginning of the study, as indicated in Table (1).

Table (1) Summary Table Showing the Equivalence of Groups

Tests	Groups	df	Normality Test	Means	Std. Deviation	Mann-Whitney U, Independent t-test	P-value	Significant Difference
Previous Average	Exp	35	Normal	73.29	12.043	639.000	0.924	No
	Cont	37	Not Normal	72.95	11.025	**Mann-Whitney U**		
Student Age	Exp	35	Normal	166.09	11.179	646.000	0.986	No
	Cont	37	Not Normal	166.19	11.333	**Mann-Whitney U**		
Previous Science Average	Exp	35	Not Normal	62.43	16.306	529.000	0.179	No
	Cont	37	Not Normal	63.14	12.693	**Mann-Whitney U**		
Academic Level (Father)	1.primary and below 2.preparatory and below 3.Diploma and above	2	-	-	-	**Chi-Square**	0.795	No
Academic Level (Mother)	1.primary and below 2.preparatory and below 3.Diploma and above	2	-	-	-	**Chi-Square**	0.267	No
IQ Test	Exp	35	Normal	30.74	4.320	1.489	0.141	No
	Cont	37	Normal	29.41	3.252	**Independent t-test**		

3.3. Research Requirements

To fulfill the goal of the study and test its hypotheses, the researchers chose six chapters of the eighth-grade science textbook (2024-2025) covering important scientific topics. A total of 20 scientific concepts were identified through definition, distinction, and generalization, subsequently reviewed and refined in consultation with experts. Furthermore, 70 behavioral objectives were prepared in accordance to Bloom's taxonomy (Remembering, Understanding, Application, Analysis) and were validated by a committee of experts (see Appendix1).

The researchers prepared (32) teaching plans for the experimental group utilizing the Numbered Heads Together strategy, whereas for the control group, (32) teaching plans were prepared based on the conventional approaches.

3.4: Research Tools

3.4.1: The Scientific Concepts Acquisition Test is a design for measuring the acquiring of eighth-grade students on scientific concepts from units (1,2,3,4,5 and 6) of their science textbook, intended for the (2024-2025) academic year.

A. Objectives and Dimensions of the Test

The test assesses three cognitive dimensions for concept acquisition:

- **Definition** (recall and explanation of concepts)
- **Discrimination** (distinguishing between similarities and differences)
- **Generalization** (applying concepts in novel situations)

B. Table of Specifications

The Table of Specifications was made to achieve a fair distribution of the items over the topics. The test comprises thirty items in multiple-choice format, bearing equal weight for each cognitive level, as shown in Table (2).

Table (2): The Table of Exam Specification

Chapters	The rate of Concepts	Receiving 20 concepts	Percentage of Concepts	Definition %33.3	Differentiation %33.3	Generalization %33.3	Total Questions
1	13	4	%20	2	2	2	**6**
2	9	2	%10	1	1	1	**3**
3	13	4	%20	2	2	2	**6**
4	11	3	%15	2	1	2	**5**
5	13	4	%20	2	2	2	**6**
6	11	3	%15	1	2	1	**4**
Total	**70**	**20**	**%100**	**10**	**10**	**10**	**30**

C. Test validity

- Face Validity: Test items were considered by experts for clarity and relevance. Cooper's agreement formula, with an acceptance level of 86% and above, was utilized (see Appendix 1).
- Content Validity: The items were checked against the study materials by a panel of experts.

D. Pilot Experiment

The clarity, timeliness, and item efficacy were assessed by 100 students in three schools (Table 3). The average duration of test is 35 minutes.

Table (3) shows the number of female students in the pilot sample for the scientific concept acquisition test

No.	School Name	Number of Students	Test Date
1	Solav Basic School	70	28\11\2024
2	Bistana Secondary School	20	28\11\2024
3	Shaomer Basic School	10	27\10\2024
Total	-----	**100**	----

E. Statistical Analysis

- Difficulty Index: From (0.39 to 0.78) and Item (17) was removed (see Appendix 2), the acceptable range between (0.20-0.80), as shown in Table (4).

