# INQUIRY ORIENTED ELECTRONIC STUDENT WORKSHEET USING LIVEWORKSHEET ON CHEMICAL EQUILIBRIUM MATERIAL TO TRAIN ANALYSIS THINKING SKILLS

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**Abstract:** This study aimed to describe the feasibility of inquiry-oriented electronic student worksheets using live worksheets on chemical equilibrium material to train the analytical thinking skills of class XI students of Senior High School. The feasibility of the Electronic Student Worksheet is viewed from validity, effectiveness, and practicality. This study uses the Research and Development (R&D) method. A limited trial was conducted in April 2023 for 30 students who had received chemical equilibrium material. The results showed that the validity of the electronic student worksheet was stated to be valid based on the results of the validation of the electronic student worksheet, which received a mode of 4. The practicality of the electronic student worksheet was stated to be practical with a percentage of 93.7%. The electronic student worksheet was declared effective based on the t-test results with a significance level of 5% obtained tcount>ttable of 12.294>2.045, which means Ho was rejected, Ha was accepted, and the N-gain score was 0.7. Based on these results, it can be concluded that electronic student worksheet is appropriate to be used to train analytical thinking skills in chemical equilibrium material

## INTRODUCTION

Chemistry learning focuses on providing direct learning experiences to students [1]. Learners have the opportunity to gain concepts independently, as well as shape attitudes and values through the development of processing skills[2]. The learning plan using the independent curriculum is a learning plan that is structured and officially recognized, aiming to optimize students' attention, talents, and skills from an early age. The independent curriculum focuses not only on students' test results but on developing students' knowledge, skills, and personality [3]. Important skills needed in this learning are analytical thinking skills.

Analytical thinking skills are important skills that high school students must have[4]. The Ministry of Education and Culture (2013) also requires high school students to have adequate analytical skills[5]. Analytical thinking skills are one of the main goals of 21st-century education[6]. Analytical thinking skills refer to skills to link each element systematically, draw conclusions from communications, and guide action. Based on Bloom's Taxonomy, analytical thinking skills are divided into three sub-categories, namely elemental analysis, relationship analysis, and organizational analysis [7]

The analytical thinking skills test results on January 19, 2023, showed that of the 34 participants in class XII IPA 6, the elemental analysis thinking skills reached 33.33%, relationship analysis reached 64.62%, and organizational analysis reached 33.33%. It is necessary to increase analytical thinking skills in chemical material, especially in elemental and organizational analysis.

Improving analytical thinking skills in chemical equilibrium material can be done using student worksheets as a learning tool. However, student worksheet is not only used as a mandatory task that students must complete but also must be integrated with approaches that can support students' conceptual understanding and improve analytical thinking skills [8].

Electronic student worksheet offers the advantages of facilitating students and time effectiveness, which can make learning more effective [9]. In addition, electronic student worksheet is easily accessible using a laptop or smartphone [10]. Therefore, electronic student worksheets are used to make teaching materials easily accessible, one of which is by using live worksheets. Liveworksheet is a free application provided by Google. It is a web-based platform called liveworksheet.com. This application will make it easier for teachers to convert plain printable worksheets, such as png, jpg, pdf, or documents, into interactive online exercises. The advantage of this application for teachers is that it can help save time [11]

Based on the results of interviews with teachers, there were obstacles in the delivery of chemical equilibrium material because time was felt limited, especially because this material was taught as the last chapter in class XI. The questionnaire also showed that 55.88% of students considered this material difficult to learn. So it is necessary to develop an electronic student worksheet that can improve analytical thinking skills and be oriented toward learning models for chemical equilibrium material.

The inquiry learning model is a learning model that emphasizes analytical thinking processes to seek and find answers to a problem in question. The teacher must guide students in learning, just like answering questions in the electronic student worksheet. Thus, students can independently solve a problem by being oriented to the guidance given by the teacher. The inquiry learning model has been developed to teach students how to think, and the teacher's main role in conducting inquiry learning is to provide facilities in the form of stages of the inquiry process to help students become more intense in learning to improve skills [12]. The stages of inquiry above are expected to improve students' analytical thinking skills.

This research is important to do because it is important for students to have analytical thinking skills in the independent curriculum, and the existence of electronic student worksheets is very suitable for chemical equilibrium material because chemical equilibrium material requires efficient time for teaching; this material is at the end of the semester odd and is not well-conveyed maximum.

