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# Implementation of Expository Learning Integrated with Active Students Learning Strategy to Improve Learning Outcomes in Stoichiometry

**Ion Wijaya[1*], Muchlis Muchlis[2], Ariwati Wahyu Mumpuni[3]**

[1] Chemistry Education Study Program, Department of Chemistry, Universitas Negeri Malang
[2] Chemistry Education Study Program, Department of Chemistry, Universitas Negeri Surabaya
[3] SMA Negeri 1 Kediri
[*] Corresponding Author e-mail: ion.wijaya.2203318@students.um.ac.id

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**Abstract**
Stoichiometry material is often still considered difficult for students in learning chemistry, causing low learning outcomes. This study aims to determine the effect of integrating the Expository Learning with the Active Student Learning on student learning outcomes in stoichiometry material in class X-4 SMA Negeri 1 Kediri. This research involved 36 students of class X-4 SMA Negeri 1 Kediri as research subjects. This research used classroom action research method with two cycles. The results showed an increase in the average learning outcomes of students. Before the research ($T_0$), the average score was 65.33, categorized as low, with a learning completeness rate of 55.56%. In cycle 1 ($T_1$), the average score increased to 80.56, classified as good, with a learning completeness rate of 75%. In cycle 2 ($T_2$), the average score increased to 88.47, classified as very good, with a learning completeness rate of 88.89%. Based on these results, the integration of the expository learning with active student learning can be considered for use in students who have a low understanding of chemical concepts in order to improve their learning outcomes on stoichiometry material.

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## INTRODUCTION

Chemistry is a field of natural science that focuses on the study of the composition, structure, and transformation of matter (Effendy, 2008). It involves understanding the basic laws and theories that explain how matter undergoes change. Chemistry is characterized by abstract concepts that simplify the complexity of phenomena in the real world, making it a continuous discipline (Kean & Middlecamp, 1985). The study of chemistry involves handling complex and abstract concepts, which results in dense knowledge (Symington & Kirkwood, 1996). This science follows a hierarchical structure, where mastery of more complex concepts depends on the understanding and correct explanation of simpler concepts so that to understand complex concepts it is necessary to understand the fundamental concepts first (Sastrawijaya, 1998). Stoichiometry, a basic concept in chemistry, is highlighted as one of the simple concepts that are beneficial to learn in senior high school.

Stoichiometry is a field in chemistry that deals with the calculation and measurement of quantitative relationships between substances involved in chemical reactions (Utami et al., 2009). It covers topics such as basic chemical laws, mole conversion, empirical and molecular formulas, and reaction stoichiometry (Sappaile, 2019). However, many learners find stoichiometry difficult to understand because it is often taught mathematically, which can make interpretation of chemical concepts unclear (Kind, 2004; Sunaringtyas et al., 2015). Manipulating numbers and symbols can be challenging for learners and can lead to the perception that stoichiometry is a difficult subject. This lack of understanding can have an impact on the quality of the learning process and the results achieved by students.

Based on observations at the beginning of the research in class X-4 showed that 55.56% of students only completed chemistry learning on bonding material. Observations made in class X-4 showed that this level of completion was obtained through traditional teaching methods. In addition, interviews with chemistry teachers in class X-4 showed that students in this class had a lower understanding of chemical concepts compared to other classes taught by the same teacher. The results obtained from the initial research conducted highlighted the importance of learners' conceptual understanding in determining their learning outcomes. To improve learning outcomes, the role of the teacher is very important in applying the right learning models and strategies. One of the learning models considered is the expository learning.

The expository learning, as defined by Wina Sanjaya (2010), is a teacher-focused teaching model that conveys information verbally to a group of learners to enhance understanding. It consists of five stages: preparation, presentation, correlation, generalization and application. This model is generally used when learners have a low level of knowledge and need a more thorough explanation from the teacher (Sukmawati & Purbaningrum, 2015). The expository learning is particularly useful in situations where teachers need to provide a broader knowledge base to compensate for learners' limited abilities. To improve the efficiency of learning with this model, teachers can incorporate additional strategies such as the Active Student Learning Strategy.

