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Validity of the *Situntas* Learning Model to Improve Conceptual Understandings

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ABSTRACT

This study aims to describe the validity of the *SITUNTAS* learning model to improve conceptual understanding abut the Group among the students of the Mathematics Education program. This descriptive study involved the students of the department who took the Algebra Structure course. Data were collected using the worksheets for content and construct validity of the learning model. Validation was performed by the experts in the Focused Group Discussion. Data were analyzed using descriptive analysis of percentage. This study found that the content validity score of the model was 91.18% and the construct validity was 87.86%. Both scores are categorized as very valid. In conclusion, the *SITUNTAS* learning model is very valid to improve conceptual understanding of the Group among the students of Mathematics Education, especially in the algebraic structure course.

Keywords
Learning model validity; Improving conceptual understanding

Introduction

Algebraic Structure is a mandatory course in the fifth semester at the Mathematics Education Study Program, Department of Mathematics and Natural Sciences, Faculty of Teacher Training and Education, Universitas Tadaluka. According to the National Standard of Higher Education (SN Dikti) curriculum and The Indonesian National Qualification Framework (KKNI), among the courses learning outcomes (CP-MK) are implementing algebraic concepts and applying logical, critical, systematic, and creative thinking in mathematics education. To reach these objectives, the basic material includes the concept of Group and Subgroup. Abstractness as a manipulation of symbols in the material has made it difficult for the students to comprehend the concept of algebraic structures. This difficulty has resulted in the low grade the students obtained. From the teaching experience in the algebraic structure course in the last five years, the students' grade needs to be improved. The percentage of students who obtained grades below B in 2015 was 85.12%, while in 2016 this was 86.77%, in 2017 this was 75%, and in 2018 and 2019, this was 69% and 45.84%, respectively. From these data, it can be seen that every year the grades of most students remained below B, although the percentage has declined every year.

The errors the students made during the Algebraic Structures exams were mostly in answering questions about the Group [1], for example, errors in translating the abstract symbols, unable to pay attention to the sequence of the concepts, and errors in proving interrelated theorems. This illustrates that conceptual understanding among the students is still low and tends to be limited to memorizing the facts and algorithms. In addition, given with assignment, the students actually can do it well, but when it comes to the exams, most students failed to complete. This means that most students just copy the works of their fellows without understanding the concept. Also, it was found that the students did not take notes on particularly important topics that were being taught. They only duplicated the materials provided by the lecturer and only have a single reference source for the course materials provided by the lecturer. They did not actively search for other sources.

Based on observations and reflections on the researcher's teaching experience during the algebraic structure course, conceptual understanding about the Group among the students of Mathematics Education needs to be improved, as the concept of Group is a fundamental concept in the Algebraic Structures course. Therefore, the researcher wants to improve the conceptual understanding of the students through the following plans: a. Students must present their assignments, by which students will learn the material more comprehensively so that they can anticipate questions from their fellows. Students often give presentations in each course they take so that they should be familiar with this activity; b. Students should actively explore additional literature on the internet and make important notes. These activities are expected to help students understand the concept. Learning activities that offer flexibility for the students in exploring additional sources according to the subject being studied will enrich the information they obtained so that it can broaden students' knowledge. This can in turn improve conceptual understanding skills among the students. Unfortunately, this activity is still only performed by a small group of students; c. Students give grades for assignment presentation of their fellow students. Assessing or giving feedback to their classmates can facilitate them to understand the learning materials because to do so, they need to understand the material more deeply. To conduct this assessment, students feel challenged to apply their understanding to the material at hand. Assessing or providing feedback to their fellow students can also enhance learning collaboration and make the learning process more lively.

Several studies provide empirical support to the three plans. Discussion presentation methods have a positive effect on student's learning outcomes, performances, and participation in the classroom [2, 3]. The implementation of the discussion-presentation method combined with the critical analysis of articles can also improve conceptual understanding, critical thinking skills, and communication on the materials [4]. Presentation is a learning method that aims to disseminate ideas, thoughts, or problems to the public. Students who present their assignments will understand their assignments well, so they can correctly answer questions from their fellows.

The other studies found note-taking improves students' performance in mathematics. Students take notes using the strategy of formatting, revising, and summarizing that enable them to review and link important information together to improve their overall understanding of the material [5]. Using these key strategies can improve students' performance. Some important elements of the note-taking involve finding important ideas from the text, describing and concluding the texts, rewriting ideas, and recording details of bibliographies such as the initials and last names of authors, book titles, journals, publishers, places of publication, journal pages, and the internet or web address. Effective notes facilitate students in memorizing information from the sources that have been read either in preparation for the exams or other needs [6]. Good note-taking practice can lead to efficient learning practices, better learning outcomes, and is used to externally "store" contents of a lesson's conclusion. Note-taking is also very useful for information review. For example, after the lectures, the student can easily recall what he/she has read from the sources to determine learning plans and learn for exam preparation [7, 8].