## RESEARCH METHODS

This type of research is development. The research method used is the Research and Development (R&D) method, which aims to test the effectiveness and create products [13]. The limitation of this research is only at the product trial stage. The research was carried out in the even semester of the 2022/2023 academic year. The data collection technique used is the method of observation, tests, and questionnaires. The results of the data were obtained from the results of validity, practicality, and effectiveness in the form of quantitative data.

Validity is obtained from the data validation results using a validation sheet. The data obtained is then converted according to the following table:

Table 1. Criteria for Validity

| Score | Criteria |
|-------|----------|
| 1 | Not Good |
| 2 | Not Enough |
| 3 | Enough |
| 4 | Good |
| 5 | Very Good |

The assessment of each aspect by the validator is declared valid if it has a score mode $\geq 4$. If aspects do not meet the valid requirements, then repairs (revisions) must be made, and validation is carried out again until they reach the specified criteria.

The practicality of the electronic student worksheet was obtained through student response questionnaires and implementation observation sheets as supporting data. The results of the response questionnaire data were analyzed as follows:

Table 2. Criteria for Student Response

| Answer | Positive Score | Negative Score |
|--------|----------------|----------------|
| Yes | 1 | 0 |
| No | 0 | 1 |

The results obtained are converted on a Likert scale as in the following table:

Table 3. Likert Scale

| Range | Criteria |
|-------|----------|
| 0%-20% | Not Good |
| 25% - 40% | Not Enough |
| 41% - 60% | Enough |
| 61% - 80% | Good |
| 81% - 100% | Very Good |

Student responses are said to be positive if they get a percentage of $\geq 61\%$.

The effectiveness of the electronic student worksheet is obtained from the pretest and posttest test sheets for analytical thinking skills and student learning outcomes. The index category of student's analytical thinking skills according to the following classification:

Table 4 Criteria for Gain Value

| Value Range | Category |
|-------------|----------|
| $g \geq 0.70$ | High |
| $0.30 \geq g < 0.70$ | Medium |
| $g < 0.30$ | Low |

An electronic student worksheet is effective with a minimum n-gain value of 0.3. The results of the pretest and posttest were also analyzed using the normality test and the t-test, which refers to the provisions of the hypothesis, namely:

1. Ho: there is no increase in students' analytical thinking skills on chemical equilibrium material after using inquiry-oriented electronic student worksheet learning media
2. Ha: there is an increase in students' analytical thinking skills on chemical equilibrium material after using inquiry-oriented electronic student worksheet learning media.

## RESULTS AND DISCUSSION

The results showed that inquiry-oriented electronic student worksheets using live worksheets on chemical equilibrium material could train the analytical thinking skills of class XI students. The research results include validity, practicality, and effectiveness.

**Validity**

Validity was carried out through the validation stage by two chemistry lecturers and one chemistry teacher with content validation criteria including the suitability of the contents of the electronic student worksheet with learning indicators, suitability with the inquiry learning model, suitability with analytical thinking skills, the correctness of the substance of the learning material.

Construct validation eligibility criteria include; (1) graphical criteria (harmony between the colors of text, background, images, and tables), (2) presentation criteria (cover representation, having a place to write answers as needed, and presentation system consistency), (3) linguistic criteria (clarity of information and suitability of good and correct Indonesian writing rules). The validation results obtained are as follows:

Table 5. Validation Results

| No | | Aspect | Mode |
|---|---|---|---|
| 1 | a. | suitability of chemical material in the electronic student worksheet with learning indicators | 5 |
| | b. | suitability of the electronic student worksheet with the Inquiry learning model | 5 |
| | c. | suitability of the needs of the electronic student worksheet to improve elemental analysis thinking skills | 4 |
| | d. | suitability of electronic student worksheets needs to improve relationship analysis thinking skills | 4 |
| | e. | the suitability of the needs of the electronic student worksheet to improve organizational, analytical thinking skills | 5 |
| | f. | the truth of the substance of learning material | 4 |
| 2 | a. | alignment between the colors of text, background, images, and tables | 5 |
| 3 | a. | cover represents content | 4 |
| | b. | space is available to write answers as needed | 5 |
| | c. | serving system consistency | 4 |
| 4 | a. | clarity of the information presented | 5 |
| | b. | suitability with good and correct Indonesian writing rules | 5 |

On the content aspect, mode four is obtained with valid criteria. The highest score, namely the point of conformity between the electronic student worksheet and the inquiry learning model, received a score of 5 from validator 3. It follows the needs of the electronic student worksheet, which was developed by emphasizing the needs of students for analytical thinking skills. It is demonstrated through formulating problems, determining variables, developing hypotheses, collecting data, analyzing, and concluding. Through this activity, students can construct knowledge in obtaining information. An electronic student worksheet guides understanding skills and achieving certain student competencies [14]. According to the validator's suggestion on the relationship analysis component, the researcher also made improvements; in preparing hypotheses, students needed to read literacy before developing hypotheses. Researchers add new questions to the electronic student worksheet before compiling hypotheses. These questions ask students to search for literature related to the problem formulation they have created so that they have a reference for compiling hypotheses.

