PAPER NAME

Suradi_2021_J._Phys.__Conf._Ser._1899_012139 (1).pdf

WORD COUNT	CHARACTER COUNT
2753 Words	**15577 Characters**
PAGE COUNT	FILE SIZE
6 Pages	**760.1KB**
SUBMISSION DATE	REPORT DATE
Jun 26, 2023 5:24 PM GMT+8	**Jun 26, 2023 5:24 PM GMT+8**

17% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

- 17% Internet database
- 2% Publications database

Excluded from Similarity Report

- Crossref database
- Crossref Posted Content database
- Submitted Works database
- Bibliographic material
- Quoted material
- Cited material
- Small Matches (Less then 10 words)

PAPER • OPEN ACCESS

The Effectiveness of the Pipek Model (Concept Map-Based Interactive Learning) in Learning Modern Algebra

To cite this article: Suradi and Nurwati Djam'an 2021 *J. Phys.: Conf. Ser.* **1899** 012139

The Effectiveness of the Pipek Model (Concept Map-Based Interactive Learning) in Learning Modern Algebra

Suradi[1], Nurwati Djam'an[1*]

[1]Mathematics Department, Universitas Negeri Makassar, Indonesia

[*]Email: nurwati_djaman@yahoo.co.id

Abstract. The major objective of this study was to investigate the effectiveness of the PIPEK model in learning modern algebra. This study was to identify the effects of the use of PIPEK model on students' engagement and students' learning in modern algebra course at Mathematics Department in Semester 2, 2020. During this study, the students completed achievement test and questionnaire. The study revealed that, in terms of surface strategy, students tended to memorize formulas and the method for solving problems. Moreover, students still relied heavily on the lecturer's instructions; Particularly, related to the aspects of the attitude, student participant generally found modern algebra as a boring and difficult course. Futhermore, students felt stressed and anxious; The findings related to the behavioral aspect indicated that although student's attention were high, they were not diligent in accomplishing independent work task. The finding also demonstrated that, the level of mastery achievement of student learning outcomes has not achieved classical completeness. However, the PIPEK model has given students the opportunity to engage more in student center learning process.

Keywords: *PIPEK Model, engagement, modern algebra, students' learning*

1. Introduction

Algebraic structure as part of modern algebra is a subject with a strict axiomatic deductive structure. The algebraic structure is full of definitions and theorems so that students in studying them are required to be able to prove theorems, and can take advantage of existing definitions and theorems in solving problems which are generally in the form of proof ([1] ; [2]; [3]; [4] and [5]). Thus, learning algebraic structures by relying on lecturer-centered activities by strengthening memory in memorizing concepts is ineffective. Learning algebraic structures requires student activeness to think, namely mental, physical, and emotional cooperation in capturing, processing, storing, retrieving, transforming information into new structures, and using new knowledge.

Learning modern algebra requires an interactive learning model based on psychological constructs and sociological constructs so that students can interact with each other in solving the algebra problems. One of the models in learning algebraic structures that has been developed by [6] is interactive learning based on concept maps (abbreviated as PIPEK Model). This model is based on the philosophy of cognitivism and constructivism. The focus of learning is not only on what is done (student behavior), but also on what is thought when students do activities. In this study, the model was applied to see its effectiveness in terms of student involvement and achievement in learning modern algebra.

2. Literature Review

Learning mathematics is not just about knowing definitions and theorems to recognize when they are used and applied. [7] states that learning mathematics is like doing mathematics at least in one important way. At each stage of learning mathematics, students have several concepts and methods that they already known and understood. Furthermore, individuals using their mathematical knowledge effectively in various contexts need to have several mathematical competences.

In learning mathematics, student need to know what the object of mathematics is. Begle ([8]) argues that the object of mathematics consists of facts, concepts, operations, and principles. Meanwhile, The two kinds of objects in mathematics, namely direct objects, and indirect objects. Direct objects consist of facts, skills, concepts, and principles. Meanwhile, indirect objects consist of proof of theorem (theorem proving), problem solving (problem solving), transfer of learning, intellectual development (working individually), working in groups. and positive attitudes.

In relation to learning modern algebra, a student will find it easier to learn the material at hand, if the student has understood the prerequisite material [9]. This is necessary because the hierarchy nature of the material in the algebraic structure is strong. Weaknesses over mastering the previous material or prerequisite material will make it difficult to learn the next material. Understanding of prerequisite materials such as binary operations on sets greatly affects the success of students in studying groups. Likewise, if students do not have difficulty in group study, it will be easy for students to learn material about the ring.

In addition, [10] suggests six categories of thought processes known as Bloom's Taxonomy, namely (1) remembering, (2) understanding, (3) using (application), (4) analyzing, (5) synthesizing, and (6) evaluate. For example, a student at one time was asked by his lecturer to mention the definition of a group, because he had memorized the definition of a group so he could speak the definition of a group fluently. In the process of answering, the student uses thinking activities to remember with or without understanding its meaning. If there are other students who try to answer the same question but do not memorize the definitions and only try to express their characteristics in their own sentence structure even though they may not be fluent, then it is said that the student has understood the concept of groups.

