Measuring Changes in Creativity Thinking of Hydrocarbon Concepts in Students Taught with *Hyperdocs* Worksheet Modeling

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Abstract

This research was conducted to determine the changes in conceptual thinking creativity in hydrocarbons among students who were taught by using the *Hyperdocs* Worksheet at SMA Negeri 7 Gorontalo. The method used in this research is quasi experiment with nonequivalent control group design. The samples consisted of students from class XI Merdeka 1 as the experiment group and XI Merdeka 2 as a control group at SMA Negeri 7 Gorontalo, selected using purposive sampling. The result showed normal distribution and homogeneity. The average *pre-test* score for the experimental class was 31% and the *post-test* score was 82%, while the control class had an average *pre-test* score of 28% and a the *post-test* score 60%. Furthermore, based on the hypothesis testing using a t-test at a significance level of $\alpha = 0.05$, a t_{count} was 9.25 with a t_{table} of 1.671. The value indicates a change in hydrocarbon conceptual thinking creativity among students taught using Hyperdocs Worksheet modeling. The results of the N-Gain test showed that the average N-Gain score for the experiment class was 0.73 and that for the control class, was 0.43, This indicates a high N-Gain score in the experimental class and a low N-gain score in the control class. Therefore, using *Hyperdocs* Worksheets modeling effectively enhances students' creativity in thinking about hydrocarbon concepts.

1. INTRODUCTION

According to the Global Creativity Index 2015, Indonesia ranks 115 out of 139 countries, indicating that the level of creativity in the country is still low. Lack of teacher effort to enhance students' creative thinking skills results in limitations in students' creative thinking abilities (Qomariyah & Subekti, 2021).

Teachers in the modern day are expected to be able to use technological advancements to create engaging learning experiences. This is done to help the students comprehend the content that is being taught (Timumun et al., 2022). Learning media plays an important role in the learning process. During the process, teachers can utilize the Student Worksheet (LKS) as a learning resource. According to the National Department of Education, Student Worksheets are learning materials that contain tasks that must be done by students (Depdiknas, 2008).

Teaching materials that are interesting and not monotonous are expected to help students understand the tasks given and facilitate the learning process for educators. In addition, educators are also expected to create an environment that supports students in acquiring relevant skills (Habibah & Mitarlis, 2020).

The use of *Hyperdocs* is one method to integrate digital technology in making Student Worksheets (LKS) which aims to increase students' scientific creativity (Highfill et al., 2016). As per the findings of Highfill et al. (2016), this platform fosters critical thinking, creativity stimulation, idea generation, exploration, inquiry

technique selection, and teamwork among students. Additionally, generating digital worksheets with Hyperdocs might help students become more adept at applying their creative ideas.

Given that science learning involves abstract material and requires the right approach to achieve effective learning goals, learning should not only be limited to textbooks or instructions from teachers but should also provide space for students to discover and create new things in their way (Manurung et al., 2023).

Based on the description above, this study aims to determine changes in the creativity of thinking about the concept of hydrocarbons in students who are taught with *Hyperdocs* Student Worksheet (LKS) modeling.

2. METHOD

Quasi Experiment Design research using Non-equivalent Control Group Design is used in this kind of study. Class XI Merdeka 1 is the experimental class that employs Hyperdocs worksheet modeling, and class XI Merdeka 2 is the control class that uses traditional worksheet modeling with the problem based learning learning model. this sampling technique is known as purpose sampling.

Data collection using the test method with the aim of measuring changes in students' thinking creativity in the form of 5 essay-shaped questions on hydrocarbon material that have been tested for validity and reliability tests. Data analysis techniques for *pre-test* and *post-test* results using Excel software for calculating the percentage of changes in students' thinking creativity, L-test, F-test, N-Gain test, and T-test.

3. RESULT AND DISCUSSION

3.1. Result

The average score for the pre- and post-tests indicates that the experimental class outperformed the control class, with the experimental class scoring 31% and 82% on average, while the control class scored 28% and 60%, according to the research findings. Thus, it is evident that the pre-test value and the post-test value have significantly increased.

