

**DEVELOPMENT OF STUDENT WORKSHEET PQ4R STRATEGY WITH
APPLICATION OF FILL IN SCAFFOLDS ON CHEMICAL BOND
SUBJECT MATTER**

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Abstrak

Penelitian ini dilakukan untuk mengetahui dan mendeskripsikan kelayakan LKS strategi PQ4R dengan penerapan *fill in scaffolding* untuk mengetahui aktivitas dan hasil belajar peserta didik pada materi ikatan kimia untuk yang dikembangkan. LKS dikatakan layak jika memenuhi kriteria kevalidan, kepraktisan, dan keefektifan. Jenis penelitian yang dilakukan dalam penelitian ini adalah pengembangan dengan modifikasi model 4-D terbatas pada *define*, *design*, dan *develop*. Instrumen penelitian yang digunakan adalah lembar telaah dan validasi, *pretest* dan *posttest*, lembar respon peserta didik, serta lembar observasi aktivitas peserta didik. LKS ini diuji cobakan kepada 15 peserta didik kelas XI MIA SMAN 1 Krian Sidoarjo. Kriteria kevalidan diketahui dari hasil validasi tiga LKS masing-masing sebesar 85,74%; 86,03%; dan 85,37%. Kriteria kepraktisan diketahui dari hasil respon peserta didik terhadap LKS yang menunjukkan hasil positif yaitu sebesar 88,57% dan didukung dengan data aktivitas peserta didik selama ujicoba. Sementara kriteria keefektifan ditunjukkan dengan pencapaian ketuntasan individu dan klasikal sebesar 100%. Berdasarkan hasil penelitian tersebut, dapat disimpulkan bahwa LKS strategi PQ4R dengan penerapan *fill in scaffolding* untuk mengetahui aktivitas dan hasil belajar peserta didik pada materi ikatan kimia dinyatakan layak digunakan.

Kata Kunci: LKS, PQ4R, *scaffolding*, *fill in the blank*, ikatan kimia

Abstract

The aim of this study is to know and describe the feasibility of student worksheet PQ4R strategy with application of fill in scaffolding to know the students' activities and students' learning outcome on chemical bond subject matter. The worksheet is feasible if satisfy validity, practicality, and effectiveness criteria.. The type of this study was development by using modified 4-D model limited to define, design, and develop. The instruments of this study used were review sheet, validation sheet, pretest and posttest, students' response sheet, and observation of student's activity sheet. The worksheet was tested to 15 students of XI class SMAN 1 Krian Sidoarjo. Validity criterion was shown from validation result of three worksheet developed, each 85,74%; 86,03%; and 85,37%. Practicality criterion was shown from student's response result which was positive response, was 88,57% and supported by students' activities date while testing. While effectiveness criterion was shown by students' outcome both individual and classical which reached 100%. According to result of research, could be concluded that student worksheet PQ4R strategy with application of fill in scaffolding to know the students' activities and students' learning outcome on chemical bond subject matter which developed was feasible to be used.

Keywords: Worksheet, PQ4R, scaffolding, fill in the blank, chemical bond

PRELIMINARY

Curriculum 2013 is the new applied curriculum type in Indonesian education. Curriculum 2013 follow: (1) learning process that performed by teacher (taught-curriculum) in form of process which developed that consisted of learning activities in school, class, and society; and (2) students' direct learning experience (learned-curriculum) in accordance with background, characteristic, and preceding ability of students. Students' direct learning experience is the learning achievement of themselves, while the classical students' learning outcome of curriculum [1]. Learning experience is obtained if students were actively involved in gaining knowledge. Learning experience could be obtained through much kind of physical and mental activities both in class and outside the class. Learning experience in the class could be performed by interaction between students, using object/learning sources, according to description of learning material had been formulated.

The curriculum demands above are also expected to be achieved on Chemistry subject matter. Material that included in Chemistry subject matter is chemical bond that taught in senior high school level in math and natural sciences class specification. Concept is classified into concrete and abstract concept. Chemical bond included into abstract concept, which is a concept that perceived having no concrete example make it difficult to find clear example and non-example. Thus made critical and variable attribute in that concept was difficult to be understood and analyzed. Such concept is relatively difficult to be understood and to be taught or studied, because that is impossible to communicate the information of its critical attribute through direct observation [2].

While being seen from chemical representation view, in studying need multi-representation [3].

