Train Science Process Skills (SPS) Through the Development of Guided Inquiry Student Worksheets Oriented to Blended Learning on Chemical Equilibrium Materials

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Abstract- The purpose of this research is to produce a guided inquiry student worksheets oriented to blended learning that is appropriate to train students' Science Process Skills (SPS) on the sub-material of factors that affect the shift in the direction of chemical equilibrium. The appropriateness of student worksheets is reviewed from 4 aspects, namely validity, training, effectiveness, and practicality. This study uses a type of Research and Development (R&D) based on a 4D development model (Define, Design, Develop, and Disseminate) which has changed the 3D development model (Define, Design, and Develop) with only limited trials. A limited trial was conducted on 20 students of class XI MIPA 4 SMAN 1 Balongpanggang by applying a pre-experimental one-group pretest-posttest design. The research instrument consisted of student worksheets validation sheets, SPS training observation sheets, SPS pretest-posttest sheets, and student response questionnaire sheets. The results showed (1) The average percentage of student worksheets validity was 89%, with a very valid category. (2) The average percentage of students' SPS training for each SPS component, namely observing, formulating the problems, formulating hypotheses, designing investigations on aspects of determining tools and materials and determining variables, conducting the investigations, analyzing data, and concluding at three meetings, is 100%, 93%, 96%, 100%, 96%, 99%, 91%, and 91% with very good categories. In designing investigations aspects of making flowcharts and communicating components are 73% and 61%, respectively, with good categories. The overall average percentage is 90%, with a very good category. (3) The significance value (sig 2-tailed) of the paired sample T-test results is 0.000, and the average n-gain score of the SPS pretest-posttest is 0.47 in the medium category. (4) The average percentage of the practicality of student worksheets based on student response questionnaires is 95%, with a very practical category. Based on the study results, it can be concluded that the guided inquiry student worksheet oriented to blended is appropriate to train students' SPS on the sub-materials of factors that affect the shift in the direction of chemical equilibrium.

Index Terms- Student Worksheets, Guided Inquiry, Blended Learning, Science Process Skills, Chemical Equilibrium

I. INTRODUCTION

Chemistry is the study of matter, the composition of matter, and the energy that accompanies it [1]. Chemistry subjects combine memorization systems, calculations, and understanding concepts and contain experimental or practical activities. Materials in chemistry lessons required to carry out practical activities include thermochemistry, reaction rates, colligative properties of solutions, electrolyte and non-electrolyte solutions, and chemical equilibrium [2].

Chemical equilibrium is a material taught in class XI of senior high school in odd semesters, which discusses irreversible and reversible reactions and the factors that affect the shift in the direction of the equilibrium [3]. The results of a pre-research questionnaire distributed to 98 students from 4 different XII MIPA classes at SMAN 1 Balongpanggang on 8 November – 10 December 2021, 88% of students stated that chemical equilibrium is difficult material, and 89% of students stated that Chemistry is generally a difficult subject. Learning activities only emphasize the knowledge aspect in the chemical equilibrium material at the high school level, and students rarely do practical activities. This is supported by the results of a pre-research questionnaire in which 91% of students stated that during chemistry learning activities, especially chemical equilibrium material, they had never carried out practical activities. Whereas it is clearly stated in Basic Competence (BC) 3.9, which reads to analyze the factors that influence the

shift in the direction of the equilibrium and its application in industry, as well as BC 4.9, which reads to design, carry out, and conclude, as well as present the experimental results of the factors that affect the shift in the direction of the equilibrium [4]. Practicum activities are believed to make students build their knowledge and better understand the knowledge gained through scientific work and develop SPS and scientific attitudes in students.

Science process skills (SPS) are the ability of students to use scientific methods to understand, apply, develop, and discover knowledge [5]. In learning chemistry, students need to be given experience in scientific activities as a manifestation of science as a process that emphasizes the SPS approach [6]. SPS helps students achieve higher thinking skills and provides students with a meaningful learning experience. In addition, SPS will help students be more independent in finding and developing facts and concepts [7]. Students are invited to learn to formulate problems and find practical solutions [8]. This follows the primary and secondary education standard, which states that knowledge is acquired through remembering, understanding, applying, analyzing, and evaluating activities. Meanwhile, skills are obtained by observing, questioning, trying, reasoning, presenting, and creating [9]. The results of the SPS test in the pre-research activity showed that the students' abilities in formulating problems, formulating hypotheses, determining variables, designing investigations, and collecting data were 43%, 32%, 28%, 9%, and 12% respectively. This shows that students' SPS is still low and needs to be trained.

Student worksheets based on the guided inquiry learning model are one of the media and learning models that can be used to train SPS [10], [11], [12]. Guided inquiry is a learning model that focuses on students and teachers only as facilitators [13]. Students will be stimulated, taught, and invited to think critically, analytically, and systematically in finding answers to various problems given independently [14]. The guided inquiry learning model is suitable for training SPS because it has learning characteristics that emphasize the development of scientific attitudes and process skills [15]. A guided inquiry has a more significant potential to train SPS [16]. This is in line with the characteristics of learning contained in the standard of primary and secondary education, which states that to strengthen scientific, integrated thematic (inter-subject thematic), and thematic (in one subject) approaches, it is necessary to apply disclosure/research-based learning (discovery/inquiry learning). The phases of the guided inquiry learning model are: phase 1: problem formulation, phase 2: proposing a hypothesis, phase 3: designing experiments, phase 4: collecting data, phase 5: analyzing data, phase 6: making conclusions, and phase 7 : communicate [17], [18], [19].

