

## DEVELOPMENT OF HANDOUTS ON ACID-BASE MATERIAL WITH THE SOROGAN LEARNING METHOD

Siska Widiana Putri and Rinaningsih\*

Chemistry Education Study Program, Faculty of Mathematics and Natural Science, Universitas Negeri Surabaya, Surabaya, Indonesia

\*Email: [rinaningsih@unesa.ac.id](mailto:rinaningsih@unesa.ac.id)

Received: June 6, 2023. Accepted: June 19, 2023. Published: July 30, 2023

**Abstract:** The Sorogan learning method is individual learning with the activities of students giving their learning outcomes (strong) to the teacher. This study aims to determine the feasibility of handouts in improving students' mastery of concepts in acid-base material using the developed Sorogan learning method in terms of validity, practicality, and effectiveness. The research for developing this handout refers to the Research & Development (R&D) development method, which is limited to the limited trial stage. Handout validity consists of content and construct validity. Content validity gets mode 5 with very valid criteria. Construct validity includes graphical, presentation, and linguistic criteria. Graphic criteria get mode 5 with very valid criteria, presentation criteria get mode 4 with valid criteria, and linguistic criteria get mode 4 with valid criteria. The practicality of the handout is seen from the results of observing the activities of the students by obtaining a percentage of 95.71% and the student response questionnaire in terms of the criteria for content, graphics, presentation, and language, getting a percentage respectively 98.33%, 96.67%, 97, 77%, and 100% with very practical criteria. The effectiveness of the handout is seen from the increase in pretest to posttest scores for each student using the N-Gain Score formula, and a value of  $<g> 0.8$  is obtained, or it can be said to increase by 80% with high criteria. Classical completeness gets a percentage of 100% with very effective criteria. It shows that using handouts with the Sorogan learning method in acid-base chemistry learning can improve students' mastery of concepts and learning outcomes. The handout on acid-base material using the Sorogan learning method was declared feasible because it met the validity, practicality, and effectiveness criteria.

**Keywords:** *Handout, Acid-Base, Sorogan*

### INTRODUCTION

Education is a deliberate and structured action to create a learning environment that enables students to develop their talents through an exciting and fun learning process to achieve national education goals [1]. One of the efforts to achieve these national education goals is to improve the quality of education at every level through curriculum development. Since the 2021/2022 school year, the latest curriculum has been launched to recover from learning lag, namely the Independent Curriculum is implemented in stages at various school levels.

The Merdeka curriculum is a simple and flexible curriculum to support learning loss. The Independent Curriculum focuses on independence in applying essential and flexible material according to students' interests, needs, and characteristics. In this case, setting students is the most important goal. There are three main objectives of the Independent Curriculum, namely students, students, and students. Teachers and students are given the freedom to implement an effective and fun learning system. Such a pattern of teaching and learning contributes to improving the quality of the national education system [2].

The first step that must be taken by every teacher who will apply Independent Curriculum learning is to carry out a diagnostic test. Diagnostic test results can be used as the main guideline regarding students' initial abilities for teachers in

preparing lesson plans. Learning that is formed is learning that is carried out in a differentiated manner or based on the talents and interests of students [2].

The difference between the Independent Curriculum and other curricula is emphasizing using student-centered learning methods and training student independence, namely the learning model Project Based Learning (PjBL) [3-4]. The Independent Curriculum has main characteristics aim to support the learning recovery process. The main attributes in question are project-based learning aiming to develop student character competencies and focus on essential material so that in-depth learning on basic competencies, such as literacy and numeracy, has sufficient time [4].

Several things form the basis of the shift in the learning paradigm, including the view of teacher-centered learning towards student-centered, one-way towards interactive, isolation towards a networked environment, virtual/abstract towards real-world contexts, personal towards team-based learning, passive towards active-investigative, broad to distinctive behavior empowering rules of engagement, single-taste stimulation to all-round stimulation, one-way relationship to cooperative, single tool to multimedia tool, mass production to customer needs, single conscious effort to plural, one science shift towards multidisciplinary knowledge, centralized control towards autonomy and trust, factual thinking

towards critical, and knowledge transfer towards knowledge exchange [5].