Table (4) Difficulty and Ease index for Items

Items	Upper Group	Lower Group	Ease Index	Difficulty Index	Items	Upper Group	Lower Group	Ease Index	Difficulty Index
1	17	7	0.44	0.56	16	15	6	0.39	0.61
2	14	7	0.39	0.61	17	26	19	0.83	0.17
3	23	18	0.76	0.24	18	26	7	0.61	0.39
4	24	16	0.74	0.26	19	24	10	0.63	0.37
5	26	9	0.67	0.33	20	24	16	0.70	0.30
6	26	15	0.76	0.24	21	25	16	0.76	0.24
7	20	9	0.54	0.46	22	21	9	0.56	0.44
8	17	6	0.44	0.56	23	25	9	0.63	0.37
9	23	9	0.59	0.41	24	26	7	0.61	0.39
10	27	15	0.78	0.22	25	25	15	0.72	0.28
11	22	14	0.67	0.33	26	24	13	0.69	0.31
12	24	16	0.74	0.26	27	27	14	0.75	0.25
13	26	15	0.76	0.24	28	23	16	0.70	0.30
14	24	10	0.63	0.37	29	20	14	0.63	0.37
15	26	15	0.76	0.24	30	23	9	0.59	0.41

- Discrimination Index: Items assessed their ability to distinguish high- and low-performing students. The discrimination values between (0.22 and 0.70), except for item (3), which were deleted (Appendix 2), as shown in Table (5).

Table (5) Discrimination Index for Items

Items	Upper Group	Lower Group	Discrimination Index	Items	Upper Group	Lower Group	Discrimination Index
1	17	7	0.37	16	15	6	0.33
2	14	7	0.25	17	26	19	0.26
3	23	18	0.19	18	26	7	0.70
4	24	16	0.30	19	24	10	0.52
5	26	9	0.59	20	24	16	0.30
6	26	15	0.41	21	25	16	0.33
7	20	9	0.40	22	21	9	0.44
8	17	6	0.44	23	25	9	0.59
9	23	9	0.52	24	26	7	0.70
10	27	15	0.44	25	25	15	0.37
11	22	14	0.30	26	24	13	0.41
12	24	16	0.30	27	27	14	0.48
13	26	15	0.41	28	23	16	0.26
14	24	10	0.52	29	20	14	0.22
15	26	15	0.41	30	23	9	0.52

-Effectiveness of Distractors: The range in effectiveness from (-0.44) to (-0.04). Some items were modified because they did not attract students of the lower group, as indicated in Table (6).

Table (6) Effectiveness of Distractors

Items	A		B		C		D		A	B	C	D
	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower				
1	7	16	/	/	1	3	1	2	-0.22	/	-0.07	-0.04
2	6	12	3	5	4	2	/	/	-0.22	-0.07	-0.07	/
3	1	9	/	/	1	2	1	1	-0.30	/	-0.04	0
4	/	/	1	4	4	6	0	2	/	-0.11	-0.07	-0.07
5	1	13	/	/	0	2	0	1	-0.44	/	-0.07	-0.04
6	/	/	0	7	0	2	0	0	/	-0.26	-0.07	0
7	3	7	3	11	1	1	/	/	-0.15	-0.30	0	/
8	4	16	4	4	/	/	0	1	-0.44	0	/	-0.04
9	5	11	/	/	0	5	1	3	-0.22	/	-0.19	-0.07
10	0	11	/	/	0	1	0	1	-0.41	/	-0.04	-0.04
11	5	10	/	/	0	2	0	0	-0.19	/	-0.07	0
12	3	8	0	2	/	/	0	1	-0.19	-0.07	/	-0.04
13	/	/	0	8	0	2	0	2	/	-0.30	-0.07	-0.07
14	/	/	2	10	0	6	1	2	/	-0.30	-0.22	-0.04
15	/	/	0	4	0	1	1	5	/	-0.15	-0.04	-0.15
16	6	13	/	/	2	6	4	4	-0.26	/	-0.15	0
17	1	5	1	4	/	/	0	0	-0.15	-0.11	/	0
18	/	/	0	10	0	1	1	7	/	-0.37	-0.04	-0.22
19	/	/	2	7	1	7	1	5	/	-0.19	-0.22	-0.15
20	2	6	/	/	0	3	1	2	-0.15	/	-0.11	-0.04
21	2	9	/	/	0	0	0	0	-0.26	/	0	0
22	2	13	3	2	/	/	0	0	-0.41	0.04	/	0
23	1	8	0	5	1	7	/	/	-0.26	-0.19	-0.22	/
24	2	14	2	1	/	/	0	3	-0.44	0.04	/	-0.11
25	0	2	0	0	/	/	2	11	-0.07	0	/	-.033
26	1	4	0	3	/	/	2	9	-0.11	-0.11	/	-0.26
27	0	3	0	4	0	4	/	/	-0.11	-0.15	-0.15	/
28	3	10	0	2	/	/	0	1	-0.26	-0.07	/	-0.04
29	/	/	1	0	5	12	0	1	/	0.04	-0.26	-0.04
30	3	9	/	/	0	5	1	5	-0.22	/	-0.19	-0.15