In the graphical aspect of the electronic student worksheet, a mode of 5 is obtained with very valid criteria. The graphical aspect is related to the harmony between text, background, image, and table colors. The preparation of the electronic student worksheet is very important in paying attention to appearance because students will first be interested in the

appearance of the electronic student worksheet, not the contents [15].

In the presentation aspect, the results are obtained with a mode of 4 with valid criteria. The highest score, namely the point where there is a place to write answers according to needs, gets a score of 5 from validator 3. It is relevant to the electronic student worksheet, which has been given a place to write answers with live worksheet features according to needs. In the results of experimental observations, students must write down the colors of each existing solution. The place for writing answers to these questions is in the form of a drop-down select box where students have to choose which color suits their answers because students' opinions about colors vary, and many colors are similar. Hence, the drop-down, select box feature is according to writing needs answers to observations.

In the linguistic aspect, the developed electronic student worksheet gets results with a mode of 5 with very valid criteria. The highest score, namely the point of clarity of the information presented, received a score of 5 from the validator 3.

It follows the electronic student worksheet, developed using sentences adapted to the student's cognitive abilities and are easy to understand. Darmodjo and Kaligis also stated that students must understand the language used, sentence structure, vocabulary, difficulty level, and sentence clarity (15). One of the requirements for a good electronic student worksheet is to make it easier for electronic student worksheet users to use good EYD and clear sentences [16].

Based on the validator's assessment of the three electronic student worksheets, the electronic student worksheets are suitable for use with a mode of 4 with valid criteria.

**Practicality**

Practicality in terms of response questionnaires and observation sheets of learning implementation as supporting data: The questionnaire aims to determine student responses to the inquiry-oriented electronic student worksheet that was developed. Recapitulation of student responses as follows:

Table 6. Response Questionnaire Results

| No | Question | $\Sigma$ Positive response | Percent |
|----|----------|---------------------------|---------|
| 1 | Is the video on the given phenomenon quite interesting, easy to understand, and related to chemical equilibrium material? | 30 | 100% |
| 2 | Can the electronic student worksheet use help me to formulate the problem? (Elementary Analysis) | 28 | 93.3% |
| 3 | Can the electronic student worksheet use help me determine the experimental variables? (Elementary Analysis) | 30 | 100% |
| 4 | Can the electronic student worksheet used help me to propose a temporary hypothesis/hypothesis (Relationship Analysis) | 27 | 90% |
| 5 | Can the electronic student worksheet help me determine the tools and materials for the experiment? (Relationship Analysis) | 30 | 100% |
| 6 | Can the electronic student worksheet help me write down the trial procedure? (Relationship Analysis) | 30 | 100% |
| 7 | Can the electronic student worksheet help me write down the observations before and after the reaction? (Relationship Analysis) | 30 | 100% |
| 8 | Can the electronic student worksheet use help me to analyze the observed data? (Relationship Analysis) | 24 | 80% |
| 9 | Can the electronic student worksheet help me conclude the results of experimental observations? (Organizing Analysis) | 28 | 93.3% |
| | Average | 253 | 93.7% |

The results of the student response questionnaire were 93.7% positive responses given by students to the developed electronic student worksheet. Students gave a negative response of 6.3%. The different perceptions of students cause this because of their different perspectives, experience, and knowledge of a particular object.

All students responded positively to whether the video on the phenomenon given was quite interesting, easy to understand, and related to chemical equilibrium material. It is supported by the

results of observing the implementation of learning where 100% of students make observations on the learning videos in the electronic student worksheet. It causes students to determine tools and materials easily, write experimental procedures, and write down the results of observations.

The results of the responses to the elemental analysis were as many as 28 positive responses given by students in the formulation of the problem and 30 negative responses given by students in determining variables. It is also supported by the observation

sheet, namely, 100% of students are working on formulating the problem and variables. The formulation of the problem and variables are interrelated; as many as two students argue that the electronic student worksheet cannot help compile determining the variables to occur because a few students need clarification when distinguishing between manipulation, control, and response variables. It can cause some students to think that determining these three variables is difficult.