Teaching materials are all types of materials (written and unwritten) that are systematically arranged and used to help teachers carry out the learning process in class. Teachers, teaching materials, and the learning environment positively affect student learning satisfaction [6]. In addition, teaching materials can also help improve student learning outcomes [7][8]. One of the teaching materials that students can use as a learning resource is handouts. Handouts are one of the teaching materials that are useful for students during the learning process [9]. Through flyers, it is easier for students to understand essential concepts in learning material, positively impacting student learning outcomes [10][11]. Handouts as learning resources can be used by students to study independently before the teacher explains during class learning [12].

Handouts as teaching materials were developed based on the needs of students, which can be seen from the results of the test questions and the distribution of questionnaires conducted at one of the public high schools in Surabaya. Under the test questions' results and the questionnaire filled out by 30 students who had received acid-base material, the average score on the test questions was 48.33. Based on the questionnaire results, students considered chemistry lessons difficult to understand because there were many formulas. They had embedded in students' minds that chemistry is a complex subject. Still, in acid-base material, some students think the material is difficult to understand depending on how the teacher explains the material. Based on interviews with chemistry teachers, students have never used handout teaching materials in the learning process because the teacher considers Chemistry LKS and textbooks sufficient as teaching materials for students.

The low learning outcomes of students in chemistry subjects, especially acid-base material, are because students quickly forget the material that the teacher has taught, and acid-base material is quite tricky because, in general, students rely more on explanations from the teacher without trying to want to know more. Acid-base material contains many essential concepts to be understood by students. Acid-base material requires understanding, skill, and practice. Therefore, if students cannot master the concepts in the material being studied, students will have difficulty following the learning process [13].

To make it easier for students to remember and understand the concept of material before learning, teaching materials that apply the Independent Curriculum with unique learning methods are needed to store information so that it is easy to remember for a long time and also makes it easier for students to understand the concept of the material being studied. The learning method is the method that the teacher uses to teach, and this method is used as a tool to achieve learning objectives [14]. The problems above

can be overcome by using the Sorogan learning method, in which in this learning method handouts are the primary teaching material besides Student Worksheets [11]. In the syntax of the Sorogan learning method, there is a diagnostic test according to one of the stages of implementing the Merdeka Curriculum. Learning using the Independent Curriculum is centered on students [15]. It follows the student-centered Sorogan learning method [16]. Using teaching materials in the form of handouts with the Sorogan learning method, students can find their conceptual understanding that will be applied in project-based learning.

The Sorogan learning method is individual learning in which students usually provide learning achievement (substantial) by paying attention to and listening to the accuracy of the material concepts they have understood to the teacher [17]. Kyai (teacher) acts as a recipient of the results of individual learning development of students (students) and must provide feedback in the form of reinforcement or justification if an error occurs from students; in this case, Kiya is a source of knowledge for students [18].

## RESEARCH METHODS

The subjects in this study were 30 class XI students at SMA Negeri 16 Surabaya who were conducted in the even semester of the 2022/2023 academic year. The learning time lasts 40 minutes in the first meeting and 120 minutes in the second. This research uses Research and Development research type (R&D). As for the steps in this type of research, R&D, namely: 1) Preliminary study stage, 2) Media development stage, dan 3) Media trial stage [19]. However, this study was limited to limited trials at the media trial stage. This research design uses a "One group pretest-posttest design," the sample only uses 1 class without a comparison class, as described below.

$$O_1 \times O_2$$

Information:

$O_1$  : Pretest score (before being given learning with handouts)

$O_2$  : Posttest score (after being given learning with handouts)

X : Learning with handouts

The data collection methods used are the questionnaire method, the observation method, and the test method. The results of the data were obtained from the effects of validity, practicality, and effectiveness in the form of quantitative data.

