Conference Proceedings
(Regular Edition)

4th INTERNATIONAL CONFERENCE ON RESEARCH, IMPLEMENTATION AND EDUCATION OF MATHEMATICS AND SCIENCE (4th ICRIEMS)
Yogyakarta, 14 – 16 May 2017

Research And Education For Developing Scientific Attitude In Sciences And Mathematics

Faculty of Mathematics and Science
Yogyakarta State University
Preface

This is the regular edition (non-Scopus-indexed) of the proceedings of the 4th 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 14 – 16 May 2017. All of the papers in this proceeding are 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 the American Institute of Physics (AIP). This proceedings comprises 9 fields, that is mathematics, mathematics education, physics, physics education, chemistry, chemistry education, biology, biology education, and science education.

The theme of this 4th ICRIEMS is ‘Research And Education For Developing Scientific Attitude In Sciences And Mathematics’. The main articles in this conference are given by six keynote speakers, which are Dr. Jean W.H. Yong (University of Western Australia & Curtin University), Assoc. Prof. Khajornsak Buaraphan, Ph.D. (Mahidol University, Thailand), Prof. Maitree Inprasitha, Ph.D. (Khon Kaen University, Thailand), Prof. Dr. Zuhdan Kun Prasetyo, M.Ed. (Yogyakarta State University, Indonesia), Dr. Liem Peng Hong (NAIS Co. Inc., Japan), and Assoc. Prof. Dr. Nor Azowa Ibrahim (Universiti Putra Malaysia). Besides the keynote and invited speakers, there are also parallel articles that present the latest research results in the field of mathematics and sciences, and the education. These parallel session speakers come from researchers from Indonesia and abroad.

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

Yogyakarta, June 2017

Editorial Team
Forewords by Head of Committee of the 4th ICRIEMS 2017

Assalamu’alaikum warahmatullahi wabarakatuh

May peace and God’s blessings be upon you all

First of all, on behalf of the organizing committee of the 4th ICRIEMS let me welcome you to Yogyakarta State University, Indonesia. This International Conference on Research, Implementation, and Education of Mathematics and Science which is organized by the Faculty of Mathematics and Science is dedicated to the 53rd anniversary of Yogyakarta State University. The theme of this conference is “Research and Education for Developing Scientific Attitude in Science and Mathematics”.

This conference facilitates academics, researchers and educators to publish and disseminate their research findings in the fields of pure, application and education of Science and Mathematics. We hope that this conference enable us to establish and maintain cooperation, communication, and networking among academics, researchers and educators in the levels of both national and international.

The success of this conference depends not only on the committee but also on the other parties. Therefore, in this occasion I would like to express my highest appreciation and gratitude to the following keynote speakers and invited speakers.

Keynote speakers:

1. Dr. Jean WH Yong - University of Western Australia & Curtin University (Biology);
2. Assoc. Prof. Khajornsak Buaraphan, Ph.D. - Mahidol University, Thailand (Science);
3. Assistant Prof. Maitree Inprasitha, Ph.D. - Khon Kaen University, Thailand (Mathematics Education);
4. Prof. Dr. Zuhdan Kun Prasetyo, M.Ed. - Yogyakarta State University, Indonesia (Physics Education);
5. Dr. Liem Peng Hong - Nippon Advanced Information Service (NAIS Co.,Inc), Japan (Physics);
6. Associate Professor Dr. Nor Azowa Ibrahim - Universiti Putra Malaysia, Serdang (Chemistry)

Invited speakers:

1. Prof. Muthuraaman (Madras University, India)
2. Prof. Pipat Chooto (PSU Thailand)
3. Dr. Azlan Kamari (UPSI Malaysia)
4. Beni Setiawan, M.Pd. (UNESA)

5. Prof. Dr. Abdullah Dolah Dalee (Yala Rajabhat University, Thailand)

6. Prof. Dr. Eddy Hermawan (LAPAN Indonesia)

7. Dr. Hongki Julie (USD Yogyakarta)

Furthermore, allow me to inform you that the number of papers to be presented in this conference is about 304 papers out of 400 applicants from six countries, i.e. Australia, Indonesia, India, Japan, Malaysia, and Thailand. There are more or less 130 selected papers will be published by AIP Publisher which is Scopus Indexed. The rest of the papers will be published on selected DOAJ Journals and Regular ICRIEMS Proceeding. Therefore, we address very big appreciation and many thanks to all presenters and participants who have been actively involved in this seminar. Without your participation, we – the committee – are nothing.