The results of the data normality test used the Liliefors statistical test at the significance level $\alpha = 0.05$. If $L_{count} < L_{tabel}$ and the hypothesis H_1 is accepted, then the data is considered normal. By using L_{tabel} 0.161, the normality test resulted in pre-test and post-test values of 0.128 and 0.119 for the experimental class. In contrast, the control class' L_{tabel} 0.161 consisted of 0.125 and

0.145. Since $L_{count} < L_{tabel}$ in both cases, the normality test is normally distributed in both classes. The homogeneity test resulted in pre-test and post-test values of 1.359 and 1.202 respectively and an F_{table} value of 4.001, which indicates that both classes are homogeneous when $F_{count} \leq F_{table}$. The experimental class's N-*Gain* score test result was 0.73, which falls into the high category. Even though the control class's N-*Gain* score was 0.43, this outcome fell into the poor category. Therefore, hypothesis testing was performed using the T-test. The results of hypothesis testing using the T-test obtained $t_{count} = 9.250$. The calculation data shows the value of $t_{count} > t_{table}$ which is $9.250 > 1.671$ which means H_1 is accepted and H_0 is rejected. Based on the hypothesis testing above, it can be concluded that there is a change in students' creativity in thinking about the concept of hydrocarbons among those taught using the Hyperdocs Student Worksheet (LKS) at SMA Negeri 7 Gorontalo.

3.2. Discussion

Based on the research data, there is a notable increase in the average scores from the pre-test to the post-test. Additionally, there are differences in scores between the experimental and control classes, with the experimental class achieving the highest average score. The N-*Gain* score for the experimental class was 0.73, which falls into the high category, representing a 73% gain. In contrast, the control class had an N-*Gain* score of 0.43, placing it in the low category, with a 43% gain. The results obtained are an increase in students' concept understanding which can be concluded that the learning model used is quite effective. *Pre-test* and *post-test* data in both classes can be seen in Figure 1.
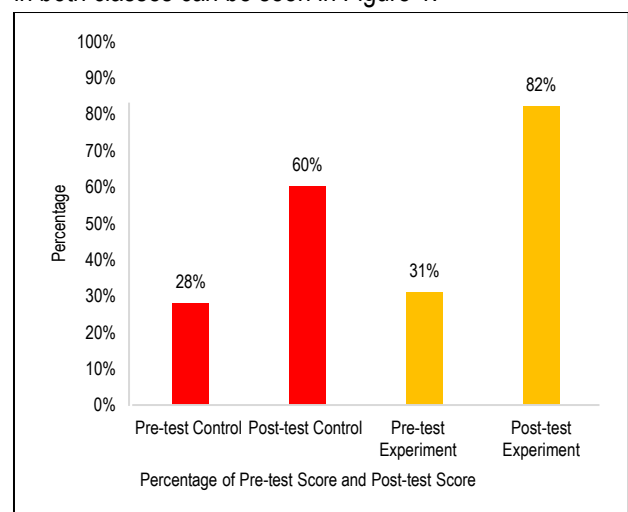

Figure 1. Results of Percentage Score (%) of Thinking Creativity Results

There was a significant increase in the average scores from the pre-test to the post-test. Additionally, differences in scores between the experimental and control classes were observed, with the experimental class achieving the highest average score. This is because the experimental class received a different treatment, specifically using Hyperdocs Student Worksheet Modeling (LKS), while the control class used conventional worksheet modeling. In the experimental class and the focus of research includes 5 stages of the PBL (*Problem Based Learning*) model, namely at the student orientation stage, beginning with discourse and questions that lead to the material and during learning there are already several students who actively answer. The stage of orienting students to the problem, it begins with students observing the problems that surround students and questions that lead to the material and during learning so that *Hyperdocs* provides advantages in the learning process by allowing students to start with the problem orientation stage. This means that students can observe the problems around them and ask questions that lead to learning material. In addition, *Hyperdocs* facilitates students' active interaction with learning, as seen when some students are enthusiastic and active in answering questions during learning.

The stage of organising students to learn is through the use of *Hyperdocs* Student Worksheets (LKS) which can be accessed via mobile phones, students are given access to different problems, allowing them to learn according to their own needs and interests. In addition, in the stage of helping students solve problems, *Hyperdocs* facilitates students in collecting relevant data and developing critical thinking skills by questioning, reasoning, and finding explanations of problems given in the previous phase. With the teacher serving as a facilitator and guide, Hyperdocs ensures that the learning process remains focused and effective, while keeping students actively engaged in their own learning.

At the stage of developing and presenting the results of problem solving, *Hyperdocs* offers a significant advantage at this stage. Its collaborative features enable students to engage in active discussions with their group members. This allows them to try and make connections between the concepts they have learnt in the lesson, deepening their understanding together. In addition, after answering the various questions posed, students

automatically gain a deeper understanding of the concepts in the hydrocarbon material. *Hyperdocs* helps students apply the concepts they learnt to new questions, facilitating a deeper understanding and practical use of the learning material.