The Active Student Learning Strategy emphasizes that learners have untapped potential and abilities that need to be nurtured by teachers through various stimuli and challenges (Anitah, 2007). Teachers play an important role in enhancing learners' skills based on their individual developmental level, so that they can understand new concepts. By honing their acquisition processing skills, learners are empowered to generate and improve their own knowledge and understanding, as well as develop desired behaviors and values. Therefore, teachers are expected to have professional competencies that enable them to analyze the learning environment and then design efficient and effective learning systems.

Classroom action research in Indonesia often uses discovery learning (Nugrahaeni et al., 2017), problem-based learning (PBL) (Wahyuni et al., 2017), and project-based learning (PjBL) (Jannatu et al., 2015). However, there is still little research on the effectiveness of expository learning integrated with students active learning strategy. This type of research is important because it can provide insight into how to teach chemistry more efficiently and effectively. The findings from this research can be the basis for future classroom action research in chemistry education and help educators in choosing the right learning model to achieve learning objectives based on the problems found. The purpose of this class action research is to investigate whether there is an increase in the learning outcomes of students in class X-4 SMA Negeri 1 Kediri through the Implementation of the Expository Learning Integrated with the Student Active Learning Strategy in Stoichiometry.

## METHOD

This research is a classroom action research in class X SMA Negeri 1 Kediri in the second semester of the 2022/2023 academic year. The participants of this research were all students of class X-4, totaling 36 people. This research consists of 2 cycles, each with 4 stages:

planning, implementation, observation, and reflection. Quantitative data on students' learning outcomes in the cognitive domain were obtained through tests given at the end of each cycle. The tests consisted of essay questions, with 4 questions in the first cycle and 5 questions in the second cycle. In addition, observations were also made to assess the level of learner activeness during the learning process. An observation sheet was used for this purpose, which consisted of 9 markers and 36 descriptors. The collected data was then analyzed to evaluate the learning outcomes.

$$Students\ score = \frac{score\ obtained}{maximum\ score}\ x\ 100\%$$

(Sudijono, 2008)

Overall, the average value of students' learning outcomes is obtained using the following formula:

$$M_x = \frac{\sum x}{N}$$

(Sudijono, 2008)

Description:
$M_x$ = average
$\sum x$ = number of students' scores
$N$ = number of students

The learning outcome score categories can be seen in Table 1.

Table 1. Learning Outcome Score Categories

| **Value** | **Category** |
|---|---|
| 86 – 100 | Very good |
| 76 – 85 | Good |
| 66 – 75 | Enough |
| 56 – 65 | Less |
| 0 – 55 | Very less |

(Arikunto, 2022)

If 85% of learners score 75 or higher, then the learning in that class has been completed. The formula below is used to determine the percentage of learning completeness:

$$P = \frac{\sum students\ who\ complete\ learning}{\sum students}\ x\ 100\%$$

(Arikunto, 2022)

Comparing observation data with predetermined criteria is the data analysis technique used in this research to assess observation sheet data. Learners' ability to ask questions and do problems on the board is an indication of how engaged they are in the learning observed in this rise. The following formula was used to determine the percentage of learners who were active during the research:

$$value\ conversion = \frac{total\ students\ score}{maximum\ score}\ x\ 100\%$$

Description:
Total students score = number of descriptors observed
Maximum score = number of all descriptors

The learner activeness category can be seen in Table 2.

Table 2. Learner Activity Categories

| Value | Category |
|---|---|
| 86 – 100 | Very active |
| 66 – 85 | Active |
| 56 – 65 | Enough |
| 0 – 55 | Less active |

(Aqib et al., 2011)

## RESULTS AND DISCUSSION

### Description of Research Result Data

***Students Learning Outcomes Before Action ($T_0$)***

Students' test scores on chemical bonding material are used to generate test data before action ($T_0$).

Table 3. Learning Outcomes of Class X-4 Learners Before Action ($T_0$)

| Value | Number of students | Percentage | Total Percentage of Learning Completeness | Average Learning Outcome |
|---|---|---|---|---|
| 86 – 100 | 6 | 16,67% | 55,56% (Completed) | 65,33 (Less) |
| 76 – 89 | 14 | 38,89% | | |
| 66 – 75 | 8 | 22,22% | 44,44% (Incomplete) | |
| 56 – 65 | 4 | 11,11% | | |
| 0 – 55 | 4 | 11,11% | | |

The average learning outcomes of learners in class X-4, as shown in Table 3, indicate that their performance falls into the "less" category, with a score of 65.33. When looking at the learners' learning completeness, only 20 out of 36 students achieved a score of 75 or higher, which means they have completed their learning. However, 16 out of 36 learners did not reach this threshold, indicating that their learning was not complete. Overall, only 55.56% of learners had completed their learning, which falls short of the overall completion target of at least 85%. This is an important concern for teachers, who must strive to improve learners' learning outcomes to achieve the desired level of completeness. One way to overcome this problem is to apply an expository learning that integrates Active Student Learning strategies.

