

Artikel ICRIEMS 2018

by Apriani Maria

Submission date: 25-Jun-2021 01:26PM (UTC+0700)

Submission ID: 1611913590

File name: Artikel_ICRIEMS_2018.pdf (1.28M)

Word count: 9585

Character count: 54595

PROCEEDINGS OF THE 5th INTERNATIONAL CONFERENCE
ON RESEARCH, IMPLEMENTATION AND EDUCATION OF
MATHEMATICS AND SCIENCES (5th ICRIEMS)

Revitalizing Research And Education
On Mathematics And Science For
Innovations And Social Development

Yogyakarta, 7 – 8 May 2018

FMIPA UNIVERSITAS NEGERI YOGYAKARTA

Proceedings of The 5th International Conference On Research, Implementation And Education Of Mathematics And Sciences (5th ICRIMS): Revitalizing Research And Education On Mathematics And Science For Innovations And Social Development

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Published by:

FMIPA Universitas Negeri Yogyakarta
Karangmalang, Yogyakarta 55281
Tel. (0274)550227, Fax. (0274)548203
© October 2018

ISBN 978-602-74529-3-0

Preface

This proceedings is the regular edition (non-Scopus-indexed) of the conference proceedings of the 5th International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS) held by the Faculty of Mathematics and Science, Yogyakarta State University, Indonesia on 7 – 8 May 2017 at Eastparc Hotel Yogyakarta. All papers in this proceeding were obtained from a selection process by a team of reviewers and had already been presented in the conference. Some selected papers from the conference were compiled under separate proceedings and published by Institute of Physics (IoP) which is Scopus-indexed. This proceedings comprises 9 fields, they are mathematics, mathematics education, physics, physics education, chemistry, chemistry education, biology, biology education, and science education.

The theme of this 5th ICRIEMS is '*revitalizing research and education on mathematics and science for innovations and social development*'. This conference presented five keynote speakers, which were Prof. Dr. Fang-Ying Yang (Graduate Institute of Sciences Education, National Taiwan Normal University), Prof. Muammer Calik, Ph.D (Karadeniz Technical University, Turkey), Prof. Ferry Butar Butar, Ph.D. (Department of Mathematics and Statistics, Sam Houston State University, USA), and Prof. Dr. Eng Khairurrijal (Department of Physics, Bandung Institute Technology, Indonesia), and two invited speakers, which were Prof. (Assoc.) Dr. Azmi Mohamed (Department of Chemistry, Universiti Pendidikan Sultan Idris, Malaysia) and Dr. Lilla Adulyasas (Yala Rajabat University, Thailand). Besides the keynote and invited speakers, there were also parallel articles that present the latest research results in the field of mathematics, sciences, and education. These parallel session speakers came from researchers from Indonesia and abroad.

Hopefully, this proceeding may contribute in disseminating research results and studies in the field of mathematics, sciences and education such that they are accessible by many people and useful for the development of our civilization.

Yogyakarta, October 2018

Editorial Team

Forewords From The Head of Committee 2018

Assalamu'alaikum warahmatullahi wabarakatuh.

On behalf of the organising committee of the 5th ICRIEMS, please let me welcome you to Yogyakarta, Indonesia. Nothing is more precious for us, besides enable to fete you all here, in the 5th of the International Conference on Research, Implementation, and Education of Mathematics and Science, that is organized by the Faculty of Mathematics and Science, Yogyakarta State University.

It is not only about the research as well as the papers that will be presented. But it is also about the academic networks, mutual cooperation, and meaningful communications amongst us – the researchers, academics, and educators – those which we are expecting to be built and established, in this conference. We believe that this occasion may lead our commitment to strength our roles together, particularly to achieve the innovation and social development through research and education on mathematics and science, as it is accentuated by the theme of this conference.

