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Application of the NHT Model Combined with Question Cards on Biology Learning Outcomes

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ABSTRACT

Online learning that lasts more than two years makes it difficult for teachers to measure learning outcomes in the attitude and psychomotor aspects of students. Students tend to be silent and passive which makes learning difficult to be interactive. Teachers need to apply learning innovation strategies so that students are more enthusiastic in learning. This study aims to determine the learning outcomes of class XI MIPA students at SMA Negeri 5 Surakarta in the 2022/2023 school year on the subject of the human reproductive system by applying the Numbered Head Together (NHT) learning model combined with question cards. This study used a quantitative approach with a quasi-experimental method involving two classes, namely class XI MIPA 1 as the experimental class and class XI MIPA 4 as the control class, each of which consisted of 36 students. The instruments used in this study were multiple choice question sheets to determine students' cognitive learning outcomes and observation sheets to determine student activity. The posttest average score for the cognitive aspects of the control class was 78.5 and that of the experimental class was 87.72. Meanwhile, the average percentage of student activity (PKS) for the affective aspect of the control class was 71.14% and that of the experimental class was 82.27%. The data analysis technique uses the Independent Sample T-Test, which was previously tested for normality and homogeneity. The results of the F test show that there is a difference in the average values in the two classes (sig. 0.000 <0.05). The application of NHT is able to increase student activity in class.

1. INTRODUCTION

The development of a nation is denoted by progress across various domains, with education being a crucial one. It can be asserted that education is effective when it contributes to the advancement of a nation. This holds true for Indonesia, where the caliber of education necessitates enhancement, particularly with regard to elevating the educational standards. Additionally, education serves as the principal asset for a nation to attain optimal growth (Lestari, 2018).

The attainment of maximum learning outcomes by students is an indication of a thriving learning process. These outcomes refer to modifications in behavior that are accomplished within a particular timeframe, encompassing cognitive, affective, and psychomotor aspects of learning (Gracia and Anugraheni, 2021). As a result, it is imperative to adopt a suitable, non-teacher-centered learning approach that can encourage students to take a keen interest, display enthusiasm and dedication towards learning, culminating in an upswing in their learning outcomes.

As a result of the pandemic that broke out in mid-2019, it also had an impact on the education sector. More than a year of online learning has found a negative impact on students. Students begin to lose interest in learning and even discipline. School work is taken over by parents as a result of which teachers experience difficulties in measuring the learning outcomes of their students (Ramadhan et al., 2022).

The impact of post-pandemic learning has also greatly affected student activity in class. According to Handita, Prasetyo, and Sugiyem (2022) a decrease in the level of activity is seen in students who do not pay attention to collecting homework and when students are carrying out distance learning activities (PJJ) students wish to be silent and passive. During limited face-to-face learning (PTMT), students are still sensitive so learning is not interactive. This learning causes students to feel difficult because the teacher always focuses on demonstrating material and learning that is still teacher centered (Bano, Supu, and Lantik, 2019). As a result, educators must incorporate various pedagogical techniques, including introducing novelty in the learning experience, to foster greater engagement and excitement among learners (Widyasari, 2022).

Furthermore, the relationship between students is also not good because the learning process is still in the nature of one instruction, namely only between the teacher and students. This unfavorable relationship between students will affect the relationship between students. For example, there will be a lack of capacity for cooperation and communication. Active learning learning styles can be applied on students. Different types of learning make it easier for teachers to choose the style most relevant to the subject, educational object, classroom atmosphere, and student situation. An example of active learning that can be applied is Numbered Head Together (NHT) (Bano, Supu, and Lantik, 2019). It is easier for students to pursue learning (Risnawati and Saefuloh, 2019) and students can play an active role in improving their learning outcomes (Sari, 2017).

Therefore, researchers are interested in testing the application of Numbered Head Together (NHT) learning media combined with question cards in improving aspects of student biology learning outcomes in the material of the human reproductive system class XI MIPA SMA Negeri 5 Surakarta Academic Year 2022/2023.

2. MATERIALS AND METHOD

The research was conducted in March-May 2023 at SMA Negeri 5 Surakarta

2.1. Population

The population in this study were students in class XI MIPA 1-5 SMA Negeri 5 Surakarta Academic Year 2022/2023.

2.2. Sample

The samples used in this study were students of class XI MIPA 1 as the experimental class and class XI MIPA 4 as the control class.

2.3. Sampling Technique

The sampling technique used in this study was a purposive sampling technique in which samples were taken from the entire population according to certain criteria, such as the recommendations and considerations of the biology teacher.

