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Validity of Student Worksheet Based on Scientific Literacy to Train Argumentation Skills on Buffer Solution

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Abstract
The purpose of this research is to produce student worksheet based on scientific literacy to train argumentation skills on buffer solution seen from content and construct validation. The research subject were high school students grade XI. This research is development research with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) which is limited to the development stage to find out the validation of student worksheet. The instrument used to obtain validity data (content and construct) is a validation sheet. The validity of the developed student worksheet is based on the assessment of three validators through expert judgment namely two chemistry lecturers and one chemistry teacher. Student worksheet based on scientific literay is declared the validity criteria if it gets a minimum assessment mode of 4 (valid) from a range of 1 to 5 on a Likert scale. The results showed that all components of the assessment both content validity (relevance) and construct validity (consistency) received an assessment mode of 4 with a valid category. So that the student worksheet based on scientific literacy was declared valid to train argumentation skills on buffer solution.

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INTRODUCTION

Education is an activity carried out consciously and has been planned with the aim that students can develop their potential actively in order to have spiritual abilities active spiritual abilities, intelligence, noble morals, and various skills that are useful for themselves, others, the nation, and the state (Roesminingsih & Susarno, 2016).

The 2013 curriculum used prioritizes learning by using learner-centered methods and contextual learning models. Learning that is carried out requires students to have 21st-century competencies called 4C, namely critical thinking and problem solving, collaboration, creativity, and communication skills (Irvan & Admoko, 2020). Critical thinking skills are needed so that students have sensitivity to a problem that is around. Communication skills are needed for students to convey the process and results of problem solving so that it is easier to understand and provide certainty to others. Learners can have critical thinking skills and communication skills if they are trained in argumentation skills (Roviati & Widodo, 2019). Students' argumentation skills are shown when students communicate the results of problem solving.

Argumentation skills are viewed from scientific questions, namely ontologically, argumentation is a scientific skill that connects facts and concepts (Devi, Susanti, & Indriyanti, 2018). Epistemologically, argumentation is the skill of comparing theories

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(rational) by giving reasons accompanied by logical evidence (empirical) (Mcneill, 2011). Axiologically, argumentation is a skill developed for human benefit through a thorough understanding of scientific concepts (Heng, Surif, & Seng, 2014).

Argumentation skills for learners are important to know for several reasons. The first reason is that argumentation skills are used to identify activities to be applied in learning to increase understanding and achieve cognitive levels. Furthermore, argumentation can restore the goals of science education in a balanced manner (Devi et al., 2018). Argumentation skills must be trained to improve understanding of science concepts, literacy achievement, and critical thinking (Handayani, 2015).

Yuliati (2017) explains that mastering science literacy skills can help develop 21st-century skills. In line with what was stated by Merta et al. (2020), the ability to interpret or interpret data needs to be improved. This shows that the level of analyzing a result is still lacking, which results in students' argumentation skills. According to Osborne, Erduran, & Simon (2004) to create a society that argues scientifically when engaging in debates, a society that has science literacy skills is needed. Argumentation skills affect students' science literacy skills. The higher the students' argumentation skills, the higher the students' science literacy skills. Vice versa, if students' science literacy skills increase, students' argumentation skills will also increase (Fadlika, Hernawati, & Meylani, 2022).

Chemical literacy-oriented learning can be implemented in chemistry concepts because chemistry is part of science. Chemistry is a science that discusses compounds, their formation, and their transformation processes (Arryanto et. al, 2006). In learning chemistry, using learning concepts guided by science literacy allows students to think scientifically about evidence encountered in later life. Toharudin, Hendrawati, & Rustaman (2011) argue that the concept of science literacy-based learning is one of the alternatives to science learning in schools because it is by the current curriculum and even very flexible because it is not related to the curriculum.

Science literacy-based learning requires students to convey arguments because argumentation is a skill to solve problems. According to Osborne in Herlanti (2014), argumentation skills can be explored because students present arguments from various points of view. Science literacy is an important part of argumentation, because when students can argue well then the students at least master the concept.