- Test Reliability: Tests reliability is defined as a way that states that results may be stable or consistent through time (Foster, 2001, p. 19). Reliability Measurement of the Scientific Concepts Acquisition Test was determined by two methods:

1. Kuder-Richardson-20 Formula: A pilot study with 100 students produced a KR-20 coefficient of 0.766, in which the reliability value is acceptable.

2. Parallel-Forms Reliability: Testing on (50) students resulted in a Spearman correlation of (0.85) and an acceptable value for Cronbach's Alpha of (0.88), thereby proving high reliability and strong internal consistency. As shown in Table (7).

Table (7) Reliability of Scientific Concepts Acquisition

Methods	N	Measures	Values	Interpretations
KR-20 Formula	100	KR-20 Coefficient	0.766	Acceptable Reliability
Parallel-Forms Reliability	50	Spearman (r)	0.85	High Reliability
Parallel-Forms Reliability	50	Cronbach's Alpha	0.88	Strong Consistency

The final test, consisting of **(28 items)**, is now ready for implementation with both the control and experimental groups (as shown in Appendix 2).

3.5. Research Implementation

- Held between December 19, 2024, for both sets of subjects under supervision, with the completion of the Scientific Concepts Acquisition Test.

4.Results and Discussion

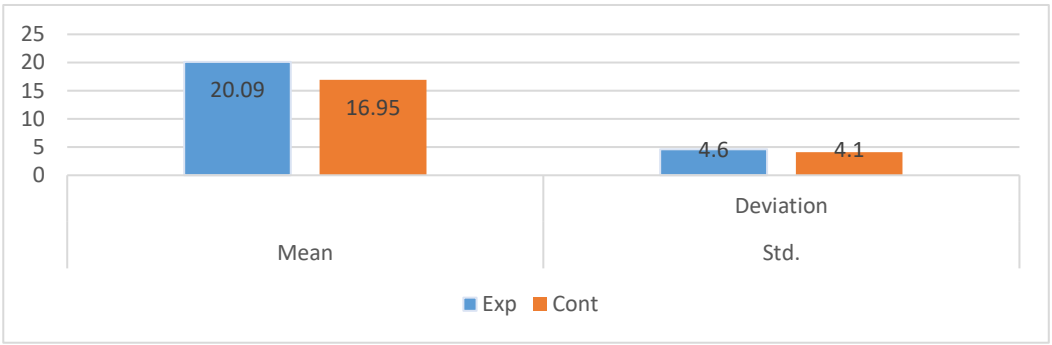
This research evaluated the influence of the Numbered Heads Together strategy on eighth graders' acquisition of scientific concepts is summarized as below:

The Hypothesis: The experimental group (NHT strategy) outperformed the control group in post-test with a statistically significant difference ($p = 0.003$). Indicating that NHT strategy has effective enhancement of scientific concepts installed to students moderated to large effect size (0.72). As indicated in Table (8) and Figure (2).