In the relationship analysis, all students thought that the electronic student worksheet helped carry out the relationship analysis, including determining tools and materials, writing procedures, and writing down observations. It is also related to videos on phenomena because the experimental videos shown on the electronic student worksheet have coherent explanations that make it easier for students to work on the tools and materials and experimental procedures and write down the results of observations. Students gave the lowest positive response to the question of whether the electronic student worksheet can help me analyze. It is caused when learning using electronic student worksheets at the stage of analyzing students and teachers is not going well. The analytical activity relates to the phenomena and the chemical equilibrium material they have received before. When the teacher gave the students directions to determine how to analyze, some students were confused about the chemical equilibrium material because this material was at the end of the odd semester and was not well conveyed.

In the organizational analysis, as many as 28 students thought that the electronic student worksheet could help conclude the observations' results. It is continuous by compiling hypotheses in which as many as 27 students think that the E-LKPD helps in compiling hypotheses. Formulating a hypothesis is explaining what is being observed[17]. By paying attention to this description, when students are skilled in making hypotheses, it is expected that they are also skilled in making conclusions.

**Effectiveness**

Effectiveness is seen from the pretest and posttest sheets which consist of tests of analytical thinking skills and learning outcomes.

The skills test has six description questions related to analytical skills. The increase in students' analytical thinking skills is measured based on the results of the pretest and posttest, which are calculated using the t-test. Before the t-test was carried out, the Normality test was carried out using Microsoft Excel. The results of the normality test found that D count <D table with D table of 0.242 and D count for pretest obtained at 0.209 and D count for posttest of 0.218, which means the data is normally distributed in the Kolmogorov Smirnov test.

The normality test results were normally distributed, and then a t-test was carried out to determine the increase between the pretest and posttest. The t-test results with a significance level of 5% obtained t count> t table of 12.294> 2.045, which means that Ho is rejected and Ha is accepted. He stated that there was no significant difference between the pretest and posttest. Meanwhile, Ha stated that there was a significant difference between pretest and posttest. Based on these results, the developed electronic student worksheet was declared effective in training analytical thinking skills.

The magnitude of the increase in students' analytical thinking skills was also measured using the N-gain test. The results of the N-gain test obtained an increase in students' analytical thinking skills in the High category with a gain score of 0.7, which can be said to have increased by 70%. These increases can be described in the following table:

Table 7. Results of Analysis Thinking Skills

| No | Analysis Thinking Skills Component | Pretest (%) | Posttest (%) | N-Gain | Criteria |
|---|---|---|---|---|---|
| 1 | Elemental Analysis | 43.33 | 92.78 | 0.87 | High |
| 2 | Relationship Analysis | 29.17 | 77.50 | 0.68 | Medium |
| 3 | Organizing Analysis | 23.33 | 77.78 | 0.61 | Medium |
| | N-gain Analysis Thinking Skills | | 0.77 | | High |

Based on the n-gain data obtained, elemental analysis (formulating problems and determining variables) obtains n-gain values with high criteria. During learning, the teacher guides and explains to students the problem formulation and determines the variables because the three aspects are interrelated and continuous. If students can formulate problems, then students are also skilled in determining hypotheses. It makes it easy for students to formulate problems and determine hypotheses so that they get an n-gain score with high criteria from the posttest data. Elemental analysis in this study obtained the same results, which found an increase in elemental analysis skills with an n-gain score with a percentage of 92% in the high category[17].

In the relationship analysis (developing hypotheses, determining tools and materials, determining experimental procedures, and analyzing), get an n-gain of 0.68 with moderate criteria. Relationship analysis gets medium criteria; this is possible because elemental analysis gets high criteria. Elemental analysis and relationship analysis are

interrelated because relationship analysis is a further level of elemental analysis; for example, the hypothesis in relationship analysis is the answer to the problem statement in elemental analysis. Analysis of the relationship to get the criteria is caused when learning using the electronic student worksheet at the stage of analyzing students and teachers could be better. The analytical activity relates to the phenomena and the chemical equilibrium material they have received before. When the teacher gave the students directions to determine how to analyze, many students were confused about the chemical equilibrium material because this material was at the end of an odd semester and was not well conveyed. It proves that students need intense guidance from the teacher when working on relationship analysis activities on the electronic student worksheet so that learning using an inquiry-oriented electronic student worksheet takes a long time and affects the next stage of learning. Level relatively low skills indicate that students need more experience formulating research problems for development [18]. Students need help with processing and analyzing data [19-21]. Analysis of the relationship in this study obtained the same results, which found an increase in the n-gain score relationship analysis skills with a percentage of 86.1% in the medium category.