Validity is obtained from the data validation results using a validation questionnaire sheet. The data obtained are interpreted according to the following categories on the Likert scale:

Table 1. Likert Scale

Criteria	Score
Very valid	5
Valid	4
Quite valid	3
Less valid	2
Very invalid	1

The data obtained during validation is ordinal data which cannot be performed using mathematical operations (addition, subtraction, multiplication, and division). Therefore, the determination is made according to the mode. The decision is set at the highest number [20]. The developed handout can be declared valid if it gets a minimum mode on a scale 4.

The practicality of the handouts was obtained through student response questionnaires and activity observation sheets as supporting data. Assessment of student response questionnaire data is calculated based on the following Guttman scale:

Table 2. Guttman Scale

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

Calculations to find out the percentage of student responses can be used the following formula:

$$\% \text{ Positive answer} = \frac{\sum \text{Answer score YES}}{\sum \text{Maximum score}} \times 100\%$$

$$\begin{aligned} \% \text{ Negative answer} \\ &= \frac{\sum \text{Answer score NO}}{\sum \text{Maximum score}} \times 100\% \end{aligned}$$

The percentage obtained is interpreted into the following criteria:

Table 3. Criteria for Interpreting Student Response Scores

Percentage	Criteria
0 – 20	Very less effective
21 – 40	Less effective
41 – 60	Effective enough
61 – 80	Effective
81 – 100	Very effective

The students' responses in this study were said to meet the criteria if the responses obtained received a percentage of  $\geq 61\%$  [21].

The effectiveness of the handout is obtained from the pretest and posttest sheets. The results of the pretest and Posttest are tested for normality. After that, it can be searched for an increase in learning outcomes using the N-Gain formula as follows:

$$\langle g \rangle = \frac{\text{Posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

The N-Gain Score obtained is interpreted into the following criteria:

Table 4. N-Gain Score Criteria

Value $\langle g \rangle$	Criteria
$\langle g \rangle \geq 0.7$	High
$0.7 > \langle g \rangle \geq 0.3$	Medium
$\langle g \rangle < 0.3$	Low

Based on the N-Gain Score criteria, the developed handout can be feasible if the increase in learning outcomes obtained by students reaches  $\geq 0.7$  with high criteria or  $\geq 0.3$  with medium criteria.

## RESULTS AND DISCUSSION

The results of this study indicate that handouts on acid-base material using the Sorogan learning method can improve students' mastery of concepts and learning outcomes. The research results include validity, practicality, and effectiveness.

### Validation

Validation was carried out by three validators: two chemistry education lecturers and one chemistry teacher. The validation results are validity data in terms of content and construct validity criteria which include the suitability of the handout content with the curriculum, usefulness of the material in the handout with learning outcomes, suitability of the material in the handout with learning objectives, and suitability of the handout with the Sorogan learning method. It also includes graphics, presentation, and language. The following are the validation results obtained:

Table 5. Validation Results

No.	Rated Aspect	Mode
1.	Content Validity	5
2.	Construct Validity	
	Graphic	5
	Presentation	4
	Language	4

On the content aspect, mode five is obtained with very valid criteria. It shows that the handout's contents follow the Sorogan learning method and the Merdeka Curriculum. The Merdeka Curriculum focuses on essential, relevant, in-depth material to build creativity and innovation. Students achieving critical competencies such as literacy and numeracy have sufficient time [22]. It is in line with the leading spirit of the Independent Curriculum, which is to improve the basic competence of numeracy literacy in students. The use of numeracy literacy-based questions in the developed handout follows the characteristics of the Independent Curriculum used in

this study. Researchers analyzed learning outcomes to develop learning objectives.

The handout developed according to the Sorogan learning method consists of 1) Concept maps equipped with the relationship between prerequisite material and subject matter, 2) Prerequisite material, 3) Each learning objective consists of subject matter, sample questions, and literacy-based practice questions numeracy, and 4) In the subject matter, sample questions, and practice questions based on numeracy literacy, there are keywords marked in bold that answer the learning objectives. The content of the handout has the substance of learning material, namely the accuracy of concepts and definitions.