***Students Learning Outcomes After Action ($T_1$, $T_2$)***

Table 4 provides general information about the learning outcomes of students in class X-4 for cycles 1 and 2.

Table 4. Learning Outcomes After Action ($T_1$, $T_2$)

| Value | Cycle 1 | | | Cycle 2 | | |
|---|---|---|---|---|---|---|
| | Number of students | Learning completeness | Average learning outcome | Number of students | Learning completeness | Average learning outcome |
| 86 – 100 | 22 | 75% (Completed) | 80,56 (Good) | 20 | 88,89% (Completed) | 88,47 (Very good) |
| 76 – 85 | 5 | | | 12 | | |
| 66 – 75 | 0 | 25% (Incompleted) | | 0 | 11% (Incompleted) | |
| 56 – 65 | 3 | | | 3 | | |
| 0 – 55 | 6 | | | 1 | | |
| **Total** | 36 | 100% | | 36 | 100% | |

Table 4 shows that there was an increase in learning completeness and average learning outcomes in cycle 1 ($T_1$) and cycle 2 ($T_2$). The average learning outcomes of students in class X-4 in cycle 1 ($T_1$) were 80.56 with a good category and 88.47 with a very good category in cycle 2 ($T_2$). The results of learning completeness of class X-4 students also increased. Cycle 1 ($T_1$) the level of learning completeness was 75%, with the number of students who completed 27 students. There was an increase in learning completeness in cycle 2 ($T_2$) which reached 88.89% with a total of 32 students who were complete. Because the learning completeness of class X-4 students has reached an average of 85%, the action can be stopped.

***Results of Observation of Student Activeness After Being Given Action ($T_1$, $T_2$)***

Table 5 provides general information about the activeness of students in class X-4 for cycles 1 and 2.

Table 5. Student Activeness After Action ($T_1$, $T_2$)

| Cycle | Skills | Student Activity | Average Student Activity |
|---|---|---|---|
| 1 | Ask questions | 5,56% | 12,5% (Less active) |
| | Working on problems on the board | 19,44% | |
| 2 | Ask questions | 13,89% | 33,33% (Less active) |
| | Working on problems on the board | 52,78% | |

Table 5 shows the increase in learner activeness in class X-4. The average learner activeness of 12.5% in cycle 1 ($T_1$) with the less active category increased to 33.33% in cycle 2 ($T_2$) with the same category, namely less active.

The following is a summary of the learning completeness and average learning outcomes of class X-4 students before and after action ($T_0$, $T_1$, $T_2$).

Table 6. Summary of Learning Completeness and Average Learning Outcomes

| | Number of students | Average Value of Learning Outcomes | % Learning Completeness | Learning Success |
|---|---|---|---|---|
| $T_0$ | 20 | 65,33 | 55,56 | Very less |
| $T_1$ | 27 | 80,56 | 75 | Good |
| $T_2$ | 32 | 88,47 | 88,89 | Very good |

The following is a bar chart of learning completeness and average learning outcomes of class X-4 students before and after being given action ($T_0$, $T_1$, $T_2$).