Concept mastery is explained through students' argumentation skills (Manz, 2015). This is corroborated by a statement regarding students' low concept understanding, proving that students' argumentation skills are also low (Noviyani, Kusaeri, & Amin, 2017). Learning activities at school found that many of the students still have difficulty in conveying argumentation, so it is necessary to train argumentation skills (Probosari, 2016). Based on previous research that has been conducted on SMA X students, it shows that the argumentation skills owned by students is fairly low. Students' argumentation skills are at low to moderate levels or at levels one and two (Devi et al., 2018). In line with research conducted by Hanri et. al (2019), the skills in writing scientific argumentation of students are at level one by 7%, level two by 54%, and level three by 39%. Where students can only write claims without writing evidence and reasons that connect claims with the evidence presented (Hasibuan et. al, 2019).

The lack of argumentation skills possessed by students is due to the use of the lecture model (Hasibuan et al., 2019). The learning that is applied, lacks training for students to argue. Learners are not accustomed to constructing their knowledge as a result, mastery of concepts is very weak. Another factor is that teachers who are experts in managing teaching materials can also improve the quality of students (Kusdiningsih, Jalmo, & Agung, 2016). Quality

learning tools can affect learning outcomes and guide students to learn independently (Asrofi, 2010). To train students' argumentation skills, a suitable learning media is needed, one of which is the student worksheet. Student worksheet plays an important role in supporting learning. Because the existence of student worksheet helps students understand the material provided, especially experiment-based material which requires instructional media to guide practicum (Muna & Rusmini, 2021).

This buffer solution material is included in material that has characteristics that require an understanding of complex concepts (properties of buffer solution) then mathematical (where there is a calculation of the pH of the buffer solution) and is real and applicable regarding the role of buffer solutions in various fields of life. This resulted in students having difficulty learning it (Sanubari et. al, 2014) The developed student worksheet raises issues related to "How is the validity of student worksheet based on scientific literacy (SL) to train argumentation skills on buffer solution?" The purpose of this research is to produce student worksheet on buffer solution that follows the standards of learning tools so that student worksheet based on scientific literacy is valid for use as a learning tool that can train argumentation skills.

Content validity estimates the suitability of items on the instrument with the content or subject matter that the instrument intends to measure (Newman, Lim, & Pineda, 2011). Construct validity is a measurement that correlates one indicator with another indicator and is associated with variables contained in the theory of the construct to be measured (Westen & Rosenthal, 2003). The developed student worksheet aims to be able to train thinking skills, especially argumentation skills and facilitate students' understanding of buffer solution material comprehensively.

METHOD

This research is development research with uses the ADDIE model. The concept of development according to the ADDIE model proposed by Branch (2009) consists of five general stages, namely analysis, design, development, implementation, and evaluation. This research is limited to the development stage because this research was conducted to determine the validity of student worksheet. This research was conducted in the Chemistry Department of FMIPA UNESA from February to May 2023. Research subject of this research is student worksheet based on scientific literacy to train students' argumentation skills (AS) on buffer solution. The target of this research is that the draft student worksheet based on scientific literacy meets the eligibility criteria based on validity. The target of implementation in this study is grade XI students in one of the public high schools in Jombang with the research time in the even semester of the 2022/2023 school year.

The operational steps taken in achieving the research objectives are as follows: (1) formulate argumentation skills indicator, (2) developing the content of student worksheet based on scientific literacy grids (question items and argumentation skills indicators), (3) developing the validation sheet and its guidelines, (4) consult the content of student worksheet based on scientific literacy lattice and validation sheet with the supervisor, (5) validation process by three experts, (6) data organization and analysis, and (7) conclusion of research results. The instruments used in the study were review sheets and student worksheet validation sheets. This validation sheet is used to determine the suitability of the developed student worksheet. This research produces quantitative data, namely validity (content and construct). Validity data was obtained by filling in the validation sheet by three validators (Two lecturers majoring in chemistry and one chemistry teacher). Data obtained from the validation sheet of

student worksheet based on scientific literacy by experts will be analyzed descriptively quantitatively using a Likert scale in Table 1.

