SPEKTRA: Jurnal Kajian Pendidikan Sains
Vol. 10, No. 1, 2024, pp. 97-109
ISSN: 2548-642X, DOI: 10.32699/spektra.v10i1.432

CONTEXTUAL TEACHING & LEARNING-ORIENTED STUDENT WORKSHEET TO IMPROVE SCIENCE LITERACY ON CHEMISTRY EQUILIBRIUM MATERIALS

Ilmiatul Mufa'idah[1], Utiya Azizah[2]
[1,2]Chemistry Department, Faculty of Mathematics and Natural Science, State University of Surabaya, Surabaya, Indonesia

Article Info

Article history:
Received 06/08/2023
Accepted 22/04/2024
Published 30/05/2024

Keywords:
Student worksheet
Contextual teaching & learning
Science literacy
Chemical equilibrium

ABSTRACT

The challenges of 21st century skills are in line with the objectives of the Merdeka Curriculum, one of which is to grow the ability to analyse various scientific issues and evaluate various phenomena in everyday life. The purpose of this study is to produce contextual teaching and learning-oriented student worksheets that can improve science literacy skills on chemical equilibrium material. The method used in this research refers to the Borg and Gall development model, but is limited to the product trial stage. This research design uses One Group Pretest Post-test. The feasibility of the student worksheet related to the validity aspect is measured based on the results of the assessment of 3 validators, the practicality aspect is reviewed from the results of the response questionnaire and observation of student activities, while the effectiveness aspect is seen from the N-gain value of the pretest - post-test of science literacy. The results of this study showed that the content validity was 87.88% and construct validity was 90.79% with a very valid category, the practicality value was 96.1% positive response and 94.43% based on student activity, and the average N-gain was 0.8853 in the high category. In conclusion, the contextual teaching and learning oriented student worksheet is valid, practical, and effective to improve students' science literacy on chemical equilibrium material.

Corresponding Author:
Utiya Azizah
[2]Chemistry Department, Faculty of Mathematics and Natural Science, State University of Surabaya, Surabaya, Indonesia
Email: utiyaazizah@unesa.ac.id

1. INTRODUCTION

In line with today's rapid technological advances, 21st century education prioritizes competencies that are important for students to have. Based on the 21st Century Skills Partnership (2015), competencies that must be promoted include critical thinking and problem solving, creative, communicative and the ability to work together. Not only as a user of existing technological facilities, students are also required to be able to creating or utilizing the latest innovations well (Zubaidah, 2019; Wijaya, 2016). Through 21st century learning in schools, students are expected to master the skills needed to face life in a global society (Pratiwi, 2019).

To prepare a competitive next generation, the national curriculum is designed in line with the demands of 21st century education. The Merdeka Curriculum is being used as an effort to recovery learning after the COVID-19 pandemic. The Merdeka Curriculum prioritizes intracurricular learning with simpler and optimized content so that students can explore concepts and strengthen competencies (Kemendikburistek, 2022). The learning process in the classroom continues to be improved and directed to increase the active involvement of learners. In an effort to improve the quality of science learning in schools, teachers must be able to bring up the domains of science literacy so that they can realize 21st Century Skills (Widhy, 2013; Pratiwi, 2019). However, the facts show that the results of the last Program for International Student Assessment (PISA) study in 2022 have not given good enough results. Indonesian students' science literacy skills are low with a score of 398, which is still 68th out of 81 countries. Average 2022 results were down compared to 2018 in all trends (OECD, 2023)

Scientific literacy is the ability to angage with science related issues, and with the ideas of science as a reflective citizen (OECD, 2017). Science literacy sees the importance of critical thinking and action skills that involve mastery and meaningful applications of science concepts in recognizing, addressing, and making decisions on social issues in students' lives. Based on PISA (2017), science literacy consists of 4 related domains, namely context, knowledge, competence, and attitude. Science literacy is important for understanding the environment, health, economics, modern society, and technology (Kasse & Atmojo, 2022).

Science learning such as chemistry in the 21st century is designed to develop the ability to think creatively and think critically, to solve problems, to be able to make innovations, and to emphasize the importance of collaboration and communication (Widhy, 2013; Pratiwi, 2019). Based on SK BSKAP No. 33 of 2022, it is stated that chemistry is a practical science, where one of the objectives of studying chemistry is to foster the ability to think critically to analyze various scientific issues and evaluate various phenomena in everyday life (Kemendikbudristek, 2022). This shows that science literacy, especially in chemistry, is the main goal in science education (Yanni & Azizah, 2018; Dewi C. A., 2022).

Based on pre-research activities, as many as 67.9% of students consider chemistry to be a difficult subject. Chemical equilibrium is one of the materials where the majority of concepts require understanding at 3 levels of chemical representation, namely macroscopic, sub-microscopic, and symbolic (Utari, 2017; Agatha, 2022). This is in accordance with the statement (Fassenda & Yonata, 2016) in his research that *"...the concept of chemical equilibrium is difficult for even high school students to comprehend"*. Chemical equilibrium contains factual knowledge related to symbols and phenomena in life, conceptual because it studies principles and laws, procedural by involving the calculation/experiment process, and metacognitive related to problem solving strategies regarding factors that shift equilibrium (Arifin, 2014).