At the beginning of 2020, the COVID-19 virus spread like a pandemic throughout the world, including Indonesia [20], [21]. The Indonesian government issued various policies to prevent the spread of the virus, such as wearing masks, social restrictions, prohibiting crowds, maintaining physical distance, and constantly washing hands. This policy causes a change in work culture, including in education [22]. The Indonesian government decided that during the COVID-19 pandemic, it was carried out through limited face-to-face meetings by implementing health protocols and distance learning [23]. The pandemic conditions forced educational institutions to adjust their learning designs to be carried out in an integrated manner between limited face-to-face and distance learning activities [24], [25]. Based on a pre-research questionnaire, facts in the field showed that 99% of students stated that their school implemented mixed learning (online and offline). The pandemic problem causes the need for adjustments to the guided inquiry student worksheets to train SPS to suit limited face-to-face and distance learning. One form of adjustment can be made by integrating the student worksheets of guided inquiry online based on the blended learning model.

Blended learning combines two elements: learning in the classroom and learning online. In blended learning, learning occurs online and offline, synchronously and asynchronously, complementing each other. Blended learning allows the subject matter to be delivered anywhere and anytime flexibly [26], [27], [28]. During the COVID-19 pandemic, blended learning is one of the most suitable learning models to apply because of the division of learning activities into online and face-to-face, allowing students to continue carrying out learning activities amid restrictions on physical interaction [29], [30]. Most educational institutions implement blended learning during learning activities during the COVID-19 pandemic [24], [31]. Therefore, during the COVID-19 pandemic, the suitable learning media to be used in learning activities, especially to train students' SPS, is the guided inquiry student worksheets which integrate limited face-to-face and long-distance activities (online). This integration is in line with students' which based on the results of pre-research questionnaires, 86% of students want student worksheets that provide face-to-face and online learning activities.

Based on the description, the researcher conducted a study to develop learning media in guided inquiry student worksheets oriented to blended learning on the factors influencing the shift in the direction of chemical equilibrium. The aim is to produce learning media in student worksheets suitable for learning activities, especially to train students' scientific process skills during the COVID-19 pandemic.

II. METHOD

This study uses a type of Research and Development (R&D) based on a 4D development model (Define, Design, Develop, and Disseminate) which has changed the 3D development model (Define, Design, and Develop). This research is limited to the development stage, which is only up to a limited trial [32]. The flow of the 3D model development in this study is depicted in Figure 1.