In the graphical aspect, mode five is obtained with very valid criteria. Visual aspects consist of 1) The handout format makes it easier for students to learn, 2) Selection of models, sizes, and colors, and 3) Harmony between the colors of text, background, images, and tables. Handouts are printed teaching materials that explain the subject matter very briefly and are used to assist students in participating in learning activities [23]. The choice of model, size, and color is adjusted to the students' clarity in reading the handout's contents. Meanwhile, color harmony makes the teaching material attractive [24].

In the presentation aspect, mode 4 is obtained with valid criteria. Presentation aspects consist of 1) Cover presenting the contents of the handout, 2) There is a place to write answers according to needs, 3) Presentation order, 4) Providing motivation and attraction, and 5) Interaction (giving stimulus and response). The cover handout displays an image, namely an image of an orange that has acidic properties and a colored solution in a beaker and Erlenmeyer, which is assumed to be the solution being tested with natural indicators. The accuracy of the size and type of font will provide comfort as long as students use teaching materials to create a pleasant learning atmosphere for students [24]. The developed handout provides a place to write down answers as needed. The developed handout also has a consistent presentation, and there is interaction with students, as well as providing an attraction for students.

In the linguistic aspect, mode four is obtained with valid criteria. The linguistic aspect consists of 1) Clarity of the information presented, 2) Compliance with excellent and correct Indonesian writing conventions, and 3) Use of language effectively and efficiently (clearly and briefly). The information on the handout is well understood by students, as evidenced by all students answering practice questions for each learning objective on the handout. Researchers use effective and efficient language that students easily understand while following the rules of good and correct Indonesian writing. Suitable teaching materials or books are teaching materials or books that are written using good language and are easy to understand [25].

### Practicality

The practicality of the handouts was obtained through student response questionnaires and activity observation sheets as supporting data for the questionnaire. The response questionnaire is aimed to determine students' responses to handouts on acid-base material using the developed Sorogan learning method.

Table 6. Student Response Questionnaire Results

No.	Rated Aspect	Percentage
<b>Content Criteria</b>		
1.	Did you see the keywords (bold letters) when doing the practice questions?	100% (Yes)
2.	If the answer to number 1 is "Yes," do you feel faster in doing the practice questions?	96.67% (Yes)
3.	Do you feel that you understand the material more quickly by looking at the keywords (bold letters)?	100% (Yes)
4.	Did this handout help you relate acid-base materials to everyday life?	9.67% (Yes)
Average Percentage of Content Criteria		98.33%
<b>Graphical Criteria</b>		
1.	Was this acid-base handout attractive?	96.67% (Yes)
Average Percentage of Graphical Criteria		96.67%
<b>Presentation Criteria</b>		
1.	Did the acid-base handout with the Sorogan learning method not motivate you to study chemistry?	93.33% (No)
2.	Can this acid-base handout with the Sorogan learning method make your learning fun?	100% (Yes)
3.	Can you study acid-base materials independently with this handout?	100% (Yes)
4.	Are the images displayed attractive enough and support the object being described?	100% (Yes)
5.	Doesn't present examples of questions help clarify your understanding of the material you have received?	96.67% (No)
6.	Doesn't presenting practice questions help you hone your understanding of acid-base material?	96.67% (No)
Average Percentage of Presentation Criteria		97.77%
<b>Language Criteria</b>		
1.	Is the material in the acid-base handout using the Sorogan learning method easy to understand?	100% (Yes)
2.	Is the language used in this acid-base handout easy to understand?	100% (Yes)
Average Percentage of Language Criteria		100%

Assessment of students' response questionnaires on content criteria obtained a percentage of 98.33% with very practical criteria. It

shows that students understand the content (subject matter, sample questions, and practice questions) in the handout.

Assessment of students' response questionnaires on graphical criteria got a percentage of 96.67% with very practical criteria. Students can see the attractiveness of the handout from its appearance. Teaching materials can increase students' learning motivation by making teaching materials with lots of pictures and made in color so that it is interesting for students to study them [26].

