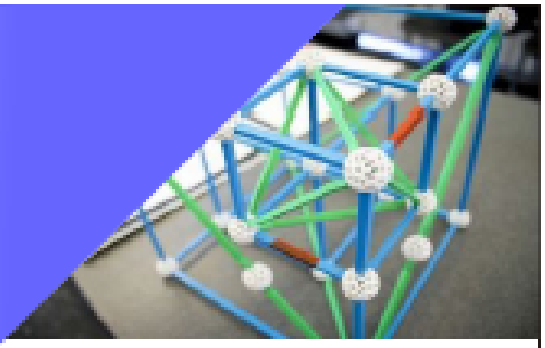
Proceeding



"Recent innovative issues and findings on the development and the education of mathematics and science"

2nd ICRIEMS

The 2nd International Conference on Research, Implementation and Education of Mathematics and Science

17 - 19 May 2015
Yogyakarta State University

ISBN 978-979-96880-8-8

Conference Proceedings

2nd INTERNATIONAL CONFERENCE ON RESEARCH, IMPLEMENTATION AND EDUCATION OF MATHEMATICS AND SCIENCE (2nd ICRIEMS)

Yogyakarta, 17 – 19 May 2015

ISBN 978-979-96880-8-8

Recent Innovative Issues and Findings
on The Development and The Education
of Mathematics and Science

Faculty of Mathematics and Science
Yogyakarta State University

2nd ICRIEMS : Recent Innovative Issues and Findings on The Development and The Education of Mathematics and Science

- Mathematics & Mathematics Education
- Physics & Physics Education
- Chemistry & Chemistry Education
- Biology & Biology Education
- Science Education

Published by:
Faculty of Mathematics and Science
Yogyakarta State University
Karangmalang, Yogyakarta 55281
Telp. (0274)550227, Fax. (0274)548203

Board of Reviewer

Preface

Bless upon God Almighty such that this proceeding of 2nd International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS) may be compiled according to the schedule provided by the organizing committee. All of the articles in this proceeding are obtained by selection process by the reviewer team and have already been presented in the conference on 17 – 19 May 2015 in the Faculty of Mathematics and Science, Yogyakarta State University. This proceeding comprises nine fields, these are mathematics, mathematics education, physics, physics education, chemistry, chemistry education, biology, biology education, and science education.

The theme of this 2nd ICRIEMS is '*Recent Innovative Issues and Findings on The Development and The Education of Mathematics and Science*'. The main articles in this conference are written by seven keynote speakers, which are Prof. David F. Treagust (Curtin University, Australia), Prof. Slava Kalyuga (University of New South Wales, Australia), Prof. Dr. Sopia binti Md Yassin (Universiti Pendidikan Sultan Idris, Malaysia), Susanne W. Brahmia, Ph.D. (Rutgers University, USA), Dr. Norjan Yusof (Universiti Pendidikan Sultan Idris, Malaysia), Prof. Dr. Supriadi Rustad, M.Si (Directorate General of Higher Education, Indonesia) and Prof. A.K. Prodjosantoso, Ph. D. (Yogyakarta State University, Indonesia). Besides the keynote speakers, there are also regular articles presenting the latest research results in the field of mathematics and sciences, and the education in the parallel sessions. These regular speakers are academics, researchers, teachers and practitioners from various places in Indonesia and abroad, including Australia, Malaysia and Thailand.

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 future development.

Yogyakarta, May 2015

The Editor Team

Forewords From The Head Of Committee

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

This conference entitled International Conference on Research, Implementation, and Education of Mathematics and Science (ICRIEMS) 2015 is organized by the Faculty of Mathematics and Science, State University of Yogyakarta. This is the second time that our Faculty is proudly holding an international conference, where this year's theme is "Recent innovative issues and findings on the development and the education of mathematics and sciences". This conference is also dedicated to the 51st anniversary of Yogyakarta State University.

