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Proceeding

"Revitalizing Research And Education On Mathematics and Science for Innovations And Social Development"

5th ICRIEMS

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"Revitalizing Research And Education On Mathematics and Science for Innovations and Social Development"

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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 ICRIEMS): Revitalizing Research And Education On Mathematics And Science For Innovations And Social Development

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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

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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

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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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The Students' and Teacher Reflection for Introduction Probability Theory Course at 2016

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Abstract. One of purposes of this study was describing the students' and teacher reflection after they followed the introduction probability theory course for five years. In this paper, the researcher only will present about the students' and teacher reflection for the first year at 2016. The teaching and learning process in this course used the reflective pedagogical paradigm (RPP) that could be divided into five stages, namely (1) students' contexts, (2) students' learning experiences, (3) students' actions, (4) students' reflection and (5) students' evaluation. The type of research used in this research was descriptive qualitative research. The students' and teacher reflection would be described qualitatively. The research subjects in this study were one teacher and 34 students. From the students' reflection, the following results were obtained: (1) from this course they learnt three things, i.e. competence, conscience, and compassion development, and (2) 32 students said that through this course (a) they were helped to build enthusiasm attitude in learning mathematics, and (b) they were encouraged to be more concerned with other students. From the lecturer's reflection, the following results were obtained: (1) students' critical attitude was built through questions that must be answered by the students, (2) students' awareness of other students can be built through assignment, and (3) the lecture's feedback will make students encouraged and eager in learning.

Keywords: reflective pedagogy paradigm (RPP), and reflection.

INTRODUCTION

The introduction probability course is one of the mathematics subjects that which must be taken by students in Mathematics Education in the third semester. This course aimed to assist students to reinvent the probability basic concepts, and to apply these concepts to solve probabilistic problems. This subject was important for them, as it contained a provision for them to develop teaching and learning process about probability theory for senior high school students and / or vocational school students, and a pre-requisite knowledge for the Elementary Statistics course, the Statistical Methods and Practical Methods of Statistics course. The nature of this course is mandatory to pass. It means that if a student wants to pass from this course, then he or she should get minimum C for this course.

From the experience of previous years, there were still many students who have difficulty to understand the material from this course. The most difficulties experienced by students were a horizontal mathematizing process, i.e. the translating process from the daily problems to the appropriate mathematical symbol. In general, if a student has been able to translate the word problems into mathematical symbols, then the student would be able to solve the problem. The difficulties faced by the students had a bad impact, i.e. the low graduation rate.

The research was planned by researcher for two big cyclus in two academic years, i.e. 2016/2017 and 2017/2018. The results discussed in this paper were limited to the results achieved in the 2016/2017 academic year or in 2016. There were three questions that would be answered by the researcher in this paper, namely:

1. What steps developed by the teacher to reflect the students' experience?
2. What were the students' reflection and the teacher' reflection after they followed a teaching and learning process by using RPP?
3. What was the teacher' reflection after he managed a teaching and learning process by using RPP?

REFLECTIVE PEDAGOGICAL PARADIGM (RPP)

According to Komunitas Studi dan Pengembang Paradigma Pedagogi Reflektif (PPR) Yogyakarta, pedagogy was the efforts made by teachers in assisting students in their growth and development [1]. Pedagogy was closely related to the beliefs and vision of teachers about a personal ideal figure to be formed through a teaching and learning process. According to Father Arrupe, the aim of Jesuit education was to form men and women for others [1]. Father Kolvenbach, formulated in more detail that the purpose of education of the Jesuits was to form leaders of ministry, men and women who were competent in their fields, have a conscience that was true, and has a compassion that grew out of love to others [1]. To achieve all core values, the Jesuit's university to seek other forms of assistance for students called *cura personalis* approach which means caring for each individual must be consistent with the character and potential of each individual [2].