The result of questionnaire for Chemistry on Chemical bond subject matter showed 48,38% out of 33 students in SMAN 1 Krian said that chemistry was less interesting and only 38,70% said chemistry was an easy subject matter. Their reasons were chemical bonding was difficult concept to be understood. 74,19% of students said that the worksheet had been used was less interesting and 70,49% of them said that that worksheet was not giving assistance enough. Added by 93,54% students stated that the assistance given by their teacher was verbal explanation using lecturing method. They wanted students worksheet that having difficulty level, guiding by facilitating well-structured assistance/help and more connected with daily life.

Scaffolding is providing students structural assistance in the beginning of learning process and gradually engaging student to be responsible to work on themselves [4]. Scaffolding approach could give solution in assisting student to obtain their optimal potential and reduce their learning difficulty. The scaffolding form that teacher given as stated above was called soft scaffold. Hard scaffold is form that developed using computer-based or paper-based cognitive tool like worksheet [5]. So the assistance become more well-structured and students gained learning experiences so that approach was integrated into worksheet.

Providing the right type of question influenced in students' cognitive activities increase. Fill in the blank type question would rehearse students to mastery the chemical bond concept. Providing assistance using fill in the blank was given stage

by stage, those stage was the learning stage of scaffolding. This aimed to give students practice and assistance. They would easily know concept by link them with keywords, giving meaning to concept by completing texts, and find the relation between concepts. When students' knowledge and competence increased, the supports would be gradually removed.

To ensure meaningful learning is carried out, the material must be logic, students had to insert the material into their cognitive structure, and in cognitive structure had have suitable elements to nonarbitrarily and substantively connect or link new material [6]. Thus to minimize rote learning. Right stimulus and coding would be able to help information processing to give learning achievement so the knowledge obtained become meaningful [7]. By only completing fill in the blank, students would reach reading, exercising, and memorizing only. To ensure chemical concept being understood and ignite meaningful learning experience also reduce students' learning difficulties PQ4R were enclosed and inserted in stages of students worksheet.

Student worksheet PQ4R strategy with application of fill in scaffolds is students worksheet which developed using scaffolding approach. Focus of this students worksheet is to reduce learning difficulties in chemical bond and to give space for learning activities as a way of process obtaining learning experiences. Students' learning experience could be gained through learning activities during learning process. Activities that might cover expected competence were reading, asking question, answering question, and giving opinion.

From the statements above, it needs to developed worksheet that could provide

students' learning activities which give supports and assists so they can achieve their optimal potential. So, the study of student worksheet PQ4R strategy with application of fill in scaffolds was carried out to know students' activities and student's learning on chemical bond subject matter.