Table (8) Result of the Hypothesis by Independent t-test

Groups	N	Mean	Std. Deviation	p-Value	Significance at (0.05)	Effect Size (Cohen's d)
Exp **(post-t)**	35	20.09	4.60	0.003	Significant difference	0.72
Cont **(post-t)**	37	16.95	4.10			Moderate to large effect size

Figure (2) Shows the Difference Between two Groups for Post-tests of Scientific Concepts Acquisition



Discussions and Conclusions

The study shows that the Numbered Heads Together strategy enhances the acquisition of scientific concepts by students. The experimental group gains more understanding than the control group, thereby suggesting that the NHT strategy is effective towards the academic improvement of students in the science subject. The strategy motivates students to work with their peers, encourages interaction with other students, actively engages them to help students comprehend abstract scientific concepts, by nurturing the sense of accountability by asking such questions with the peer help that engage and encourage students to do the activity in NHT-learning thereby promoting retention, neglecting, and chunking.

What is now known about the NHT in learning is consistent with previous studies on cooperative learning in which this interaction and joint effort is highly regarded for the student's learning achievement. The study findings suggest that this NHT not only improves the cognition of students but also encourages them wherein they become active learners in their learning process. The strategy therefore, is extremely useful for teachers, especially those teaching science subjects, where it is crucial that students grasp the concepts as needed. NHT, therefore, promises to be a strategy that greatly improves the acquisition of scientific concepts by students. It serves the purposes of success in motivating them, encouraging collaboration, and achieving better results. Hence, it is expected that such strategy should be included in the teaching practice of much more effective teachers so that student participation and understanding in science subjects can be maximized. Future research could examine the effects of NHT on long-term student academic achievement in several disciplines**.**

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Appendix (1)

Validity Evaluation for Scientific Concepts Acquisition

No.	Name of Evaluators	University - College	Workplace
1	Prof. Hamed Mustafa Hamad	Salahaddin University / College of Physical Education	Teaching Methods of Physical Education
2	Prof. Hussein Saadi Ibrahim	Salahaddin University / College of Physical Education	Method of Teaching
3	Prof. Abdulrazzaq Yassin Abdullah	University of Mosul / College of Education for Humanities	Teaching Methods of Physics
4	Prof. Salwa Ahmed Amin	Salahaddin University / College of Basic Education	Measurement and Evaluation
5	Prof. Farhad Ali Mustafa	Salahaddin University / College of Physical Education	Teaching Methods of Physical Education
6.	Asst.prof. Ashqi Suleiman Hassu,	Salahaddin University / College of Basic Education	Teaching Methods of Science

Appendix (2)

The Scientific Concepts Acquisition Test for Eighth Graders

No.	Items	Options (A, B, C, D)
1	Microorganisms are prokaryotes and do not have a nucleus?	A. Bacteria B. Paramecium C. Ameba D. Protozoa
2	Which approach best represents the organization of bacterial classification?	A. Disease-causing ability B. Antibiotic resistance C. Shape, metabolism, and nutrition D. Habitat
3	Which statement best describes Bacteria and Archaea? (Canceled)	A. Unicellular & sexual reproduction B. Bacteria have a nucleus. C. Bacteria survive extremes, Archaea asexual D. Bacteria lack nucleus, Archaea survive extremes.
4	Which of the following best defines the reproduction of prokaryotes?	A. Eukaryotic with nuclei B. Sexual reproduction C. Asexual (binary fission). D. Multicellular with complex structures
5	What is an immature frog that lives in water and gets oxygen through gills called?	A. Frog B. Tadpole C. Larva D. Salamandar
6	What is the typical method of prokaryotic reproduction?	A. Sexual (meiosis). B. Asexual (binary fission) C. Spore formation D. Mitosis
7	Infectious agents with protein coat & genetic material requiring a host?	A. Bacteria B. Viruses C. Fungi D. Protists
8	What supports the claim that viruses are non-living?	A. Viruses replicate alone B. Require host for reproduction. C. Infect & cause disease D. Have protein coat but no genetic material
9	What describes viral structural diversity?	A. Circular, square, oval B. Rod, spiral, cuboidal, C. Crystals, spheres, cylinders, spacecraft. D. Flat, irregular, triangular
10	Which viral process turns a host into a virus-producing factory?	A. Lysogenic cycle B. Binary fission C. Lytic cycle D. Conjugation
11	How does the lysogenic cycle differ from the lytic cycle?	A. Lysogenic: dormant in DNA B. Lytic: dormant until division C. Lysogenic: integrates & replicates D. Lysogenic: forms protective coat
12	Which of the following best defines innate behavior?	A) A behavior that is learned through experience and practice B) A behavior that is genetically inherited and present at birth C) A behavior that is acquired through observation of others D) A behavior that changes in response to environmental factors
13	Define protists.	A. Prokaryotic & unicellular. B. Viruses infecting plants. C. Multicellular & sexual. D. Diverse eukaryotic microorganisms
14	Which differentiates protists?	A. Uni/multicellular, auto/heterotrophic. B. Unicellular, autotrophic, no nucleus