Finally, I would like to say thank you very much to all members of the committee who have been working very hard since November last year in order to ensure the success of this conference. However, nothing is perfect, of course except the God, so if you find any shortcomings and inconveniences in this conference, we really apologize, indeed. We hope that this conference will be very succesful. Have a nice conference and enjoy Yogyakarta

Thank you very much.

Wassalamu’alaikum warahmatullahi wabarakatuh.

Yogyakarta, May 2017

Drs. Joko Sudomo, MA
Forewords by Dean of Faculty of Mathematics and Sciences
Yogyakarta State University

Assalamu’alaikum warahmatullahi wabarakatuh

May peace and God’s blessings be upon you all.

On behalf of the Organizing Committee, first of all allow me to extend my warmest greeting and welcome to the 4th International Conference on Research, Implementation, and Education of Mathematics and Sciences 2017, held in Yogyakarta State University, one of the qualified education universities in Indonesia.

To celebrate the 53rd Anniversary of Yogyakarta State University, our faculty, has an opportunity to conduct the 4th ICRIEMS 2017 with the theme of Research and Education for Developing Scientific Attitude in Sciences and Mathematics. This conference proudly presents six keynote speeches by six fabulous speakers: Dr. Jean WH Yong, Assoc. Prof. Khajornsak Buaraphan, Ph.D., Assistant Prof. Maitree Inprasitha, Ph.D., Prof. Dr. Zuhdan Kun Prasetyo, M.Ed., Dr. Liem Peng Hong, and Associate Professor Dr. Nor Azowa Ibrahim.

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.

To conclude, let me wish you a fruitful discussion and a very pleasant stay in Yogyakarta.

Wa’alaikumsalam warahmatullahi wabarakatuh

Yogyakarta, May 2017

Dr. Hartono
Forewords by Rector of Yogyakarta State University

Assalamu’alaikum warahmatullah wabarakatuh.

May peace and God’s blessings be upon all of us.

Education is in Indonesia has long been an object of criticism. Mathematics and Science Education, in particular, has been considered pretty low in terms of international ranks. In reports released by Program for International Student Assessment (PISA), for example, the students’ mathematics achievement were very low, that was rank 66 of 72 countries in 2015. Although it improved when compared to the rank released in 2012 – rank 71 of 72 countries, it is still far behind the other countries, even from Thailand (56), Malaysia (45), Vietnam (22), and Singapore (1). Science is not much better when referring to PISA report. Indonesian students Science achievement was only slightly better than that of Mathematics. In addition, many students consider Mathematics and Science among the most difficult and scary school subjects. Many students feel depressed because they have Math in the schedule, or would rather escape, when it is possible.

Such a condition is not ideal and should be a significant consideration for Mathematics and science teachers, lecturers and researchers to devote more works to improve the quality of not only students’ mathematics achievement, but also leaning processes. It is through The 4th International Conference on Research, Implementation and Education of Mathematics and Science (4th ICRIEMS), that we expect to find solution to the problems. The 4th ICRIEM brings together teachers, lecturers, researchers, and practitioners in Mathematics and Science Education to sit together, discuss, and share their experiences, research findings, and ideas to make better practices and innovations in Mathematics and Science Education, and thus improve students learning and achievement.

Yogyakarta State University (Universitas Negeri Yogyakarta), with its new leaderships, has high commitment and is highly determined to promote research and publications among the university members to help improve the quality of Mathematics and Science learning in particular, and the quality of education in general. Furthermore, with the commitment to lead to the World Class University, Universitas Negeri Yogyakarta strive to increase its impact on the education worldwide, by promoting research and publications to journals with international reputation. In addition, Universitas Negeri Yogyakarta with its new leaderships has launched a commitment to a transformative leadership by promoting transparency, participation, and collegiality. With this commitment, it is expected that Universitas Negeri Yogyakarta can contribute better in improving the educational system in particular, and the society in general.

Finally, appreciation and gratitude are for those who have been working hard to make this conference possible. I also hope that this conference be one of the conferences that really contribute to the upbringing of the scientific life.

Wassalamu’alaikum warrahmatullah wabarakatuh.
Yogyakarta, 15 May 2017

Prof. Dr. Sutrisna Wibawa, M. Pd.