The teaching and learning process using peer assessment can improve learning outcomes. Peer assessment facilitates students in receiving favorable feedback from their group and serves as a determining factor for the group learning success. Peer assessment can be applied in all areas of learning and will contribute to conceptual understanding [9, 10]. Self-assessment and Peer Assessment (self-assessment and peer assessment) which become the components of the 2013 Curriculum assessment are the most effective assessment techniques for students' character building. The character can have a positive impact, and once the positive personal character is formed, self-actualization and intellectual development (knowledge and skills) will also improve. This principle can be implemented in all areas of learning and will contribute to conceptual understanding of the subject matter.

Based on the description above, the researcher is motivated to improve students' conceptual understanding in the algebraic structure course by developing a learning model namely *SITUNTAS*, which stands for Assignment Presentations, Notes, and Peer Assessment. The concept in the Algebra Structure course to be studied is the concept of Group.

Methods

The type of this study is developmental research because this study examined a new learning model that was developed from the pre-existing learning methods and was packaged in a learning model of Task Presentations, Notes, and Peer Assessment (SITUNTAS Learning Model). The research subjects were students of the Mathematics Education Study Program at the Mathematics and Natural Sciences Education Department of Universitas Tadaluko who registered for the Algebraic Structure course. The research design used refers to the Borg & Gall development research model which consists of three steps, namely: (1) preliminary study, (2) model development, and (3) model test [12].

After the preliminary study was carried out, the subsequent stage is model development, by making an initial draft of the model. The initial draft contains the background and objectives of the learning model developed, as well as the characteristics of the learning model that consist of model syntax, social systems, reaction principles, support systems, instructional impacts, and accompaniment impacts. The initial draft was then validated by some experts. The produced learning model (product) has good quality if it fulfills the requirements of validity, practicality, and effectiveness. A product is said to be valid if its material components are based on state-of-the art knowledge (content validation) and all of its components are consistently related (construct validation) [13]. The validation of the learning model was carried out in a Focused Group Discussion (FGD). The data collection was performed by filling out a validation sheet. The data was the scores with a value of 1 to 5, in a Likert scale, converted to the validation criteria table, and was then converted into qualitative data. The criteria for the validity of the learning model are as follows:

$83\% \leq$ Average values $\leq 100\%$: Very Valid
$67\% \leq$ Average values $< 83\%$: Valid
$51\% \leq$ Average values $< 67\%$: Fairly Valid
$35\% \leq$ Average values $< 51\%$: Invalid
$19\% \leq$ Average values $< 35\%$: Very Invalid

The data analysis was performed using a descriptive analysis technique, by analyzing the scores on the validation sheet against the characteristics of the learning model in the hypothetical initial draft of the model and by considering the recommendation from the validator to enhance the materials.

Results

The validation of the learning model for the Presentation of Assignments, Notes, and Peer Assessment begins with the development stage, namely designing an initial draft of the model, that contains the background, the concepts, and the characteristics of the learning model consisting of syntax, social systems, reaction principles, support systems, instructional impact, and accompaniment impact. The initial draft was then logically validated by six experts of lecturers and 2 lecturers who teach the Algebra Structure course. The

results of the judgment of the validators are presented in Table 1 and 2.

Table 1. The results of content validation of the Assignment Presentation, Notes, and Peer Assessment Learning Model.

No.	Evaluation Aspect	Expert Judgement								Total	%
		I	II	III	IV	V	VI	VII	VIII		
I	***Objective***										
1.	***Rationality of the objective for developing the learning model is clearly conveyed.***	4	5	5	4	4	5	5	4	36	90.00
II	***Theoretical Supports***										
2.	***The SITUNTAS model is consistent with Piaget's cognitive theory.***	4	5	4	5	4	5	5	5	37	92.50
3.	***The SITUNTAS model is in line with Bruner's learning theory.***	4	4	5	5	4	5	4	5	36	90.00
4.	***The SITUNTAS model is in line with Ausubel's learning theory.***	4	4	5	5	4	5	4	5	36	90.00
5.	***The SITUNTAS model conforms with Piaget's constructivism learning theory.***	4	5	5	5	4	5	4	4	36	90.00
6.	***The SITUNTAS model is in line with Vygotsky's constructivism learning theory.***	4	5	5	5	4	5	5	5	38	95.00
III	***Learning Syntax***										
7.	***The learning stages are arranged in a good and clear sequence.***	4	5	5	5	4	4	5	5	37	92.50
8.	***The learning stages are logical and correct.***	4	5	4	4	4	4	5	4	34	85.00
9.	***The learning stages provide clear direction for students' and lecturers' activities.***	4	5	5	5	4	5	5	5	38	95.00
10.	***Details of the learning activities in each stage of the SITUNTAS model reflect the flow of activities to be performed by the lecturers and students.***	4	5	5	5	4	5	5	5	38	95.00
IV	***Social System***										
11.	***Coverage of social system within a series of learning activities.***	4	5	4	4	5	4	5	4	35	87.50
12.	***The potentials for the establishment of a social system in a series of learning activities.***	4	5	5	4	5	5	5	5	38	95.00