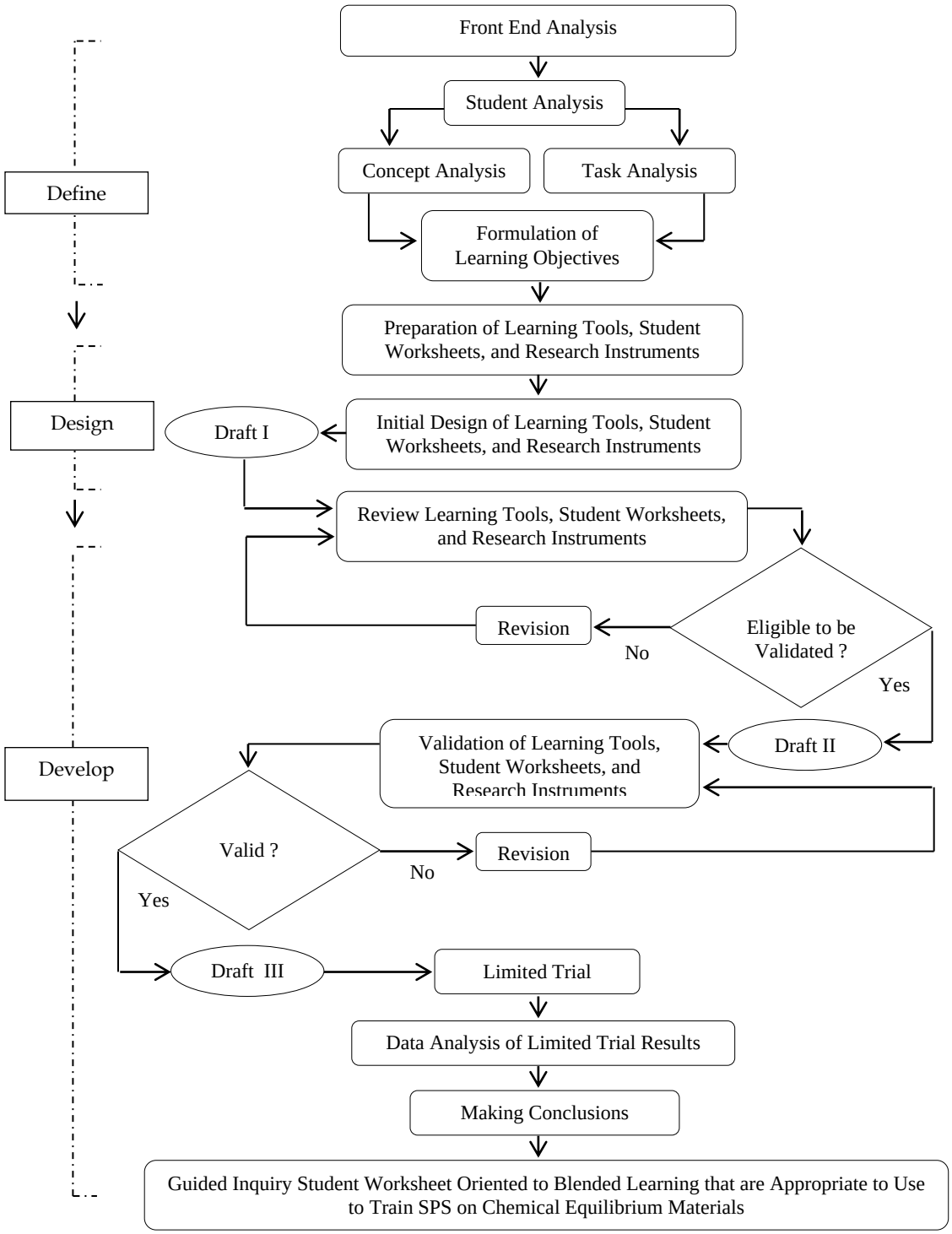

Figure 1. Research Flow of 3D Model Development

[33].

This study used a pre-experimental one-group pretest-posttest design. The design of this research can be described as follows :

$$O_1 \; X \; O_2$$

Information :

O_1 : Pretest to find out students' SPS before being given treatment in the form of testing the developed student worksheets

X : The treatment is in the form of a test of the developed student worksheets

O_2 : Posttest to find out students' SPS after being given treatment in the form of testing the developed student worksheets [34].

The student worksheets limited trial was conducted on 20 students of class XI MIPA 4 SMAN 1 Balongpanggang on 17-31 January 2022. The learning tools used consisted of a syllabus, lesson plans, and developed worksheets. Meanwhile, the research instrument consisted of student worksheets validation sheets, SPS training observation sheets, SPS pretest-posttest sheets, and student response questionnaire sheets. Data collection methods used are questionnaires, observation, and test methods. The questionnaire method was used to obtain data on the validity of the student worksheets and student responses to the student worksheets. The observation method obtained data on students' SPS training during the student worksheets limited trial. The test method was used to obtain student SPS data before and after the student worksheets limited trial.

The appropriateness of student worksheets is reviewed from 4 aspects, namely validity, training, effectiveness, and practicality. The student worksheets' validity was analyzed based on the score of the validation results of the student worksheets by two expert validators (chemistry lecturer at the State University Of Surabaya) and one practitioner validator (chemistry teacher). The score obtained is then calculated the percentage of validity using the formula :

$$\%\ \text{Validity} = \frac{\text{Total Score Obtained}}{\text{Criteria Score}}\ \text{x}\ 100\%$$

[34].

The results of calculating the percentage validity of the student worksheets are then interpreted according to the categories in table 1.

Table 1. Category of Student Worksheets Validity Assessment

Percentage (%)	Category
0-20	Very Invalid
21-40	Less Valid
41-60	Quite Valid
61-80	Valid
81-100	Very Valid

[35].

Student worksheets are declared valid if the average percentage of validity obtained is ≥ 61% with a valid category [35].

The SPS training analysis was carried out based on two observers' scores from the SPS observations. The score obtained is then calculated the percentage of training using the formula :

$$\%\ \text{Training} = \frac{\text{Total Score Obtained}}{\text{Criteria Score}}\ \text{x}\ 100\%$$

[34].

The results of calculating the percentage of students' SPS training are then interpreted according to the categories in table 2.

Table 2. Category of SPS Training Assessment

Percentage (%)	Category
0-20	Very Not Good
21-40	Less Good
41-60	Quite Good
61-80	Good
81-100	Very Good

[35].

Students' SPS are declared trained if the average percentage of training obtained for each SPS component in three meetings and overall ≥ 61% with a good category [35].

The effectiveness of the student worksheets was analyzed based on the SPS pretest-posttest scores. The pretest-posttest scores were analyzed using parameterized statistics, namely paired sample t-test and n-gain calculations. Prior to the paired sample t-test, the normality test of the SPS pretest-posttest scores was first performed as a requirement for the paired sample t-test to be carried out. The pretest-posttest scores are normally distributed if a significance value (sig) > 0.05 is obtained. If the pretest-posttest scores are declared normally distributed, the pretest-posttest scores can be analyzed using parameterized statistics, namely the paired sample t-test. The SPS pretest-posttest scores were declared to have significant differences, and the treatment is given had a significant effect if the significance value (sig 2-tailed) < 0.05 [36]. Furthermore, the calculation of the n-gain score SPS pretest-posttest using the formula :

$$\text{N} - \text{Gain} = \frac{\text{S}_{\text{posttest}} - \text{S}_{\text{pretest}}}{\text{Ideal Score} - \text{S}_{\text{pretest}}}$$

[37].

The n-gain score obtained is then interpreted according to the categories in table 3.

Table 3. Category of N-Gain

N-Gain Score	Upgrade Category
$G \leq 0,3$	Low
$0,3 \leq G \leq 0,7$	Medium
$G \geq 0,7$	High

[37].

A student worksheet is declared effective for training SPS if the significance value (sig 2-tailed) of the paired sample T-test results is < 0.05 and the average n-gain score obtained is $0.3 \leq G \leq 0.7$ in the medium category [36], [37].