		C. Multicellular, heterotrophic, no control. D. Prokaryotic, single-celled, nucleus
15	How do protists obtain food?	A. Only autotrophic. B. Only heterotrophic. C. Either auto or heterotrophic. D. External nutrient absorption
16	Eukaryotic organisms with nucleus, cell wall, no chlorophyll, decomposers?	A. Plants B. Algae C. Bacteria D. Fungi
17	How do fungi obtain nutrients? (Canceled)	A. Eukaryotic with chlorophyll. B. Photosynthesis C. Decomposers on dead matter D. Absorb from plants
18	Mold fungi belong to which group?	A. Sac fungi B. Threadlike fungi C. Club fungi D. Imperfect fungi
19	Define photosynthesis.	A. Nutrient breakdown B. Absorbs nutrients & releases CO_2 C. Uses sunlight to synthesize food & oxygen D. Converts water into nutrients
20	Which characteristic best differentiates amphibians? .	A. Dry, scaly skin and shelled eggs. B. Dual life cycle with gills in water and lungs on land. C. Four-chambered heart and marine habitat. D. Warm-blooded with feathers
21	Role of plant pigments in photosynthesis?	A. Absorbed in chloroplasts for glucose. B. Converts light into water. C. Absorbed outside chloroplasts. D. Produces CO_2.
22	What is cellular respiration?	A. Plants converting sunlight. B. Oxygen use to produce energy. C. Plants absorbing nutrients. D. Cells releasing CO_2 & H_2O
23	What defines animals?	A. Unicellular, prokaryotic, with cell walls and autotrophic. B. Multicellular, eukaryotic, heterotrophic, without cell walls. C. Multicellular, eukaryotic, autotrophic, with cell walls. D. Unicellular, eukaryotic, heterotrophic, with cell walls.
24	How do cells convert sugar into energy?	A. Mitochondria breakdown sugar. B. Sugar into sunlight. C. Glycolysis → ATP D. Sugar stored in nucleus
25	What is pollination?	A. Pollen from ovule to seed. B. Pollen from anther to stigma. C. Seeds from fruit & nutrients. D. Pollen in ovules develops into seed.
26	Difference between pollination & fertilization?	A. Pollination: pollen transfer; Fertilization: gamete fusion. B. Pollination: pollen production. C. Pollination: insect transfer; Fertilization: root-based. D. Pollination: seed germination.
27	What is fertilization in flowering plants?	A. Ovules dispersed, fuse externally. B. Pollen absorbs nutrients. C. Pollen fertilizes ovule in soil. D. Pollen lands on stigma, fuses in ovule
28	What are tropisms?	A. Growth response to gravity. B. Growth towards/away from light. C. Response to touch. D. Growth influenced by environment
29	What is the purpose of down feathers in birds?	A. Aid in flight. B. Attract mates. C. Cover the bodies of young birds. D. Protect from predators.
30	Main types of tropisms?	A. Two B. Three C. Four D. Five

کاریگەریی ستراتیژی بەژداریکردنی قوتابیان بە گرووپی سەرەژمارە NHT لە وەرگرتنی چەمکە زانستییەکان بۆ قوتابیانی پۆلی هەشتەمی بنەڕەتی

