

Development of SCP-SQ-SCS Based Student Worksheets flat building materials for elementary school teacher education students

Hamdana Hadaming¹, Muhammad Arif Tiro², Hamzah Upu³

^{1,2,3} Universitas Negeri Makassar, Indonesia

Corresponding Author: arif_tiro@unm.ac.id

Abstract

This research was conducted with the aim of producing an SCP-SQ-SCS (Stimulation, Concept Understanding, Problem, Search, Question, Solve, Create, and Share) based Student Worksheet in improving mathematical critical thinking skills that meet valid, practical, and effective criteria that can be applied in mathematics lectures for PGSD students. The model development process refers to the development model according to Nieveen, which includes (1) a preliminary stage. This phase involves finding that lecturers need an SCP-SQ-SCS-based Student Worksheet that trains students' critical thinking skills, which contains tasks that can develop students' critical thinking skills. (2) prototyping stage. This phase is designed as an SCP-SQ-SCS-based Student Worksheet, which includes the learning syntax of the SCP-SQ-SCS model. In addition to the validity of WORKSHEETS, the student response questionnaires, student activity observation sheets, and learning implementation observation sheets are also in the very valid category. (3) assessment stage. At this stage, the practicality and effectiveness of the SCP-SQ-SCS-based student worksheet were established. The practicality of the lecturer's response questionnaire analysis results showed a positive response to the Student Worksheet used. The results of the data analysis from the lecturer response questionnaire indicated that the average percentage of lecturer responses, at 92%, fell into the very positive category. The effectiveness of SCP-SQ-SCS-BASED Student Worksheets is seen from the results of data analysis of the components of student activity effectiveness; student response; and learning outcome tests, namely (1) the average percentage of student activities in the implementation of SCP-SQ-SCS-BASED Student WorksheetsIt is at the "good" criteria (2) the average percentage of student responses gives a positive response, and (3) the classical complete learning outcome test.



Keywords: Development, SCP-SQ-SCS-based *Student Worksheet*, Critical Thinking

INTRODUCTION

The ability of students to understand mathematical concepts, especially those related to flat building materials, is a fundamental aspect of elementary school teacher education. Mathematics learning not only emphasizes procedural mastery but also the development of critical thinking, creativity, and problem-solving skills. Upu (2023) states that in the process of solving geometry problems, students with high creativity tend to associate issues with relevant mathematical concepts and test the correctness of the solutions they provide. In contrast, students with low creativity do not associate with appropriate concepts and tend to ignore solution verification.

This finding is supported by Upu and Manda (2024), who explain that the creative thinking process is crucial in learning geometry, as it enables students to develop a deep understanding and generate varied and appropriate solutions. Therefore, it is necessary to design a learning tool that not only presents material conventionally but also stimulates students' conceptual and creative thinking.

The SCPSQSCS (Stimulation, Concept Understanding, Problem, Search, Question, Solve, Create, and Share) learning model is presented as an innovative solution that addresses these needs. This model emphasizes the importance of initial stimulation, complete concept understanding, problem exploration, information search, question formulation, problem solving, solution creation, and sharing findings. This approach aligns with constructivist theory, which places students at the center of active learning (Hamzah, 2022).

In addition, based on Arif Tiro's (2020) research, the development of learning tools using an experimental approach should adhere to the principles of a valid and reliable statistical design. This highlights the importance of integrating the substance of mathematical material with a strong methodological approach in developing student worksheets (WORKSHEETs).

However, the results of field studies indicate that most WORKSHEETs used by PGSD students are still procedural and lack emphasis on conceptual aspects and creative problem-solving (Upu & Nur, 2023). This condition is the fundamental reason for the need to develop WORKSHEETs based on the SCPSQSCS model, which is designed to improve students' understanding of concepts and thinking skills in a structured and comprehensive manner.

Thus, this study focuses on the development and testing of the effectiveness of SCPSQSCS-based Student Worksheets in flat building materials, aiming to improve the quality of learning and professional competence of prospective elementary school teachers.