Table 1. Likert Scale

Score/Value	Criteria
5	Very valid
4	Valid
3	Fairy valid
2	Not valid
1	Very invalid

Adaptation: (Riduwan, 2015)

The validity data (construct and content) obtained from the expert judgment of three validators were analyzed descriptively using the mode or value that often appears (Afni & Suyono, 2022). The student worksheet developed is declared valid if it meets the requirements with a minimum three validator assessment modes of 4 (valid).

Student worksheet based on scientific literacy that have been validated and the results are valid then be implemented on students of class XI in one of the public high schools in Jombang. This implementation stage begins with pre-test to determine the initial ability of argumentation skills students. Then, students are given treatment by applying the student worksheet. Next, a post-test was contucted to determine the argumentation skills of students after the implementation of the student worksheet.

RESULTS AND DISCUSSION

The results of this study are in the form of review data and student worksheet validation data. This student worksheet was developed using the ADDIE method which consists of the following stages:

Analysis Stage

The analysis stage contains needs analysis and curriculum analysis. The needs analysis carried out in this study is by exploring and searching for important information related to the science literacy skills and argumentation skills of students. It was found that in reality argumentation skills were still poorly applied to science programs and activities in the laboratory. This is in line with the results of interviews conducted with chemistry teachers, it is known that students have never been trained in argumentation skills during chemistry learning. The students' argumentation skills have not been practiced because there is no worksheet for argumentation skills. A quality Learning Tool is needed to train argumentation skills on buffer solution material because learning tools can affect learning outcomes and guide students to be able to learn independently.

The curriculum analysis carried out in this study is by analyzing core competencies, basic competencies, and indicators of competency achievement by referring to the 2013 Curriculum regarding buffer solution material. The basic competencies is explaining the working principles, pH calculation, and the role of buffer solutions in the bodies of living things; making buffer solutions with a certain pH.

Evaluation of the Analysis Stage

An evaluation of the analysis stage is carried out, in the form of a review of the analysis results by the advisor and researcher. The results of the review were obtained in the form of suggestions from the supervisor. The suggestions obtained include:

1. Adding the results of the review of student worksheet regarding science literacy skills and argumentation skills. The addition was made to strengthen the urgency of the research.
2. Adding criteria used to review the student worksheet. The added criteria aim to find out how much argumentation skills is trained on the student worksheet.

Revision of Analysis Stage

At this revision stage, improvements were made to the analysis results based on the results of the review. The revisions carried out at the analysis stage are presented in Table 2.

Table 2. Results of Analysis Stage Before and After Revision

Before Revision	After Revision
• Information on the science literacy skills (SLS) of Indonesian students in PISA 2018. • - Information on argumentation skills of SMA X students.	• Information on the SCS of Indonesian students in PISA 2012, 2015, 2018. • Information about the argumentation skills of SMA X students. • Information about the causes of low argumentation skills of students. • Adding the results of the review of student worksheet regarding science literacy and argumentation skills. • - Adding the criteria used to review the student worksheet.

Design Stage

At this stage, the formulation of learning objectives, design of student worksheet display, and preparation of student worksheet content are carried out.

Formulation of Learning Objectives

Learning objectives are adjusted to the argumentation skills that will be trained and used as a guide for preparing the material in the student worksheet.

Student Worksheet Display Design

Next is the design of the appearance of the student worksheet based on scientific literacy to be developed. The initial product design uses Microsoft office word 2016.

Preparation of Styudent Worksheet Content

The last step is the preparation of the content of the student worksheet. The developed student worksheet based on scientific literacy contains understanding, properties, and making buffer solutions. This student worksheet begins with reading and pictures of phenomena for students to gather information in it and assess a claim (claim argumentation stage). Students'are then asked to prove the claim that has been formulated through a practicum, by conducting an experiment in the school chemistry laboratory. Students are asked to collect data in the observation table (evidence argumentation stage) and analyze it and connect it with the claim that has been made (warrant argumentation stage). After that, students look for data supporting claims from articles/teaching books (backing the argumentation stage).

The next stage is the qualifier stage, which is the stage where student make a solidifying statement of the claim made and universal claims can be limited with words such as sometimes, usually, mostly, or always. In the next stage, learners can refute statements that are not true about the claim given (rebuttal argumentation stage). The scientific products

written in the student worksheet are associated with phenomena in life to fulfill the knowledge domain (content, procedural, and epistemic) and context (personal or individual).