The implementation of learning must be able to provide learning experiences for students to increase their involvement in learning (Handayani & Wulandari, 2021). In chemical equilibrium material, there are many components that require students to do practicum activities and their connection to real life (Aristina & Azizah, 2018; Rahmawati & Yonata, 2019). Contextual Teaching and Learning (CTL) is a learning concept that involves activities that connect science with everyday life problems in ways that are meaningful to students (Johnson, 2007). Through the CTL approach, it is expected to be able to motivate students to learn and understand the material in school through events or situations that occur around them. The Washington State Consortium

for Contextual Teaching and Learning explained that the CTL approach involves seven main components, namely: constructivism, questioning, inquiry, learning communities, modeling, reflection and authentic assessment (Wasis, 2020). Students may be able to build their own knowledge based on facts in everyday problems, collect and analyze data and draw conclusions together with their groups based on teacher guidance, and reflect on what benefits they get after studying (Rahmawati & Yonata, 2019).

One of the efforts made to overcome the low chemical literacy skills of students by developing teaching materials in the form of student worksheets that present everyday phenomena. Student Worksheet are teaching tools that are made and tailored to the learning needs of students to help the learning process (Prastowo, 2015). Student worksheet as teaching material can be used to train a skill of students based on certain learning stages (Depdiknas, 2008). Several previous studies have mentioned that the use of CTL-oriented student worksheets can improve students' abilities. CTL-oriented student worksheets has been developed by Sari & Agustini (2020) obtaining the results that CTL-oriented student worksheets can improve students' problem solving skills with N-gain in the medium 40% and high 60% categories. Other research also states that a valid CTL-oriented module was developed to foster students' science literacy (Ahmadi, 2016). Similarly, research by Anggraeni, et al (2020) that the contextual approach by linking and applying material to life can foster an attitude of environmental care, while supporting students' science literacy skills.

CTL-oriented student worksheets are expected to train students' science literacy in chemical equilibrium material which is closely related to everyday phenomena, which can encourage students to actively connect meaning and real world situations with the concepts learned. Therefore, the development of CTL-oriented students worksheet to improve science literacy in chemical equilibrium material is valid, practical, and effective.

2. METHOD

This research is a development research or Research and Development (R&D) which adapts the Borg and Gall development model which limited to the product trial stage (Sugiyono, 2015).

The limited trial in this study used One Group Pretest-Posttest Design.

Table 1. Limited Trial Design

O_1	X	O_2

Information:
O_1 = Science literacy pretest score
X = Treatment is learning using CTL-oriented student worksheets
O_2 = Science literacy post-test score