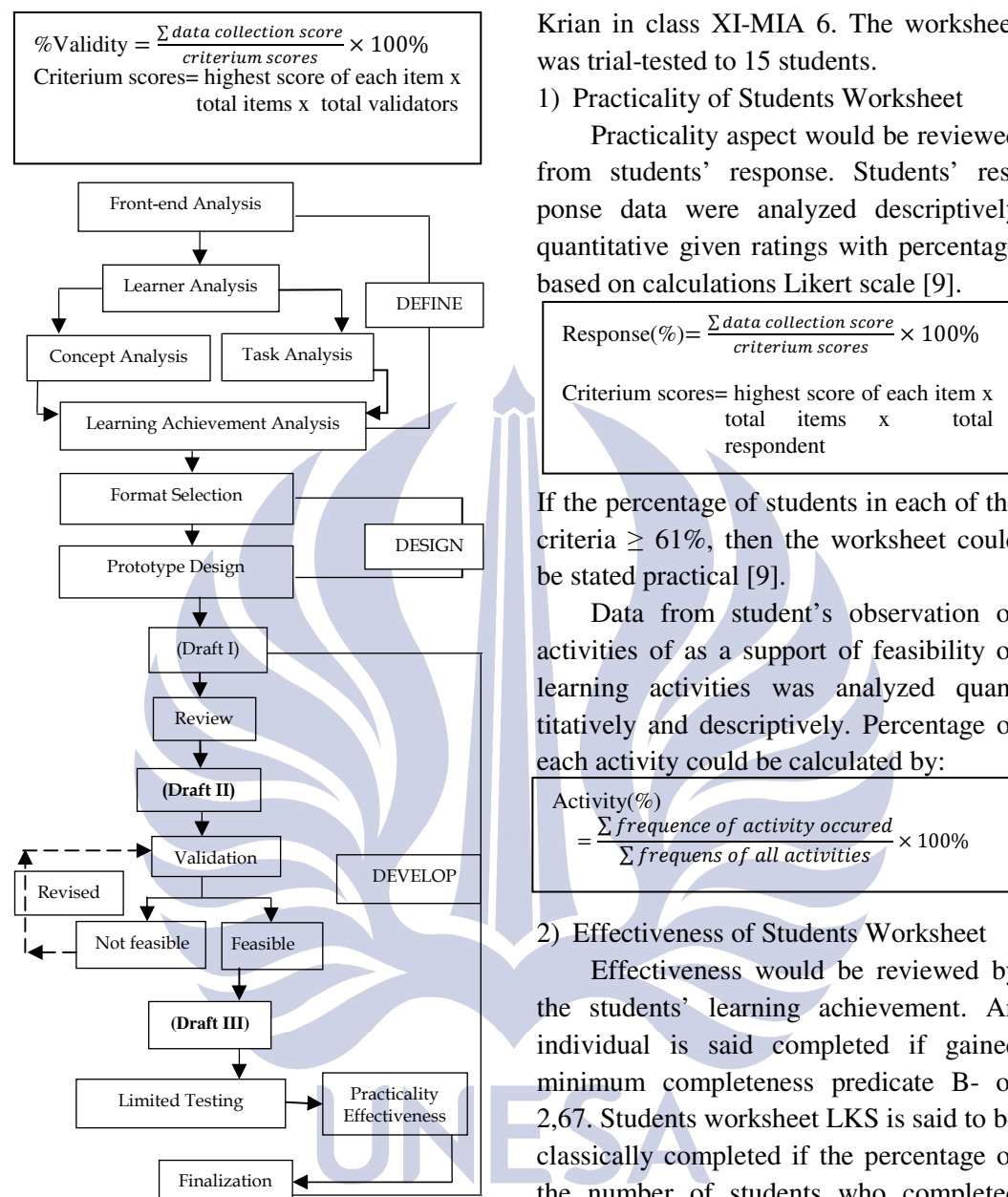
METHOD

This study was using development 4-D Thiagarajan. The stages of study in 4-D model consist of define, design, develop, and disseminate. Disseminate stage was not carried out and the study limited on limited testing. The modification of the stages of 4-D model is shown on Picture 1 [8].

The methods used to obtain the data are questionnaires, pre-study, and test. The questionnaire consist of a review questionnaire to obtain experts' suggestions for better improvements in developing worksheet, validation questionnaire for experts to obtain a quality product developed assessment, student questionnaire responses to determine the level of worksheet practicality. The instruments of this study used were review sheet, validation sheet, students' response sheet, pre test and post test, and observation of student's activity sheet.

Analysis Method of Validity

Draft I of student worksheet PQ4R strategy with application of fill in scaffolds on chemical bond subject matter would be reviewed by two chemistry lecturers and one chemistry teacher. After being revised based on reviewers' advices, students worksheet *draft II* being resulted which then being assessed by validators who were two chemistry lecturers and one chemistry teacher. Formula used for calculation of validation result:



Picture 1. Modification of Stages of 4-D Model

Students worksheet is valid if each of the criteria gained percentage $\geq 61\%$ based on calculations Likert scale [9].

Students worksheet draft III that had been stated valid by validators would be limited tested to students.

Trial-testing of Worksheet

By conducting trial-testing would be obtained practicality and effectiveness data. The trial was conducted at SMAN 1

RESULTS AND DISCUSSION

In this study would be described the result of study obtained and its discussion

during the development of student worksheet PQ4R strategy with application of fill in scaffolds to know students' activities and students' learning achievement on chemical subject matter.

Validity of Students Worksheet

Draft I was reviewed by chemistry lecturers and teacher. Draft of revised students worksheet then would be validated. Validation was executed by 3 validators. Here's the result presented on Table 2:

Table 2. Data Result of Validation

No	Criteria	Percentage	Category
1.	Component and physic of students worksheet	85,37%	Very good
2.	Adjustment with scaffolding approach	86,29%	Very good
3.	Presentation of students worksheet	85,33%	Very good
4.	Content of students worksheet	86,67%	Very good
5.	Linguistic of students worksheet	85,33%	Very good
6.	Graphic of students worksheet	86,56%	Very good

Assessment of students worksheet was based on criteria of construct and content validation. Construct validation consisted of component and physic of students worksheet, adjustment with scaffolding approach. While, content validation consisted of content, presentation, and graphic criteria.