The phenomena in student worksheet 1 are events that occur in everyday life and are related to buffer solutions, namely the nature of buffer solutions. The phenomenon presented is about iced tea drinks, soft drinks, and isotonic drinks. Studs are asked to carry out scientific investigations, to identify which drinks are included in the buffer solution. This is because soft drinks contain phosphoric acid and sodium phosphate while isotonic drinks contain citric acid and sodium citrate. In both drinks when a little acid, base, or dilution is added, the pH price is relatively fixed or does not change significantly.

The phenomena in student worksheet 2 are events that occur in everyday life and are related to buffer solutions (related to blood). In the phenomenon described blood pH, namely even though substances that are acidic, basic, or water continuously enter the bloodstream, the pH of the blood can still be maintained due to the buffer system of phosphate, carbonate, and hemoglobin. The phenomenon makes learners want to know more, so it makes learners conduct scientific investigations regarding the manufacture of buffer solutions and their ability to maintain pH.

The phenomenon of buffer solutions in life contained in the student worksheet can build a relationship between concepts that are already owned with phenomena. The process of connecting concepts and phenomena that are being studied is learning based on constructivism (Suyono & Hariyanto, 2015). Therefore, the addition of phenomena associated with the concepts being studied is by constructivist learning theory.

In addition to the preparation of the material, the preparation of scientific inquiry activities was carried out. In the developed student worksheet, this activity is called an experiment. This activity meets the criteria of student worksheet that can train science literacy skills, namely investigating the nature of science and science as a way of thinking. Therefore, the skills of evaluating and designing scientific investigations and interpreting scientific data and evidence can be trained.

In the experimental activity, students are asked to write down the tools and materials along with experimental procedures, observe, analyze data, and conclude scientific investigations. This activity is located after the material so that students can construct new ideas based on the concepts they already have. The process of constructing new ideas based on existing concepts is learning according to Jerome S Bruner's discovery learning theory. Therefore, the addition of experimental activities to the student worksheet developed is by discovery learning theory (Suyono & Hariyanto, 2015).

Evaluation of The Design Stage

The evaluation was carried out by reviewing the design of student worksheet by experts, namely the supervisor. The review includes a review of the content (material) and its suitability for science literacy and argumentation skills. The results of the evaluation of the draft student worksheet based on scientific literacy are as follows: a) include the names of the authors and supervisors on the cover, b) color selection on the cover of student worksheet 1, c) replacing the isotonic drink picture, and d) writing the source of the picture.

Revision of the Design Stage

The shortcomings of the draft student worksheet that has been known through evaluation are improved by making revisions so that it becomes a good student worksheet. At this stage, the revision of the draft student worksheet is carried out by the results of the review conducted by the advisor.

Development Stage

This stage is the process of the realization of the design into reality. The student worksheet design that has been evaluated and revised is then developed at the development stage.

Product Development

Product development of student worksheet based on scientific literacy is made using microsoft office word 2016 and Canva which is adjusted to the learning objectives of buffer solution material. Parts of the student worksheet include cover, preface, table of contents, competency achievements, instructions for use, aspects of science literacy, especially science literacy competencies used as the basis of student worksheet, argumentation skills, the relationship between science literacy and argumentation skills, concept maps, material summaries, activities, and bibliography. Indicators of argumentation skills according to Toulmin that are achieved include claim, evidence, warrant, backing, qualifier, and rebuttal while the science literacy competencies used include explaining phenomena scientifically, evaluating and designing scientific investigations, and interpreting scientific data and evidence (PISA, 2015).

Development of Assessment Instrument

To determine the validity of the developed student worksheet, it is necessary to conduct a validity test. Therefore, the instrument development of the student worksheet validation sheet is used to determine the validity of student worksheet.

Evaluation of the Development Stage

Evaluation carried out after the development stage is in the form of validation by to determine the validity of the developed student worksheet. One of the criteria for the feasibility of student worksheet as a learning device is validity which includes construct validity (consistency) and content validity (relevance). The validity of the student worksheet is determined based on expert judgment of three validators and then analyzed descriptively using the mode or value that often appears (Afni & Suyono, 2022). Validation is carried out based on a Likert scale, namely from numbers 1-5 with invalid to very valid criteria. Student worksheet developed is declared valid if it meets the requirements with a minimum three validator assessment mode of 4 (valid).