There were five educational principles in the RPP, namely [2, 3]:

1. Context
   According Preis and Stauder, the context was the things that the teacher need to know about their learners [2]. In preparing the teaching and learning process with the RPP, a teacher needed to recognize with the context of their students, include: the context of individual students, the initial concept and knowledge of the students, the context of the economic, social, political, cultural, and media, the college environment, and educational context in Indonesia [1, 3]. Why recognize the initial concept and knowledge of the students was important for a teacher? According Skemp, a scheme had three functions: (1) integrate existing knowledge; (2) a tool for learning; and (3) make someone understand something [4]. Therefore, if a teacher knew about the initial concept and knowledge of their students, then the teacher was expected to create appropriate learning path for their students, and plan the appropriate scaffolding for their students.
2. Experience
   On the experience elements, the teacher need to create situations that could make the students to gather and remember their experience. These experience used by them to sift the facts, feelings, values, understanding, and intuition that knew by them and to make a connection with what they were learning [2]. According to Preis and Stauder, the experience was the best effort that could be done by the teacher in using all the students' potential to achieve the learning objectives [2].
3. Reflection
   In the reflection element, students were helped to dig their experiences owned by the students in-depth and extensive, and to take the meaning for their personal life, and others [4]. In the reflection, memory, understanding, imagination and feeling were used to grasp the basic meaning and values from the material being studied by them [1]. According to Preis and Stauder, a reflection was the efforts done by the teacher that made their learners to explore their experiences in greater depth [2].
4. Action
   In the action element, students were helped to do good actions which were at the mind level or the physical activity level after they reflected on their learning experience [2]. According to Paul, an action might be a changing attitude that was better than before, and a real action which was directed out of themselves that could be seen and felt by others [3]. According Preis and Stauder, the action was the effort made by the teacher encouraged their students to move from knowledge into a concrete action [2].
5. Evaluation
   The evaluation element could help the teacher to understand that the element of experience, reflection, and action has been available well in the teaching learning process or not. The purpose of the evaluation was to look thoroughly whether the learning process with the RPP has occurred or not and whether the learning process could help students to develop their competence, conscience, and compassion for others or not. The evaluation was also to see whether the scaffolding provided by the teacher during the learning could develop the students or not [3]. According Preis and Stauder, evaluation was an attempt used by the teacher to assess the learners progress in competence, conscience, and compassion for others [2].

RESEARCH METHODOLOGY

In a qualitative study, researchers sought to describe a phenomenon that occurs in a natural situation and not make a quantification of the phenomenon [5, 6]. This research was classified in qualitative research, because in this study the researchers sought to describe a phenomenon that occurs in a natural situation and not make a quantification of the phenomenon. The natural phenomenon that seeks described in this study was the student learning experiences, and the actions performed by students. The study also the quantitative research, because in this study, the researcher quantified the results achieved by the students in the reflection and evaluation process.

According to Miles and Huberman, there were three steps to analysis the qualitative data, namely: (1) data reduction, (2) data presentation, and (3) making conclusion and data verification [6]. In this study, the researcher used data analysis steps developed by Miles and Huberman to analyze qualitative data obtained by the researcher in this study.

The subject of this research was all the students taking the Introduction Probability Theory course on Class C at Sanata Dharma University and the lecture who taught this class. The researcher chose this class because the researcher taught this class. There were 38 students who were the subject of this research consisted of seven men and 31 women. The research instrument used to get data about the students' reflection was an open questionnaire that gave to students after the finished the course. The research instrument used to get data about the teacher's reflection was a teacher's journal.

The study consisted of three cycles. Each cycle consists of five main elements, namely context, experience, action, reflection, and evaluation. The learning process in the first cycle talked about the counting principle, permutation and combination, the problems relating to the counting principle, permutation and combination, experiment, sample space and events, the notion of the probability of the event and the definition of the axiomatic probability, the probability properties, independent and conditional events, and the conditional probability. The learning process in the second cycle talked about random variables. The learning process in the third cycle talked about the binomial distribution, the Poisson distribution, and the normal distribution. In every cycles, the learning model that used in this research was Realistics Mathematics Education. In this paper, the researcher would only be limited exposure about the reflection process that occurred at the end of the third cycle.

RESULTS AND DISCUSSION

After the lecture has finished, the students were asked to fill in the reflection sheet. The reflection sheet was intended to capture the impact of lectures on the development of students' knowledge and personality. There were six reflection questions asked by the lecturer to students, namely:

1. What do you get after you take this course?
2. Is it through this lecture that you are helped in building enthusiasm in learning math? If your answer is yes, what activities or experiences does that attitude build? Explain!
3. Is it through this lecture that you are assisted in building accuracy in doing something? If your answer is yes, what activities or experiences does that attitude build? Explain!
4. What attitude or spirit can you build after attending this lecture? What activities or experiences does that attitude build? Explain!
5. Is it through this lecture that you are helped to be more concerned with fellow students who attend this lecture or other fellow students who do not attend this course? If your answer is yes, what activity or experience is that concern for the fellow being built? Explain!
6. What is the good thing or good practice that you get after following this lecture?