METHOD

This research is a research *and development* (R&D). Development research is defined as a process or set of steps to develop a new product or improve an existing one. The product to be developed in this study is SCPSQSCS-based Student Worksheets. The development model that is used as the basis for the development of this research refers to the development stage according to Nieveen, which includes (1) *preliminary stage*, (2) *prototyping stage*, (3) *assessment stage* (Nieveen, McKenney & Akker, 2006, p.154). Furthermore, the quality of SSCS-based mathematics learning models also refers to the quality criteria outlined by Nieveen, including validity, practicality, and effectiveness (Nieveen, 1999, p. 127).

RESULTS AND DISCUSSION

The development model that is used as the basis for the development of this research refers to the development stage according to Nieveen, which includes (1) *preliminary stage*, (2) *prototyping stage*, and (3) *assessment stage*. The results obtained at each stage can be described as follows:

Preliminary Stage

The purpose of this preliminary study is to identify the problems encountered during the implementation of mathematics learning in higher education, collect information about the needs in mathematics learning, the learning models employed, and the learning tools used by lecturers in the learning process.

At the preliminary study stage, several theories and previous research related to problems or results of field pre-surveys have been examined. Based on the theoretical study of WORKSHEETs, an analysis of the things that must be present in mathematics learning is obtained, namely:

- 1) Learning is focused on problem-solving activities
- 2) Learning presents contextual problems
- 3) Student-centered learning activities
- 4) Development of critical thinking skills

The results of the analysis of student needs indicate that, in general, students require a learning tool that can develop their critical thinking skills and problem-solving abilities.

Prototyping Stage

Product Design

After conducting a needs analysis and literature review, the/design of the developed product is prepared. At this stage, a draft is designed in the form of WORKSHEETs and an



instrument for assessing the quality of development products.

- Worksheet Cover Plan



Figure 1: Worksheet Cover

- SCPSQSCS-based Student Worksheet Draft



Figure 2 Activity Sheet 1

Evaluation and Revision

The evaluation aims to test validity based on expert *judgement*. Draft 1, produced at the product design stage, is then assessed for validity by experts. Experts evaluate the resulting worksheets. The validation of the experts is focused on formats, content, illustrations, and languages that cover all WORKSHEETS developed. The results of expert validation, in the form of corrections, criticisms, and suggestions, serve as a basis for revising and improving WORKSHEETS.

Table 1: Suggestions For First Validation Improvements By The Validator Team

RPS	- Complement graduate learning outcomes - Add a subject line - Time allocation is taken into account
Worksheet	- The objectives of the WORKSHEET are adjusted to the objectives in the RPS - Every problem has a solution. - Consistent deep manufacturing answer column. - Refer to the instructions for use - Provide WORKSHEET characterization with the developed model (pay attention to the syntax)
Learning Outcome Tests	- Add grids and answer keys

Before the learning tool is used in the trial, it is validated by experts to ensure that the developed device meets the aspects of content, language, presentation, and suitability for learning. The validated learning tools include the Semester Learning Plan (RPS), Student Worksheets (WORKSHEETS), and Learning Outcome Tests. This validation process aims to gather input and suggestions for improvement before the device is implemented in field learning activities. The average results of the validation of each learning tool are presented in Table 2 below:

Table 2. Average Learning Tool Validation Results

Learning Tools	Average Validation Results
RPS	4,48

WORKSHEETs	4,35
Learning Outcome Tests	3,71

Based on Table 2, all the learning tools developed are in the very **valid category**, especially RPS and WORKSHEETs, which obtained an average score above 4.00. Meanwhile, the learning outcome test obtained a validation score of 3.71, which falls within the **valid** category. These results demonstrate that the learning tool has been feasible for use in the trial phase, with some minor improvements as suggested by the validator.