We are strongly considered that this conference would not be meaningful without other parties. Therefore, I would like to express my highest appreciation and gratitude to our keynote speakers and invited speakers. They are:

1. Prof. Ferry Butar Butar, Ph.D.,
2. Prof. Muammer Calik, Ph.D.,
3. Prof. Dr. Eng Khairurrijal, M.Si.
4. Prof. Dr. Fang-Ying Yang
5. Prof. Assoc. Dr. Azmi Mohamed
6. Dr. Lilla Adulyasas.

I also would like to address our big thank to our motivated and valuable participants. There are 570 papers will be presented and 2 posters displayed, out of 575 registered participants. A few selected papers would be published in the Scopus-indexed proceeding whilst others will be in either regular proceeding or journals.

We believe that there would be any shortcomings and inconveniences in this conference. Thus, we really apologize. We hope that this conference will be very succesful. Have a nice talk, discussion, and surely enjoy Yogyakarta. Thank you.

Wassalamu'alaikum warahmatullahi wabarakatuh.

Yogyakarta, May 2018

Agung W. Subiantoro

**Forewords From the Dean of Faculty of Mathematics and Sciences,
Universitas Negeri Yogyakarta**

Assalamu'alaikum warahmatullahi wabarakatuh. May peace and God's blessings be upon you all.

On behalf of the Committee, first of all allow me to extend my warmest greeting and welcome to the 5th International Conference on Research, Implementation, and Education of Mathematics and Sciences 2018, organized by Faculty of Mathematics and Natural Sciences (FMNS) Yogyakarta State University.

To celebrate the 54th Anniversary of Yogyakarta State University, our faculty has an opportunity to conduct the 5th ICRIEMS 2018 with the theme of Revitalizing Research and Education on Mathematics and Science for Innovations and Social Development. This conference proudly presents five keynote speeches by five fabulous speakers: Prof. Ferry Butar Butar, Ph.D., Prof. Muammer Calik, Ph.D., Prof. Dr. Eng Khairurrijal, M.Si., and Prof. Dr. Fang-Ying Yang and two invited speakers: Prof. Assoc. Dr. Azmi Mohamed and Dr. Lilla Adulyasas.

The independence of a country is impossible to gain if the education does not become the priority and it is not supported with the development of technology. We all know that the technology development could be achieved if it is supported by the improvement of firm fundamental knowledge. The empowerment of fundamental knowledge could not be separated from research which is related to the development of technology and the learning process in school and universities.

This conference is aimed to pull together researchers, educators, policy makers, and practitioners to share their critical thinking and research outcomes. Therefore, we are able to understand and examine the development of fundamental principle, knowledge, and technology. By perceiving the matters and condition in research and education field of mathematics and sciences, we could take a part in conducting qualified education to reach out the real independence of our nation.

This conference will be far from success and we could not accomplish what we do without the support from various parties. So let me extend my deepest gratitude and highest appreciation to all committee members. I would also like to thank each of participants for attending our conference and bringing your expertise to our gathering. Should you find any inconveniences and shortcomings, please accept my sincere apologies.

Wa'alaikumsalam warahmatullahi wabarakatuh.

Yogyakarta, May 2018

Dr. Hartono

Conference Program

THE 5th INTERNATIONAL CONFERENCE ON RESEARCH, IMPLEMENTATION & EDUCATION OF MATHEMATICS AND SCIENCES (ICRIEMS) 2018 7-8 MAY 2018, HOTEL EASTPARC, YOGYAKARTA, INDONESIA

#DAY 1: MONDAY, 7 MAY 2018

TIME	PROGRAM
07.00 – 08.00 AM	Registration
08.00 – 09.00 AM	Opening Ceremony 1. Opening 2. National Anthem: 3. Traditional Dance: 4. Welcome Speech: Chairman of ICRIEMS 2018 5. Opening Conference by Rector of YSU 6. Photo Session
09.00 – 09.30 AM	Tea/Coffee Break
09.30 – 12.00 PM	Keynote Speech #1 : Prof. Ferry Butar Butar, Ph.D. Keynote Speech #2 : Prof. Dr. Eng Khairurrijal, M.Si
12.00 – 01.00 PM	Lunch Break
01.00 – 05.00 PM	Parallel Sessions & Coffee Break