The analysis of the practicality of the student worksheets was carried out based on the results of the student response questionnaires. Student response questionnaires consist of positive and negative statements. Scoring is done based on the Guttman scale, as shown in table 4.

Table 4. Guttman Scale

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

[34].

The score obtained is then calculated the percentage using the formula :

$$\% \text{ Practicality} = \frac{\text{Total score obtained}}{\text{Criteria Score}} \text{ x } 100\%$$

[34].

The results of calculating the percentage of the practicality of the student worksheets are interpreted according to the categories in table 5.

Table 5. Category of Student Worksheets Practicality Assessment

Percentage (%)	Category
0-20	Very Impractical
21-40	Less Practical
41-60	Quite Practical
61-80	Practical
81-100	Very Practical

[35].

Student worksheets are declared practical if the average response questionnaire results obtained are ≥ 61% in the practical category [35]. Student worksheets are declared appropriate if they have met the aspects of validity, training, activity, and practicality.

Description for calculation formulas :

Criteria score : The highest score for each item x number of items x number of respondents
$S_{Prettest}$: Pretest score
$S_{Posttest}$: Posttest score
Ideal Score : 100 [34].

III. RESULTS AND DISCUSSION

Student Worksheets Validity

Two expert validators (chemistry lecturer at the State University of Surabaya) and one practitioner validator (chemistry teacher) validated the student worksheets. The validity of the student worksheets is viewed from six criteria, namely content, presentation, language, graphics, guided inquiry-oriented blended learning, and SPS. The validation results can be seen in Figure 2.

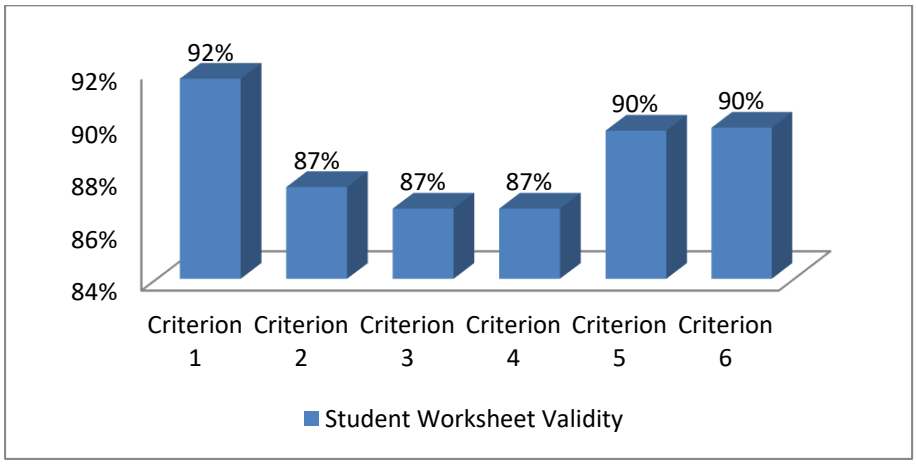

Figure 2. Average Percentage of Student Worksheets Validation Results on Each Criterion

Information :
Criterion 1: Content
Criterion 2: Presentation
Criterion 3: Language
Criterion 4: Graphics
Criterion 5: Guided Inquiry-Oriented to Blended Learning
Criterion 6: SPS.

Content criteria get a percentage of 92%. If interpreted in table 1, the student worksheets are declared very validly [35]. This shows that the activities and materials presented in the student worksheets follow the learning objectives. In addition, the phenomena, practical steps, and illustrations presented are judged to be following the subject matter and can be used to train students' SPS.

The presentation criteria get a percentage of 87%. If interpreted in table 1, the student worksheets are declared very validly [35]. This shows that the appearance of the student worksheets is considered exciting and not dull. Student worksheets are also considered to have met the presentation's completeness, including basic competencies, competency achievement indicators, learning objectives, pages, instructions for use, and bibliography. In addition, the student worksheets presented through the live worksheets platform are considered easy to access and where the answers are filled out well. Presenting teaching materials and learning media, including student worksheets, is essential because learning outcomes will be better if verbal stimuli are accompanied by visual stimuli [38]. The presentation of attractive student worksheets will arouse students' motivation in learning, build effective communication, and make it easier for students to learn the competencies that must be mastered. [39], [40].

Language criteria get a percentage of 87%. If interpreted in table 1, the student worksheets are declared very validly [35]. This shows that the language on the student worksheets follows good and correct Indonesian. In addition, the choice of terms used is considered to be following students' level of thinking. The use of language that is good, correct, and following the level of thought will make the reader understand the contents of the sentence conveyed, as well as the questions and orders given [11].

Graphic criteria get a percentage of 87%. If interpreted in table 1, the student worksheets are declared very validly [35]. This shows that font size and type selection can be read easily. In addition, the compatibility of the layout of text, images, tables, and diagrams are considered appropriate and suitable. The selection of image icons was also judged to follow chemistry subjects. Graphic criteria that must be considered when preparing learning media such as student worksheets include readability of letters, structured and easy-to-read text sequences, and pleasant stimulants to look at. The legibility of letters and the compatibility of the layout of the text affect the conveyance of the meaning of messages and commands. The use of images must also provide meaning and be easy to understand so that students know what is being studied [38].