Table 3. Results of Validation of Student Worksheet 1

No	Items	V1	V2	V3	Mo	Criteria
	Content Validity					
Suitability of student worksheet with content and content						
1	Suitability of learning objectives with basic competencies	5	4	4	4	Valid
2	The correctness of the facts, concepts, principles, laws, and theories contained in the student worksheet.	5	4	4	4	Valid
3	Content/topic has relevance to the thinking skills set as learning targets.	5	4	4	4	Valid
	Construct Validity					
Compliance of student worksheet with criteria related to presentation						
1	Cover presents the content of the student worksheet	4	4	5	4	Valid
2	There is a place to write answers as needed	5	5	5	5	Very valid
3	Completeness of the components presented in the student worksheet	4	4	4	4	Valid
The construct of student worksheet as a guide for science literacy skills						
1	Explain phenomena scientifically	5	4	4	4	Valid
2	Evaluate and design scientific investigations	5	4	4	4	Valid
3	Interpret scientific data and evidence	5	4	4	4	Valid

The construct of student worksheet as a guide for argumentation skills						
1	Make a claim	5	5	4	5	Very valid
2	Showing data (evidence)	5	4	4	4	Valid
3	Develop a reason (warrant)	5	5	4	5	Very valid
4	Showing backing	5	5	4	5	Very valid
5	Constructing a qualifier	5	4	4	4	Valid
6	Composing a rebuttal	5	4	4	4	Valid

Based on Table 3, all aspects of content validity get an assessment mode with a value of 4 (Valid). Construct validity related to presentation criteria, numbers 1 and 3 get an assessment mode of 4 (Valid), while number 2 gets an assessment mode of 5 (Very valid). All aspects of construct validity related to science literacy skills, get an assessment mode of 4 (Valid). Construct validity related to argumentation skills in numbers 1, 3, and 4 get an assessment mode of 5 (Very valid) while in numbers 2, 5, and 6 get an assessment mode of 4 (Valid). The developed student worksheet 1 is also by science literacy competencies and the question activities on student worksheet have integrated argumentation skills indicators. So in terms of validity, the developed student worksheet 1 is valid for use in learning chemistry on buffer solution material to train students' argumentation skills.

Table 4. Results of Validation of Student Worksheet 2

No	Items	V1	V2	V3	Mo	Criteria
	Content Validity					
Suitability of student worksheet with content and content						
1	Suitability of learning objectives with basic competencies	4	4	4	4	Valid
2	The correctness of the facts, concepts, principles, laws, and theories contained in the student worksheet.	4	4	4	4	Valid
3	Content/topic has relevance to the thinking skills set as learning targets.	4	4	4	4	Valid
	Construct Validity					
Compliance of student worksheet with criteria related to presentation						
1	Cover presents the content of the LKPD	4	4	4	4	Valid
2	There is a place to write answers as needed	5	4	4	4	Valid
3	Completeness of the components presented in the LKPD	4	4	4	4	Valid
The construct of student worksheet as a guide for science literacy skills						
1	Explain phenomena scientifically	5	4	4	4	Valid
2	Evaluate and design scientific investigations	5	4	4	4	Valid
3	Interpret scientific data and evidence	5	4	4	4	Valid
The construct of student worksheet as a guide for argumentation skills						
1	Make a claim	5	5	4	5	Very valid
2	Showing data (evidence)	5	5	4	5	Very valid
3	Develop a reason (warrant)	5	5	4	5	Very valid
4	Showing backing	5	5	4	5	Very valid
5	Constructing a qualifier	5	4	4	4	Valid
6	Composing a rebuttal	5	4	4	4	Valid