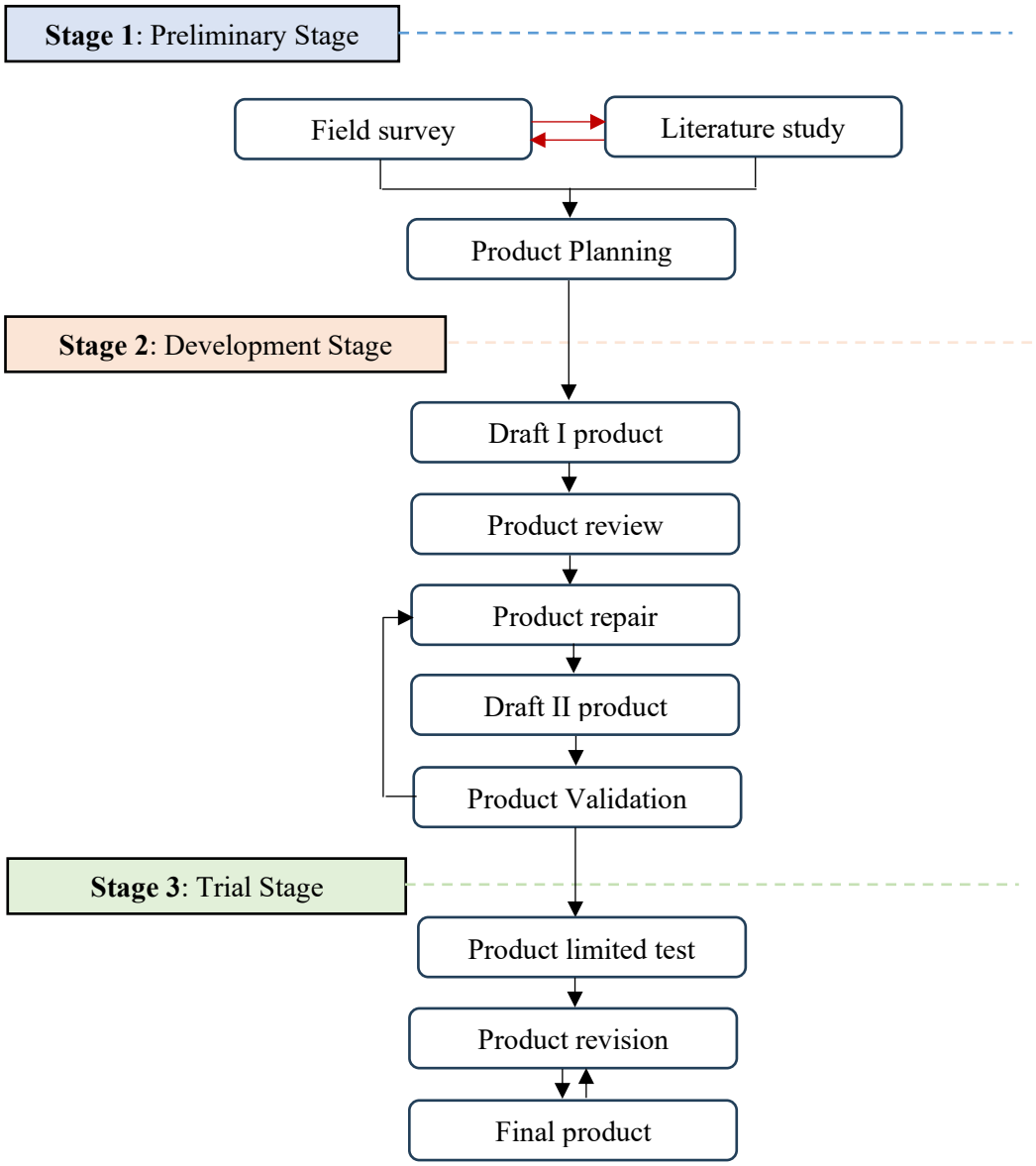


Figure 1. Borg and Gall Development

In this study, the data collection techniques used were questionnaires, tests, and observations. The questionnaire method was used to collect validation data and student responses. The validation data was obtained from the assessment of 3 validators of the student worksheets developed in terms of content and construct criteria. The validity assessment uses a Likert scale.

Table 2. Likert scales score

Score	Category
1	Very bad
2	Bad
3	Medium
4	Good
5	Very good

Source: (Riduwan, 2016)

The scores obtained are calculated in percentage using the following formula.

$$Validation\ Precentage(\%) = \frac{\Sigma\ total\ score\ obtained}{maximum\ score}\ x\ 100\% \quad (1)$$

The percentage results are interpreted in the following criteria. The student worksheets developed are declared valid if the percentage for content and construct validity reaches ≥ 61%.

Table 3. Likert Scale Percentage Criteria

Percentage (%)	Category
0 – 20	Invalid
21 – 40	Less valid
41 – 60	Moderately valid
61 – 80	Valid
81 – 100	Very valid

Source: (Riduwan, 2016)

The student response questionnaire was used to determine the practicality of the student worksheets developed. Data analysis used a Guttman scale in the form of questions with the answer options "Yes" and "No".

Table 4. Guttman scale score

Answer	Positive Question Score	Negative Question Score
Yes	1	0
No	0	1

Source: (Riduwan, 2016)

Student responses were calculated using the following formula:

$$Response\ Precentage(\%) = \frac{\Sigma\ total\ score\ obtained}{maximum\ score}\ x\ 100\% \quad (2)$$

The percentage results obtained are interpreted in the following table criteria.

Table 5. Interpretation of Practicality Score

Percentage (%)	Category
0 – 20	Not practical
21 – 40	Less practical
41 – 60	Practical moderately
61 – 80	Practical
81 – 100	Very practical

Source: (Riduwan, 2016)

The observation method is carried out when observing the activities of students during the learning process using the student worksheets. The following formula is used to calculate the percentage of student activity observation data:

$$Activity\ Precentage(\%) = \frac{\Sigma\ activity\ that\ appears}{\Sigma\ overall\ activities} x\ 100\% \quad (3)$$

The results of student activity observations can be used to support the results of student response questionnaires in meeting the criteria for practicality. Student worksheets are stated practical if the percentage of relevant student activities is greater than irrelevant activities (Riduwan, 2016).

The test method was used to determine the effectiveness of the student worksheets developed. The improvement of science literacy skills was analyzed based on the results of the pre-test and post-test using the N-gain score calculation.

$$< g > = \frac{posttest\ score - pretest\ score}{maximum\ score - \ pretest\ score} \quad (4)$$

Then the results of the N-gain score calculation are interpreted in the criteria in Table 5. Science literacy skills are said to increase after learning using CTL-oriented worksheets if the N-gain value reaches ≥ 0,3.

Table 6. N-gain score category

N-gain score	Categories
<g> ≥ 0,3	Low
0,3 ≤ <g> < 0,7	Medium
<g> ≥ 0,7	High

Source: (Hake, 2002)

3. RESULTS AND DISCUSSION

3.1. Preliminary Study Stage

At this stage, information collection was carried out related to chemistry learning problems related to the development of student worksheets. Field surveys were conducted by interviewing chemistry teachers, distributing pre-research questionnaires and science literacy tests to students. Based on the facts obtained from the field study, data collection continued, namely by collecting data and information in the form of theoretical and empirical studies derived from various sources such as textbooks, journals, or previous research on the development of student worksheets, CTL learning approaches, science literacy, and chemical equilibrium materials.

The results of the questionnaire dissemination at State Senior High School 1 Krian, as many as 66.1% of students consider chemical equilibrium to be difficult material. Most of the reasons are because there are many terms that are not understood and too many calculations. Students want chemistry learning that is meaningful, fun, and relates to phenomena around them. This is in accordance with previous studies that students expect student worksheets phenomena which are problems that must be solved through practicum activities (Dewi & Azizah, 2019).

