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PROCEEDINGS

INTERNATIONAL CONFERENCE ON MATHEMATICS, SCIENCE, TECHNOLOGY, EDUCATION AND THEIR APPLICATIONS

Makassar, August 20-21, 2014

ICMSTEA 2014

State University of Makassar

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"Recent Research and Issues on Mathematics, Science, Technology, Education and their Applications"

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Conference Proceeding

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Faculty of Mathematics and Science

State University of Makassar

ICMSTEA 2014: RECENT RESEARCH AND ISSUES ON MATHEMATICS, SCIENCE, TECHNOLOGY, EDUCATION AND THEIR APPLICATIONS

Forewords from the Head of Committee

Assalamu'alaikumWarahmatullahiWabarakatuh.
Good morning and may God's blessings be upon us all.

Your Excellency the Rector of State University of Makassar (UNM) Prof. Dr. H. Arismunandar, M.Pd. Ladies and gentlemen, on behalf of the conference committee, first, I would like to give our welcome to all the delegates, keynote speakers, invited speakers, parallel speakers and participants coming today. Welcome to the conference, welcome to State University of Makassar, and welcome to Makassar.

This conference entitled "*International Conference on Recent Research and Issues in Mathematics, Sciences, Technology, Education and Their Applications (ICMSTEA) 2014".* It is assigned to celebrate the 53rd commemoration of State University of Makassar. The conference is organized by the Faculty of Mathematics and Science in conjunction with several committee members from other faculties within State University of Makassar.

Ladies and gentlemen, the conference proudly invites eleven keynote speakers coming from several countries. Therefore, I would like to express my sincere thanks to the keynote speakers, including:

1. Professor Max Warshauer (Texas State University, USA)
2. Professor Naoki Sato (Kyoto University, Japan)
3. Professor Peter Hubber (Deakin University, Australia)
4. Professor Susie Groves (Deakin University, Australia)
5. Dr. Frans Van Galen (Utrecht University, Netherlands)
6. Professor DuangjaiNacapricha (Mahidol University, Thailand)
7. Professor Baharuddinbin Aris (Universiti Teknologi Malaysia, Malaysia)
8. Professor SuratmanWoroSuprodjo (Gadjah Mada University, Indonesia)
9. Professor Ismail bin Kailani (UniversitiTeknologi Malaysia, Malaysia)
10. Professor Muhammad ArifTiro (State University of Makassar)
11. Dr. SitiNuramaliatiPrijono (the Indonesian Institute of Sciences)

I would like also to give sincere thanks and gratitude to the invited speakers, including:

1. Prof. Dr. H. Arismunandar, M.Pd. (State University of Makassar)
2. Prof. Kristian H. Sugiyarto, Ph.D (State University of Yogyakarta)
3. Prof. Dr. Sutarto Hadi (Lambung Mangkurat University)
4. Dr. Nurdin Noni, M.Hum (State University of Makassar)
5. Dr. Yuni Sri Rahayu, M.Si. (State University of Surabaya)
6. Dr. Ayuddin M.T. (State University of Gorontalo)
7. Dr. Usman Pagalay (State Islamic University of Malang)
8. Dr. Suyanta, M.Si. (State University of Yogyakarta)
9. Dr. Elisa Sesa, M.Sc. (Tadulako University, Palu)

Next, I want to thanks and welcome to 149 parallel speakers and totally, 450 participants approximately are registered to participate from many universities in Indonesia from Aceh to Papua, and other countries. All of them have shared their research and theoretical papers presented and discussed in the conference.

In this occasion, I would like to thanks Deputy of Governor of South Sulawesi Province (Ir. H. Agus Arifin Nu'mang, M.Si), Mayor of Makassar City (Ir. H. Ramdhan Dhany Pomanto), Rector of UNM (Prof. Dr. H. Arismunandar, M.Pd.), and Director of Post Graduate Program of UNM (Prof. H. Jasruddin Daud Malago), who are very kind to be the host of welcoming dinner and lunch during the conference.

I want to thanks also to Kalla Group, KIA Kalla, Erlangga Press, Opti Lab, and e-Bimbel Yogyakarta for their contribution as the sponsors of this conference.

Finally,it is my privilege to thanks all organizing committee members who have been showing good work and determination for the accomplishment of this conference. I would like to apologize to all of you when there are some inconvenience things during the implementation of this conference.

Thank you and wish you have a meaningful conference.

Assalamu'alaikumWarahmatullahiWabarakatuh.

Head of Committee,

SuwardiAnnas, Ph.D.

Forewords from the Dean ofFaculty of Mathematics and Science, State University of Makassar

Bismillahirrahmanirrahim
Assalamu'alaikumWarahmatullahiWabarakatuh

First of all, let us praise to the Almighty, Allah SWT, because of his Blessings and Helps, we are able to gather here to attend the International Conference on Recent Research and Issues in Mathematics, Sciences, Technology, Education and Their Applications (ICMSTEA) 2014.