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پوختە

ئامانجی توێژینەوەکە زانینی کاریگەریی ستراتیژی بەژداریکردنی قوتابیان بە گرووپی سەرەژمارە NHT لە وەرگرتنی چەمکە زانستییەکان بۆ قوتابیانی پۆلی هەشتەمی بنەڕەتی بۆ هەردوو گرووپی تاقیکاری و کۆنترۆڵکراو هاوتا کراو. نمونەی توێژینەوەکە پێکهاتبوو لە حەفتا و دوو قوتابی کچی پۆلی هەشتەمی بنەڕەتی لە قوتابخانەی پەروا بنەڕەتی کچان کە بە شێوەیەکی هەڕەمەکی بۆ گرووپی تاقیکاری (٣٥) قوتابی بە بەکارهێنانی ستراتیژی NHT ، وە گرووپی کۆنترۆڵ (٣٧) قوتابی کە بە شێوەیەکی ئاسایی. تاقیکردنەوەیەک بۆ وەرگرتنی چەمکە زانستییەکان بەکارهێنرا بۆ هەڵسەنگاندنی دەرەنجامەکان، کە بۆ متمانەپێکردن بە جێگیری بەکارهێنانی کودەر-ریچاردسۆن(٠.٧٧) و فۆرمەکانی هاوتەریب(٠.٨٥) جێبەجێکرتنی توێژینەوەکە لە ٣٢ پلانی وانە پێکهاتبوو ، بۆ ماوەی حەوت هەفتە. ئەنجامەکان جیاوازییەکی بەرچاویان نیشان دا لە ئاستی ئاماری (٠،٠٥) لە بەرژەوەندی گرووپی تاقیکاری. ئەم دۆزینەوە بە ڕوونی پشتگیری لە ستراتیژییەکانی فێربوونی هاریکاری دەکات، وەک ستراتیژی NHT، لە گەشەپێدانی وەرگرتنی چەمکە زانستییەکان، بەشداریکردن و ئارەزووی زانست. توێژینەوەکانی داهاتوو پێویستە کاریگەرییە درێژخایەنەکانی بەکارهێنانی NHT لە سەرانسەری بابەت و ئاستەکانی تردا ئانجام بدرێت.

وشەی سەرەکییەکان: ستراتیژی بەژداریکردنی قوتابیان بە گرووپی سەرەژمارە NHT، وەرگرتنی چەمکە زانستییەکان، قوتابیانی پۆلی هەشتەمی بنەڕەتی.

فاعلية استراتيجية الرؤوس المرقمة (NHT) في اكتساب المفاهيم العلمية لدى طالبات الصف الثامن الاساس

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الملخص

هدف البحث التعرف على فاعلية استراتيجية الرؤوس المرقمة (NHT) في اكتساب المفاهيم العلمية لدى طالبات الصف الثامن الاساس. كان تصميم التجربة اختبارًا بعديًا بمجموعتين تجريبية وضابطة (المتكافئتين). تكونت العينة من اثنين وسبعين طالبة من الصف الثامن من مدرسة بقروا للبنات تم توزيعهن عشوائيًا على المجموعة التجريبية (٣٥) طالبة التي تم تدريسها باستخدام استراتيجيةNHT ، والمجموعة الضابطة (٣٧) طالبة التي تم تدريسها بالطريقة التقليدية. تم استخدام اختبار اكتساب المفاهيم العلمية المكون من ٢٨ فقرة لتقييم النتائج، والتي تم ضمان الثبات باستخدام معادلة كيودر ريتشاردسون-٢٠ (٠.٧٧) والثبات بطريقة الصور المتوازية(٠.٨٥). واحتوت التجربة على ٣٢ خطة درس لمدة سبعة أسابيع. أظهرت النتائج فرقًا كبيرًا ($p \leq 0.05$)لصالح المجموعة التجريبية. يدعم هذا الاكتشاف بوضوح استراتيجيات التعلم التعاوني، مثلNHT ، في تحسين فهم المفاهيم والمشاركة والاهتمام بمادة العلوم وقد تحدد الدراسات المستقبلية الآثار طويلة المدى واستخدام NHT في المواد والمستويات الأخرى.

الكلمات المفتاحية: استراتيجية الرؤوس المُرقمة ، اكتساب المفاهيم العلمية، طالبات الصف الثامن الاساس .