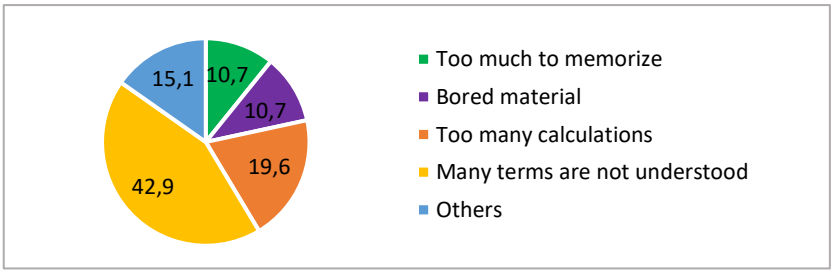


Figure 2. Results of Questionnaire on Chemical Equilibrium Material Difficulty Reasons

In the interview, the chemistry teacher stated that the student worksheets that have been used so far only contain a summary of the material, questions and have not trained science literacy. Students are still not trained to use scientific knowledge to analyze problems and apply them in daily activities. The data and information obtained were used as materials for the initial design and content of student worksheets.

3.2. Product Development Stage

CTL-oriented student worksheets are prepared based on seven components of CTL learning, namely: constructivism, questioning, inquiry, learning community, modeling, reflection, and authentic assessment. Science literacy skills trained in the worksheets include four domains, namely: science context, science knowledge, science competence, science attitude. At this stage of development, the product review and validation process has been carried out. The review of student worksheets was carried out to obtain suggestions and input on the student worksheets developed. The following picture is the result of the revision of the first draft of the student worksheet.

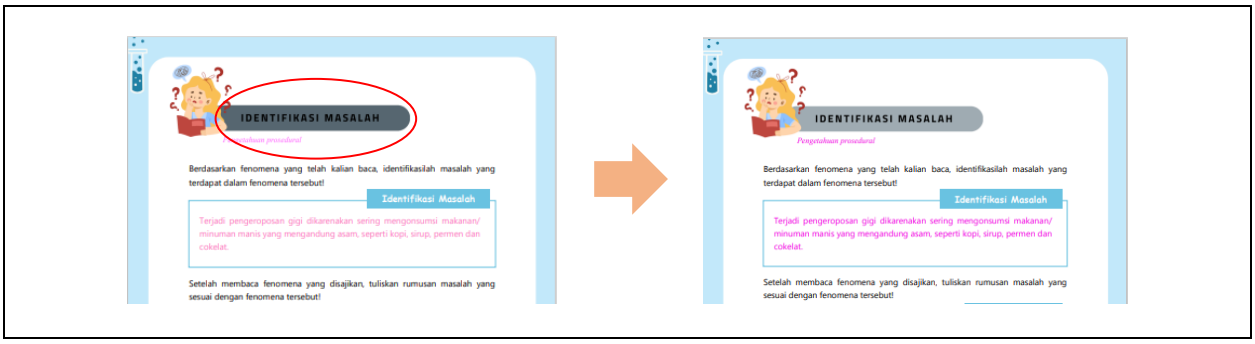


Figure 3. Improvement of text and background color

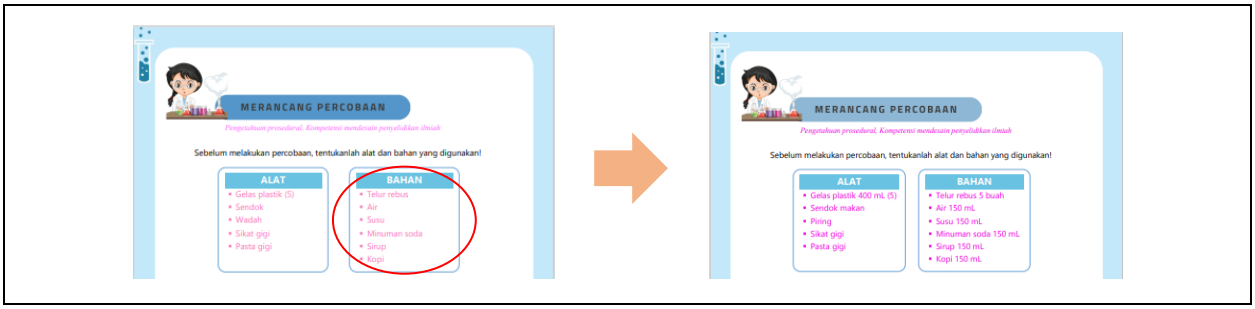


Figure 4. Improved specifications of tools and materials

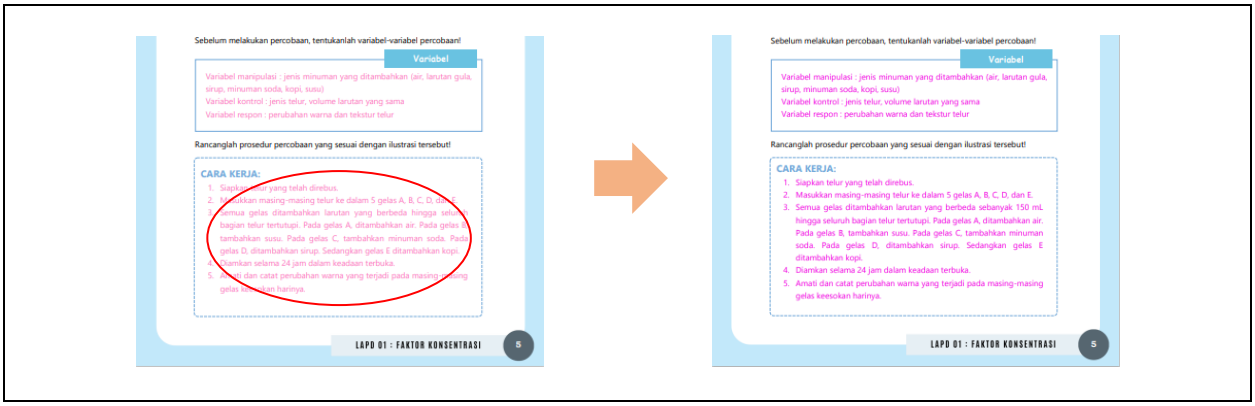


Figure 5. Improvement of experiment procedure

The revised student worksheets were then validated by 3 validators, namely 2 chemistry lecturers from Surabaya State University and one chemistry teacher from State Senior High School 1 Krian. The student worksheets developed are valid if they are valid in terms of content and construct validity.