In the last stage, namely analyzing and evaluating the problem-solving process, namely the *Hyperdocs* Student Worksheet (LKS), each student can present the results of their discussion in a structured and documented manner. Through teacher guidance, students are encouraged to face problems with more confidence and present their problem-solving results clearly and in detail. In this case, the teacher can provide timely and in-depth feedback, and assist students in evaluating and improving their problem-solving process. *Hyperdocs* fosters purposeful, reflective, and continuous learning, allowing students to develop critical analysis and evaluation skills in problem-solving. This aligns with the findings of previous research by Poba et al., (2023) that students seemed enthusiastic and more active during the learning process. This can make a difference between modeling *Hyperdocs* Student Worksheets (LKS) and Conventional Student Worksheets (LKS) with students learning in groups that have determined their respective roles. This role can form different responsibilities in each of them so that there is more directed cooperation in analysing information and finding the concept of each activity in the syntax included in the Student Worksheet (LKS).
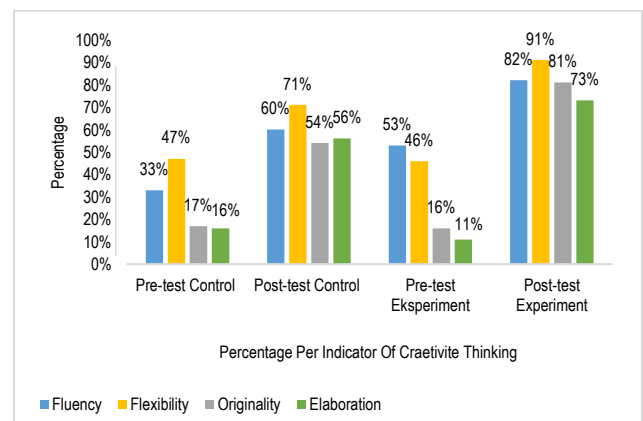

Figure 2. Results per indicator creative thinking with Hyperdocs and conventional worksheet modeling

The measurement results of changes in thinking creativity in each indicator in SMA Negeri 7 Gorontalo

students can be seen in Figure 2. In testing changes in students' thinking creativity, 5 items in the form of essays were given. The percentage of students' creative thinking in the experimental class increased significantly from the pre-test to the post-test, showing an average of 31% in the low category and 82% in the very high category. In contrast, the control class averaged 28% in the low category and 60% in the medium category. In the experimental class, the average percentages for creativity indicators were as follows: in the pre-test, fluency was 53%, flexibility was 46%, originality was 16%, and elaboration was 11%. In the post-test, these percentages increased to 82% for fluency, 91% for flexibility, 81% for originality, and 73% for elaboration. Whereas in the control class, the average percentage of *pre-test* on fluency indicators was 33%, *flexibility* 47%, originality 17%, and elaboration by 16% and *post-test* in the control class was on fluency indicators 60%, *flexibility* 71%, *originality* 54%, and *elaboration* by 56%. The data from these indicators show that the experimental class achieved higher values due to the different treatment. Therefore, it can be concluded that there is a notable improvement in the creativity of thinking about the hydrocarbon concept among students taught with Hyperdocs Student Worksheet (LKS) modeling at SMA Negeri 7 Gorontalo.

4. CONCLUSION

Based on the results of data analysis and discussion after learning about hydrocarbon material with *Hyperdocs* Student Worksheet (LKS) modeling treatment in the experimental class, the average *pre-test* and *post-test* scores of students' thinking creativity abilities from 31% increased to 82%. In the control class, the average *pre-test* and *post-test* of students' thinking creativity ability from 28% only reached 60%. The t-test results show the t_{count} is 9.25 with a t_{table} value of 1.671, the value shows the $t_{count} > t t_{able}$. The *N-gain* test also shows changes in creativity in thinking about the concept of hydrocarbons in students who are taught with the *Hyperdocs* Student Worksheet (LKS) modeling used is included in the high category. So it is concluded that H_0 is rejected and H_1 is accepted so that it is known that there are changes in the creativity of thinking about the concept of hydrocarbons in students who are taught with *Hyperdocs* Student Worksheet (LKS) modeling.

For future researchers, it is recommended to conduct further research on other materials or certain conditions as a development of this study. In addition, further research could also involve additional factors, such as the use of different technologies or combinations of other learning methods.

5. ACKNOWLEDGEMENTS

6. REFERENCES

DeCamillis, K. (2023). HyperDocs, GIFs, and Collaboration Boards: Online Writing Instruction Supports for English Learners. CATESOL Journal, 34.

Depdiknas. (2008). *Pedoman Khusus Pengembangan Silabus dan Penilaian Kurikulum 2006*. Direktorat Pendidikan Menengah Umum.