This conference facilitates academics, researchers and teachers from two areas, mathematics and science which may be classified into physics, chemistry and biology. Innovative issues and findings are emerging from time to time, especially in the field of mathematics, science, and the education. It is through education that these developments may be understood and implemented. Hence, it is therefore necessary for us to follow come together and discuss these exciting recent developments of mathematics, science, and the education through this conference.

On behalf of the organizing committee of this conference, I would like to express my highest appreciation and gratitude to the keynote speakers from Australia, the USA, Malaysia and Indonesia. They and the keynote title are:
From educational field:

1. Prof. Slava Kalyuga (School of Education, University of New South Wales, Sydney, Australia), "Cognitive load issues in teaching and learning mathematics"
2. Prof. David Treagust (School of Science, Curtin University, Perth, Australia), "The development and use of diagnostic instruments for assessing students' chemistry knowledge and understanding"
3. Prof. Dr. Sopia binti Md Yassin (Department of Science Education, Universiti Pendidikan Sultan Idris, Malaysia), "Teaching Science And Mathematics In English (TeSME): The Malaysian CLIL Experience"
4. Suzanne W. Brahmia, Ph.D (Rutgers University, New Jersey, US), "Developing expert mathematization of physics in the introductory course: an impedance mismatch"
5. Prof. Dr. Supriadi Rustad (Directorate General of Higher Education, Department of Research, Technology and Higher Education), "Current reform and research in higher education in Indonesia"

From basic knowledge field:

1. Prof. AK. Prodjosantoso, Ph.D. (Department of Chemistry Education, Yogyakarta State University, Indonesia), "The chemistry of heavy metals immobilisation in Portland Cement"

2. Dr. Norjan Yusof (Department of Biology, Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris, Malaysia), "Pollution and management of landfill leachate".

Furthermore, I would also like to express my appreciation to about 180 regular presenters who have travelled from Australia, China, Malaysia, Thailand, Sumatera, Kalimantan, Sulawesi, Papua, Bali and many places in Java and Yogyakarta to attend this conference. Slightly more than 30 per cent of the presenters are from mathematics education and around 20 per cent are from mathematics. About 16 per cent of the presenters deliver findings on chemistry and the education, and about 14 per cent on physics and the education. The other 20 per cent presents biology, biology education and general science education. We do hope this conference will bear fruitful results and promote networking and future collaborations for all participants from diverse background of expertise, institutions, and countries to promote science, mathematics, and the education.

Finally, I would like to extend my highest appreciation to the organizing committee who has been working very hardly since a half of a year ago to ensure the success of the conference. However, should you find any shortcomings and inconveniences, please accept my apologies.

Hope all participants have a very good moment during the conference and enjoy the city of Yogyakarta, the city of education, cultural and tourism. Thank you very much.

Wassalamu'alaikum warrahmatullah wabarakatuh. May peace and God's blessings be upon you all.

Yogyakarta, 17 May 2015

Endah Retnowati, Ph.D.

Forewords From The Dean Of Faculty Of Mathematics And Science, Yogyakarta State University

Assalamu'alaikum warahmatullahi wabarakatuh. My greetings for all of you. May peace and God's blessings be upon us all.

On behalf of the Organizing Committee, first of all allow me to extend my warmest greeting and welcome to the International Conference on Research, Implementation, and Education of Mathematics and Sciences, the second to be held by the Faculty of Mathematics and Science, State University of Yogyakarta, one of the excellent and qualified education universities in Indonesia. This conference is also celebrate the 51th Anniversary of State University of Yogyakarta.

This conference proudly presents keynote speeches by seven excellent academics, these are: Prof. Dr. Supriadi Rustad, Prof. Slava Kalyuga, Prof. A. K. Prodjosantoso, Dr. Norjan Yusof, Prof. Dr. Sopia Binti Md Yasin, Prof. David F. Treagust, and Dr. Suzanne W. Brahmia, and around 180 reguler speakers.