Table 7. Validation results of student worksheets

No	Aspects of assessment	Validity Percentage (%)	Criteria
Content Criteria			
1	The suitability of learning outcomes and learning objectives to be achieved with the Merdeka curriculum	93,33%	Very Valid
2	The suitability of chemical equilibrium material with learning objectives	86,67%	Very Valid
3	Correctness of phenomena and material	88,89%	Very Valid
4	The suitability of the contents of the student worksheet with the CTL learning approach	86,67%	Very Valid
5	The suitability of the contents of the student worksheet with the criteria for science literacy skills	86,67%	Very Valid
	% Content Validity	87,88%	Very Valid
Construct Criteria			
A. Linguistics			
1	Using terms that are easy to understand	93,33%	Very Valid
2	Using simple and clear language	100%	Very Valid
3	Using good and correct Indonesian language.	93,33%	Very Valid
4	Using effective and efficient language.	86,67%	Very Valid
B. Presentation			
1	Contains clarity of purpose	100%	Very Valid
2	Systematic order of material	93,33%	Very Valid
3	Presentation of images is appropriate	86,67%	Very Valid
4	Increase students' motivation and curiosity	80,00%	Valid
5	Presentation of material encourages students to be actively involved	93,33%	Very Valid
6	The images is accompanied by references	93,33%	Very Valid
7	Student worksheets are interesting or fun	93,33%	Very Valid
C. Graphics			

No	Aspects of assessment	Validity Percentage (%)	Criteria
1	The cover is attractive and presents the content of the student worksheet	86,67%	Very Valid
2	The use of font types and text sizes used makes it easy for readers to use student worksheets	100%	Very Valid
3	The harmony of the layout of text and images on the student worksheet	86,67%	Very Valid
4	Illustrations, graphics, images, and photos help in understanding concepts	86,67%	Very Valid
	% Construct Validity	90,79%	Very Valid

Based on the table above, from all aspects of content and construct validity, it obtained an average percentage of 87.88% and 90.79% respectively with a very valid category, so that the CTL-oriented student worksheets met the validity criteria because they obtained a percentage ≥ 61%.

3.3. Product Trial Stage

Student worksheets that have been declared valid were tested on 30 students of class XI at State Senior High School 1 Krian on June 15 and 16, 2023. The student worksheet trial was carried out for 3 meetings which can be seen in Table 8.

The practicality of the student worksheet was reviewed from the students' responses after learning using the CTL-oriented student worksheet. The response questionnaire was given to students at the end of the meeting after the posttest was completed, which contained 20 questions consisting of positive and negative questions. The practicality of the developed student worksheets is achieved if the results of students' positive responses obtain an average percentage of ≥61% (Riduwan, 2015).

Table 8. Schedule for student worksheet trial

No.	Day, Date	Learning Activity
1	Thursday, June 15th 2023	Pretest Student worksheet 1 Trial Trial of student worksheet 2
2	Friday, June 16th 2023	Student worksheet 3 Posttest and Distribution of Student Response Questionnaires

Based on the data analysis of the response questionnaire results, each aspect assessed obtained a percentage of ≥74.2% with an average of 96.1% which was categorized as very practical. Figure 6 presents the student response results.