From the description above and regarding to the material in the modern algebra, it can be concluded that the ability to think logically is needed in working on proof problems. Thus, the inability of students to think logically, especially in understanding the relationship between premises and conclusions in a proof of problem, will result in the student having difficulty in proving that problem. This will appear in the mistakes that student made in every step of the proof.

Particularly, in this study, modern algebra course was taught through the use of concept maps. The learning process was designed to be attractive so that it allowed students to interact optimally with other students. Students interacted each other so that it was easy for them to absorb the information provided by the lecturer if presented with an interesting concept map. In this study, the PIPEK model was applied in learning modern algebra to assess students' engagement and students' learning.

Engagement is defined as the psychological investment of students in an effort to direct learning, understanding, or mastering knowledge, skills, or crafts that are academically intended to be achieved. Factors that influence student involvement in learning include being according to intrinsic desires, offering a sense of belonging, connecting with the real world, and involving some fun things that are more authentic and more likely to engage students.

According to [11], learning task engagement refers to cognitive criteria, behavioral criteria, and affective criteria. There are several items related to cognitive and affective engagement according to [11], namely: (1) involvement of the cognitive aspects, by asking students to report factors such as attention to impairment, mental effort expended, task persistence in the face of initial failure, and responses during learning; (2) affective engagement, by asking students to rate their interest and emotional reactions to learning tasks on an index such as choice of activities, desire to find out more about a particular topic, and feelings or excitement; (3) involvement behavior, which has a tendency that can be observed and conceptualized in terms of active responses to instructions.

Cognitive engagement is closely related to academic engagement or learning approaches that involve ideas, recognition of the value of learning and the willingness to go beyond minimum requirements [12]. There are three approaches to learning, namely; Surface strategy (closely related to lower levels of learning outcomes - memorization, practice, test handling), in-depth strategy (closely related to higher levels of learning outcomes understanding questions, summarizing what is learned, linking new knowledge to a different way of learning long), and dependence (relying on lecturers). Behavioral involvement is closely related to student participation in class. Active participation in the classroom is indicated by adherence to classroom procedures, taking initiative in groups and classes, being involved in class activities, asking questions, crafting class attendance, and comprehensively completing assignments [11].

Student involvement in learning algebraic structures was investigated based on [11] criteria, namely involvement refers to cognitive criteria, behavioral criteria, and affective criteria by applying the PIPEK model. The syntax of the PIPEK model that was applied consists of 5 (five) phases, namely: (1) phase-1: Apperception; (2) phase-2: learning objectives; (3) phase-3: Organizing students in groups; (4) Phase-4: Creating a Scheme of Evidence; and (5) phase-5: Assessment. The term phase is defined as the steps taken by the lecturer in lectures. Thus, the phase describes a sequence of activities, but specifically for assessment activities, even though it is placed in the fifth (last) phase, it does not mean that the assessment is always carried out at the end of the lecture. Assessment can be done at the beginning, during or at the end of the lecture. Placing the assessment phase as one of the phases in the syntax of the PIPEK model, is intended to show that assessment is an important part of the PIPEK model.

3. Research Method
In this study, the methods used, namely: mixed methods (a combination of quantitative and qualitative methods). The participants were limited to one class of 36 students who took the modern algebra course in the even semester of the 2019/2020 academic year in mathematics education program of FMIPA UNM Makassar.

4. Result and Discussions
The results obtained from action research include that the PIPEK model can be implemented properly, through the following phases.

a. Phase-1 Apperception: the lecturer reminds the material that has been taught previously, by the lecturer asking random questions to students. The answers from students were responded by other students, and finally the lecturer concluded the prerequisite material about the material to be taught at the meeting that day.
b. Phase-2 Learning Objectives: the lecturer conveyed the learning objectives to be achieved at the meeting that day, and briefly delivered material about the concepts in the textbook related to the material to be taught.
c. Phase-3 Organizing Students in Groups: the lecturer divides students into groups (this is attempted by each member of the heterogeneous group in terms of student academic abilities). Then asked to make a concept map of the material in the textbook guided by student worksheets (LKM).
d. Phase-4 Creating a Proof of Scheme: students create a flow of proof based on a concept map that has been made from the proving questions. Based on this scheme, solving problems of proof can be carried out in the following steps.
   (1) Understanding the problem (what is the problem?): Understanding what is known and understanding what will be proved.

(2) Planning the proof (what will be show?): Finding a known relationship with the one to prove, selecting the theorems, or concepts that can be used in the proof.

(3) Carrying out verification: the validity of each step is checked (provide reasons for each step).

(4) Re-checking (evaluation): do the results match? What is known in the problem that everything has been used? And does the theorem or concept used meet the requirements?

e. Phase-5 Assessment: in this phase the lecturer provides an assessment of the student's work, based on the concept map developed and the results of the evidence carried out. In addition, student activities are also assessed in group assignments.