The development of education and technology in recent decades grows very rapidly. In addition, they have been specialized into many specific topics. Indeed, for researchers and lecturers, being qualified of a specific field as well as being aware of the contemporary development of other fields are two crucial things. One of the reasons why we undertake the conference is to fulfill those two things. By attending the conference, researchers and lecturers have a good opportunity to share their research findings and to obtain broader descriptions of the development of other general knowledge.

We convey our deep appreciation and gratitude to all of the committees that work from the beginning to support and organize the conference. We also strongly expect the participants of the conference to be continually productive, increase the capacity in conducting a research, and carry out both national and international scientific publications.

Finally, let me again recite thank you to the all participants of the conference who are receptive to spend their time to be present and entirely involved at this events. I wish the conference advantageous for all of us.
Billahitaufiqwalhidayah,

Wassalamu'alaikumWarahmatullahi Wabarakatuh.

Dean of Faculty of Mathematics and Science
State University of Makassar

Prof. Dr. H. HamzahUpu, M.Ed.

Forewords from Rector of UNM

Bismillahirrahmanirrahim
Assalamu'alaikumWarahmatullahiWabarakatuh

Your respectable, the high officials of State University of Makassar, the committee, the speakers, and the participants of conference.

It gives me a great pleasure to extend to you all a very warm welcome, especially to our keynote speakers who have accepted our invitation to attend the conference.
It is an opportune time to convey to you that UNM is celebrating the 53rd Dies Natalis and it commends the faculty of Mathematics and Science (FMIPA) to be in charge of all activity sequences in the Dies Natalis. However, the support of other faculties is also really influential and gives valuable contribution to the success of the event.

In that celebration, we undertake several agendas including educational and sport activities. The conference, ICMSTEA, is one of our educational activities that covers a wide range of very interesting items relating to mathematics, sciences, education, technology and their applications.

By taking participation of this seminar, it is highly expected to all of us to share our research findings to society and continuously develop new ideas and knowledge. Those things are two significant steps in improving the quality of nations around the world, increasing our familiarity to each other, and even avoiding underdevelopment.

On this good occasion, let me quote what Obama said about the education related to this conference and I wish fruitful for all of us:

Every single one of you has something you're good at. Every single one of you has something to offer. And you have a responsibility to yourself to discover what that is. That is the opportunity an education can provide.

Furthermore, I would like to take this opportunity to express my heartfelt gratitude to all organizing committee especially for the Faculty of Mathematics and Science that primarily hosts this conference particularly and other Dies Natalis events generally.

Finally, this is a great time for me to declare the official opening of the International Conference on Recent Research and Issues in Mathematics, Sciences, Technology, Education and Their Applications (ICMSTEA) 2014.

I wish you a very enjoyable stay in Makassar, I warmly welcome you again, as in Makassar, we say "salamakkibatturimangkasara".

Wassalamu'alaikumwarahmatullahiwabarakatuh.

Rector of State University of Makassar

Prof. Dr. H. Arismunandar, M.Pd.

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IS REFORMING SCHOOL MATHEMATICS CURRICULUM URGENT IN INDONESIA?

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Abstract

The reformed curriculum for school mathematics in Indonesia has been implemented on a massive scale and it has invited various criticisms. The critics focus mainly on the three reasons for the reform. Firstly, it is believed that the 2004 Curriculum is outdated. Secondly, the reformers say that it could not be implemented effectively by teachers. The third reason is that it has failed to raise the rank of Indonesian students in international assessment programs. In the new curriculum, teachers are given the instructional package complete and ready to implement in the classroom. The development of syllabi and lesson plans is no longer fully assigned to the teachers. With fewer burdens, they are expected to focus on teaching practice and ensuring that the instructional objectives are achieved by their students. With this policy, the teacher empowerment is in question. It has been warned not to treat teachers as mere executors of prescribed syllabi, thus inevitably limiting their chance to innovate. This paper will examine the reasons for the reform and argue about the importance of continuing professional development in order to produce competent teachers.

Keywords: Curriculum reform, school mathematics, continuous professional development.

1. Introduction

The reformed curriculum for school mathematics in Indonesia has been implemented on a massive scale and it has invited various criticisms. The critics focus mainly on the reasons for the reform which have been expressed by the representatives of the government. The Ministry of Education and Culture give three main reasons for reforming the mathematics curriculum yet again. Firstly, they believe that the 2004 Curriculum is outdated. Secondly, they say that it could not be implemented effectively by teachers. Their third reason is that it has failed to raise the rank of Indonesian students in international assessment programs. This essay will examine these reasons. It will then argue that the government must focus its attention on conducting continuing professional development in order to produce competent teachers rather than reform the curriculum through the preparation of ready-to-use instructional packages.