Assessment of students' response questionnaires on presentation criteria obtained a percentage of 97.77% with very practical criteria. Learning motivation arises from students' curiosity about handouts. The existence of attractive displayed pictures can also motivate students to learn. The emergence of motivation to learn will make the learning atmosphere of students fun. Learners can study independently to find material concepts. According to Jaroem S. Bruner's discovery learning theory, students learn independently to see concepts from their obtained information [27]. From this, the presentation of sample questions can make it easier for students to understand the material. Meanwhile, producing practice questions can hone students' understanding of the material.

Assessment of student response questionnaires on language criteria gets a percentage of 100% with very practical criteria. The use of language that is easy to understand can help students understand the material.

### Effectiveness

The effectiveness of the handout is obtained from the pretest and posttest sheets. The pretest and posttest questions have 16 multiple-choice questions with reasons for each answer. The pretest and posttest values obtained were tested for normality, shown in Table 7 below.

Table 7. Normality Test Results for Pretest and Posttest Values

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		30
Normal Parameters <sup>b</sup>	Mean	.0000000
	Std. Deviation	4.72668716
Most Extreme Differences	Absolute	.103
	Positive	.103
	Negative	-.085
Test Statistic		.103
Asymp. Sig. (2-tailed)		.200 <sup>c,d</sup>

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. This is a lower bound of the true significance.

The normality test results in Table 7 for the pretest and posttest values are normally distributed with a Sig. of 0.2. A significance value of  $0.2 > 0.05$  indicates that the data in this study are normally distributed so that it can be continued to calculate the N-Gain of each student.

The increase in student learning outcomes was analyzed using the N-Gain Score. The following in Table 8 shows the results of calculations with the N-Gain Score on students' knowledge tests.

Table 8. Knowledge Test Results for Each Individual with the Student's N-Gain Score

Student attendance number	Pretest Value	Posttest Value	N-Gain Score	Criteria
1	66	97	0.91	High
2	63	91	0.75	High
3	50	94	0.88	High
4	88	100	1.00	High
5	34	78	0.66	Medium
6	47	88	0.77	High
7	38	91	0.85	High
8	44	94	0.89	High
9	38	88	0.80	High
10	28	81	0.73	High
11	41	94	0.89	High
12	28	78	0.69	Medium
13	66	91	0.73	High
14	38	91	0.85	High
15	34	91	0.86	High
16	25	81	0.74	High
17	50	88	0.76	High
18	72	97	0.89	High
19	84	100	1.00	High
20	47	81	0.64	Medium
21	50	91	0.82	High
22	34	78	0.66	Medium
23	28	88	0.83	High
24	25	94	0.92	High
25	28	78	0.69	Medium
26	22	78	0.71	High
27	22	78	0.71	High
28	28	81	0.73	High
29	50	91	0.82	High
30	25	78	0.70	High
N-Gain Learning Outcomes			0.8	High

In Table 8, the N-Gain Score obtained is equal to 0.8, which can be said to increase by 80% with high criteria. Data on improving student learning outcomes is also explained in Figure 1.

Figure 1 shows the N-Gain results of 30 students who got N-Gain scores with high criteria for 25 students, or 83.33%, and medium criteria for five students, or with a percentage of 16.67%.

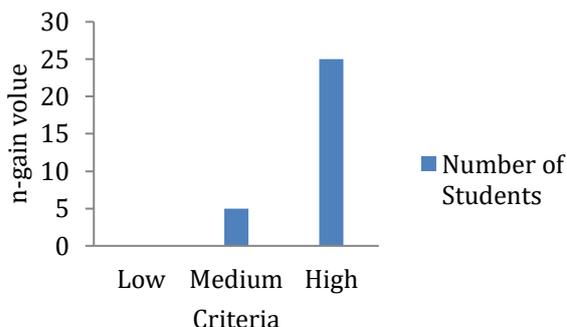


Figure 1. Graph of N-Gain Student Learning Outcomes

Students learning outcomes increased after reading and doing handout assignments on acid-base material using the Sorogan learning method, as evidenced by the students' posttest scores and N-Gain scores. The average N-Gain Score is included in the high criteria. It follows previous research data, which states that handouts in teaching chemistry can improve student learning outcomes [8]. Then, previous research also noted that the Sorogan learning method on acid-base material could effectively improve students' mastery of concepts [17].