2.4. Data Analysis Technique

The data analysis technique uses SPSS Statistics 20 which begins with testing the level of difficulty and validity of the items. Then the cognitive learning outcomes data obtained will be analyzed using the normality test and homogeneity test. If the data is normally distributed, it will be followed by testing the hypothesis with the Independent Sample T Test.

3. RESULT AND DISCUSSION

3.1. Result

Based on the validity test of the items conducted in class XI MIPA 5 as an instrument test class, the following results were obtained:

Table 1. Test results of the validity of the items.

Question item	r count	r table	Criteria
1	0,007	0,355	Invalid
2	0,670	0,355	Valid
3	0,423	0,355	Valid
4	0,206	0,355	Invalid
5	0,338	0,355	Invalid
6	0,559	0,355	Valid
7	0,289	0,355	Invalid
8	0,225	0,355	Invalid
9	0,739	0,355	Valid
10	0,290	0,355	Invalid
11	0,456	0,355	Valid
12	0,391	0,355	Valid
13	0,589	0,355	Valid
14	0,408	0,355	Valid
15	0,285	0,355	Invalid
16	0,583	0,355	Valid
17	0,153	0,355	Invalid
18	0,060	0,355	Invalid
19	0,463	0,355	Valid
20	0,353	0,355	Invalid
21	0,417	0,355	Valid
22	0,080	0,355	Invalid
23	0,190	0,355	Invalid
24	0,023	0,355	Invalid
25	0,302	0,355	Invalid

$$r\ table: DF = number\ of\ samples - 2$$
$$= 33 - 2$$
$$= 31 \rightarrow 0.355$$

Based on the reliability test of questions conducted in class XI MIPA 5 as an instrument test class, the following results were obtained:

Table 2. The results of the reliability test questions.

Cronbach's Alpha	**Reliability scale**	**Criteria**
0,674	0,6	Reliable

Based on the different power tests conducted in class XI MIPA 5 as an instrument test class, the following results were obtained:

Table 3. The results of the power test are different questions.

Question item	**Corrected item**	**Different power scale**	**Criteria**
1	-0.112	0.4	Bad
2	0.587	0.4	Good
3	0.344	0.4	Bad
4	0.127	0.4	Bad
5	0.217	0.4	Bad
6	0.500	0.4	Good
7	0.155	0.4	Bad
8	0.160	0.4	Bad
9	0.665	0.4	Good
10	0.175	0.4	Bad

Question item	Corrected item	Different power scale	Criteria
11	0.372	0.4	Bad
12	0.264	0.4	Bad
13	0.498	0.4	Good
14	0.301	0.4	Bad
15	0.152	0.4	Bad
16	0.488	0.4	Good
17	0.025	0.4	Bad
18	-0.031	0.4	Bad
19	0.343	0.4	Bad
20	0.280	0.4	Bad
21	0.329	0.4	Bad
22	-0.049	0.4	Bad
23	0.067	0.4	Bad
24	-0.116	0.4	Bad
25	0.170	0.4	Bad

Based on the problem difficulty level test conducted in class XI MIPA 5 as an instrument test class. the following results were obtained:

Table 4. The test results of the difficulty level of the questions.

Question item	Mean	Criteria
1	0.76	Easy
2	0.67	Medium
3	0.12	Hard
4	0.09	Hard
5	0.30	Medium
6	0.91	Easy
7	0.55	Medium
8	0.94	Easy
9	0.52	Medium
10	0.24	Hard
11	0.85	Easy
12	0.45	Medium
13	0.27	Hard
14	0.24	Hard
15	0.42	Medium
16	0.70	Medium
17	0.30	Medium
18	0.12	Hard
19	0.48	Medium
20	0.09	Hard
21	0.15	Hard
22	0.30	Medium
23	0.27	Hard
24	0.48	Medium
25	0.42	Medium

Based on the normality test conducted in class XI MIPA 1 as the NHT treatment class and class XI MIPA 4 as the control class, the following results were obtained:

Table 5. Normality test results.

	Kolmogorov-Smirnow	Saphiro-Wilk
	Sig.	Sig.
Pretest NHT	0.200	0.110
Pretest Kontrol	0.200	0.250
Posttest NHT	0.118	0.080
Posttest Kontrol	0.018	0.017

Based on the homogeneity test conducted in class XI MIPA 1 as the NHT treatment class and class XI MIPA 4 as the control class, the following results were obtained:

Table 6. Homogeneity test results.

