QUANTUM: Jurnal Inovasi Pendidikan Sains, Vol. 17, No. 1, 86-94
p-ISSN : 2086-7328 e-ISSN : 2550-0716
Website: https://ppjp.ulm.ac.id/journal/index.php/quantum/index
DOI: https://dx.doi.org/10.20527/quantum.v17i1.25903

THE EFFECT OF THE GOOGLE SITES-BASED FLIPPED CLASSROOM LEARNING MODEL ON STUDENTS ' PROBLEM-SOLVING ABILITIES IN REACTION RATE MATERIAL

Dindah*, Mujakir, Yuli Kusuma Dewi
Tadris Kimia, Universitas Islam Negeri Mataram
Jl. Gajah Mada No. 100, Mataram 83116, Nusa Tenggara Barat, Indonesia
*corresponding author: dindakirana100704@gmail.com

Abstract. This research was motivated by the low-level students' problem-solving abilities in chemistry, particularly in reaction rate material. This study aims to examine the effect of the Google Sites-based flipped classroom learning model on students' problem-solving abilities in reaction rate material. This study used a quantitative approach with a one-group pretest-posttest design. The instruments used in this study were 10 essay questions and 20 students' response questionnaires. Data collection was conducted through pretests and posttests. Data analysis used a paired-sample t-test after previously conducting prerequisite tests, namely the Shapiro-Wilk normality test and the N-Gain test. The results of the data analysis showed a significance value of ($p < 0.001$) for the paired sample t-test, indicating a statistically significant difference between pretest and posttest scores. The N-gain value of 0.8662 was categorized as high, indicating an increase in students' problem-solving abilities after treatment. Based on the data analysis, it can be concluded that the Google Sites-based flipped classroom learning model has a positive effect on students' problem-solving abilities in reaction rate material.

Keywords: flipped classroom learning model, Google Sites, problem solving skills

INTRODUCTION

Education plays a vital role for everyone, improving the standard and quality of life and preparing human resources for national development. In the 21st century, educational transformations have occurred, including changes in learning models and student competency development. These changes have encouraged the emergence of innovative ideas to enhance students' thinking skills, resulting in more meaningful learning experiences. To face the challenges of the 21st century, students need to master several important skills, such as critical thinking, teamwork, and problem-solving.

In chemistry learning, students are expected to develop problem-solving abilities. This is evidenced by research conducted by Prima et al., (2024), which indicates that reaction rate material is difficult for students due to its abstract nature, leading to difficulties in understanding concepts and solving problems. In research conducted by (Lestari & Yenti, 2024), students tend to memorize formulas without understanding underlying concepts, which hinders their problem-solving ability.

Based on the results of initial observations conducted in class XI MIPA at MAS Annajah Sesela School, West Lombok, there were several students who still experienced difficulties in learning chemistry. The results of a preliminary study questionnaire distributed by researchers to 20 grade XI MIPA students showed that approximately 75% of students considered chemistry difficult, and 95% stated that

Published by: Program Studi Pendidikan Kimia FKIP Universitas Lambung Mangkurat
How to Cite: Dindah, D., Mujakir, M., & Dewi, Y. K. (2026). The Effect of The Google Sites-Based Flipped Classroom Learning Model on Students ' Problem-Solving Abilities in Reaction Rate Material. *QUANTUM: Jurnal Inovasi Pendidikan Sains*, *17*(1), 86–94. https://dx.doi.org/10.20527/quantum.v17i1.25903.

Article History:
Received : 14-04-2026, *Accepted* : 14-05-2026, *Published* : 25-05-2026

the material on reaction rates was difficult to understand. The main problems arose in understanding the concept and working on calculation problems, with 55% of students having difficulty calculating and 45% having difficulty understanding the concept. Furthermore, 65% of students did not understand the factors that influence reaction rates, and another 25% had little understanding. The learning process in class so far has been dominated by assignments (70%) and discussions (30%), with limited practical activities. This results in a lack of in-depth conceptual understanding, as 65% of students reported not receiving any help. Furthermore, 90% felt there wasn't enough classroom time, and 65% were not accustomed to independent study prior to the lesson.