The criteria for guided inquiry with blended learning orientation obtained a percentage of 90%. If interpreted in table 1, the student worksheets are declared very validly [35]. This shows that the series of activities in the student worksheets are following the phases of the guided inquiry learning model, namely phase 1: problem formulation, phase 2: proposing a hypothesis, phase 3: designing experiments, phase 4: collecting data, phase 5: analyzing data, phase 6: making conclusions, and phase 7: communicating [17], [18], [19]. The suitability of activities in student worksheets with the guided inquiry learning model will play an important role in emphasizing learning activities on student activity [41]. In addition, activities in student worksheets divided into online and offline activities are considered to be following the characteristics of blended learning. Blended learning combines the online learning process using e-learning and the web with face-to-face learning [42]. Blended learning has several characteristics and learning settings, including live synchronous, virtual synchronous, independent asynchronous, and collaborative asynchronous [43], [44].

The SPS criteria get a percentage of 90%. If interpreted in table 1, the student worksheets are declared very validly [35]. The series of activities in the student worksheets was judged to have been following the trained SPS components, namely observing, formulating problems, formulating hypotheses, designing investigations (determining tools, materials, variables, and making

flowcharts), conducting investigations, analyzing data, concluding, and communicating. Student worksheets are considered suitable to be used for SPS. Process skills-based learning provides a specific stimulus to develop the basic skills in students [38].

The average percentage of student worksheets validity based on six criteria is 89% based on the above description. If interpreted in table 1, the student worksheets are declared very valid.

Science Process Skills (SPS) Training

The student worksheets that had been validated were then tested on a limited basis to 20 students of class XI MIPA 4 SMAN 1 Balongpanggang. The data obtained are in the form of an SPS training score based on the results of observations by two observers. The SPS components trained in this limited trial are observing, formulating problems, formulating hypotheses, designing investigations (determining tools, materials, variables, and making flowcharts), conducting investigations, analyzing data, concluding, and communicating. The percentage of SPS training can be seen in table 6.

Table 6. Percentage of Students' SPS Training

No	SPS Component	1st Meeting	2nd Meeting	3rd Meeting	Average	Category
1	Observing	100%	100%	99%	100%	Very Good
2	Formulating the Problem	80%	100%	100%	93%	Very Good
3	Formulating Hypotheses	93%	95%	100%	96%	Very Good
4	Designing Investigations: Determining Tools and Materials	100%	100%	100%	100%	Very Good
	Determining Variable	91%	100%	98%	96%	Very Good
	Making Flowcharts	70%	73%	77%	73%	Good
5	Conducting the Investigation	96%	100%	100%	99%	Very Good
6	Analyzing Data	84%	90%	100%	91%	Very Good
7	Concluding	76%	97%	99%	91%	Very Good
8	Communicating	56%	62%	65%	61%	Good
Average Percentage of Overall SPS Training					**90%**	**Very Good**

Observing is the ability to use all five senses to find relevant information from the observed phenomenon and then interpret it [45]. Based on table 6, observing skills get an average percentage for three meetings of 100% with a very good category. Thus, the observing skills of students are stated to have been trained in a very good category [35].

Formulating a problem is the ability to formulate questions about a topic, problem, or phenomenon to find the answer, and the answer can be scientifically justified [46]. Based on table 6, problem formulation skills get an average percentage for three meetings of 93% with a very good category. Thus, the skills of formulating problems of students are declared to have been trained in a very good category [35].

A hypothesis is a quick answer or guesses from the proposed problem formulation based on the knowledge possessed. The skill of formulating a hypothesis is the ability to state a tentative assumption about the existence of a factor in a situation that is thought to have inevitable consequences [47]. Based on table 6, the skills to formulate hypotheses get an average percentage for three meetings of 96% with a very good category. Thus, the skills to formulate hypotheses are stated to have been trained in a very good category [35].

Designing an investigation is the ability to design activities to test ideas or hypotheses through practical investigation. This practical investigation can be carried out in practical or experimental activities. Designing the experiment is done through determining the tools, materials, experimental variables, and workflow [46]. Based on table 6, investigative design skills in determining tools and materials get an average percentage for three meetings of 100% with a very good category. Thus, the students' investigative design skills in determining tools and materials were stated to have been trained in a very good category [35].

The variables trained in this study consisted of three types, namely control variables, manipulation variables, and response variables. Control variables are variables whose conditions are not changed and are determined. Manipulating variables are variables whose conditions are deliberately changed. Meanwhile, the response variable is a variable that changes or is affected as a result of the manipulation variable [47]. Based on table 6, investigative design skills in determining variables get an average percentage for three meetings of 96% with a very good category. Thus, the students' investigative design skills on determining variables were declared to have been trained in a very good category [35].

Making flowcharts is the ability to arrange practical steps into a systematic and easy-to-understand flowchart form. Based on table 6, investigative design skills in making flowcharts get an average percentage for three meetings of 73% with good category. Thus, the students' investigative design skills in making flowcharts were declared to have been trained in a good category.

Conducting an investigation is the ability to collect data through experiments and experimental video observations to be then recorded in the observation table [46]. Based on table 6, investigation skills get an average percentage for three meetings of 99% with a very good category. Thus, the students' investigative skills were stated to have been trained in a very good category [35].

Analyzing data is the ability to relate the facts obtained through the investigative process and then find patterns that will serve as the basis for generalizing or making conclusions [46]. Based on table 6, data analysis skills get an average percentage for three meetings of 91% with a very good category. Thus, the students' data analysis skills were stated to have been trained in a very good category [35].