#DAY 2: TUESDAY, 8 MAY 2018

TIME	PROGRAM
07.00 – 08.00 AM	Registration
08.00 – 09.30 AM	Keynote Speech #3: Prof. Muammer Calik, Ph.D
09.30 – 10.00 AM	Tea/Coffee Break
10.00 – 11.30 AM	Keynote Speech #4: Prof. Dr. Fang-Ying Yang
11.30 AM – 00.30 PM	Lunch Break
00.30 – 04.00 PM	Parallel Sessions & Coffee Break
04.00 – 04.30 PM	Certificate Collection

#DAY 3: WEDNESDAY, 9 MAY 2018

TIME	PROGRAM
07.00 AM – 05.00 PM	City tour

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Students' Skills in Teaching Statistics on the Simulation Process of High School Mathematics Learning Course

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Abstract. In an effort to establish a high quality of education, it is necessary to improve the competence and professionalism of teachers in teaching activities. One of the efforts undertaken by the Mathematics Education Study Program, Sanata Dharma University is to provide courses that assist students in preparing themselves to become a teacher. One of them is Senior High School Mathematics Course. One of learning design in this course is simulation process. Therefore, through this process, researcher wanted to know the skills of the students in teaching Statistics. Because, statistics is one of the subject that they had to teach in school. To get the data of the students' skills in teaching statistics, the researcher used observations guidelines and video learning process. The data were analyzed with descriptive qualitative approach with quantitative assisted. The findings of this research showed that: [1] The lesson opening skill student in statistics learning process was very good. Teacher had ability to engage the students' interested by giving general election of Jakarta's governor problem, and used it for making apperception. [2] The skill of explaining the materials was good. The orientation was appropriate with the purpose. Despite misconception, teacher had a good ability to make the learning process be meaningful and to make the students be active. [3] The lesson closing skill was not good. Most of the time is used up to explain the materials, so that there were not affirmation from the teacher and teacher did not do the reflective activities.

Keywords: Teaching Skills, Statistics

INTRODUCTION

In an effort to establish a high quality of education, it is necessary to improve the competence and professionalism of teachers in teaching activities. Increased competence and professionalism of teachers can start from the institution that prints prospective teachers. Sanata Dharma University in particular Mathematics Education program, is one of the study programs that produce graduate teachers in the field of mathematics. Thus, it is natural that various efforts are made by the Mathematics Study Program to produce competent and professional candidates.

One of the efforts undertaken by the Mathematics Education Study Program is to provide courses that assist students in preparing themselves to become a teacher. Two of them are Micro Teaching and Field Experience Program. Through the courses, students learn directly to play the role of a teacher. Another course that can help students become better prepared to become a teacher is High School Mathematics Learning. This course should be taken by students before they join in micro teaching course. In this course, students learn to deepen the science of mathematics learned in high school, one of them is Statistics, and also learn to teach the material to the students through the simulation process that is done at the end of the lecture.

Through the simulation process, students are prepared in facing micro teaching subjects and expected to be ready to become a teacher. Due to the subject, there is a process whereby the student must learn to deliver the material. Through the results of this study is expected that the lecturers of micro teaching courses get enough information related to the context of students who take the micro teaching course. So that the learning process in micro teaching courses can run more leverage and optimally. More broadly, through this simulation, Mathematics Education Study Program is able to produce competent and professional mathematics teachers.

Based on the background, researcher formulated the research question of this study was as follows "How are the teachers' (students) teaching skills in teaching statistics?"