Scaffolding stages used in this worksheet were: (1) recruitment, (2) reduction degrees of freedom, (3) direction maintenance, (4) marking critical features, (5) frustration control, and (6) demonstration. The explanation of the fading of scaffolding as follow. Stage 1 is

focused on how to get students' attention by providing introduction of matter, presentation of relation with prior knowledge, and quick review feature. Stage 2 and 3, the scaffolding is given as fill in the blank, interval feature, help yourself, and PQ4R feature. The task is combined with PQ4R strategy. Stage 4 and 5, the scaffolding begins to be fading, students mark the important things by analysis, associating and inferring. Stage 6, scaffolding is completely fading in the last stage. Students will independently do their task without the help of scaffolding.

Based on Table 2 known that students worksheet could be stated as valid because each criterion got percentage $\geq 61\%$ or in very good category. Moreover each aspect in criterion also obtained $\geq 61\%$. So, students worksheet could be used in limited testing.

Trial-testing of Worksheet

Testing of students worksheet was carried out for three meeting on date 20th, 21st, dan 24th April 2016 on SMAN 1 Krian. Total sample was 15 students from XI grade. From limited testing could be obtained effectiveness and practicality data of students worksheet.

1) Effectiveness of Students Worksheet

Effectiveness of students worksheet was reviewed from students' learning achievement. Here's the students' learning achievement data:

Table 3. Students' Learning Achievement

Learning Outcome	Not complete	Complete
LKS 1	0	15 (100%)
LKS 2	0	15 (100%)
LKS 3	0	15 (100%)

Students had individually completed learning if the minimum completeness reached $\geq 2,67$ or B- predicate. On posttest all individual had been stated completed

learning. Classical students' learning completeness was 100% .

Analysis related to students' concept understanding after implementation of student worksheet PQ4R strategy with application of fill in scaffolds on chemical bond was using gain analysis. Here's students' learning achievement increase using gain analysis:

Tabel 4. n-Gain Students' Learning Achievement

Category	Σ Student
Medium	12
High	3

Students' learning achievement increase was classically satisfied by 20% of students were on high category ($g \geq 0,7$) and 80% of students were on medium category ($0,7 > g \geq 0,3$). Student worksheet PQ4R strategy with application of fill in scaffolds on chemical bond was effective viewed from students' learning achievement of XI MIA grade SMAN 1 Krian.

2) Practicality of Students Worksheet

Practicality was viewed from students' response result to student worksheet PQ4R using fill in scaffolds type on chemical bond and supported by students' activities data. There were 14 aspect responded by students. All aspects included students' understanding to students worksheet, confidence, teamwork, motivation, presentation of students worksheet, and linguistic of students worksheet used. Students worksheet developed got percentage $\geq 61\%$ on each aspect and all got 88,57%.

Students' activities were observed by three observant with each observed five students. Students' activities were observed each three minutes during 90 minutes of testing. Data of students' activities was used to support learning feasibility using students worksheet.

Here's students' activities frequency during three limited testing.

Table 5. Frequency of Students' Activities

Testing	Percentage of Students' Activities (%)			
	A	B	C	D
Worksheet 1	23,56	15,11	59,11	2,22
Worksheet 2	31,11	13,56	51,11	4,22
Worksheet 3	28,28	12,69	52,34	6,68

Note:

A = reading

B = asking question

C = answering question

D = giving opinion

CLOSING

Conclusion

Based on data that obtained and discussion, could be concluded that student worksheet being developed satisfied feasibility with details:

1. Validity of student worksheet PQ4R strategy with application of fill in scaffolds developed satisfy content validation and construct validation criteria which was shown by acquisition of percentage of each students worksheet 85,74%; 85,27%; and 86,03% with very good criteria, also obtained $\geq 61\%$ on each criterion.
2. Practicality of students worksheet was obtained from students' response questionnaire which got 88,57% on very good category also obtained $\geq 61\%$ on each aspect and supported with students' activities data.
3. Effectiveness of students worksheet was based on learning achievement. Classical completeness after testing was 100% and minimal individual completeness was to reach 2,67 score or B- predicate, also n-gain increase was on high and medium criteria. That's students worksheet was effective.

Suggestion

1. Development of student worksheet PQ4R strategy with application of fill in scaffolds on chemical bond obtained good response, so there's need to develop similar learning source on other appropriate chemistry material.
2. Need more exploration on students worksheet's feature so it will support giving opinion activities.

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