Concluding is the ability to decide the state of an object, event, or phenomenon based on known facts, principles, and concepts [6]. Based on table 6, skills in concluding get an average percentage for three meetings of 91% with a very good category. Thus, the concluding skills of students are stated to have been trained in a very good category [35].

Communicating is the skill of conveying the results of learning, work, discoveries, and concepts to others in the form of pictures, spoken, written, motion, action, and or appearance [48]. Based on table 6, communication skills get an average percentage for three meetings of 61% with good categories. Thus, students' communication skills have been trained in a good category [35].

The average percentage of students' overall SPS training is 90%, with a very good category [35]. This shows that the students' SPS have been trained in a very good category. These results are consistent with the results of previous studies, which show that the guided inquiry learning model can and is feasible to be used to train SPS [11], [49], [50].

Student Worksheets Effectiveness

The effectiveness of the developed student worksheets was reviewed based on the results of the paired sample T-test and the n-gain SPS pretest-posttest score. Student worksheets are declared effective for training SPS if the significance value (sig 2-tailed) of the paired sample T-test results for the SPS pretest-posttest score < 0.05 and the average n-gain for the SPS pretest-posttest score is $0.3 \leq G \leq 0.7$ with medium category [36], [37].

A normality test was first performed before the paired sample T-test was performed on the SPS pretest and posttest scores. The SPS pretest-posttest score data was declared normally distributed if the significance value (sig) > 0.05. The results of the normality test can be seen in table 7.

Table 7. SPS Pretest-Posttest Score Normality Test Results

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Tes	Statistic	df	Sig.	Statistic	df	Sig.
Hasil Tes Peserta Didik	Pretest SPS	,174	20	,115	,929	20	,150
	Posttest SPS	,159	20	,197	,924	20	,120

a. Lilliefors Significance Correction

Based on table 7, the significance values (sig) obtained for the SPS pretest-posttest scores are 0.115 and 0.197, respectively. Both are greater than 0.05 so that the SPS pretest-posttest score data is declared normally distributed and has met the requirements to be tested using parametric statistics using paired sample T-test [36]. The paired sample T-test results can be seen in table 8.

Table 8. SPS Pretest-Posttest Score Paired Sample T-Test Results

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pretest SPS – Posttest SPS	-37,30050	10,88211	2,43331	-42,39349	-32,20751	-15,329	19	,000

The significance value (sig 2-tailed) based on the paired sample T-test results, the SPS pretest-posttest score was 0.000. The score is less than 0.05. This shows that the SPS pretest and posttest scores have significant differences, and there is a significant effect of the treatment given, namely the limited trial of guided inquiry student worksheets oriented to blended learning orientation [36].

After the paired sample T-test was performed, the n-gain score from the SPS pretest-posttest was calculated. The SPS pretest-posttest scores for each component can be seen in Figure 3.

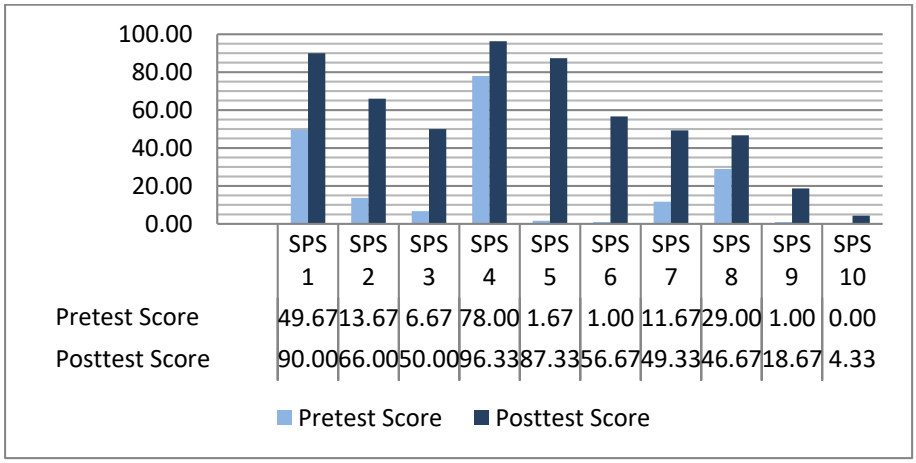

Figure 3. Pretest-Posttest Score of Each Component of SPS

The n-gain score obtained for each SPS component can be seen in Figure 4.