One of the learning models that can be used in chemistry learning to train students' problem-solving abilities is the flipped classroom learning model. The flipped classroom learning model is a learning model whose concept is reversed, in which learning materials are provided before class so that classroom activities focus on discussion and problem-solving activities. The flipped classroom learning model, with the problem-based learning flipped type, in the research of (Dwi Putri Mulyasari & Soleh, 2020), encourages students to study independently before class using learning media such as instructional videos, which are then used as a basis for problem-solving activities in classroom discussions.

In the research conducted by Yunithasari (2024), it was stated that by moving learning activities such as reading material or watching videos outside the classroom, face-to-face learning time can be allocated optimally for active activities such as discussions and problem-solving. The advantages of the flipped classroom learning model are that it gives students a long time to understand the learning material and the existence of learning videos that allow students to play them repeatedly if they forget the previous material. Thus, the flipped classroom model serves as a primary instructional medium and facilitates independent learning. This model provides a foundation for learning patterns that are more contextual and responsive to the needs of today's students.

Several previous studies have discussed the implementation of the flipped classroom model in chemistry learning. However, most studies have focused on learning outcomes and student motivation, while research specifically examining students' problem-solving abilities in reaction rate material is still limited. In addition, the integration of Google Sites as a learning platform in flipped classroom learning at the senior high school level, particularly at MAS ANNAJAH SESELA, has not been widely explored. Therefore, this study aims to fill this gap by investigating the effect of the Google Sites-based flipped classroom learning model on students' problem-solving ability in reaction rate material.

Based on the background of the problem and the considerations that have been put forward, the researcher is interested in conducting research with the title "The Effect of the Google Sites-Based Flipped Classroom Learning Model on Students' Problem-Solving Ability on the Reaction Rate Material of MAS ANNAJAH SESELA." The problem-solving skills referred to in this research include the ability to understand problems related to factors that influence reaction rates, plan solution strategies based on collision theory, determine reaction sequences based on experimental data, and provide return solution results in reaction rate material calculations.

METHOD

Types and Design of Research

This type of research is pre-experimental research (pre-experimental design). Pre-experimental research is research that aims to determine the effect of implementing the Google Sites-based flipped classroom learning model on students' problem-solving abilities by comparing students' learning outcomes at the pretest and posttest stages. Although this design has limitations in controlling external variables, it is still suitable for obtaining an overview of the effectiveness of the learning model in the context of the class being studied. This research design is a one-group pretest-posttest design. This design was used because the research only involved one class, namely the experimental class, which was carried out by comparing the pretest results with the posttest results. As shown in Figure 1.

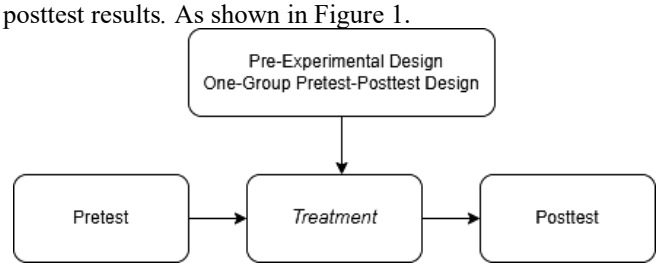

Figure 1. One-group pretest-posttest Design

Research Subjects

This research was conducted at MAS ANNAJAH SESELA, West Lombok. The population consisted of all in class XI MIPA in the 2025/2026 academic year. The sample consisted of 20 students selected using a saturated sampling technique, in which all members of the population were involved as research participants. The samples consisted of 20 students, all of whom were female, aged 15-16 years. Based on their academic achievement in chemistry, students were classified into high, medium, and low academic levels. This technique was applied due to the relatively small population size to ensure that all students were involved in the data collection process.

The learning process in this study was conducted in five sessions, consisting of one pretest, three learning sessions, and one posttest. The intervention was implemented over five meetings to ensure sufficient exposure to the learning model. The final session concluded with the distribution of a student response questionnaire. The implementation of the flipped classroom learning model was supported by the use of Google Sites as the primary medium to facilitate student independent learning prior to face-to-face classroom activities.