TEACHING SKILLS

According to Mulyasa (2005: 69) teaching skills was professional competence that was quite complex, as the integration of the various competencies of teachers as a whole and comprehensive. Learning process could run well if the teachers have good enough skills. If the teachers had good enough skills, students could receive and understand the subject well. Because the process of students learnt was caused by learning process that was done by the teacher in classroom. Therefore, teachers' teaching skills was one of requirements that teachers had to have. According to Mulyasa (2005:69) teaching skill had important role in creating a creative, professional, and fun learning. Those were the teaching skills:

1. Lesson opening and closing skills
Teacher had to motivate students; teacher connected the subject that would be learnt with the students' experience; teacher connected between facts, concepts, and principles.
2. Lesson explaining skill
Teacher used the correct language and could be understood by students; had loud voice so that all students in the classroom can hear teacher's voice; gave the appropriate definition.
3. Skill to vary
Teacher used variative media; Teacher used variative methods.
4. Evaluating skills
Formative evaluation; summative evaluation; remedial program.

According to guidebook of micro learning (2012), there were 4 skills that would be explored, those were:

1. Lesson opening and closing skills
Generated the students' attentions and interests; motivated; provided the references; showed the relationship between the materials.
2. Explaining and varying stimulus skills
Orientation; language; illustrations or examples; clear structures; feedbacks; clear voice; orientations; pause; eyes contact; expression; hand gestures; gestures; interaction; conventional or technology media utilization
3. Asking and giving affirmation skills
Gave short and clear questions; used question techniques; gave time for students to think; responded to the questions; gave good questions; verbal affirmations; non-verbal affirmations; affirmation techniques.

On this research, researcher took a look at three skills. Those were lesson opening skill, skill explain the materials, and lesson closing skill.

RESEARCH METHODOLOGY

This research was conducted from August to December 2017 with the number of the subject was one group consist of two students who got statistics as the subject matter that had to be taught in the teaching simulation process. To get the data of the students' Statistics teaching skills, the researcher used observations guidelines and video learning process. The data were analyzed with descriptive qualitative approach with quantitative assisted. It was analyzed using interactive technique (Miles and Huberman, 1984) that consist of three things. Those are data reduction, display the data, and verification.

RESEARCH RESULTS

Before students did simulation, there were some activities in the high school mathematics course that researcher did, those were:

- 1) Before the student performed in the simulation process, the researcher divided the mathematics materials in senior high school.
- 2) Researcher asked the students to observe and interview the students and the mathematics teacher about the difficulties and obstacles faced in studying or teaching the materials.
- 3) The results of the observations and interviews were used by the students as a reference in presenting the material and in preparing the simulation.
- 4) Students learnt to deepen the sub subjects that deemed difficult to teach and learn by teachers and students.
- 5) After they deepened the sub subject then presented it in a material deepening presentation, and then students learnt to transfer the sub subject to students through the simulation process.
- 6) Before they did the simulation, the lecturer explained how they taught from the activities of opening, explaining, and closing lessons.
- 7) Then the students created a learning scenario which was then responded by lecturer.

After students followed the learning process in the High School Mathematics Learning Course, students started their simulation. The following is the description of the learning activities in the simulation process that was done by the students.

1) Lesson Opening Activities

There were activities that teacher did in opening lesson, those were:

- a) Teacher started the learning process with pray
 In the beginning of the lesson, teacher ask the students to pray by saying *"Students before we start the class let us pray. Is there someone want to lead the prayer?"*. After that, teacher checked the students' presence by asking *"Is there someone not present?"*.
- b) Teacher motivated the students by giving the example of the utilization of statistics
 Before the lesson was started, teacher tried to motivate the students by showing the utilization of the statistics in daily life. Using contextual problem, that was general elections of Jakarta's governor, teacher shown the pie diagram of the polling result of the Jakarta's governor candidates. In the video, teacher said *"You can take a look at the slide.this is statistic. This is the diagram of general election of Jakarta's governor. Do you know, what statistics is?"*. Using the general elections, teacher wants to teach the students about the utilization of statistics in politics. The contextual problem also used by the teacher to teach the view of the statistics. He said that statistics was not only about science but it was tools that was used to present the data concisely. Trough statistics students can summarized the data so that they can got the information easily.
- c) Teacher explained the purpose of the lesson
 After showed the utilization of the statistics, teacher also delivered the purpose of the lesson. He said *"Today we will learn about Statistics, have you ever learnt about it? Have you?"*.
- d) Teacher did an apperception
 After the teacher explained the purpose of the learning, teacher continued with a little question, *"Is there someone know, what the definition of statistics is? Anyone knows?"*. Afterwards, teacher gave a chance to students to answer the question. Some students tried to answer the question. One of student said *"Statistics is one of science in mathematics that learn about data collecting methode"*. Teacher confirmed the students' answer, he said that *"Good"*. Thereafter teacher continued by giving other question about statistic, *"How about statistic?"*. Teacher gave an opportunity to students to answer the question, and then teacher gave confirmation to the students' answer.