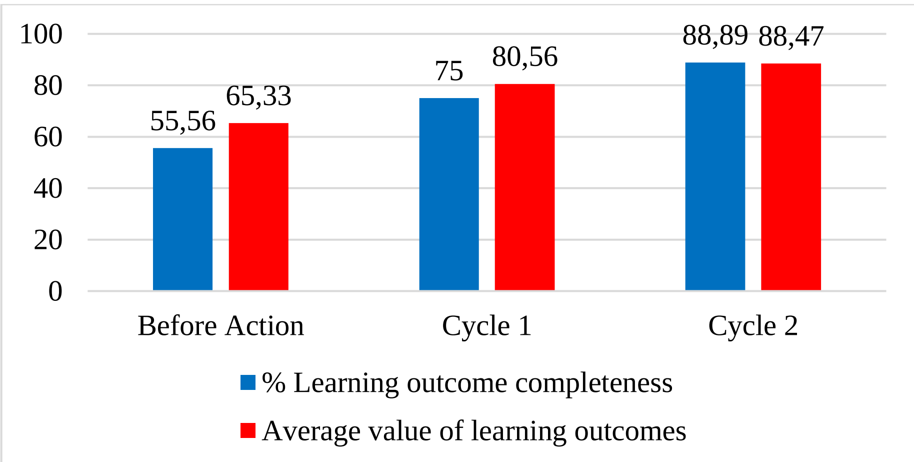


Figure 1. Diagram of Learning Completeness and Average Learning Outcomes of Class X-4

## Description of Research Results for Each Cycle

### *Cycle I*

The application of the expository learning involves several phases in cycle 1. The phases involved in the application of the expository learning are as follows:

a. Preparation
   In this situation, a teacher prepares the tools that will be used during learning activities during the preparation stage. The device prepared in this situation is the learning module. The most important components of the teaching module that must be made are learning objectives, learning stages, and learner worksheets that serve as a road map for learners to achieve learning objectives. Furthermore, the teacher in this phase writes the questions that will be used as a learning outcome measurement tool in cycle 1.
b. Presentation
   A teacher must have the right delivery strategy during the presentation stage so that the subject or material taught can be easily understood and accepted by students. The whiteboard media and LCD projector in this example are used for teacher presentation during the learning activity process. In addition, to make learning more interesting, the teacher incorporates some learners' daily vocabulary into this presentation stage and makes small jokes that are appropriate to the age and condition of the learners.
c. Connecting
   A teacher should be able to relate the subject being taught to the learners' lives during the connecting stage. In this scenario, the aim is to make learners feel important to learn the content or material. The teacher in this study connected the material taught to the event of the death of living things in a polluted river due to low ppm levels.
d. Summarizing
   At the conclusion stage, the teacher plays an important role in ensuring that learners understand the essence of the content or material being taught. In this case, the teacher tries to lead learners to be able to conclude the material being taught. The method used in summarizing the material is by giving several example problems which are then worked out together on the blackboard by students.
e. Application
   At the application stage, the teacher provides assignments that are in accordance with the material and the lives around students. At this stage of application, the test is given as a benchmark for completing student learning using the expository learning.

Based on the observation and analysis conducted during the learning activities, the application of the expository learning in cycle 1 had the following shortcomings.

a. Because the books used at school are still limited, not all students have their own learning tools.
b. Learners are not yet accustomed to using student worksheets during learning activities.
c. Learners are still not skilled in actively asking questions and doing problems on the board.
d. The chemical formulas presented have not been understood by students.
e. Learners do not record explanations made by the teacher.
f. The teacher has not guided students optimally at the conclusion stage.
g. Students are not yet complete when working on substance levels because the example problems given are slightly different from the questions tested.

The level of learning completeness of students in class X-4 for cycle 1 has not reached 86%, and there are still some parts that need to be improved. Based on the results of observations and analysis of students in the classroom, corrective action is needed in the next learning cycle.

### *Cycle II*

As in cycle 1, there were several stages of applying the expository learning, namely preparation, presentation, connecting, and application. There are several actions that need to be emphasized in cycle 2 so that learning is better than cycle 1.

a. The teacher presents the subject matter and examples of its application in daily life in a short, simple, and clear formulation of the material.
b. The teacher provides clear guidance to students in terms of student worksheets.
c. The teacher motivates the learners by showing the benefits from daily life so that they become more active.
d. Teachers provide interesting learner worksheets so that it is easy to understand chemical formulas.
e. The teacher tells the learners that there will be additional marks if they note important things during the learning activities.
f. To assess whether the students' learning outcomes are comprehensive, the teacher refines the test questions that will be presented.

Data collected from observations and analysis in learning activities showed that the involvement or activeness of students increased from 12.5% to 33.33% with the same category of less active. Although this figure is still low, it is a significant improvement. In the second cycle test, learners achieved an overall score of 88.89%, meeting the requirements to achieve learner learning completeness above 85%. Thus, the research conducted on students in class X-4 can be stopped at cycle 2, because it has met the requirements and shows an increase in learning completeness and average learning outcomes. It was noted that $T_2$ (cycle 2) > $T_1$ (cycle 1) > $T_0$ (before action).