13.	***The potentials for implementation of social system in a series of learning activities.***	4	5	5	4	5	5	5	4	37	92.50
V	***Reaction Principle***										
14.	***The reaction principle is covered in a series of learning activities.***	4	4	5	5	4	5	4	5	36	90.00
15.	***The potentials for implementation of reaction principle in a series of learning activities.***	4	4	5	5	4	5	5	5	37	92.50
VI	***Instructional and Accompaniment Impacts***										
16.	***Instructional and accompaniment impacts are covered in a series of learning activities.***	4	4	5	5	4	5	4	5	36	90.00
17.	***The potentials for achieving instructional & accompaniment impacts in a series of learning activities.***	4	4	5	5	4	5	4	5	36	90.00
VII	***Learning Environment***										
18	***Lecturers provide adequate learning resources such as textbooks and assign the students to find out more diverse learning resources.***	4	5	4	4	4	4	5	4	34	85.00
19.	***The relationship pattern between the lecturers and students indicates the role of lecturers as facilitators and mediators.***	4	5	5	5	4	5	5	5	38	95.00
	Total	76	89	91	89	79	91	89	89	76	
	%	80.00	93.68	95.79	93.68	83.16	95.79	93.68	93.68	80.00	
	Mean	91.18	Very Valid								

Table 2. Results of Construct Validation of the Learning Model

No.	**Evaluation Aspects**	**Expert Judgement**								**Total**	**%**
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**		
1.	***Compatibility between the model and objectives.***	4	5	5	4	4	5	4	5	36	90.00
2.	***Congruence between supporting theories and characteristics of the Algebra Structure course, especially the concept of***	4	4	4	4	4	5	4	4	33	82.50

	Group.										
3.	***Internal congruence among each learning phase in the model.***	4	5	5	4	4	5	4	5	36	90.00
4.	***Interrelation between lecturer and student activities in each step of the model.***	4	5	4	5	4	5	4	4	35	87.50
5.	***The learning resources used to reach the objective complement/support each other.***	4	5	5	4	5	5	5	4	37	92.50
6.	***Supportive interaction patterns between the lecturers and students.***	4	5	4	5	4	5	4	4	35	87.50
7.	***The lecturers' actions to improve students' conceptual understanding are reflected in the learning stages.***	4	4	4	5	4	5	4	4	34	85.00
	Total	28	33	31	31	29	35	29	30		
	%	80.00	94.29	88.57	88.57	82.86	100	82.86	85.71		
	Mean	87.86	Very Valid								

The results of validator judgment are presented in Table 1 and Table 2. It can be concluded that the SITUNTAS learning model is compatible for use in classroom learning with small revisions. Recommendations from the validators and the revisions that have been made are presented in Table 3.

Table 3. Results of Construct Validation of the Learning Model

Validator	Recommendation	Revisions
I	Add a description on page 2 of the Model Book, "steps do not have to be sequential" and "should connect new knowledge with the existing knowledge"	According to Piaget, the learning process consists of three steps (these three steps are not necessarily in sequential order), namely assimilation, accommodation, and equilibration [14] Meanwhile, equilibration is the balance between the assimilation and accommodation processes or incorporating new knowledge and existing knowledge.
II and V	The syntax of the initial draft of the model consists of 6 phases. Phases 2 and 3 should be integrated because they are simultaneous.	The syntax of the model is divided into 5 phases, namely: 1) Transition to

		Team, 2) Presentation of Tasks and Notes, 3) Peer Assessment, 4) Feedback and 5) Assignments.
II and III	Add competencies in the accompaniment impact.	Additional accompaniment impacts: - developing critical thinking, - building up self-confidence
	Explain theoretical supports for the model	Additional explanations are listed in the model book in Page 3 and 6.
IV and V	The acronym for the learning model becomes SITUNTAS Learning Model	The SITUNTAS learning model
	In phase 3, in Peer Assessment, explain what aspects will be assessed.	The evaluation components are presentation organization, communication skills, and mastery of the learning materials. The assessment was carried out using a peer assessment sheet.
V	In Phase 4, Feedback, Lecture, and Students Activities need to be elaborated	Lecturers give group exercise to be completed by students
	Performance indicators should be listed in the exercise sheet. The word "example" should be added to Questions no. 3a and 3b	Include indicators on the exercise sheet. An example is not a Group
VI and VII	What groups?	The group consisted of 4-5 students with heterogeneous levels of ability in Math

Based on the research results, the learning model of Assignment Presentation, Notes, and Peer Assessment have been valid, with the following characteristics:

a. Syntax

Syntax of the learning model can be seen in Table 4.