Habibah, U. N., & Mitarlis, M. (2020). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berorientasi Mind Mapping untuk Melatihkan Keterampilan Berpikir Kreatif pada Materi Hidrokarbon. *Unesa Journal of Chemical Education*, *9*(1), 9–15.

Highfill, L., Hilton, K., & Landis, S. (2016). *Panduan HyperDoc: Desain Pelajaran Digital Menggunakan Google Apps*.

Ishlahul'Adiilah, I., & Haryanti, Y. D. (2023). Pengaruh Model Problem Based Learning Terhadap Kemampuan Berpikir Kreatif Siswa Pada Pembelajaran IPA. Papanda Journal of Mathematics and Science Research, 2(1), 49–56.

Jamila, M. R. M., Nohb, N. M., Idrisa, N., Othmana, M. S., & Md Zallia, M. M. (2023). Enhancing Higher Order Thinking Skills Among TVET. HyperDocs as a Tool for TVET Teachers.

Manurung, A. S., Fahrurrozi, F., Utomo, E., & Gumelar, G. (2023). Implementasi Berpikir Kritis dalam Upaya Mengembangkan Kemampuan Berpikir Kreatif Mahasiswa. *Jurnal Papeda: Jurnal Publikasi Pendidikan Dasar*, *5*(2), 120–132.

Nonik Gabriella, M. (2021). Pengembangan LKPD Berorientasi Problem Based Learning (PBL) Untuk Meningkatkan Keterampilan Berpikir Kritis Pada

materi Hidrokarbon. UNESA Journal of Chemical Education, 10(2), 103.

Nurjan, S. (2018). Pengembangan berpikir kreatif. Al-Asasiyyya Journal Of Basic Education, 3(1), 105–116.

Nurlela, L., Ismayati, E., Samani, M., Suparji, & Buditjahjanto, I. G. P. A. (2019). STRATEGI BELAJAR BERPIKIR KREATIF (3 ed.). PT.Mediaguru Digital Indonesia.

Poba, D., Walanda, D. K., Napitupulu, M., & Rahmawati, S. (2023). Application of Student Worksheets Based on Hyperdocs in Chemistry Learning on Scientific Creativity. *Jurnal Pendidikan Kimia Indonesia*, 7(1), 10–18.

Qomariyah, D. N., & Subekti, H. (2021). Analisis kemampuan berpikir kreatif. *Pensa: e-jurnal pendidikan sains*, 9(2), 242–246.

Riduwan. (2010). Dasar-dasar Statistika. Alfabeta.

Ridwan. (2011). Skala Pengukuran Variabel -Variabel Penelitian. Alfabeta.

Said, S. S., Mohamad, E., Pikoli, M., Sihaloho, M., Laliyo, L. A., Ischak, N. I., & Salimi, Y. K. (2022). Identifikasi Kemampuan Berpikir Kreatif Siswa dalam Menyelesaikan Soal Open Ended Pada Materi Larutan Elektrolit Dan NonElektrolit. Jambura Journal of Educational Chemistry, 4(2), 91–98.

Sulastri, E., Supeno, S., & Sulistyowati, L. (2022). Implementasi Model ProblemBased Learning untuk Meningkatkan Keterampilan Berpikir Kreatif Siswa Sekolah Dasar dalam Pembelajaran IPA.

Sultoni, A., & Agoestanto, A. (2016). Upaya peningkatan kemampuan berpikir kreatif dengan problem based learning berpendekatan scientific pada materi trigonometri. Dalam PRISMA, Prosiding Seminar Nasional Matematika (hlm. 26–35).

Timumun, K., Walanda, D. K., & Napitupulu, M. (2022). The Development of HyperDocs on Chemistry Learning for High School Students' Collaborative Skills. *Jurnal Riset Pendidikan MIPA*, 6(2), 98–108.

Uloli, R. (2021a). Berpikir Kreatif dalam Penyelesaian Masalah Tantangan Pembelajaran Abad 21 (N. Erlina, Ed.; 1 ed.). PENERBIT RFM PRAMEDIA.

Uloli, R. (2021b). Berpikir Kreatif dalam Penyelesaian Masalah Tantangan Pembelajaran Abad 21 (N. Erlina, Ed.; 1 ed.). Penerbit RFM Pramedia.

Walanda, D. K., Napitupulu, M., Poba, D., & Sandewa, V. E. (2023). Leveraging Educational Technology (Hyperdocs) On Student's Collaboration Skills. ICLSSE 2022: Proceedings of the 4th International Conference on Law, Social Sciences, and Education, ICLSSE 2022, 1.