The government has taken a considerably greater portion in the development of the 2013 Curriculum than it did in that of the 2004 Curriculum. In the new curriculum, the development team gives the teachers the instructional package complete and ready to implement in the classroom (Kasim, 2013, p. 45). Thus, the development of syllabi and lesson plans is no longer fully assigned to the teachers. By significantly lessening their burden as regards preparation of the courseware, it is expected that the teachers will focus on teaching practice and ensure that the instructional objectives are achieved by their students. With this policy, the empowerment of the teachers is in question. Regarding teacher empowerment, Laukkanen (2008, p. 319) warns us not to treat teachers as mere executors of prescribed syllabi, thus inevitably limiting their chance to innovate.

2. An Outdated Curriculum

It has been argued that the 2004 Curriculum is already out of date. According to the government representatives, this curriculum will not be able to fulfill the demands of society resulting from the changes which have taken place during the past decade. They claim that its contents are irrelevant to the current circumstances in Indonesia. Therefore, they say, this curriculum must be reformed as today's citizens will need new competencies which are not accommodated by it. According to Kasim (2013, p. 27), a new curriculum is needed which aims at producing Indonesian citizens who are productive, creative, innovative, and caring through strengthening attitude, skills, and knowledge in an integrated manner. In addition to these, the qualities of being communicative, thinking clearly and critically, being morally aware, tolerant of differences and able to live in the global community, to name just a few, should characterize Indonesian citizens who will be educated using the new curriculum (Kasim, 2013, p. 11).

However, the government seems to exaggerate its arguments. Regarding the age of a curriculum, ten years definitely does not matter. Indeed, there is no evidence that the 2004 Curriculum was projected to be implemented for only ten years. Moreover, the length of the implementation period depends mostly on the quality of a curriculum, not merely on its age. The Principles and Standards for School Mathematics (NCTM, 2000) in the US are an excellent curriculum example, which are still being used now after having been implemented for around 14 years. In fact, they were taken as an influencing example when the 2004 Curriculum was developed. Therefore, the government should not be trapped in a traditional tendency to reform the curriculum every ten years. The other reason given, i.e. the absence of several qualities in the previous curriculum, lacks justification, because a careful scrutiny of it reveals that actually it does not lack the qualities and noble mission mentioned earlier. Moreover, it is surprising that the government should suddenly take this so-called lack to be a drawback of the curriculum because, previously, most curriculum stakeholders had agreed that it was not necessary for such competencies and mission to be stated explicitly either in the curriculum texts or in instructional packages. Indeed, the curriculum assumed that they were set as implicit 'nurturant effects' (Vora, 2006, p. 112), meaning that they were achieved by students through experiencing the instructional activities. They are not to be taught; rather, they must be exemplified by the teachers in their daily activities in the school; also they must be embodied in the teaching and learning processes which were experienced by the students. Unfortunately, in implementing the previous curriculum the teachers had failed to interpret and transfer the curriculum mission and qualities into real instructional practices, and it was clearly due to incompetence on the part of the teachers.

3. Teachers' Failure

Teachers' failure to implement the 2004 Curriculum is given as another argument for reforming it. The curriculum specified 'standard competencies and 'basic competencies' nationally as ultimate learning goals to be achieved by students in all levels of school. To ensure that the students succeeded in achieving the prescribed objectives, the teachers were assigned to develop their own syllabi, lesson plans and learning resources appropriate to the context of their students' life. According to Poedjinoegroho (2013), the great amount of autonomy given to teachers to develop a school-based curriculum has turned out to be counterproductive as teachers apparently failed to do this. The government does realize that the teachers' failure in the

previous curriculum was mainly due to their low capacity of pedagogy and knowledge of mathematics. In fact, the results of the online teacher competence tests focusing on both theory of pedagogy and mathematics contents administered by the Ministry of Education and Culture in 2012 revealed that certified mathematics teachers of junior secondary schools could only attain the low average score of 51 out of 100, and those of senior secondary schools attained an even lower average score of 42 of 90 (Gultom, 2012). Generally, it means that they could answer only around 50% of the question items correctly. To end the story, instead of addressing the problems of teacher quality, the government's response was to produce a new curriculum as a ready-to-use package providing teachers with only very limited autonomy to develop their own.