Table 4. Syntax Model of The valid learning model of Assignment Presentation, Notes, and Peer Assessmen

Phases	Activities	
	Lecturers	**Students**
Opening Activities (10 minutes)		
First: Transition to the team	1. Greetings and prayers	1. Responding to greetings.
	2. Preparing students for the lesson.	2. Preparing for the lesson.
	3. Explaining (Sub-Course Learning Outcomes) and learning indicators	3. Listening to the lecturers.
	4. Apperception and motivation, information about the topics through questions answer	4. Questions and answers related to apperception and motivation as well as the topic of study
	5. Directing students to sit in their respective groups that have been made in the previous meeting. Each group consists of 3-5 students with heterogeneous abilities.	5. Sitting with respective group.
	6. Asking each group to appoint a group coordinator voluntarily.	6. Voting for a group leader.
	7. Describing the stages to be performed.	7. Paying attention to lecturer directions.
Core Activities (130 minutes)		
Second: Assignment Presentations and Notes (70 minutes)	8. Giving 5 minutes for each group to prepare to present the group assignment.	8. Rechecking preparation for assignment presentation.
	9. Assigning a group to present their assignment and asking another group to take important notes as well as grading the presentation group.	9. The group presents their assignment.
	10. Asking non-presentation groups to take important notes about the material being presented.	10. Every student takes notes.
	11. Asking each group to discuss grading preparation for the presentation group.	11. Every group discusses grading preparation for the presentation group.
Third: Peer Assessment (20 minutes)	12. Allowing each group to assess the presentation group using the peer assessment sheet. The assessment components are presentation organization,	12. Every group give a grade to the presentation group

Phases	Activities	
	Lecturers	Students
	communication skills, and mastery of subject matter. 13. Monitoring the group and ensuring active participation among the group members.	13. Students work in the group
Fourth: Feedback (40 minutes)	14. Giving group exercises	14. Every group discuss exercise completion
Closure Activities (5 minutes)		
Fifth: Giving assignments	15. Supervising students to conclude the learned materials. 16. Giving group assignments	15. Students conclude learning materials. 16. Receiving group assignments.

b. Social System

The social system in this learning model entails the role of lecturers and student involvement during the learning process according to rules which describe lectures to interactions between lecturers and students as well as the interactions among the students. The prominent social system involves students' active participation in exploring learning materials, making important notes from the materials, preparing for assignment presentations, and conducting peer assessments. These activities will help students understand the concept of Group. The students are free to be creative in preparing presentation materials and making important notes about the materials in their own language. They are also allowed to evaluate presentation assignments of their fellow students.

c. Reaction Principle

The reaction principle of this model warrants the lecturers to direct and put emphasis on the students to be able to find course materials and make important notes from the materials that are read and to prepare for presentation to their friends. In addition, the students will also grade the presentation of the course materials of their fellow students. The lecturers also organize student discussions and monitor students during the working group.

d. Support System

The support system for implementing the SITUNTAS model includes The Indonesian National Qualification Framework (KKNI), Semester Learning Plans (RPS), teaching materials, exercise sheets, and assessment tools.

e. Instructional Impacts

The expected instructional impact from this model is to enhance understanding of the concept of Group among the Mathematics Education students. Indicators of conceptual understanding to be achieved are 1) students can express the concept of Group in their own sentences without altering the essence of the concept; 2) students are able to create examples and non-examples of the concept of Group; 3) students are able to identify the characteristics of the concept of Group.

f. Accompaniment Impacts

The expected accompanying impacts from this model are: 1) students actively search for learning materials via the internet; 2) students are able to re-write the materials that have been read; 3) students get used to reading the materials before attending the class; 4) students become skillful in taking important notes; 5) students are able to record reference sources they obtained, such as author's last name, book title, journal, publisher, publication place, journal page, and the internet or web address; 6) students demonstrate creativity in preparing materials for presentation; 7) students have a sense of responsibility; 8) students show respect to the opinion of their classmate; 9) students are able to communicate effectively; 10) students foster an independent attitude and love to read; 11) students are trained to be critical; 12). students foster their self-confidence; 13) students are able to work together in a group; 14) students are confident in expressing opinions.

Conclusion

The learning model of Assignment Presentation, Notes, and Peer Assessment (SITUNTAS) are valid, with syntactic characteristics (transition to a team, Presentation of Assignments and Notes, Peer Assessment, feedback, and assignments). The other characteristics of the model include social systems, reaction principles, support systems, instructional impacts, and accompaniment impacts. Therefore, the SITUNTAS learning model can be used to improve understanding of the concept of Group among

Mathematics education students, especially in the Algebraic cours

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