There were 34 of 38 students who filled the reflection sheet given by the lecturer. The results of the student reflection were presented as follows

1. What do you get after you take this course?
   a. Competence aspects, i.e. the addition and multiplication rule, combination, permutation, the probability definition, the conditional probability definition, random variable, discrete and continuous random variables, binomial distribution, Poisson distribution, normal distribution, and how to use the table.
   b. Conscience aspects, namely accuracy. diligence, patience, using time to do things that were productive, students become more understanding what it means to maximize effort, learn to achieve what it means 3 credits, more thorough in solving problems, experiencing the development of the usually only memorize now become more understanding what I do, dare to try, not shy to ask if I have questions, understand how to teach mathematics well, understand how to learn well, and understand how to behave as a good teacher.
   c. Compassion aspects, i.e. cooperation with friends in solving difficult problems.
2. Is it through this lecture that you are helped in building enthusiasm in learning math? If your answer is yes, what activities or experiences does that attitude build? Explain!

   There were 32 of 34 students who said yes. One student said no more, and one student did not answer this question.

   For a student who said no more, his reason was that this student was always waiting for who was asked by the lecturer to advance to the blackboard to do the task given by the lecturer. This student was rarely appointed lecturer, so this student feel enthusiasm in learning only woke up a little through this course.

   According to the students, the attitude of enthusiasm in learning mathematics was built through the following activities or experiences:

a. When a student can finish a probability problem. Because before this lecture, I had the difficulty to solve a probability problem. This makes me lazy to learn a probability theory. Since attending this lecture I became more enthusiastic because the lecturer patiently accompanied the students. This made me more motivated to learn math.
b. At the time I did the simulation with dice and currency. Because this activity gives me an idea of how to use the probability theory in daily life and make students not bored in following the lecture.
c. Task or homework assigned by the lecturer, and discussion of assignments or homework. This forced me to learn and made me have a habit of doing assignments or homework not out of necessity.
d. Guidance from lecturers when I have difficulties.
e. The exercise and homework problems were challenging and different from the questions already given. This made me challenged to solve these problems.
f. Lecturer teaching methods that force students to be active. He often give assignments and point at random students who have to do the task on the board.
g. In this lecture, I started to build myself-esteem by the way I want to solve the questions given by the lecturer on the board; if there was something I did not understand, I want to ask; I was not ashamed to admit mistakes if I made a mistake; and I got positive feedback from lecturers.
h. I learned from a friend who was more understanding and willing to teach me. I did this, because I want to be able and not to be left far from friends.
i. When I was answering problems from lecturers.
j. I get guidance from lecturers when I was wrong or not yet able to work on the questions given by lecturers. This prompted me to solve the problem until I got the right process.
k. Group activities, because of this activity, I got the opportunity to share about the material and how to do a problem.
l. Because of this course, I have to change my learning patterns. In the class, I recorded the important points, and then at home I rewrite the notes.
m. The difficult lecture material forced me to be more active in learning and doing my homework.
n. The problems given to us by the lecture made us able to see clearly how mathematics closely with daily life.