The advantage of this research is that it can improve students' mastery of concepts through increasing learning outcomes. Developing handouts on acid-base material using the Sorogan learning method has never been done. This research is necessary because it can improve student learning outcomes. The developed handout can provide additional information from the teacher's explanation to students. Students can learn and gain prior knowledge before receiving an answer from the teacher.

## CONCLUSION

Based on the results of research and data analysis, handouts on acid-base material with the Sorogan learning method can improve student learning outcomes which are declared feasible to use in terms of content and construct validity criteria. On the content validity criteria, graphical criteria, presentation criteria, and linguistic criteria, the mode is 5, 5, 4, and 4, respectively. The developed handout is practical to use, as evidenced by the results of the student response questionnaire, which includes content, graphical, presentation, and language get student responses with successive percentages of 98.33%, 96.67%, 97.77%, and 100% with very practical criteria. Student response questionnaire data is supported by observation data on student activities, namely 95.71%. The developed handout is effective for use in terms of the N-Gain Score obtained at 0.8 with high criteria. It shows that using a handout on acid-base material with the Sorogan learning method can improve students' mastery of concepts and learning outcomes.

## REFERENCES

- [1] Pendidikan Nasional, M. (2003). Undang Undang No 20 tahun 2003 tentang Sistem Pendidikan Nasional.
- [2] BBPMP Jatim. (2022). 3 Tujuan Kurikulum Merdeka: Siswa, Siswa, & Siswa. (Online: <https://lpmpjatim.kemdikbud.go.id/site/detailpost/3-tujuan-kurikulum-merdeka-siswa-siswa-siswa>, diakses pada Senin, 02 Januari 2023).
- [3] Kemendikbudristek. (2022). Buku Saku: Tanya Jawab Kurikulum Merdeka. In *Kemendikbudristek* (pp. 9-46). [ult.kemdikbud.go.id](http://ult.kemdikbud.go.id)
- [4] Pertiwi, A. D., Nurfatimah, S. A., & Hasna, S. (2022). Menerapkan Metode Pembelajaran Berorientasi Student Centered Menuju Masa Transisi Kurikulum Merdeka. *Jurnal Pendidikan Tambusai*, 6(2), 8839-8848.
- [5] Pendidikan, B. S. N. (2010). Paradigma Pendidikan Nasional Abad XXI Versi 1.0. *Jakarta: BNSP*, 26.
- [6] Huong, V. T., Casadesus, M., & Marimon, F. (2017). Assessing Learner Satisfaction by Simultaneously Measuring Learner Attitude, Motivation, Loyalty and Service Quality in English Academies. *Innovations in Education and Teaching International*, 54(4), 301-312.
- [7] Prastowo, A. (2011). Panduan Kreatif Membuat Bahan Ajar Inovatif: Menciptakan.
- [8] Rahmawati Laela, R. (2021). Peran Handout Dalam Meningkatkan Hasil Belajar Pada Pembelajaran Kimia. *UNESA Journal of Chemical Education*, 10(2), 122-130.
- [9] Sari, S. A. (2020). Pengembangan Handout Materi Sistem Koloid Berbasis Guided Note Taking untuk Meningkatkan Hasil Belajar dan Respon Siswa Kelas XI SMA. *Jipi (Jurnal Ipa Dan Pembelajaran Ipa)*, 4(1), 41-59.
- [10] Humaira, H., Saputro, S., & Setyowati, W. A. E. (2019). Studi Komparasi Metode Pembelajaran Kooperatif Student Teams Achievement Division (STAD) dan Numbered Head Together (NHT) Berbantuan Media Handout terhadap Prestasi Belajar Siswa Materi Sistem Periodik Unsur Kelas X SMA Negeri 2 Sukoharjo. *Jurnal Pendidikan Kimia*, 8(2), 299-305.
- [11] Rinaningsih, R. (2014). Implementasi Model Perkuliahan Terpadu Sorogan-Bandingan untuk Menentukan Pemahaman Mahasiswa dalam Mempelajari Mekanisme Reaksi. *Jurnal Pengajaran MIPA*, 19(2), 266-274.
- [12] Trianto, M. P. (2010). Mendesain Model Pembelajaran Inovatif-Progresif: Konsep, Landasan, dan Implementasinya pada Kurikulum Tingkat Satuan Pendidikan (KTSP). *Jakarta: Kencana Prenada*. dalam Wulandari, S., dkk., 2016.
- [13] Nurhayati, I., Ratnaningsih, N., & Nimah, K. (2022). Analysis of vocational high school student metacognitive capabilities on geometry