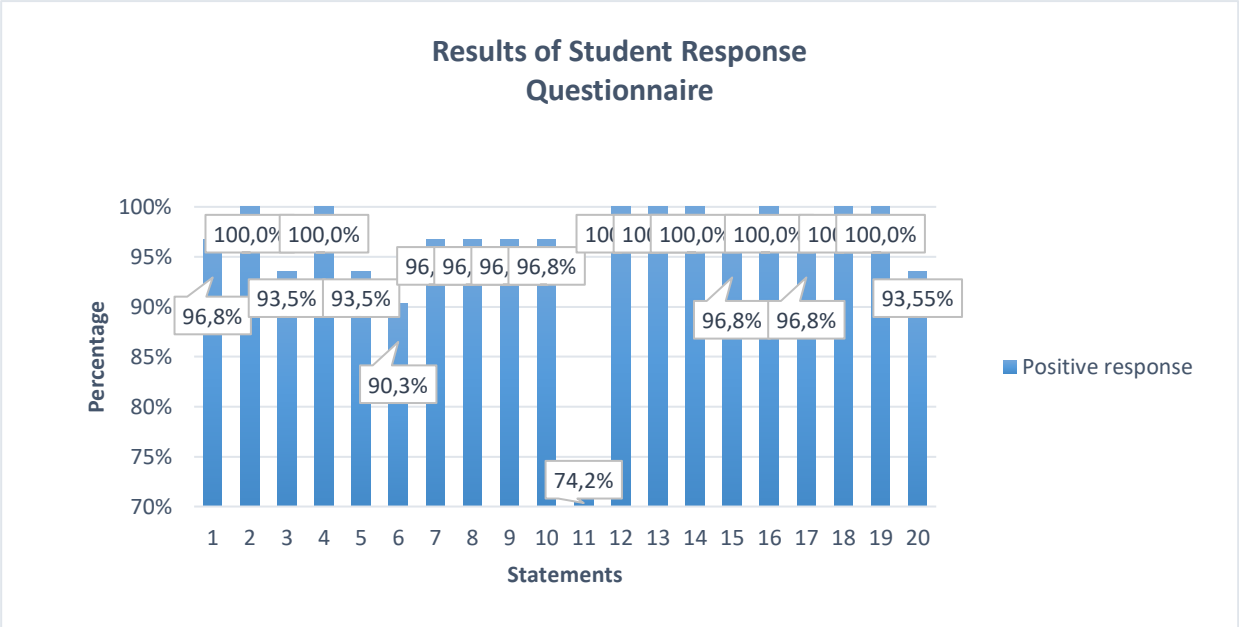
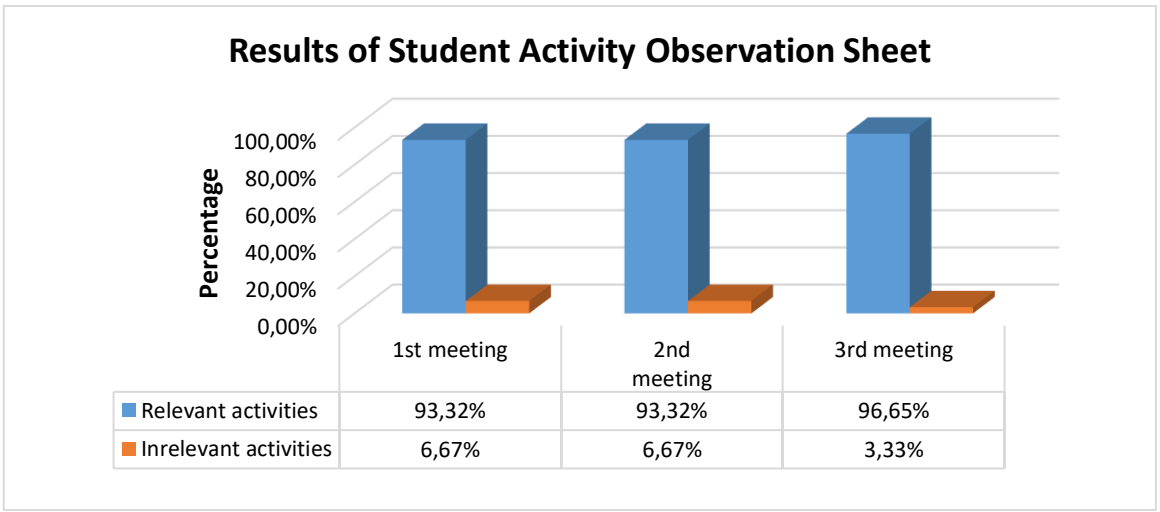


Figure 6. Percentage Chart of Student Response Questionnaire Results

The results of the student response questionnaire are supported by the results of student activity observation data. At each meeting there were three observers who observed the activities carried out by students during the limited trial process.



	1st meeting	2nd meeting	3rd meeting
Relevant activities	93,32%	93,32%	96,65%
Inrelevant activities	6,67%	6,67%	3,33%

Figure 7. Percentage Chart of Student Activity Observation Results

In Figure 7, it can be seen that in all three meetings, relevant student activities were greater than irrelevant activities. The percentage of relevant activities in the first and second meetings amounted to 93.32% and irrelevant activities amounted to 6.67%, while in the third meeting the percentage of relevant activities was 96.65% and irrelevant activities were 3.33%. Overall, from each meeting, student activities were well implemented and could support the practicality of the student worksheets developed.

The effectiveness of the student worksheets developed was reviewed from the improvement of students' science literacy skills obtained based on pretest and posttest scores. The test questions given consisted of 10 description questions related to science literacy on chemical

equilibrium material. Literacy questions are designed according to the question indicators and also adapted to the criteria of PISA questions. Each science literacy item contains domains of science knowledge, such as content knowledge, procedural knowledge, or epistemic knowledge. In addition, each item focuses on real situations in themselves, families, and individual groups (personal), related to society (local and national), and related to life across countries (global).

Student test results show that learning using CTL-oriented student worksheets can improve science literacy skills in each scientific competency.