In the organizing analysis (concluded), to get an n-gain of 0.61 with moderate criteria. Activities in analyzing relationships, namely compiling hypotheses and analyzing related activities in organizing analysis, namely concluding. Piaget stated that high school students are generally in a transitional phase from concrete operations to formal operations (> 11 years) so that students can think logically about abstract propositions, formulate hypotheses and test them systematically. Relationship analysis and organization are in the medium category because compiling hypotheses, analyzing, and concluding are interrelated and show parallels; if students can formulate hypotheses, then students are also skilled in concluding. A hypothesis is explaining what is being observed [22]. By paying attention to this description, when students are skilled in making hypotheses, it is expected that they are also skilled in making conclusions. The organizing analysis in this study obtained the same results as the research, which found an increase in the n-gain score organizational analysis skills with a percentage of 79.17% in the medium category [23].

Increased learning outcomes are measured based on the results of the pretest and posttest, which are calculated using the t-test. Before the t-test was carried out, the Normality test was carried out using Microsoft Excel. The results of the normality test found that D count <D table with D table of 0.242 and D count for pretest obtained at 0.225 and D count for posttest of 0.184, which means the data is normally distributed in the Kolmogorov Smirnov test.

The normality test results were normally distributed, and then a t-test was carried out to determine the increase between the pretest and posttest. The t-test results with a significance level of 5% obtained t count> t table of 21.502> 2.045, which means that Ho is rejected and Ha is accepted. He stated that there was no significant difference between the pretest and posttest. Meanwhile, Ha stated that there was a significant difference between pretest and posttest. Based on these results, the developed electronic student worksheet was declared effective in improving learning outcomes.

The magnitude of the increase in student learning outcomes is also measured using the N-gain test. The increase can be described in the following graph:
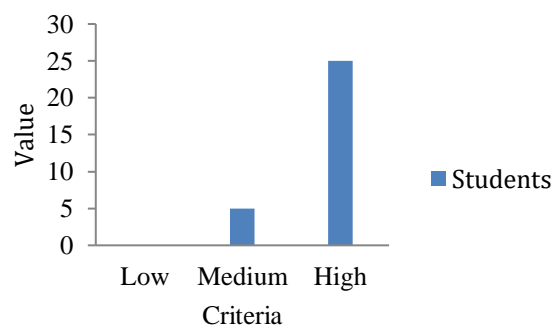


Figure 1 N-gain of Learning Outcomes

The learning outcomes test consists of 10 questions in the form of multiple choice with 5 answer options, namely 10 questions to analyze (C4) related to the sub-material of the factors that influence shifts in equilibrium. The results of the N-gain test showed that the increase in student learning outcomes was in the High category with an n-gain score of 0.8, or it could have increased by 80%. Based on the graph above, 25 students got high criteria, and 5 got medium ones. It shows that with the electronic student worksheet given to students, they can understand the existing concept of chemical equilibrium. It follows the inquiry learning model, where students are expected to find their own answers to a problem in question to form a concept that they can understand so that students can master the chemical equilibrium material well.

**CONCLUSION**

Based on the results of research and data analysis, the electronic student worksheet can train analytical thinking skills and is declared feasible in terms of several aspects, namely the electronic student worksheet is declared valid in terms of validity scores with each acquisition of mode 4 for content criteria, mode 4 for graphical criteria, mode 4 for presentation criteria, and mode 4 for linguistic criteria. This electronic student worksheet is practical to use; this is evidenced by the results of student responses, with an average student response score of 95.28% which can

be categorized as very practical. Observation data of 98% also support the response questionnaire data. This electronic student worksheet effectively analyzes the t-test results for an increase in the gain score, with a significance level of 5%. It is obtained that tcount>ttable is 12.294>2.045, and the N-gain score is 0.77. Therefore the electronic student worksheet can be used as a learning tool to train students' analytical thinking skills on chemical equilibrium material.

## REFERENCES

[1] Depdiknas. (2006). *Permendiknas No 22 Tahun 2006 tentang standar isi*. Jakarta: Depdiknas.

[2] Semiawan, C. (1984). *Pendekatan Keterampilan Proses*. Jakarta: PT. Gramedia.

[3] Amini, A. (2021). *Merdeka Mengajar Menjadi Awal Baru dalam Dunia Pendidikan*.