## Discussion

Before the action was taken, the learning completeness and average score of students in class X-4 were 55.56% (incomplete) and 65.33 (less). There are several reasons that may be the cause of the low completeness and average value of students' learning outcomes. For example, lack of support and monitoring from the teacher. Teachers often use the exploration method to teach the material and find the meaning of the material with their own thoughts about the topic being studied. This exploration method is actually very beneficial for learners. However, if the assistance and supervision carried out by the teacher is less than optimal, then learners will not explore the material being taught, they will explore other things besides the material and even play games. In addition, with a lack of supervision and assistance during exploration, students have the possibility of misconceptions because students do not always have an accurate understanding of the concepts being studied (Mayer, 2004). The result of these misconceptions is that students cannot solve problems optimally, causing errors in choosing answers to the problems or tasks given. Errors in choosing the answer occur because learners cannot recognize the correct answer or may consider the wrong answer as the correct answer (Smith et al., 1993). Errors in decision making when choosing answers cause low and incomplete test scores.

The use of the expository learning in class X-4 resulted in an increase in learning completeness and the average value of learning outcomes. In cycle 1, the increase was 75% for learning completeness and 80.56 for the average learning outcomes which were classified as good. The teacher was able to control the order and breadth of the material taught, so that an assessment of students' mastery could be made. However, cycle 1 had some weaknesses, which prompted corrective action for cycle 2. In cycle 2 there was a significant increase, with learning completeness reaching 88.89% and average learning outcomes reaching 88.47, both in the very good category. These results show that the overall minimum completeness of >85% has been achieved. Research conducted on class X-4 students confirmed that using an expository learning for stoichiometry material led to an increase in student learning outcomes.

Student activeness in class X-4 has increased, which leads to improved learning outcomes. In cycle 1, only 12.5% of students were active, but this increased to 33.33% in cycle 2. Although still included in the "less active" category, this is a significant improvement. This increase in activeness is also due to the increased motivation of students, because the teacher provides a structured and clear learning plan that helps students achieve learning objectives. The teacher presents the material in a way that starts from simple to complex, especially focusing on stoichiometric material, which is concrete and measurable (Putri & Mahdian, 2019). The teacher explains simple mathematical operations and relates them to the concept of molecules, providing concrete examples related to students' daily lives. This interaction between teachers and learners encourages engagement, leading to more questions and feedback from learners (Ganyaupfu, 2013). Students can then summarize the material with help and supervision, and are given the opportunity to apply what they have learned through relevant exercises. In this case the teacher provides relevant exercises, such as tasks, tests, questions or quizzes.

The findings in the research show that the expository learning can be an effective solution for teachers in teaching stoichiometry if students have a low understanding of chemical concepts. This model involves learners not only listening to lectures but also actively solving problems independently. Although there are some weaknesses in applying this model, they can be overcome by combining other methods or strategies, such as Active Student Learning. This research is supported by previous research which found that the expository learning model has a positive effect on students' thinking skills, such as generating ideas, asking questions, and summarizing information (Heryadi & Sundari, 2020). Overall, the expository learning shows hope or solution as a way to deliver good and easy to understand stoichiometry material to students.

## CONCLUSION

Students in class X-4 can learn more about stoichiometry by using an expository learning accompanied by active student learning. The average value of learning outcomes and the percentage of learning completeness can both show an increase in student learning outcomes. In cycle 1 and 2, the average value of students' learning outcomes increased from 65.33 (less category) to 80.56 (good category) and 88.47 (very good category). To show that $T_2>T_1>T_0$, students' learning completeness increased from 55.56% (incomplete category) to 75% (complete category) in cycle 1 and 88.89% (complete category) in cycle 2.

## RECOMMENDATIONS

Based on the findings of the research, the following recommendations are made: (1) teachers can use expository learning to improve learning outcomes and student engagement for stoichiometric material or other materials that call for mathematical operations and abstract concepts under the restriction that students have a limited understanding of chemical concepts; and (2) in order to use expository learning models, teachers must have a thorough understanding of the subject.

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## BIBLIOGRAPHY

Anitah, S. (2007). Strategi Pembelajaran. Univeristas Terbuka.