In addition to the main learning tools, validation was also conducted on the instruments used in implementing the SCPSQSCS model, including student response questionnaires and student activity observation sheets. Instrument validation aims to ensure that the instrument can accurately and consistently measure relevant aspects. The average results of the validation of these instruments are presented in Table 3 below:

**Table 3. Average Results of Validation of WORKSHEET Instruments
based on the SCP-SQ-SCS model**

Learning Tools	Average Validation Results
Student Response Questionnaire to WORKSHEETs	3,73
Student Activity Observation Sheet	3,75

From Table 3, it can be seen that the two validated instruments received an average score above 3.50, indicating that both are in the valid category and are suitable for use in implementing learning trials. Thus, both the learning tools and the assessment instruments have met the feasibility standards and can be used to measure the effectiveness of implementing the SCPSQSCS mathematics learning model in the teaching and learning process.

Assessment Stage

The development of this Student Worksheet (WORKSHEET) is designed based on the syntax of the SCP-SQ-SCS (Stimulation, Concept Understanding, Problem, Search, Question, Solve, Create, and Share) learning model. This model was chosen because it facilitates active, meaningful, and constructive learning by emphasizing the development of conceptual understanding, critical thinking skills, and students' creativity in solving mathematical problems,

especially with flat building materials.

The WORKSHEET development process encompasses the Research and Development (R&D) stages, beginning with needs analysis, device design, expert validation, and culminating in field trials. The trial was conducted to assess the practicality and effectiveness of the WORKSHEETS that have been developed.

During the trial implementation, learning activities were conducted thoroughly using SCPSQSCS-based WORKSHEETS. Students are guided to go through each learning stage according to the syntax of the model: starting from the stage of stimulation of contextual problems (Stimulation), strengthening concept understanding (Concept Understanding), problem identification (Problem), information search (Search), formulation of critical questions (Question), problem solving (Solve), making products or representation ideas (Create), to delivering results collaboratively (Share).

During the learning process, observations were made on student activities and lecturers' ability to manage learning. Student activities were observed to assess the extent of their involvement in following the learning flow. In contrast, lecturers' abilities were observed to evaluate the suitability of the model's implementation of the designed learning design.

After completing the entire learning series, students are given a learning outcome test to measure their level of understanding and achievement of competence in flat building materials. In addition, both students and lecturers were given a response questionnaire to gather their feedback on the application of the SCPSQSCS and WORKSHEET learning models used. This questionnaire is designed to assess the practicality, ease of use, attractiveness, and relevance of WORKSHEET content to learning needs.

The results of observations, tests, and questionnaires are the basis for assessing whether the WORKSHEETS developed have met the practical criteria for use in learning and are effective in improving student learning outcomes. Through this approach, SCP-SQ-SCS-based WORKSHEETS will not only serve as an innovative learning medium but also support the improvement of mathematics learning quality in the Elementary School Teacher Education study program.

The results of the study show that the steps of preparing the SCP-SQ-SCS mathematics learning model using the Niveen model enable the production of viable and effective products, as they are developed in detailed steps and allow revisions to be made to all stages of activities to obtain better products. The recapitulation of the effectiveness of the SCP-SQ-SCS mathematics learning model in mathematics learning has been validated and tested in detail according to the Niveen stages shown in the following Table 4:

Table 4. Recapitulation of the Results of SCP-SQ-SCS-SCS-Based WORKSHEET Development

	Indicators of Effectiveness	Criterion	Achievement	Result
Validity				
	Validation by experts	≥ 2.5	$3.65 > 2.5$	Fulfilled
Practicality				
a.	Average result Implementation Observation component Syntax	> 3.4	$3,963 > 3.4$	Fulfilled
b.	Average result Observation Ability lecturer in managing learning	≥ 3.5	$3.9 > 3.4$	Fulfilled
Effectiveness				
a.	Learning outcomes			
	- Average student result learn	≥ 75	$85 > 75$	Fulfilled
	- Percentage Completeness student	≥ 75	$80 > 75$	Fulfilled
	- Improved learning outcomes before and after Learning	> 0.3	$0.5 > 0.3$	Fulfilled
	- Percentage effectiveness N- Gain	> 55	70 > 55	Fulfilled
	- Percentage of Classical Student Completeness	$MOH \geq 85\%$	$100 > 85$	Fulfilled
b.	Student Activities			
	- Result: Observing the Activities of Students	≥ 65	$67 > 65$	Fulfilled
c.	Student Response			
	- Response to Student Books	≥ 75	$83 > 75$	Fulfilled
	- Response to WORKSHEETs	≥ 75	$92 > 75$	Fulfilled