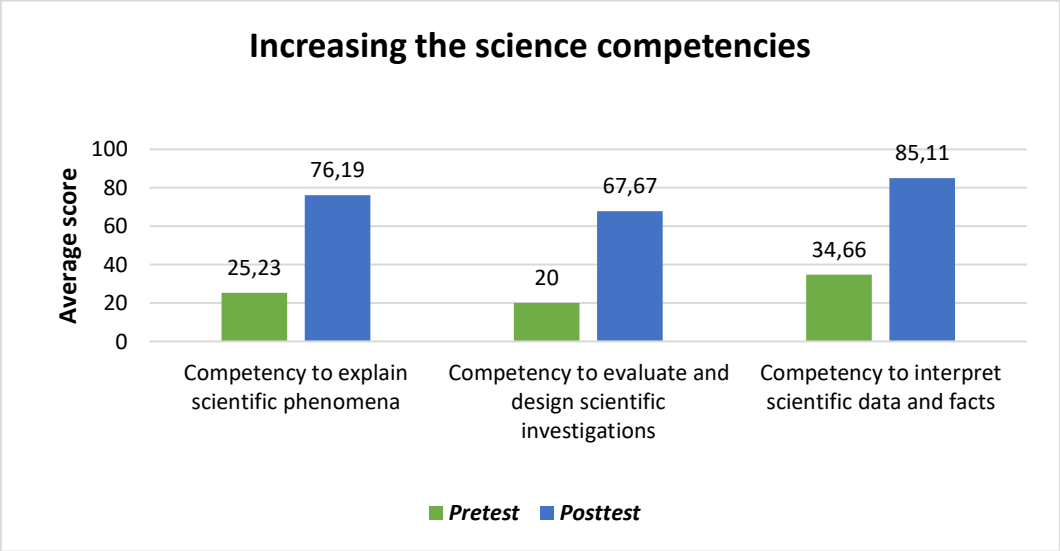


Figure 8. Improvement in each Science Competency

Figure 8 shows the increase in the average pretest and posttest of students' science literacy. According to OECD (2017), a person is said to have good science literacy skills if they have the competence to: (1) recognize, evaluate explanations of a scientific phenomenon, (2) design scientific investigations and propose solutions scientifically, and (3) analyze and evaluate data, provide arguments in various representations and draw appropriate scientific conclusions.

3.3.1. N-gain Test

The increase in students' pre-test and post-test results was analyzed using the N-gain calculation. Student worksheets are declared effective for training science literacy skills if the N-gain score reaches ≥ 0.3 with moderate criteria or ≥ 0.7 with high criteria.

This study shows that 16.67% of students obtained N-gain in the medium category and 83.33% in the high category. The results obtained indicate that the use of CTL-oriented student worksheets can be declared effective for training science literacy on chemical equilibrium material.

These results are in line with several previous studies which stated that the use of CTL-oriented worksheet can improve students' abilities. The CTL-oriented worksheet developed by Sari & Agustini (2020) obtained results that CTL worksheet was able to improve students' problem solving skills with an N-gain in the medium category of 40% and high 60%. Similarly, research by Anita & Yonata (2019) shows that worksheet's contextual approach by relating the material to daily life can improve students' science process skills by getting N-gain scores ranging from 0.68-

0.91 in the medium-high category. Other research also states that CTL-oriented modules are effective in growing students' scientific literacy (Ahmadi, 2016)

4. CONCLUSION

The conclusion of this study is that CTL-oriented student worksheets are feasible to use as teaching materials to improve students' science literacy on chemical equilibrium material because of fulfilling the criteria of validity, practicality, and effectiveness. The validity is viewed from the content aspect and the construct obtained a percentage of 87.88% and 90.79% in the very valid category. The practicality based on positive response of students get a percentage of 96.1% in the very practical and based on student relevant activity at each meeting obtain percentage 93.32%; 93.32%; and 96.65%. The effectiveness is assessed from the results scientific literacy posttest by obtaining the average N-gain score was 0.78, in which 16.67% of participant students in the medium category and 83.33% with high category. The development of CTL-oriented student worksheets to train science literacy needs to be further expanded to cover other chemistry materials

REFERENCES

Adytia, P. F., & Dwiningsih, K. (2018). Pengembangan Lembar Kegiatan Siswa Berorientasi Literasi. *UNESA Journal of Chemical Education Vol. 7, No. 3*, 358-364.

Agatha, B., et al. (2022). Analisis Miskonsepsi Calon Guru Kimia Dengan Menggunakan Two-Tier Multiple Choice Diagnostic Test Pada Materi Kesetimbangan. *Dalton : Jurnal Pendidikan Kimia dan Ilmu Kimia, Vol. 5, No. 2*, 9.

Ahmadi, H. P. (2016). Pengembangan Modul Contextual Teaching and Learning (CTL) Berorientasi Green Chemistry untuk Pertumbuhan Literasi Sains Peserta Didik. *Jurnal llmiah Pendidikan Kimia "Hydrogen", Vol. No. 1*, 17-25.

Arifin, N. H. (2014). *Analisis Kemampuan Kognitif Siswa pada Dimensi Pengetahuan dan Proses Kognitif Berdasarkan Taksonomi Bloom Revisi pada Konsep Kesetimbangan Kimia (Penelitian Deskriptif terhadap Siswa Kelas XI SMAN 1 Cileunyi).* Bandung: Skripsi UIN Sunan Gunung Jati.

Aristina, & Azizah, U. (2018). Melatihkan Keterampilan Proses Sains Peserta Didik Melalui Implementasi Model Pembelajaran Inkuiri Terbimbing Pada Materi Kesetimbangan Kimia Kelas Xi Di Sma Negeri 1 Jombang. *UNESA Journal of Chemistry Education Vol. 7, No. 2*, 105-110.

Depdiknas. (2008). *Panduan Pengembangan Bahan Ajar.* Jakarta: Depdiknas.

Dewi, C. A., et al. (2022). Pentingnya Mengoptimalkan Literasi Kimia melalui Pembelajaran Berbasis Isu-Isu Sosiosaintifik di Abad ke-21. *Proceeding Seminar Nasional IPA XII "PISA melalui Sains Masa Depan untuk Generasi Berwawasan Lingkungan"* (pp. 348-359). Semarang: Universitas Negeri Semarang.