Based on mean	Keterangan
0,418	Homogen

Based on the Independent Sample T-Test test conducted in class XI MIPA 1 as the NHT treatment class and class XI MIPA 4 as the control class, the following results were obtained:

Table 7. Independent Sample T-Test results.

Hasil uji hipotesis	Sig	Keterangan
Uji F	0.088	The variance is homogeneous
Equal Variance Assumed (Sig 2-tailed)	0.000	There is significant difference

Based on the percentage value of student learning activity carried out in class XI MIPA 1 as the NHT treatment class and class XI MIPA 4 as the control class, the results are as follows:

Table 8. Percentage value of Student Learning Activeness.

Treatment class	Percentage value (%)	Criteria
NHT	82.27	High
Control	71.14	Medium

3.2. Discussion

3.2.1. Cognitive aspect research result

The results of Table 1 test the validity of the items tested using the product moment correlation equation (rxy) to test the validity of the questions. The validity value of the questions obtained will be compared with the value of r table, if r count > r table then the research instrument has a significant correlation with the total score (the question instrument is declared valid). However, if r count < r table, the research instrument does not have a significant correlation with the total score (the item instrument is declared invalid). Value N = 33 with a significance level of 5% obtained r table = 0,355. The questions were given to class XI MIPA 5 with 33 students. Of the 25 questions tested, 10 questions were valid and 15 questions were invalid.

The reliability test results in table 2 with reference to the reliability coefficient (r11) > 0.6 or 0.7 or according to table r (Product Moment) obtained a coefficient value of Cronbach's alpha of 0.674 (0.674 > 0.6). So this research instrument has a high level of reliability.

If the corrected item > 0.4 in table 3 the results of the test for different power of the questions then the questions have good criteria. Of the 25 questions tested, 5 items had different criteria for good questions and 20 questions had bad criteria.

Table 4. The test results for the difficulty level of the questions obtained mean which is categorized according to Arifin (2014), namely the difficulty level of the item (p) has a range of $p > 0.70$ which is in the easy category, 0.30, 0.30 $\leq p \geq 0.70$ which is in the medium category, and $p < 0.30$ categorized as difficult. Of the 25 questions tested, 9 questions were in the difficult category, 12 questions were in the medium category, and 4 questions were in the easy category.

The objective of conducting the normality examination in Table 5 is to determine if the data follows a normal distribution. The normality examination using the SPSS software generates a p-value in the NHT pretest 0.200 (0.200 > 0.05), the control pretest 0.200 (0.200 > 0.05), the NHT posttest 0.118 (0.118 > 0.05), and the control posttest 0.018 (0.018 <0.05) indicating that the data follows a normal distribution.

Table 6 displays the outcomes of the homogeneity test, which was conducted using the average value of 0.418 (0.418 > 0.05). This indicates that the data is uniform or possesses equivalent initial capabilities, making it suitable for various test analyses (such as the Independent Sample T-Test)..

The statistical depiction examination comprises of the mean, standard deviation, variability, and the number of pupils based on the evaluation of the cognitive domain of pupil achievement. Information on pupil achievement was collected using examination tools in the shape of multiple-choice queries totaling 25 queries provided to each experimental group and control group. The examination tool provided is a matter that has been tested for validity, reliability, discriminatory ability, and level of complexity. Examinations were provided at the start of learning and at the end of learning in the shape of a pretest and posttest to determine pupil achievement during the treatment. The highest pretest value in the control group was 68 and in the experimental group was 80. The initial capability of the experimental group was higher than that of the control group, with an average pretest of the control group 48.89 and the experimental group 50.56.

The results obtained from the students' final learning capabilities (posttest) have shown an increase. The highest posttest scores in the control and experimental classes were 92 and 96. The final capability of the experimental class was higher than that of the control class, with an average posttest score of 87.72 for the control class and 78.5 for the control class. This aligns with the research conducted by Imam and Taufik (2022), which suggests that the Numbered Head Together (NHT) learning model has an impact on enhancing learning outcomes in Science Physics Class X SMA Negeri 1 Sanggar for the 2021/2022 academic year, with the experimental class having an average score of 79.00 and the control class having an average score of 69.35. This is also supported by the findings of Nandhitha and Wirdati (2023), which indicate that the average academic achievement of PAI students who implement the Numbered Head Together (NHT) learning approach is superior to the average score of students who receive traditional education in Islamic studies, with an average score of class IV-D (experimental class) being 92.35 and class IV-A (control class) being 72.23.