[4] Paul, R., & Elder, L. (2007). A guide for educators to:critical thinking competency standards standards, principles, performance indicators, and outcomes with a critical thinking master rubric. *Foundation for Critical Thinking Press*, 1–21

[5] Kemendikbud. (2013). *Peraturan Menteri Pendidikan dan Kebudayaan tentang Implementasi Kurikulum*. Kementrian Pendidikan dan Kebudayaan.

[6] Osborne, J. (2013). The 21st century challenge for science education: Assessing scientific reasoning. *Thinking Skills and Creativity*, *10*, 265–279.

[7] Kuswana, wowo sunaryo. (2012). *Taksonomi kognitif: perkembangan ragam berpikir*. PT Remaja Rosdakarya

[8] Sari, F. N., Nurhayati, & Soetopo, S. (2017). Pengembangan lembar kerja peserta didik (lkpd) elektronik teks cerita pendek berbasis budaya lokal. *Seminar Nasional Pendidikan Bahasa Indonesia*, *1*, 83–98.

[9] Suryaningsih, S., & Nurlita, R. (2021). pentingnya lembar kerja peserta didik elektronik (e-lkpd) inovatif dalam proses pembelajaran abad 21. *Jurnal Pendidika Indonesia*, *2*(7), 1256–1268.

[10] Apriliyani, S., & Mulyatna, F. (2021). Flipbook E-LKPD dengan pendekatan etnomatematika pada materi teorema phytagoras. *Prosiding Seminar Nasional Sains*, *2*(1).

[11] Lioba, T., Yuniasih, N., & Nita, C. I. R. (2021). Pengembangan e-lkpd berbasis aplikasi liveworksheets pada materi volume bangun ruang kelas V SDN Kebonsari 4 Malang Universitas PGRI Kanjuruhan Malang. *Seminar Nasional PGSD UNIKAMA*, *5*(1), 307–313.

[12] Arends, R. I. (2012). *Learning to teach*. New York: The McGraw-Hill Companies.

[13] Sugiyono. (2015). *Metode penelitian dan pengembangan research and development*. Alfabeta.

[14] Astuti, Y., & Setiawan, B. (2013). Pengembangan lembar kerja siswa (lks) berbasis pendekatan inkuiri terbimbing dalam pembelajaran kooperatif pada materi kalor. *Jurnal Pendidikan IPA Indonesia*.

[15] Widjajanti, E. (2008). Kualitas lembar kerja siswa. *Makalah Disajikan Dalam Pengembangan Lembar Kegiatan Siswa Dan KIT IPA Pada Materi Energi Dalam Sistem Kehidupan Untuk Melatihkan Keterampilan Berpikir Kritis Siswa SMP*.

[16] Departemen Pendidikan Nasional. (2008). *Panduan pengembangan bahan ajar*. Jakarta: Direktorat Pembinaan Sekolah Menengah Atas Departemen Pendidikan Nasional.

[17] Suyono. (2007). Penerapan pembelajaran berdasarkan masalah untuk mengatasi kesulitan siswa dalam mengerjakan soal bercirikan keterampilan proses. *Jurnal Cakrawala Pendidikan*.

[18] Novitasari, P., & Muchlis. (2020). Penerapan model pembelajaran inkuiri terbimbing untuk meningkatkan keterampilan berpikir analisis siswa pada materi kesetimbangan kimia kelas xi sma negeri 4 sidoarjo. Unesa. *Unesa Journal of Chemical Education*, *9*(1), 16–20.

[19] Baur, A., & Emden, M. (2021). How to open inquiry teaching? An alternative teaching scaffold to foster students' inquiry skills. *Chemistry Teacher International*, *3*(1).

[20] Wilatika, R. A. S. A., & Yonata, B. (2022). Implementation of guided inquiry learning model to exercise students critical thinking skills on reaction rate material. *Jurnal Pijar Mipa*, *17*(1), 34-40.

[21] Humairoh, S., & Yonata, B. (2022). Implementation of guided inquiry learning model to train students' critical thinking skills on reaction rate topic. *Jurnal Pijar Mipa*, *17*(2), 136-142.

[22] Šmida, D., Čipková, E., & Fuchs, M. (2023). Developing the test of inquiry skills: measuring the level of inquiry skills among pupils in Slovakia. *International Journal of Science Education*, 1–36.

[23] Firmanda, D. A., & Novita, D. (2022). Guided inquiry learning model application to train the students analysis skills on factors that affect reaction rate materials. *Jurnal Pijar Mipa*, *17*(1), 1–7.