However, the response is not unproblematic. For one, it is contrary to the spirit of a democratic education system where teachers are greatly empowered to ensure the attainment of instructional objectives and, at the same time, achieve job satisfaction as a professional. For this matter, Hargreaves, Lieberman, Fullan, and Hopkins (2010, p. xv) remind us that the most successful countries in the sector of education did not employ full top-down control, but allowed their fully competent teachers to be more flexible and innovative in the instructional process. Related to this warning, instead of changing the curriculum, a more rational and empowering action should be to focus on continuously improving the quality of the teachers so that they are capable of implementing it. McKinsey and Company (2007, p. 13) strongly believe that improvement of the quality of education as indicated by improved instructional outcomes absolutely requires competent teachers. Mentioning Finland as an example, Darling-Hammond (2009, p.19) points out that to produce highly competent teachers needs an investment in teacher training; if this is done, then schools can be given more autonomy to decide the contents and the teaching methods appropriate for their students. Another problem is that the current curriculum reform functions to "reverse the effects of the earlier policy" (Laukkanen, 2008, p. 319). The Indonesian government has actually invested a considerable part of its budget to train school mathematics teachers to be professionals with wider curricular authority. Moreover, to improve the teachers' professionalism, it has been implementing the teacher certification program. Unfortunately, the certification which cost around Rp60 trillion (Kamdi, 2010) in the period of 2006-2010 only resulted in the fact, as mentioned by Widiyanto (2011), that the certified teachers do not perform better than the uncertified ones. Thus, there is a huge question about the quality of training the teachers have received.

4. Curriculum Failure

Proponents of the reform have judged the previous curriculum a failure. It has not succeeded in educating Indonesian students to be internationally competitive. The critics point out that in the Programme for International Students Assessment 2012, Indonesian students' literacy in mathematics ranked the second lowest out of 65 participating countries (OECD, 2013, p. 19). Similarly, the results of the Trend in International Mathematics and Science Study 2011 showed that Indonesia ranked 38th out of 45 participating countries (Mullis, Martin, Foy, & Arora, 2012, p. 42). They attributed this failure to the curriculum, saying that it neither teaches mathematics literacy nor prepares students to be cognitively competent in mathematics. Further, the government claims that the curriculum was not compatible with PISA standards, and therefore, additional competencies should be put in the new curriculum. Kasim

(2013, p. 3) believes that by teaching the same standardized PISA contents, Indonesian students can reach the same performance level as their counterparts in well-performing countries, such as Taiwan. The problem of low ranks of Indonesia, however, does not relate mainly to the contents as the curriculum certainly deals with mathematics literacy. Authorities, such as Kasim (2013), seem to ignore the aspect of how the contents are taught by teachers of what qualities. Darling-Hammond (2009) contends that the contents of a curriculum can actually be modified to suit the students' needs by teachers who are highly trained. Taiwan is an example where teachers teach contents which are compatible to PISA and set in learning activities matching PISA's mathematical cycle (Lee, 2013). Quoting a study in Boston, McKinsey and Company (2007, p. 12) find that "students placed with high-performing teachers will progress three times as fast as those placed with low-performing teachers." Thus, when we aim at trying to improve students' performance, once again, quality teachers are a much more decisive factor than curriculum contents.

5. Continuous Professional Development

Apparently, the reasons for reforming the curriculum all converge into the problem of the teachers' quality. Therefore, instead of reforming the curriculum, the government must focus on improving the quality of the mathematics teachers. Daniel Rosyid, an expert in education, clearly states that Indonesia is currently in need of teacher reform, not curriculum reform (Ya'kub, 2013). The best way of achieving this reform is by conducting continuous professional development programs. The programs must ensure that all the components of supervision, mentoring, evaluation and monitoring function effectively and efficiently. They must aim at producing professional, experienced, and highly trained teachers who are able not only to creatively cope with any curriculum initiative but also to develop their own curriculum. The teachers must be constantly empowered through a sustainable system of training with long term objectives. The government has several exemplary models of professional development programs which have been successfully implemented in Indonesia such as the "Decentralized Basic Education 2" program funded by USAID (Jalal et al, 2009, p. 29).

Training a huge number of teachers requires a huge budget. However, with the commitment of the government to utilize some portion of the national budget allocated for the Ministry of Education and Culture, such an endeavour is affordable. Moreover, teachers can contribute financially to their own training; as for teachers who have been certified, a certain percentage of their certification salary should be used to improve their professionalism. In the long run, given the benefit the teachers gain from the continuous professional development, Darling-Hammond (2009, p. 24) assures us that they will eventually regard it as their "right rather than an obligation."

6. Conclusion

In a nutshell, the results of the international assessments should not outweigh the results of the teachers' competency test. The other point is that the curriculum contents should not be blamed for the students' low achievement. Becoming mathematically literate and competent is not about the subject contents we learn; it is about the way we learn and transform the knowledge into a form that can effectively solve real life non-routine problems. Teacher capacity improvement must be prioritized first. If the teachers are not trained appropriately to perform their assignments more professionally, we might be disappointed by similar poor results

from our students in international assessment programs in the next decade.

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