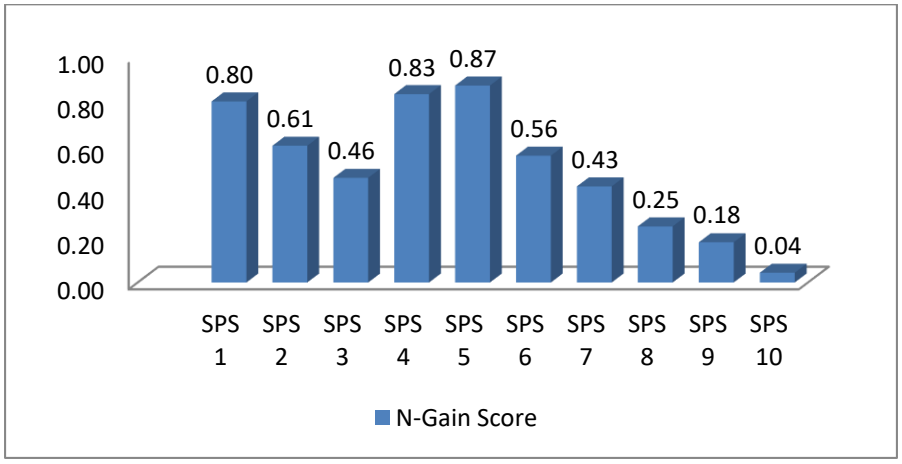

Figure 4. N-Gain Score of Each Component of SPS

Description for pictures 3 and 4:
SPS 1 : Observing
SPS 2 : Formulating The Problem
SPS 3 : Formulating Hypotheses
SPS 4 : Designing Investigations, Aspects of Determining Tools and Materials
SPS 5 : Designing Investigations, Aspects of Determining Variables
SPS 6 : Designing Investigations, Aspects of Making Flowcharts
SPS 7 : Conducting the Investigation
SPS 8 : Analyzing Data
SPS 9 : Concluding
SPS 10 : Communicating

The posttest score of each SPS component has increased from the pretest score. The observing component increased from a score of 49.67 to 90.00. The component formulating the problem has increased from 13.67 to 66.00. Meanwhile, the component formulating the hypothesis has increased from 6.67 to 50.00. The n-gain scores for each component are 0.80, 0.61, and 0.46. If interpreted in table 3, the observing component increases in the high category, while the components formulate problems and hypotheses in the medium category [37].

The component of designing investigations on determining tools and materials has increased from 78.00 to 96.33. In the aspect of determining the variable, it increased from 1.67 to 87.33, and in the aspect of making flowcharts, it increased from a score of 1.00 to 56.67. The n-gain scores for each aspect of the components of designing the investigation are 0.83, 0.87, and 0.56. If interpreted in table 3, the components of designing investigations on aspects of determining tools, materials, and determining variables have increased in the high category. Meanwhile, in making flowcharts, there has been an increase in the medium category [37].

The component conducting investigations increased from 11.67 to 49.33. The component of analyzing the data has increased from 29.00 to 46.67. The concluding component has increased from 1.00 to 18.67, and the communicating component has increased

from 0.00 to 4.33. The n-gain scores for each component are 0.43, 0.25, 0.18, and 0.04. If interpreted in table 3, the component conducting investigations has increased in the medium category, while the component analyzing data, concluding, and communicating has increased in the low category [37].

Based on the description above, information is obtained that the SPS components that have increased in the high category are observing, designing investigations on aspects of determining tools and materials and aspects of determining variables. The SPS components that have increased in the medium category are formulating problems, formulating hypotheses, designing investigations in making flowcharts, and conducting investigations. Meanwhile, the SPS components that have increased in the low category were analyzing data, concluding, and communicating. The highest increase occurred in the component of designing the investigative aspect of determining the variable, while the lowest increase occurred in the component of communicating [37].

Furthermore, the calculation of each student's n-gain SPS pretest-posttest score is carried out. The n-gain score obtained by each student can be seen in table 9.

Table 9. SPS Pretest-Posttest N-Gain Scores Each Student

No	Name	Pretest Score	Posttest Score	N-Gain Score	Category
1	MWK	17,33	55,33	0,46	Medium
2	HP	33,33	80,67	0,71	High
3	MJF	11,33	38,00	0,30	Medium
4	PDR	17,33	74,00	0,69	Medium
5	SNP	23,33	65,33	0,55	Medium
6	MAKW	14,67	42,67	0,33	Medium
7	IDP	21,33	51,33	0,38	Medium
8	JOR	15,33	53,33	0,45	Medium
9	PL	22,67	56,67	0,44	Medium
10	YW	18,00	58,00	0,49	Medium
11	CEA	11,33	39,33	0,32	Medium
12	DCARI	26,67	93,33	0,91	High
13	FY	18,00	53,33	0,43	Medium
14	FER	25,33	68,00	0,57	Medium
15	RW	21,33	57,33	0,46	Medium
16	ANA	10,67	56,67	0,51	Medium
17	AN	14,00	42,00	0,33	Medium
18	LW	18,00	40,67	0,28	Low
19	MSR	12,00	44,67	0,37	Medium
20	RMW	32,67	60,00	0,41	Medium
Average N-Gain Score				**0,47**	**Medium**

The percentage of students in each category can be seen in Figure 5.