2) Skill explain the materials

In explaining materials there were some activities that teacher did, those were:

- a) Teacher gave explanation of the materials that would be taught
 In the explaining materials activities, teacher started with this statement *"Today I will explain one part of statistics. We know central measurements, and I am sure you definitely know and remember about central mesurements. What are they?".* Students said *"Mean, median, mode."*. Teacher said *"Good."*.
- b) Teacher explained the definition of the central measurments
 Because the students had already gotten Statistics in junior high school, then teacher asked the definition of the three kinds of central measurement. The first central measurement was mean. Teacher asked *"Is there someone know what mean is? Please raise your hand."*. Students said *"the total of data divided by the number of students."*. Teacher gave an opportunity to students to answer and then gave a confirmation *"Right, mean of the set of data that later we will use in our discussion.How about mode? Is there someone know?"*. The next definition was mode. Teacher asked to the students what mode is. One of the students answered *"Mode is the most frequently occur?"*. Teacher confirmed *"Good, Mode is the most frequently occuring value with the greatest frequency. And then the third, what median is?"*. After confirmed the definition of mode to students, teacher asked the definition of median. And then student answered *"Middle"*. Other student gave another answer, that is *"Median is the value in the middle after being sorted"*.
- c) Teacher explained the suitbale of the utilization of the central measurements using students' data
 After asked about the definition of central of measurements, teacher explained what the suitable data for the three kinds of central measurements by saying *"That's right, I will give you a little concept about the difference between mean, median and mode. Besides using quantitative data, I will explain the concept using data from the member of group discussion. Are there students want to come forward for being volunteer? I need 6 students."*. Teacher asked six students to come forward, and collect sex data from them to explain the concept by saying *"I will explain about the utilization of central measurements based on the data of the group discussion member. In the front, we already have a group discussion that consist of 3 females and 3 males."*. Teacher asked other students to find the suitable of the central

measurements for the data. There were students that found the mean, median and mode. The students were asked to criticize which central measurements value that can represent the sex data. After gave a chance to analyze which values that suitable for the data, teacher made a clarification what the suitable central measurements is by explaining the the meaning of the values.

- d) Teacher gave an explanation what kind of data that suitable to be found the mean, median, and mode
 Teacher gave a confirmation about the data that suitable to be found the mean and median, ***"Yes, so mean and median are most suitable for quantitative data. Any question?"***.
 - e) Teacher gave students chance to ask
 After gave a confirmation, teacher gave a opportunity to students to ask. In the video, one of student asked about mode. She asked what the mode is, if the data had same frequency. The teacher said that the sum of the modes are same. But the teacher looked not sure with his answer.
- 3) Lesson Closing Activities
 There were some activities that teacher did in closing lesson, those were:
- a) Teacher gave homework for students
 Teacher gave homework for the students before finished the lesson, ***"We still have 3 more exercises and I will use it as your homework."***.
 - b) Teacher closed the learning process by using the student to lead the pray
 To close the lesson, teacher asked one of student to lead the pray, ***"To finished our class, please Risti leads the prayer."***.