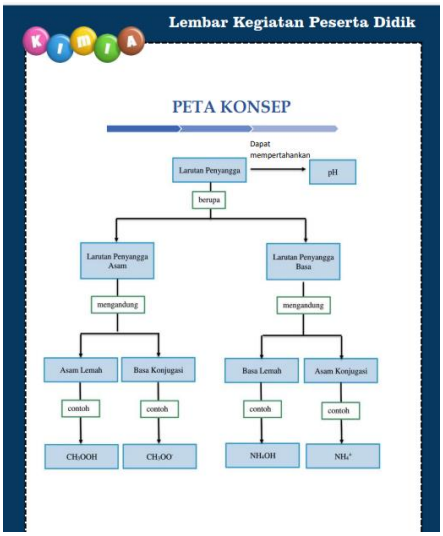
It can be seen from Table 4, that all aspects of content validity get an assessment mode of 4 (Valid). All aspects of construct validity related to presentation, get an assessment mode of 4 (valid). All aspects of construct validity related to science literacy skills, get an assessment mode of 4 (Valid). Construct validity related to argumentation skills in numbers 1, 2, 3, and 4 get an assessment mode with of 5 (Very valid) while in numbers 5 and 6 get an assessment mode of 4 (Valid). The developed student worksheet based on scientific literacy 2 is also in accordance with science literacy competencies and the question activities on student worksheet have integrated argumentation indicators. So in terms of validity, student

worksheet 2 based on scientific literacy is declared valid on buffer solution material to train students' argumentation skills.

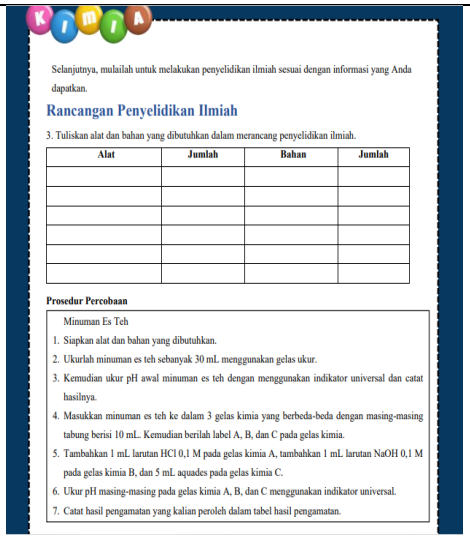
Revision of Development Stage

At this stage, the revision is carried out in accordance with the suggestions and comments given by the validator. The results of the revision of the development stage are described in Table 5.

Table 5. Revision Results of the Development Stage

After Revision	
The position of the image on the LKPD 1 cover is on the right side so that it is not cut off.	Adding features (explanation) and usage information in the preface of student worksheet 1.
	
Replace the concept map on student worksheet 1.	Add information related to buffer solutions in soft drinks and isotonic drinks.

After Revision



Selanjutnya, mulailah untuk melakukan penyelidikan ilmiah sesuai dengan informasi yang Anda dapatkan.