Dewi, R., & Azizah, U. (2019). Pengembangan Lembar Kerja Peserta Didik (Lkpd) Berorientasi Problem Solving Untuk Melatihkan Keterampilan Berpikir Kritis Peserta Didik Kelas Xi Pada Materi Kesetimbangan Kimia. *Unesa Journal of Chemical Education Vol. 8, No. 3*, 332-339.

Fassenda, N., & Yonata, B. (2016). Keterampilan Berpikir Menganalisis, Mengevaluasi, dan Mencipta Siswa SMAN 19 SUrabaya pada materi Kesetimbangan Kimia. *Unesa Journal of Chemical Education Vol. 5, No. 1*, 19-25.

Hake, R. (2002). *Analyzing Change Gain Score.* USA: Indiana University.

Handayani, R., & Wulandari, D. (2021). Modern Assessment dalam Menyongsong Pembelajaran Abad 21 dan Hambatan di Negara Berkembang. *Jurnal Pendidikan Edutama Vol. 8, No. 1*, 13-24.

Johnson, E. B. (2007). *Contextual Teaching and Learning: Menjadikan Kegiatan Belajar-Mengajar Mengasyikkan dan Bermakna.* Bandung: Mizan Leraning Center.

Kemendikbudristek. (2022). *Surat Keputusan Badan Standar, Kurikulum, dan Asesmen Pembelajaran No. 33 Tahun 2022 tentang Capaian Pembelajaran pada Pendidikan anak Usia Dini, Jenjang Pendidikan Dasar, dan Jenjang Pendidikan Menengah pada Kurikulum Merdeka.* Jakarta: Kemendikbudristek.

Kemendikburistek. (2022). *Kajian Akademik : Kurikulum untuk Pemulihan Pembelajaran.* Jakarta: Pusat Kurikulum dan Pembelajaran, Kemendikburistek.

OECD. (2017). *PISA 2018 Draft Science Framework.* Fonte: OECD.org: www.oecd.org/pisa/publicatons/PISA2018_CN_IDN.pdf

OECD. (2019). *PISA Results from PISA 2018, Country Note : Indonesia.* Paris: OECD Publishing.

OECD. (2023). *PISA 2022 RESULTS : FACTSHEETS - INDONESIA.* Paris: OECD.

Partnership for 21st Century Learning. (2015). *P21 Framework.* Fonte: P21.org: www.p21.org/our-work/p21-framework

Prastowo, A. (2015). *Panduan Kreatif Membuat Bahan Ajar Inovatif.* Yogyakarta: Diva Press.

Pratiwi, S., et al. (2019). Pembelajaran IPA Abad 21 dengan Literasi Sains Siswa. *Jurnal Materi dan Pembelajaran Fisika (JMPF) Volume 9 Nomor 1*, 34-42.

Rahmawati, A., & Yonata, B. (2019). Pengembangan LKPD Berbasis Contextual Teaching and Learning (CTL) untuk Melatihkan Keterampilan Proses Sains pada Materi Kesetimbangan Kimia. *Unesa Journal of Chemical Education Vol. 8, No. 2*, 15-22.

Riduwan. (2016). *Skala Pengukuran Variabel-Variabel Penelitian.* Bandung: ALFA BETA.

Sari, V. A., & Agustini, R. (2020). Pengembangan LKPD Berorientasi CTL untuk Melatihkan Keterampilan Memecahkan Masalah pada Materi Koloid Kelas XI SMA. *Unesa Journal of Chemistry Education Vol. 9, No. 1*, 79-83.

Sugiyono. (2015). *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D.* Bandung: ALFA BETA.

Utari, D., et al. (2017). Kemampuan Representasi Siswa pada Materi Kesetimbangan Kimia Menggunakan Animasi Berbasis Respresentasi Kimia. *Jurnal Pendidikan dan Pembelajaran Kimia Vol. 6, No.3*, 414-426.

Wasis, et al. (2020). *HoTS dan Literasi Sains: Konsep, Pembelajaran, dan Penilaiannya.* Jombang: Kun Fayakun.

Widhy, P. H. (2013). Integrative Science untuk Mewujudkan 21st Century Skill dalam Pembelajaran IPA SMP. *Seminar Nasional MIPA 2013* (pp. 1-13). Yogyakarta: Universitas Negeri Yogyakarta.

Wijaya, E., et al. (2016). Transformasi Pendidikan Abad 21 sebagai Tuntutan Pengembangan Sumber Daya Manusia di Era Global. *Prosiding Seminar Nasional Pendidikan Matematika 2016* (pp. 263-278). Malang: Universitas Kanjuruhan Malang.

Yanni, M. L., & Azizah, U. (2018). PENGEMBANGAN LEMBAR KEGIATAN SISWA (LKS) BERBASIS LITERASI SAINS PADA MATERI KESETIMBANGAN KIMIA KELAS XI. *Unesa Journal of Chemical Education Vol. 7 No. 3*, 308-314.

Zubaidah, S. (2019). Pendidikan Karakter Terintegrasi Keterampilan Abad Ke-21. *Jurnal Penelitian dan Pengkajian Ilmu Pendidikan: E-Saintika Vol. 3, No. 2*, 1.