The learning process followed the flipped classroom model: before class, during class, and after class. In the pre-class phase, students independently study the material at home through Google Sites, which contains learning videos, teaching materials, and guiding questions related to reaction rates. The students are asked to understand the material, note key points, and identify difficulties as initial preparation before participating in class. This stage facilitates independent learning and preliminary conceptual exposure before classroom instruction.

At the in-class stage, the focus is on discussion, problem-solving, and practical activities. Students are divided into several groups and work on problem-based student worksheets *(Lembar Kerja Peserta Didik*/ LKPD). The activities include discussing the concept of reaction rate, solving calculation problems, carrying out practical work to observe factors that influence reaction rate, and analyzing experimental data to determine the reaction sequence. Next, students present the

results of group discussions, while the teacher acts as a facilitator who guides and provides reinforcement for the concepts being learned. This stage emphasizes collaborative learning and active knowledge construction based on the problem-based learning approach.

In the post-learning stage, students are given evaluation tasks in the form of problem-solving ability tests. At the final meeting, students complete a posttest to measure their problem-solving abilities after participating in learning using the Google Sites-based flipped classroom model. In addition, students also complete a student response questionnaire consisting of 20 statements to determine the responses of students in class XI MIPA to the learning process that had been implemented using the flipped classroom learning model based on Google Sites. This stage functions as an evaluation phase to measure learning outcomes and student perceptions of the implemented model.

Research Instruments

The instrument for assessing students' problem-solving abilities on the reaction rate material was a descriptive test consisting of 10 essay questions that were validated through expert judgment by three chemistry lecturers to ensure alignment with the reaction rate material and the problem-solving ability indicators that are to be measured according to Heller's theory. Then, an empirical test was conducted, including validity and reliability analysis. The results of the validity test showed that for all question items $r_{count} \geq r_{table}$, which ranged from 0.906 to 0.974. Based on the results of the reliability test, the *Cronbach's Alpha* value obtained was 0.984, greater than 0.60, so it can be concluded that the instrument has a very high level of reliability and is suitable for use.

In this study, two types of tests were used, namely pretest and posttest. The pretest is a test given before the implementation of the Google Sites-based flipped classroom learning model, which aims to assess students' initial skills before the learning process begins. Meanwhile, the posttest is a test given at the end of learning, which aims to measure students' problem-solving abilities after the treatment has been carried out. These two tests consist of descriptive questions designed according to problem-solving ability indicators, totaling 10 questions with cognitive aspects C3 to C5. The test instrument was given twice, namely the initial test (pretest) and the final test (posttest). The pretest was conducted to determine students' initial abilities before being given learning treatment. Meanwhile, the posttest is given to students after the treatment using the flipped classroom learning model has been completed.

Furthermore, the non-test instrument is a student response questionnaire that was used to obtain data regarding student responses to the implementation of the Google Sites-based flipped classroom learning model**.** This instrument was given to class XI MIPA students after the learning process took place.

The questionnaire consists of 20 statements, which contain positive and negative statements developed based on flipped classroom indicators. The questionnaire is prepared in the form of a written statement that is rated using a five-point Likert scale, namely Strongly Agree (SS), Agree (S), Sufficient (C), Disagree (TS), and Strongly Disagree (STS). Scores are given on a scale from 5 to 1 for positive statements, and vice versa for negative statements. This questionnaire was used to collect supporting data on students' responses to the implemented learning model.

Data Analysis Techniques

The normality test was carried out using Shapiro-Wilk, which aims to determine the normality of the data in order to determine the statistical test in the

hypothesis (Kadir, 2017). All statistical analyses were conducted at a significance level of (α=0.05), using IBM SPSS Statistics 21. Hypothesis testing in the study was carried out using parametric statistical tests, namely a paired sample t-test, to determine the effect of the Google Sites-based flipped classroom learning model on students' problem-solving abilities in the reaction rate material (Kadir, 2017).

The N-Gain analysis was used to determine the level of improvement in students' abilities after the implementation of the flipped classroom learning model and to compare pretest and posttest results. The N-Gain score was calculated using the following formula:

Table 1. N-gain level criteria

N-Gain	Kriteria
$g > 0.7$	High
$0.3 \leq g \leq 0.7$	Middle
$0 < g < 0.3$	Low

RESULTS AND DISCUSSION

This research was conducted at MAS ANNAJAH SESELA on XI MIPA students. In its implementation, students are given learning using the flipped classroom learning model based on Google Sites. This study aims to analyze the influence of the Google Sites-based flipped classroom learning model on students' problem-solving abilities in the reaction rate material.