Moreover, in order to determine whether there are disparities in the learning outcomes of the control and experimental groups, it is essential to

conduct a hypothesis test. The aim of this study was to investigate whether the Numbered Head Together (NHT) instructional model, when combined with question cards, can enhance students' cognitive learning outcomes. The Levene test in Table 4.9 is utilized to ascertain whether the Equal Variance Assumed variant will be employed in a homogeneous manner or not. The hypothesis is then formulated as follows: H0 = There is no difference in the test scores of the experimental and control groups, and Ha = There is a difference in the test scores of the experimental and control groups. According to Table 4.7, the F test value is 0.088 (0.088 > 0.05). Therefore, H0 is accepted and Ha is rejected. Hence, it can be concluded that there is a disparity in the test score data between the experimental and control groups.

The Independent Sample T-Test is utilized to ascertain the hypothesis, specifically: H0 = There is no distinction in the average values of the experimental and control groups, and Ha = There is a distinction in the average values of the experimental and control groups. Based on the F test, the value of Equal Variance Assumed (Sig 2-tailed) was 0.000 (0.000 <0.05), resulting in the rejection of H0 and acceptance of Ha. Therefore, it can be concluded that there is a disparity in the average value between classes using the Numbered Head Together (NHT) model combined with question cards and the control class using the traditional model. This outcome aligns with Pulungan's study (2023) which confirms that the utilization of Numbered Head Together (NHT) as a learning tool in Biology class on the subject of human movement systems for class XI IPA 4 SMAN 1 Batang Angkola has an impact on enhancing student learning outcomes, with the experimental group achieving an average posttest score of 90.6 and the control group scoring 83.9. The t-test results yielded a significance of 0.000, indicating that the use of NHT had an influence on student learning outcomes. Furthermore, in Nurgufriani, Uyun, and Saputra's study (2023), the effectiveness of the Numbered Heads Together approach using cards in enhancing mathematics learning outcomes for elementary students exhibited an average difference, with the NHT card group scoring 79.38, while the NHT group without cards scored 64. This demonstrates that NHT with numbered cards and pictures has a slightly greater impact than NHT without media in enhancing mathematics learning achievement in elementary schools.

3.2.2. Result of student learning activeness research

The percentage value of Student Learning Activeness (KBS) can be categorized with intervals (Arikunto, 2016): 75% $\leq$ KBS $\leq$ 100% is in the high category, 50% $\leq$ KBS $\leq$ 75% is in the medium category, 25% $\leq$ KBS $\leq$ 50% is in the low category, and 0 % $\leq$ KBS $\leq$ 25% is very low category.

Based on the results of the percentage value of Student Active Learning (KBS) in table 8, the average KBS in the experimental class was 82.27% (high category) and in the control class was 71.14% (medium category). The affective domain is in the form of an assessment given to learning residents based on their feelings and emotional aspects. This refers to interests, attitudes, judgments, and adaptation potential (Hamdani and Nurdin, 2020). The application of Numbered Head Together (NHT) combined with question cards is considered capable of arousing student activity in learning. This is in line with the research of Viani, Bahar, and Elvinawati (2017) that student learning outcomes assisted by Tournament Question Cards media have an average pretest score of 28.24 and a posttest average score of 85.59 with a difference in average scores pretest and posttest mean of 57.35. The use of this media can also change the learning

situation to be fun and exciting which can trigger a competitive spirit for each group to be able to solve all questions well.

The application of the Numbered Head Together (NHT) model can encourage students to be more active, creative, and explore student understanding through their knowledge and can increase interaction between peers in discussions which can improve student learning outcomes (Nourhasanah and Aslam, 2022).

According to the research conducted by Sriyanti (2019), incorporating supportive tools can enhance the comprehension of mathematical theories among students in class VIII SMPN 1 Sanrobone. The pretest score, which was in the low category with an average of 27.11, improved to a posttest score of 55.74, falling in the medium category. This signifies a noteworthy advancement of 37% in students' understanding of math concepts.

4. CONCLUSIONS

Based on the findings of a study conducted in class XI MIPA 1 and XI MIPA 4 at SMA Negeri 5 Surakarta for the academic year 2022/2023, it can be inferred that the utilization of the Numbered Head Together (NHT) approach in conjunction with question cards in teaching the topic of the human reproductive system has the capability to enhance students' cognitive learning outcomes, with the experimental class averaging at 87.78. Additionally, the students' engagement in the learning process, as measured by the Student Learning Involvement (KBS) index, achieved an average score of 82% (falling within the high category).

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