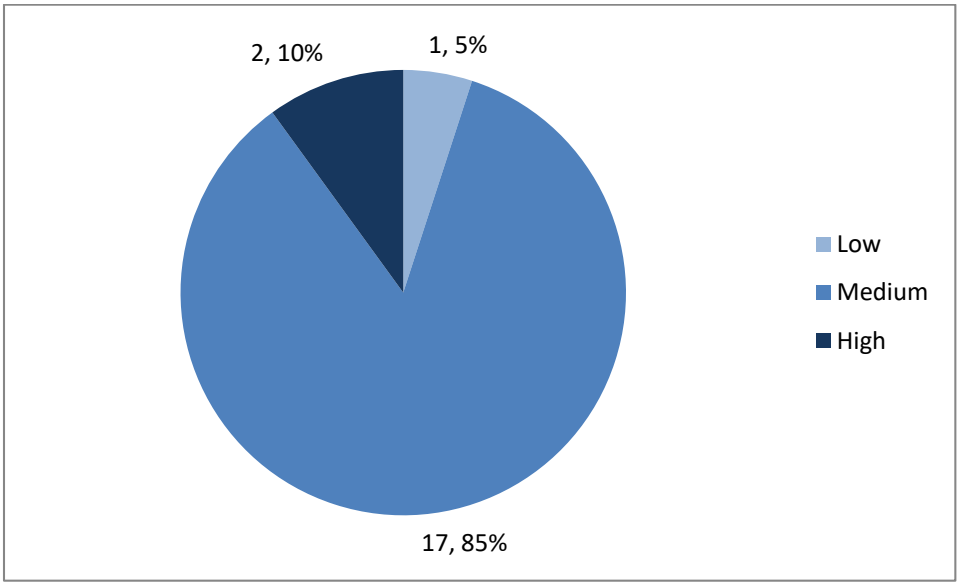

Figure 5. Percentage of Number of Students in Each N-Gain Category

Based on Figure 5, from 20 students, 1 of them or 5% is in a low category. Meanwhile, 17 students, or 85%, are in the medium category, and 2 or 10% are in the high category. Based on table 9, the average n-gain score is 0.47 in the medium category. This shows that the students' SPS has increased in the medium category [37].

The guided inquiry student worksheets oriented to blended learning are declared effective for training SPS in the paired sample T-test and n-gain results based on the description above. These results align with previous research, proving that guided inquiry-based worksheets are capable and effective in improving students' SPS. The guided inquiry has also been shown to be effective in improving student learning outcomes [2], [51], [52], [53]. In addition, the adjustment of the guided inquiry learning model with the division of activities according to the characteristics of blended learning has proven to be suitable for learning at the high school level [54], [55].

Student Worksheets Practicality

The practicality of the student worksheets was reviewed based on the results of the student response questionnaires. The student response questionnaire consisted of 27 positive and 27 negative statements with "yes" and "no" answers. The purpose of using positive and negative statements is to reduce the bias of respondents' answers. Large and relatively long statements can make respondents answer "yes" to all statements or "no" to all. One way to reduce bias and break the answering pattern is to use positive and negative statements for the same problem [56]. These statements relate to the criteria for content, presentation, language, graphics, SPS training, and the suitability of student worksheets activities with learning during the COVID-19 pandemic. Student worksheets are declared practical if the average student responses are $\geq 61\%$ in the practical category.

Statements related to content criteria include the inclusion of basic competencies, indicators of competency achievement, learning objectives, instructions for use, and the suitability of phenomena, illustrations, or videos with the subject and problems given. Based on the response questionnaire, most students stated that all these components had existed and were appropriate.

Statements related to the presentation criteria include the suitability of the cover with the contents of the student worksheets, the completeness of information about the SPS component being trained, the systematic presentation of the student worksheets, the ease of access to the student worksheets presented through the live worksheets, and a sense of interest and motivation because of the presentation of student worksheets. Most students stated that the cover was following the contents of the student worksheets based on the response questionnaire. The student worksheets are also equipped with information about the SPS component being trained. The majority of students also stated that student worksheets were presented systematically to be easy to understand. Student worksheets presented through live worksheets are also considered easy to access. The majority of students also stated that the presentation of student worksheets made them interested and motivated to learn.

Statements related to language criteria include the suitability of words and terms with students' level of thinking. Based on the response questionnaire, most students stated that the choice of words and terms used in the student worksheets followed their level of thinking.

The statement related to the graphic criteria is about the legibility of the font used. Most students stated that the font size and type used could be read easily based on the response questionnaire.

Statements related to SPS training are a sense of being trained to observe, formulate problems, formulate hypotheses, design investigations, conduct investigations, analyze data, conclude and communicate. Most students stated that the developed student worksheets trained their SPS based on the response questionnaire.

Based on the response questionnaire, most students stated that the activities presented in the student worksheets followed learning during the COVID-19 pandemic, namely online and offline learning. In addition, the majority of students stated that the student worksheets encouraged them to be actively involved in learning activities.

The average percentage of the practicality of student worksheets based on student response questionnaires is 95%. If interpreted in table 5, the guided inquiry student worksheets oriented to blended learning are stated to be very practical [35].

IV. CONCLUSION

The conclusions obtained based on the discussion are:

1. The average percentage validity of guided inquiry student worksheets oriented to blended learning is 89%, with a very valid category. This shows that the guided inquiry student worksheets oriented to blended learning are very valid.
2. The average percentage of students' SPS training for each SPS component, namely observing, formulating problems, formulating hypotheses, designing investigations on aspects of determining tools and materials, and determining variables, conducting investigations, analyzing data, and concluding at three meetings, is 100%, 93%, 96%, 100%, 96%, 99%, 91%, and 91% with very good category. In designing investigations, aspects of making flowcharts and communicating components are 73% and 61%, respectively, with good categories. The overall average percentage is 90%, with a very good category. This shows that the students' SPS have been trained in a very good category.
3. The significance value (sig 2 tailed) of the paired sample T-test results is 0.000 and the average n-gain SPS pretest-posttest score is 0.47 in the medium category. This shows that guided inquiry student worksheets oriented to blended learning effectively train SPS.
4. The average percentage of student worksheets practicality based on student response questionnaires is 95%, with a very practical category. This shows that the guided inquiry student worksheets oriented to blended learning are very practical.

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