The results of the study are in the form of descriptive pretest and posttest data obtained from class XI MIPA students on the reaction rate material. The pretest data results are used to determine students' initial abilities, while the posttest data is used to determine students' final abilities after the application of the Google Sites-based flipped classroom learning model. The results of the pretest and posttest data for class XI MIPA students on the reaction rate material can be seen in Table 2 below:

Table 2. Descriptive statistics results of students' pretest and posttest

Components	pretest	posttest
Number of Students	20	20
Highest Score	37	97
Lowest Score	19	78
Mean	25.55	89.95
Standard Deviation	5.031	4.925

Based on the results of descriptive statistics of the students' pretest and posttest, it shows that students' initial problem-solving abilities on the reaction rate material are still relatively low, with the lowest pretest score being 19 and the highest score being 37. This shows that before being given treatment, students still had difficulty in understanding and solving problems in the reaction rate material. After being given treatment in the form of implementing the flipped classroom learning model based on Google Sites, the posttest score obtained was a lowest score of 78 and a highest score of 97.

This improvement occurred because students accessed learning materials through Google Sites before classroom activities, which allowed them to build prior knowledge, reduce cognitive load, and participate more actively in problem-solving tasks during classroom learning.

Statistical Test Results

In data analysis, prerequisite tests were carried out in the form of normality tests, hypothesis tests, and N-Gain tests. The decision rule for normality testing is that if sig. is ≥ 0.05, then H_0 is accepted and H_1 is rejected, indicating that the data are normally distributed. Meanwhile, if sig. is ≤ 0.05, then H_0 is rejected and H_1 is accepted, indicating that the data are not normally distributed. The results of the normality test can be seen in Table 3 below:

Table 3. **Normality test results data on students ' problem-solving ability on reaction rate**

Data	Statistical	Sig.	Description
Pretest	0.945	0.301	Normal
Posttest	0.955	0.442	Normal

The results of the normality test using the Shapiro-Wilk test show that the problem-solving ability data of 20 class XI MIPA students were analyzed at a significance level of 0.05. The results of the analyzed pretest data obtained a significant value of 0.301>0.05, indicating that the data are normally distributed. Furthermore, the posttest data obtained a significance value of 0.442>0.05, which also indicates that the data are normally distributed.

Table 4. Hypothesis test results students' problem-solving ability on reaction rate

Data	t	Sig.	Description
Pretest-Posttest	-53.884	0.000	Significant Difference

The results of hypothesis testing using the paired sample t-test show that the significance value (Sig.2-tailed) is ($p < 0.001$), so it can be concluded that H_0 is rejected and H_a is accepted. In addition, the t value of -53.884 shows that there is a significant difference in student learning outcomes from pretest to posttest. Thus, it can be concluded that there is a significant influence of the Google Sites-based flipped classroom learning model on students' problem-solving abilities in the reaction rate material.

The improvement in students' problem-solving ability can be explained through constructivist learning theory, where students actively construct knowledge through experience, discussion, and problem-solving rather than receiving information passively. In addition, the flipped classroom model supports problem-based learning (PBL) stages, where students identify problems, plan solutions, implement strategies, and evaluate answers, which is consistent with Heller's structured problem-solving framework emphasizing problem representation, solution planning, and evaluation.

This is in line with research conducted by (Silalahi, 2022), which shows that there is an influence of the flipped classroom learning model on students' mathematical problem-solving abilities, as evidenced by the results of the t-test with a significance value of 0.000 so that the model is declared effective. In the research conducted by Putri et al., (2021), it was stated that this research used a true-experimental research type with a post-test-only control group design with a cluster random sampling technique. The results of the study show that there is an influence of the flipped classroom learning model on student learning outcomes in the subject matter of buffer solutions. The flipped classroom model supports this process by shifting direct instruction outside the classroom so that class time is used for discussion and problem-solving activities.