Based on the description of the learning activities in the simulation process, researcher got the results of this research, those were:

- a. The Results of Students' Teaching Skills Qualitatively
 - 1) Lesson opening skill
 Based on the learning process video and the observation, there were the findings of the student's lesson opening skill in teaching Statistics:
 - a) Teacher opened the lesson well by asking student to lead the pray
 - b) Teacher was able to motivate the students by giving a contextual problem to explain the utilization of statistics. The contextual problem that was used by teacher was the general elections of Jakarta's governor.
 - c) Teacher tried to engage the students' interested in the lesson by showing the utilization of statistics in politics.
 - d) Teacher was able to make apperception in the lesson opening by asking the students about statistics, statistic, and diagram that were learnt in the previous meeting.
 - e) Teacher did not forget to introduce the purpose of the learning process. But the purpose was very general.
 - 2) Skill explain the materials
 - a) Teacher was able to design the learning steps well according to the level of student ability;
 - b) Teacher was able to choose the appropriate example and use students' data to explain the materials. In this learning process, teacher used students' sex data to explain the suitable of the utilization of the central measurements;
 - c) Teacher involved students in the learning process. It can be seen from the opportunity that teacher given for students to try to answer the teacher's question. Besides, to find the data, teacher used students' data by asking some students to come forward and other students to note the data from the students;
 - d) In the explanation, teacher gave some chances to students for asking some materials that they did not know;
 - e) Teacher made misconception regarding mode. Through the video, teacher was not sure with his answer and he was not ready with unpredictable question from students.
 - 3) Lesson closing skill
 - a) Teacher did not have enough time to make conclusion because the time was up. It shows that teacher can't manage the time well;
 - b) Teacher gave homework in the end of the learning process. It means that teacher tried to push the students study besides in the school.
- b. The Results of Students' Teaching Skills Quantitatively
 - 1) Lesson opening skill

The lesson opening skill quantitatively as follows:

TABLE 1 Lesson Opening Skill

Indicators	Score
Greetings, prayers, and presences	4
Arouse students' attention and interest	4
Generate motivation	4
Tell the learning purpose	2
Do apperception	4
Total	19
Percentage Score	$\frac{19}{20} \times 100\% = 95\%$
Category	Very good

2) Skill explain the materials

The materials explanation skill quantitatively as follows:

TABLE 2 Skill Explain the Materials

Indicators	Score
Orientation	4
a. The purpose of the learning	
b. Explain the materials that will teach	
Language	3
a. Use the correct language	
b. Simple and clear	
c. The structure is correct	
Example/illustration	4
a. Quite a lot	
b. Concrete and appropriate	
Voice	3
a. Volume dan rhythm	
b. Articulation and intonation	
Mastery of matter	2
a. No misconception	
b. Not depend on book	
The use of propos in accordance with the concept	1
Appearance	2
a. Neat	
b. Authoritative	
Class Management	3
a. Manage time efficiently	
b. Manage class well	
Show other sources that can be learnt	1
Total	23
Percentage Score	$\frac{23}{36} \times 100\% = 63.9\%$
Category	Good

3) Lesson closing skill

The lesson closing skill quantitatively as follows:

TABLE 3 Lesson Closing Skill

Indicators	Value
Summarize the lesson	2
Do reflection	2
Closing (Greetings, pray)	2
Total	6
Percentage Score	$\frac{6}{12} \times 100\% = 50\%$
Category	Not Good

CONCLUSIONS

There are some conclusions about student's statistics teaching skill that can be drawn from the the simulation process on high school math learning course, those are as follows:

1. As quantitatively lesson opening skill student in statistics learning process is very good. Student has ability to engage the students' interested by giving contextual problem, that is general election of Jakarta's governor, and use it for making apperception about the function of statistics in daily life and about the definitions of statistics and statistic.
2. As quantitatively the skill of explaining the materials is good. The orientation of the teacher in learning is appropriate with the purpose. Despite misconception, teacher has a good ability to make the learning process be meaningful. Teacher utilizes the data that it is obtained from students. The data is used to teach the concept of central measurements in the data. Through this activities, students be active and they are directly involve in the learning process.
3. As quantitatively the lesson closing skill is not good. It is due to lack of time to close the learning process. Most of the time is used up to explain the materials, so the teacher cannot conclude the learning activities and reflexes the learning process that has been done.

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