Rancangan Penyelidikan Ilmiah

3. Tuliskan alat dan bahan yang dibutuhkan dalam merancang penyelidikan ilmiah.

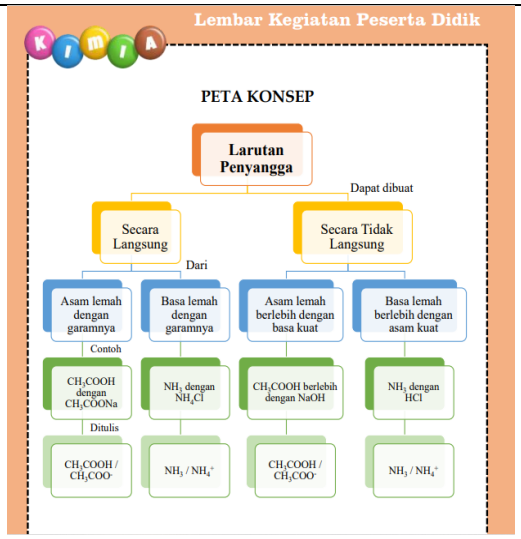
Alat	Jumlah	Bahan	Jumlah

Prosedur Percobaan

Minuman Es Teh

1. Siapkan alat dan bahan yang dibutuhkan.
2. Ukurlah minuman es teh sebanyak 30 mL menggunakan gelas ukur.
3. Kemudian ukur pH awal minuman es teh dengan menggunakan indikator universal dan catat hasilnya.
4. Masukkan minuman es teh ke dalam 3 gelas kimia yang berbeda-beda dengan masing-masing tabung berisi 10 mL. Kemudian berilah label A, B, dan C pada gelas kimia.
5. Tambahkan 1 mL larutan HCl 0,1 M pada gelas kimia A, tambahkan 1 mL larutan NaOH 0,1 M pada gelas kimia B, dan 5 mL aquades pada gelas kimia C.
6. Ukur pH masing-masing pada gelas kimia A, B, dan C menggunakan indikator universal.
7. Catat hasil pengamatan yang kalian peroleh dalam tabel hasil pengamatan.

Added a column for student to write the experimental procedure.



Recreate the concept map so that the writing of chemical compounds becomes clear

DISCUSSION

Validation is carried out to produce a valid student worksheet based on scientific literacy that is feasible to implement. This is in accordance with Nieeven's (2010) statement that validation is a process to improve, create, and develop student worksheet by the manufacturing procedures that have gone through the validation stage by the validator. The validity of the student worksheet based on scientific literacy (SL) developed is reviewed based on validity criteria, namely content validity and construct validity.

Content validity is related to the suitability of items on the instrument with the content or subject matter that the instrument wants to measure (Newman, Lim, & Pineda, 2011). Content validity relates to the correctness of the content or substance in the student worksheet which is used as a vehicle for argumentation training. The substance in this student worksheet is a buffer solution. Assessing with another scale is analogous to that applied to construct validity. The student worksheet based on SL is declared valid if each criterion has a mode of assessment from three validators of at least 4.

Based on the assessment by the three validators, on student worksheet 1, the content validity criteria in the first aspect, namely the suitability of learning objectives with basic competencies, which gets an assessment mode of 4 (Valid). In student worksheet 2, the content validity criteria in the first aspect, namely the suitability of learning objectives with basic competencies, also get an assessment mode of 4 (Valid). The validation results on the first component show that the learning objectives formulated in the student worksheet are in accordance with the basic competencies set out in the revised 2013 curriculum. The truth component of facts, concepts, principles, laws, and theories contained in student worksheet 1 and student worksheet 2 obtained an assessment mode of 4 (Valid).

The last component, namely content/topic has relevance to the argumentation skills set as a learning target, both in student worksheet 1 and student worksheet 2 obtained an assessment mode of 4 (Valid). The validation results on the last component show that the content contained in student worksheet 1 and student worksheet 2 is valid to be used to train argumentation skills. This means that both student worksheet 1 and student worksheet 2 on buffer solution material developed have met the content validity criteria based on the Likert

scale. In addition, the student worksheet developed is in accordance with the content validity according to Nieeven (2010) that the validity criteria of a product are reviewed based on content validity (relevance) and construct validity (consistency).

Construct validity is a measurement that correlates one indicator with another indicator and is associated with variables contained in the construct theory to be measured (Westen & Rosenthal, 2003). Construct validity is related to the ability of the student worksheet to guide students' activities according to the science literacy skills and argumentation skills indicators.

The first aspect of the construct criteria on the construct of student worksheet as a science literacy skills guide, namely explaining phenomena scientifically in both student worksheet 1 and student worksheet 2, obtained an assessment mode of 4 (Valid). The second aspect is evaluating and designing scientific investigations, both in student worksheet 1 and student worksheet 2 obtained an assessment mode of 4 (Valid). The last aspect is interpreting data and evidence scientifically, both student worksheet 1 and student worksheet 2 obtained an assessment mode of 4 (Valid). The student worksheet based on scientific literacy on buffer solution material developed is in accordance with the science literacy domain. This is reviewed from the validation results, where all the criteria for construct validity as a guide for science literacy skills are included in the valid category with the mode of assessment of the three validators with a value of 4. Science literacy-based student worksheet is said to be valid because it has met the criteria of the science literacy domain consisting of the context, competence, and knowledge domains according to PISA 2015 (OECD, 2016).