Observations were made during the implementation of the PIPEK model. Based on the data, there was an increasing of percentage of the level of implementation of phases for each cycle, reached 87% in cycle I and 90% in cycle II. The lowest increase occurred in phase 4 which is making a proof scheme. This fact indicated students still have difficulty finding the relationships with those to be proven, choosing theorems, or concepts that can be used in proof. In addition, in carrying out the proof: the validity of each step is not checked by the student (the reason for each step is not given), so it is difficult for the student to check again (evaluation): whether the results match or not, what is known in the problem has all been used or not; and whether the concept used meets the requirements.

The results of qualitative and quantitative data analysis showed that: (1) student involvement from the cognitive aspect indicated that students can write definitions, theorems and other characteristics well. They generally memorized more so that the cognitive strategies used are surface strategies. However, they have not implemented an in-depth strategy, thus dependence on lecturers was still very high. The number of students who achieved very good scores (scores 86-100) reached 58.3%, good scores (scores 76-85) reached 27.8%, and poor scores (scores less than 76) were 13.9%; (2) The aspect of attitude involvement showed that they generally interested in the subject reaching 86.1%. In addition, the achievement orientation was very high about 58.3%, although 83.3% of them stated that the algebraic structure was difficult, boring, anxious, sometimes even frustrated; but (3) the behavioral aspect showed that student attention to lectures was very high, reaching 91.7%. However, their perseverance is still lacking if they get into a difficult problem, student participants did not try hard to solve it.

5. Conclusion

The implementation of the PIPEK model in learning modern algebra can actively involve students in both cognitive, affective, and behavioral aspects. Students can interact dynamically in understanding concepts through the use of concept maps / mind maps. So that the PIPEK model can facilitate changes in teacher-oriented learning patterns (centering on lecturers) to being student oriented (centering on students). Students have been able to determine well what is known, what is being asked / proven, and what will be shown so that the problem is proven. However, the main difficulty faced is carrying out proof, because they have difficulty linking the known concepts with the concepts that will be used in showing the proof.

References

[1] Birkhoff and MacLane. 1979. *Algebra*. The Macmillan Company: New York.
[2] Fraleigh, J.B. 1989. *A First Course in Abstract Algebra.* Addison-Wesley Publising Company: Philipines.
[3] Herstein. 1975. *Topics in Algebra.* John Wiley & Son: New York.
[4] Suradi, Tahmir. 2003. *Teori Grup,* Andira Publisher, Makassar.
[5] Suradi., Nurwati. 2018. Interactive Learning Based on Concept Maps Learning Algebraic Structure. The Third Iternational Conference on Mathematics, Sciences, Technology, Education and Their Application (ICMSTEA), September, 2018.

[6] Minggi, Ilham. 2019. Pengembangan Model Pembelajaran Interaktif Berbasis Peta Konsep dalam Pembelajaran Struktur Aljabar. Laporan Penelitian PNBP: UNM Makassar.
[7] Boaler. 2000. Identity, agency, and knowing in mathematics worlds. In J. Boaler (Ed.), Multiple perspectives on mathematics teaching and learning (pp. 171-200). Westport:CT: Ablex Publishing.
[8] Soedjadi, R. 2000. *Kiat Pendidikan Matematika di Indonesia.* Jakarta: Direktorat Jenderal Pendidikan Tinggi-Departemen Pendidikan Nasional.
[9] Suradi, 2002. Pemanfaatan Peta Konsep dalam Menyelesaikan Soal Pembuktian dalam Teori grup. *Jurnal Buletin Pendidikan Matematika Vol. 4, Nomor 2, Oktober 2002. halaman 112 – 123.* Program Studi Pendidikan Matematika FKIP Universitas Pattimura, Ambon.
[10] Bloom, Benjamin S., Thomas J. Hasting., and George F. Madaus. 1981. *Evaluation to Improve Learning.* New York: McGraw Hill Book Company.
[11] Chapman. 2003. Alternative approaches to assesing student engagement rates. *Practical Assessment, Research & Evaluation,* 8(13).
[12] Attard, C. 2011. The Influence of Teachers on Student Engagement with Mathema-tics during the Middle Years. Retrieved from http://www.merga. net.au/documents/ RP_ATTARD_MERGA34-AAMT.pdf.

17% Overall Similarity

Top sources found in the following databases:

- 17% Internet database
- 2% Publications database

TOP SOURCES

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	download.atlantis-press.com	Internet	6%
2	researchgate.net	Internet	3%
3	eprints.unm.ac.id	Internet	3%
4	oa.las.ac.cn	Internet	2%
5	docksci.com	Internet	<1%
6	nlist.inflibnet.ac.in	Internet	<1%
7	ijmttjournal.org	Internet	<1%
8	eprints.walisongo.ac.id	Internet	<1%
9	iopscience.iop.org	Internet	<1%

10 worldscientific.com <1%

Internet