3. Is it through this lecture that you are assisted in building accuracy in doing something? If your answer is yes, what activities or experiences does that attitude build? Explain!
   All the students said yes.
   According to students, the attitude of thoroughness in doing something is built through the following activities or experiences:
   a. The problems given by the lecturer vary greatly. This makes the student must be careful in solving it.
   b. Practice a lot of daily life problem.
   c. The lecturer always discussed every task, homework, and exam. It could help me measure my level of thoroughness.
   d. I often compare my work with friends. It made us able to criticize each other.
   e. The exercise or homework assigned by lecturers were numerous.
   f. The moment the lecturer asked me to look back at my work. Because the lecturer always walk around to pay attention to the student's work when students were asked to solve a problem.
   g. Every problem given by the lecturer, the level of difficulty was always tiered.
4. What attitude or spirit can you build after attending this lecture? What activities or experiences does that attitude build? Explain!
   The attitudes and passion that students could build in this course that related with him self or her self were as follows: thoroughness, diligence, patience, perseverance, the spirit of doing the task, present in each lecture, the optimistic attitude, the willingness to try, the spirit in learning, the spirit of being responsible person, spirit to do something earnestly, attitudes to accept the results achieved with a broad chest, attitudes to accept a task not a burden, enthusiastic to ask friends and lecturers, not shy to ask questions, not afraid to be asked to explain the completion of tasks that I make, not easy to despair, always struggling in improving ability, curiosity, sharing, critical, focused in doing something, and the spirit to analyze the problems given by the lecturer.
   The attitude and spirit that students could build in this lecture related to relationships with others were as follows: the spirit of cooperation with others in learning, respect for others, and sharing knowledge to friends in need,
5. Is it through this lecture that you are helped to be more concerned with fellow students who attend this lecture or other fellow students who do not attend this course? If your answer is yes, what activity or experience is that concern for the fellow being built? Explain!

There were 32 of 34 students who said yes. One student said no, and one student said it was normal. A student who answered no, no gave further explanation.

For a student who said normal, he explained if there were friends who ask me, I will give an answer as best. But sometimes I did not understand about the material that my friend asked to me. Because I think the materials in this lecture were complicated.

According to the students, caring attitude towards fellow students who attended this lecture or any other students who did not attend this course could be built through the following activities: helping friends who have not understood the course material, lend a note to a friend. help friends who have difficulty, when there were friends who ask, when there were friends who do not understand and ask for explanations from me, learn and do joint tasks, and through workmanship and homework assignments.

6. What is the good thing or good practice that you get after following this lecture?

The good thing or good practices that students got after they follow this course were as follows: enthusiasm and passion in attending the course, spirit of sharing, spirit of helping friends, caring for others, meticulous in analyzing, the spirit in solving problems and practice questions, want to try to practice, diligent, careful, maximal in everything, honest in everything, patience, sharing knowledge, learning optimistic, effort to be selfless, dare to try, not shy ask, trying to eliminate fear, more open with friends , humble or not arrogant, changing patterns of learning, learning from mistakes, taking decisions, asking questions, and arguing, preparing for college, critical thinking, being responsible, and many opportunities to work together in groups.

After the lecturer completes the learning process, the lecturer reflected the learning process that has occurred during one semester. The result of reflection from the lecturer is as follows

1. If students were given the opportunity to study independently and given guidance when students did it, then students could learn more than what was expected by the lecturer.
2. Student's critical attitude could be constructed through questions on exercise, homework, or exam questions that students must solve, especially questions with the question why and the word of command was explained.
3. Student awareness of other students who attend this lecture could be built through the provision of practice questions, homework, papers, and presentation.
4. Feedback either in oral or written form to the completion of exercise, homework, and exam questions will make the students excited and enthusiastic in completing the task, eager to follow the lecture, and eager to learn.
5. Students need "greetings" from lecturers. There were various simple "greetings" forms that we could do in classroom learning: (1) asking students to go ahead, and write down and explain their problem answer, (2) when the student had difficulty to solve a problem, the lecturer accompanied the student with guidance questions, and lecturers did not give negative expression, (3) the lecturer walk around when he explained a material or even when students did the exercises, and (4) there were greetings from lecturers for students who were not present in previous lectures.

CONCLUSIONS

From the description above, there are several things that can be inferred from the reflections of students and lecturers, namely:

1. There are three aspects that students acquire after they followed this course, namely competence, conscience, and compassion.
2. 32 of 34 students said that through the learning process in this lecture, they were helped to build enthusiasm in learning mathematics.
3. All students say that their accuracy in doing something was built through the learning process in this lecture.
4. 32 of 34 students said that through the activities in this lecture, they were helped to care more with each other.
5. Students' critical attitude was built through questions that must be answered by the students.
6. Students' awareness of other students can be built through assignment.
7. The lecture’s feedback will make students encouraged and eager in learning.

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Certificate

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This is to certify that

Hongki Julie

has participated in

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as a

Presenter

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Dean,

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Yogyakarta, May 8, 2018
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