Effectiveness of Learning Model Implementation

The effectiveness of the Google Sites-based flipped classroom learning model used to develop students' problem-solving abilities in the reaction rate material can be seen in the results of the N-Gain value. N-Gain data on students' problem-solving abilities on reaction rate material can be seen in Table 5:

Table 5. N-Gain results students ' problem-solving ability in reaction rates

Data	N	Minimum	Maximum	Mean	Std. Deviation
N-Gain	20	0.73	0.96	0.8662	0.06204
N-Gain (%)	20	72.84	96.05	86.6178	6.20433

The N-gain analysis shows that students' problem-solving ability improvement ranged from 0.73 to 0.96, with a mean value of 0.8662 and a standard deviation of 0.06204. In percentage form, the mean N-gain is 86.6178%, indicating a high category of improvement. The flipped classroom model enhances students' engagement by shifting learning from passive reception to active participation. Through Google Sites, students are able to understand concepts that are reinforced during activities in class.

To support the findings, students' responses toward the learning implementation were analyzed using a questionnaire consisting of 20 items completed by 20 students after the learning process was finished. The results show that the average student response score was 76.05% out of 100%, which is categorized as good, indicating positive student perceptions of the learning model implementation.

This is in line with research conducted by (Paristiowati et, al. 2024). The results of the study showed that students' responses to instructions and types of instructions developed well during the learning process. This is consistent with the results of the student questionnaire data, which showed a percentage of >70% in each dimension. It can be concluded that students respond positively to the learning process and are active in every dimension of learning activities, which supports the effectiveness of flipped classes in chemistry learning. Interestingly, this positive response is also related to previous learning conditions, which still relied heavily on conventional methods. When introduced to a variety of technology-based models, curiosity and new enthusiasm emerged, and students' involvement during learning about reaction rate material increased.

CONCLUSION

Based on the results of the research data analysis, it can be concluded that the use of the Google Sites-based flipped classroom learning model was associated with an improvement in students' problem-solving abilities in reaction rate material in class XI MIPA at MAS Annajah Sesela, West Lombok, indicating that there is a statistically significant difference between pretest and posttest scores ($p < 0.001$). This statistically significant result indicates an improvement in students' problem-solving abilities after the implementation of the Google Sites-based flipped classroom learning model.

In addition, the results of the questionnaire analysis showed that students gave a positive response to the application of the flipped classroom learning model with an average percentage of student responses of 76.05%, which is included in the good category, so it can be concluded that the flipped classroom learning model based on Google Sites was well received by students in the chemistry learning process.

REFERENCES

Fadhilah, S., Lidinillah, D., & Nuryadin, A. (2024). Pembelajaran mandiri melalui model flipped classroom berbantuan google sites pada materi kenampakan alam kelas V sekolah dasar. *Collase (Creative Of Learning Students Elementary Education)*, *7*(6), 1117-1124. https://doi.org/10.22460/collase.v7i6.20112

Kadir. (2017). *Statistika terapan: Konsep, contoh dan analisis data dengan program SPSS/Lisrel dalam penelitian* (Edisi ke-3). Rajawali Pers.

Laliyo, L. A., Kau, M., La Kilo, J., La Kilo, A., & No, J. J. S. (2020). Kemampuan siswa memecahkan masalah hukum-hukum dasar kimia melalui pembelajaran inkuiri terbimbing. *Ar-Razi Jurnal Ilmiah*, *8*(1), 1-8. https://doi.org/10.29406/ar-r.v8i1.1875

Lestari, D., & Yenti, E. (2024). Penggunaan model thinking aloud pair problem solving (TAPPS) dalam menganalisis kemampuan pemecahan masalah siswa pada materi laju reaksi. *Journal of Chemistry Education and Integration*, *3*(2), 100-110. http://dx.doi.org/10.24014/jcei.v3i2.32392

Ma'muroh. (2021). *Aktualisasi nilai-nilai pendidikan humanis dan religius di sekolah*. PT Publica Indonesia Utama.