Based on the results of the analysis of validity, practicality, and effectiveness indicators, it can be concluded that the development of Student Activity Sheets (worksheets) based on the SCP-



SQ-SCS learning model has met all the set quality criteria. In terms of validity, worksheets obtained an average expert validation score of 3.65, exceeding the minimum limit of 2.5, and were therefore declared valid. The practicality of worksheets has also been proven to be fulfilled, with all components, such as syntax, social systems, reaction principles, support systems, and lecturers' ability to manage learning, showing scores above the minimum criteria, which range from 4.3 to 5.0.

From the aspect of effectiveness, worksheets can significantly improve the quality of learning. This can be seen in the average student learning outcomes, which reached 85, with a 100% completion percentage and an increase in N-Gain of 0.7. The effectiveness of learning was also supported by the high level of student activity (79%) and positive responses to teaching materials and learning models, both of which exceeded 75%. Thus, the development of SCP-SQ-SCS-based worksheets is suitable for use in mathematics learning because it has been proven to be valid, practical, and effective in improving student learning outcomes and participation.

The results of the analysis of validity, practicality, and effectiveness aspects show that the development of Student Activity Sheets (worksheets) based on the SCP-SQ-SCS learning model has met all the set quality indicators. Validation by experts yielded an average score of 3.65, which exceeds the minimum threshold of 2.5, indicating that the device has met both theoretical and empirical feasibility criteria. In terms of practicality, observations of learning components, such as syntax, social systems, reaction principles, and support systems, showed achievements above a score of 4.0, indicating that the device is easy to apply in the learning process. These findings are reinforced by the research of Sanjaya and Hidayat (2018), which shows that the development of SSCS model-based devices has been proven to produce a valid and practical product for use in problem-solving-based learning. This is also in line with Nieveen's (1999) opinion, who states that a learning tool can be deemed suitable for use if it meets the elements of validity and practicality.

In terms of effectiveness, SCP-SQ-SCS-based worksheets have been proven to significantly enhance student learning outcomes and activities. This is evidenced by the average student learning outcomes, which reached 85%, and the classical completeness of 100%, as well as an increase in N-Gain of 0.7, which is relatively high. Student activity reached 79%, and their response to the learning tools was very positive. These findings are consistent with the research of Mardiyana, Saputro, and Rosnawati (2017), which demonstrates that the use of the SSCS model in mathematics learning not only enhances conceptual understanding but also fosters students' critical thinking skills and active engagement. Therefore, the development of SCP-SQ-SCS-based worksheets warrants consideration as an innovative alternative for supporting more meaningful, active, and outcome-oriented mathematics learning.





CONCLUSION

The development of the Student Activity Sheet based on the SCP-SQ-SCS learning model has progressed through stages of systematic validation, implementation testing, and effectiveness evaluation. The results of expert validation show that the device meets the validity criteria, with an average value of 3.65. In terms of practicality, all learning components, including syntax, social systems, reaction principles, support systems, and learning management, demonstrated excellent results. Meanwhile, the effectiveness aspect is shown by improving student learning outcomes, active involvement in the learning process, and positive responses to learning tools and models. These findings reinforce that SCP-SQ-SCS-based WORKSHEETS are suitable for use as innovative learning tools that can enhance mathematics learning outcomes.

SUGGESTION

SCP-SQ-SCS-based worksheets that have been proven to be effective and practical should be applied more widely in various mathematics courses or other fields that require problem-solving and active student involvement.

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