Aqib, Z., Jaiyaroh, S., Diniati, E., & Khotimah, K. (2011). Penelitian Tindakan Kelas untuk Guru SMP, SMA, SMK. Yrama Widya.

Arikunto, S. (2022). Dasar-Dasar Evaluasi Pendidikan (2nd ed.). Bumi Aksara.

Effendy. (2008). A-Level Chemistry for Senior High School Students Based on 2007 Cambridge Curriculum Volume 1A. Bayumedia Publishing.

Ganyaupfu, E. M. (2013). Teaching Methods and Students' Academic Performance. *International Journal of Humanities and Social Science Invention*, *2*(9), 29–35.

Heryadi, D., & Sundari, R. S. (2020). Expository Learning Model. International *Journal of Education and Research*, *8*(1), 207–216.

Jannatu, N., Imah, N. ', Dan, S., & Wardani, S. (2015). Penerapan Pembelajaran Berbasis Proyek Berbantuan E-Learning untuk Meningkatkan Hasil Belajar Siswa. *Jurnal Inovasi Pendidikan Kimia*, *9*(2), 1566–1574.

Kean, A., & Middlecamp, C. (1985). Panduan Belajar Kimia Dasar. Gramedia.

Kind, V. (2004). Beyond Appearances: Students' Misconceptions About Basic Chemical Ideas. Durham University.

Mayer, R. E. (2004). Should There Be a Three-Strikes Rule Against Pure The Case for Guided Methods of Instruction. *American Psychologist*, *59*(1), 14–19. https://doi.org/10.1037/0003-066X.59.1.14

Nugrahaeni, A., Redhana, I. W., & Kartawan, I. M. A. (2017). Penerapan Model Pembelajaran Discovery Learning untuk Meningkatkan Kemampuan Berpikir Kritis dan Hasil Belajar Kimia. *Jurnal Pendidikan Kimia Indonesia*, *1*(1), 23. https://doi.org/10.23887/jpk.v1i1.12808

Putri, N. S., & Mahdian, L. (2019). Penerapan Model Problem Solving terhadap Motivasi dan Hasil Belajar Peserta Didik pada Materi Stoikiometri. *Journal of Chemistry and Education*, *3*(2), 55–63.

Sappaile, N. (2019). Hubungan Pemahaman Konsep Perbandingan dengan Hasil Belajar Kimia Materi Stoikiometri. *Jurnal Ilmu Pendidikan (JIP) STKIP Kusuma Negara*, *10*(2), 58–71.

Sastrawijaya, T. (1998). Proses Belajar Mengajar Kimia. Kanisius.

Smith, J. P., DiSessa, A. A., & Roschelle, J. (1993). Misconceptions Reconceived : A Constructivist Analysis of Knowledge in Transition. *Journal of the Learning Sciences*, *3*(2), 115–163. https://doi.org/10.1207/s15327809jls0302

Sudijono, A. (2008). Pengantar Evaluasi Pendidikan. Raja Grafindo Persada.

Sukmawati, D., & Purbaningrum, E. (2015). Pengaruh Model Pembelajaran Ekspositori terhadap Kemampuan Berbicara Anak. *Paud Teratai*, *4*(2), 1–6.

Sunaringtyas, K., Saputro, S., & Masykuri, M. (2015). Pengembangan Modul Kimia Berbasis Masalah pada Materi Konsep Mol Kelas X SMA/MA sesuai Kurikulum 2013. *Inkuiri:*

*Jurnal Pendidikan Ipa*, *4*(2).

Symington, D., & Kirkwood, V. (1996). Lecturer Perceptions of Student Difficulties in A First-Year Chemistry Course. *Journal of Chemical Education*, *73*(4), 339. https://doi.org/https://doi.org/10.1021/ed073p339

Utami, B., Saputro, A. N. C., Mahardiani, L., Yamtinah, S., & Mulyani, B. (2009). Kimia Untuk SMA dan MA Kelas X Program Ilmu Alam. HaKa MJ.

Wahyuni, N. D., Bahar, A., & Handayani, D. (2017). Perbandingan Hasil Belajar Kimia Model Pembelajaran Problem Based Learning dan Think Talk Write. *ALOTROP : Jurnal Pendidikan Dan Ilmu Kimia*, *1*(2), 144–147. https://ejournal.unib.ac.id/alotropjurnal/article/view/3546.