- topics during the Covid-19 Pandemic. *Jurnal Pijar Mipa*, 17(3), 285-291.
- [14] Ibrahim, I., Gunawan, G., & Kosim, K. (2020). Validitas perangkat pembelajaran fisika berbasis model discovery dengan pendekatan konflik kognitif. *Jurnal Pijar Mipa*, 15(3), 214-218.
- [15] BBPMP Jatim. (2022). *Kurikulum Merdeka: Pembelajaran dengan Paradigma Baru & Berdiferensiasi*. (Online: <https://lpmj Jatim.kemdikbud.go.id/site/detailpost/kurikulum-merdeka-pembelajaran-dengan-paradigma-baru-berdiferensiasi#>, diakses pada Selasa, 03 Januari 2023).
- [16] Rinaningsih, R., Kadarohman, A., & Firman, H. (2019, December). The Sorogan-Bandongan Model as Active Learning Model in Indonesia. In *National Seminar on Chemistry 2019 (SNK-19)* (pp. 109-111). Atlantis Press.
- [17] Wahdaniyah, S. A. R., & Rinaningsih, R. (2022). Profil Gaya Belajar Peserta Didik Pada Pembelajaran Model Sorogan-Bandongan Materi Kimia Asam Basa: Indonesia. *Chemistry Education Practice*, 5(2), 142-150.
- [18] Noviyanti, H., Al Hakim, Y., Kurniawan, E. S., & Akhdinirwanto, R. W. (2022). The implementation of virtual home laboratories to improve students psychomotor abilities. *Jurnal Pijar Mipa*, 17(6), 759-763.
- [19] Sukmadinata, N. S. (2012). *Metode Penelitian Pendidikan*. Bandung: PT Remaja Rosdakarya.
- [20] Lutfi, A. (2021). Research and Development (R&D): Implikasi dalam pendidikan kimia. *Surabaya: Jurusan Kimia FMIPA Universitas Negeri Surabaya*.
- [21] Riduwan. (2015). *Skala Pengukuran Variabel-variabel Penelitian*. Bandung: Alfabeta.
- [22] Kemendikbudristek. (2022). Kurikulum Merdeka: Keleluasaan Pendidik dan Pembelajaran Berkualitas. (Online: <https://kurikulum.kemdikbud.go.id/kurikulum-merdeka/>, diakses pada Minggu, 28 Mei 2023).
- [23] Yaumi, M. (2018). *Media dan Teknologi Pembelajaran*. Prenada Media. dalam Laela, R., & Rinaningsih. (2021).
- [24] Pratamadita, A., & Dwiningih, K. (2021). Validitas E-modul Interaktif Sebagai Media Pembelajaran Untuk Melatihkan Kecerdasan Visual Spasial pada Materi Gaya Antar Molekul. In *Prosiding Seminar Nasional Kimia (SNK) 2021* (pp. 248-255).
- [25] Nasional, D. P. (2006). Pedoman memilih dan menyusun bahan ajar. *Jakarta: Depdiknas*.
- [26] Sadjati, I. M. (2012). Pengembangan Bahan Ajar.
- [27] Slavin Robert, E. (2009). Psikologi Pendidikan Teori dan Praktik, terj. *Marianto Semosir*. Jakarta: PT Indeks.