Mulyasari, D. P., Hidayat, O. S., & Soleh, D. A. (2023). Pengaruh model flipped classroom tipe problem based learning flipped terhadap kemampuan berpikir kritis pada pembelajaran pendidikan pancasila di sekolah dasar. *Jurnal Basicedu*, *7*(4), 2324–2334. https://doi.org/10.31004/basicedu.v7i4.5824

Niyarci, N. (2022). Perkembangan Pendidikan Abad 21 Berdasarkan Teori Ki Hajar Dewantara. *Pedagogika: Jurnal Ilmu-Ilmu Kependidikan*, *2*(1), 46–55. https://doi.org/10.57251/ped.v2i1.336

Novalia, & Syazali, M. (2014). *Olah data penelitian pendidikan*. CV Anugrah Utama Raharja.

Paristiowati, M., Dianhar, H., Hasibuan, N. A. P., & Fitriani, R. (2024). Integration of various digital media with flipped classroom models in chemistry learning: An analysis of student activities. *Orbital: Jurnal Pendidikan Kimia*, *8*(1), 104-118. https://doi.org/10.19109/ojpk.v8i1.21928

Priadana, M. S., & Sunarsi, D. (2021). *Metode penelitian kuantitatif*. Pascal Books.

Prima, L., Mustaji, M., & Kristanto, A. (2024). Pengaruh model blended learning terhadap kemampuan memecahkan masalah siswa pada materi faktor-faktor yang memengaruhi laju reaksi. *EDUKASIA Jurnal Pendidikan dan Pembelajaran*, *5*(1), 163-168. https://doi.org/10.62775/edukasia.v5i1.733

Putri, N. A. N. ., Widiyowati, I. I., & Masruhim, M. A. (2021). Pengaruh model pembelajaran flipped classroom terhadap hasil belajar siswa pada pokok bahasan larutan penyangga. *Bivalen: Chemical Studies Journal*, *4*(1), 13–16. https://doi.org/10.30872/bcsj.v4i1.721

Ramadhanti, N. A., Enawaty, E., Junanto, T., Muharini, R., & Ulfah, M. (2024). Kemampuan pemecahan masalah peserta didik pada materi stoikiometri IPA. *Jurnal Ilmiah Pendidikan Citra Bakti*, *11*(3), 729–741. https://doi.org/10.38048/jipcb.v11i3.2836

Rohmah, V. F., Arfiani, Y., & Widiyanto, B. (2025). Flipped classroom dan edpuzzle: sinergi pendekatan saintifik dalam meningkatkan kemampuan pemecahan masalah siswa. *Jp3 (Jurnal Pendidikan Dan Profesi Pendidik)*, *11*(2), 161-168. https://doi.org/10.26877/jp3.v11i2.24239

Silalahi, E. I. (2016). Pengaruh model pembelajaran flipped classroom terhadap kemampuan pemecahan masalah matematis siswa kelas vii smp negeri 10

pematangsiantar. *Jurnal Pembelajaran Dan Matematika Sigma (Jpms)*, *2*(2), 273-279.

Sukarelawan, M. I., Indratno, T. K., & Ayu, S. M. (2024). *N-gain vs stacking: Analisis perubahan abilitas peserta didik dalam desain one group pretest-posttest*. Suryacahya.

Syakdiyah, H., Wibawa, B., & Muchtar, H. (2018, November). The effectiveness of flipped classrooms in high school chemistry education. In *IOP Conference Series: Materials Science and Engineering* (Vol. 434, No. 1, p. 012098). IOP Publishing. https://doi.org/10.1088/1757-899X/434/1/012098

Syarah, F. (2023). Pengaruh model pembelajaran flipped classroom terhadap kemampuan konsep matematis. *FARABI: Jurnal Matematika Dan Pendidikan Matematika*, *6*(2), 202-207.

Wibowo, T., & Subagiyo, S. (2022). Flipped classroom: inovasi pembelajaran untuk meningkatkan pemahaman konsep termokimia siswa. *Jurnal Pendidikan dan Pembelajaran Sains Indonesia (JPPSI)*, *5*(2), 135-143. https://doi.org/10.23887/jppsi.v5i2.52786

Yunithasari, N. P. M. (2024). Pengaruh metode flipped classroom berbantuan lembar kerja mahasiswa dalam meningkatkan hasil belajar mahasiswa pada mata kuliah kimia dasar. *Jurnal Pendidikan dan Pembelajaran Sains Indonesia (JPPSI)*, *7*(2), 164-173. https://doi.org/10.23887/jppsi.v7i2.85800