The criteria for the construct of student worksheet as a argumentation skills guide are divided into 6 aspects which include a claim, evidence, warrant, backing, qualifier, and rebuttal. The first aspect of the construct of student worksheet as a argumentation skills, namely giving directions to students to write a statement which is a claim compiled in providing an assessment of a phenomenon (compiling claims) both on student worksheet 1 and student worksheet 2, obtained an assessment mode of 5 (Very valid). The second aspect is giving directions to students to write down some appropriate evidence to strengthen the claims that have been compiled (showing data) on student worksheet 1 obtained an assessment mode with a value of 4 (Valid) while on student worksheet 2 obtained an assessment mode of 5 (Very valid). The third aspect is giving directions to students to formulate statements to explain the suitability of the evidence submitted in strengthening the claims that have been compiled (compiling warrants) both on student worksheet 1 and student worksheet 2 obtained an assessment mode of 5 or (Very valid).

The fourth aspect, namely giving directions to students to write supporting statements in strengthening the reasons given in the form of theoretical and scientific explanations (compiling support/backing) both in student worksheet 1 and student worksheet 2, obtained an assessment mode of 5 (Very valid). The fifth aspect is giving directions to students to formulate statements that can strengthen claims by providing problem limitations using the words usually, sometimes, and so on that claims are not for all situations (compiling qualifiers) in both student worksheet 1 and student worksheet 2 obtained an assessment mode of 4 (Valid). The last aspect is giving directions to students to write a statement and include the reasons proposed to say that another statement proposed is wrong (compiling rebuttal) both in student worksheet 1 and 2 obtained an assessment mode of 4 (Valid).

It can be concluded that, in student worksheet 1, the criteria for student worksheet constructs as argumentation skills guides in the aspects of claim, warrant, and backing obtained an assessment mode of 5 (Very valid). While for the construct aspects of evidence, qualifier, and rebuttal, the assessment mode is obtained with a value of 4 (Valid). In student worksheet 2, the student worksheet construct criteria as a argumentation skills guide, namely in the aspects of claim, evidence, warrant, and backing, the assessment mode is 5 (Very valid). While for

the qualifier and rebuttal aspects, the assessment mode is 4 (Valid). The student worksheet based on scientific literacy developed is said to be valid because it has met the criteria of Toulmin's argumentation skills indicators (1958) which number six, namely claim, data, warrant, qualifier, backing, and rebuttal.

The last criterion is the construct of student worksheet based on presentation criteria. Where the criteria for constructing student worksheet based on scientific literacy based on presentation criteria are divided into three aspects, namely the cover presents the contents of the student worksheet, there is a place to write answers as needed and the completeness of the components presented in the student worksheet. In the first aspect, namely, the cover presents the content, it is known that in student worksheet 1 and student worksheet 2, the mode of assessment is obtained of 4 (Valid). This means that the cover of the student worksheet developed is appropriate and presents the contents of the student worksheet.

In the second aspect, namely the availability of a place to write answers, it is known that the student worksheet 1 obtained an assessment mode of 5 (Very valid), while the student worksheet 2 obtained an assessment mode of 4 (Valid). This shows that the place to write answers is in accordance with the needs of answering questions. The last aspect is the completeness of the components presented in the student worksheet consisting of cover; preface; table of contents; competency achievements; indicators; instructions for use; science literacy aspects; argumentation skills introduction; concept map; student activities that begin with phenomena; and bibliography, it is known that both student worksheet 1 and student worksheet 2 obtained an assessment mode of 4 (Valid).

The advantages of the developed student worksheet based on scientific literacy are that the activity stages are outlined in science literacy graphics, equipped with features that can provide information to students. In addition, the student worksheet contains phenomena about buffer solutions that are related to everyday life so that it makes it easier for students to understand buffer solution material. The student worksheet also requires students to conduct scientific investigations to find answers to problems that occur.

CONCLUSION

Based on the results of the research and discussion that has been carried out, it can be concluded that the student worksheet based on scientific literacy on buffer solution material developed is declared valid in both content (relevance) and construct (consistency). The developed student worksheet based on scientific literacy is believed to be used to train the argumentation skills of high school students who learn the chemical content of buffer solutions.

RECOMMENDATIONS

Based on this conclusion, it is recommended that further research be carried out to test the feasibility of student worksheet based on scientific literacy from the criteria of practicality and effectiveness.

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