The advancement of a nation will be achieved if education becomes a priority and firmly supported by the development of technology. Furthermore, the development of technology could be obtained if it is supported by the improvement of basic knowledge such as mathematics, physics, chemistry, and biology. The empowerment of this fundamental knowledge may be achieved by conducting research which is then implemented in developing the technology and the learning process in schools and universities.

This international conference is aimed to gather researchers, educators, policy makers, and practitioners to share their critical thinking and research outcomes. Moreover, through this conference it is expected that we keep updated with new knowledge upon recent innovative issues and findings on the development and the education of mathematics and science, which is in accord with the theme of the conference this year. All material of the conference which are compiled in the abstract book and proceedings can be useful for our reference in the near future.

This conference will be far from success and could not be accomplished without the support from various parties. So let me extend my deepest gratitude and highest appreciation to all committee members who have done an excellent job in organizing this conference. I would also like to thank each of the participants for attending our conference and bringing with you your expertise to our gathering. Should you find any inconveniences and shortcomings, please accept our sincere apologies.

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

Wa'alaikumsalam warahmatullahi wabarakatuh

Yogyakarta, 17 May 2015
Dean Faculty of Mathematics and Science
Yogyakarta State University

Dr. Hartono

Forewords From The Rector Of Yogyakarta State University

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

First of all, allow me to express my great thanks to God, Allah SWT, who gives us health and opportunity, so that we can join this very important conference, may Allah always bless us. It is a great honor and pleasure for me to welcome you all to the 2nd International Conference on Research, Implementation and Education of Mathematics and Science. Educational Research and Innovation (ICRIEMS) organized by the Faculty of Mathematics and Science, Yogyakarta State University in Yogyakarta, Indonesia. On behalf of the university and the committee, let me extend my warmest greetings and appreciation to all speakers and participants who have travelled hundreds or even thousands of miles by various transportation means to come to Yogyakarta to attend this conference.

It is indeed a privilege for Yogyakarta State University to have the opportunity to organise this very important conference in which educational researchers and practitioners on mathematics and science and the education, to get together to share ideas, experiences, expectations, and research findings. This conference is held as one of the activities, in the agenda of Yogyakarta State University to celebrate its 51st anniversary.

Research is one of the activities among the academic members of a university. It is a systematic effort to solve the problems or answer the questions by collecting data, formulating the generalities based on the data, then finding and developing organized knowledge by scientific method. It is expected that from research activities, valuable empirical facts can be obtained to improve and develop the theory and practice to bring a better quality of education.

Mathematics and science have been seen as important knowledge to be acquired by our children since it could assist them solving daily life problems. Efforts to improve the quality of teaching of mathematics and science must be continuously supported to produce new innovations, high-quality research and practice. In responding to this, the conference has taken a theme namely "Recent innovative issues and findings on the development and the education of mathematics and science". Participants, either speakers or non-speakers, in this conference are highly encouraged to discuss not only the recent findings of instructional theory or practice, but also new findings of basic knowledge of mathematics and science that may be useful to be applied in our life.

It is expected that this conference provides researchers, teachers, lecturers, education practitioners, college students, and policy makers the opportunity to share

their knowledge, experiences, and research findings which are innovative and relevant to develop the educational practices focusing on the process and product. Eventually, this conference is aimed to facilitate academics, researchers and teachers to yield some recommendations on the importance of education and development of mathematics and science based on empirical proofs which bring the benefits of the prosperity of all.

This international conference will not be what it is without the cooperation and support rendered by the whole committee whose names I will impossibly mention one by one. Therefore, I would like to take the opportunity to extend my highest appreciation and sincerest gratitude to especially the Dean of Faculty of Mathematics and Science. I would also like to thank the organizing committee for their commitment and hard work. Only with their support will this international conference certainly reach its declared objectives successfully. Yogyakarta State University has done its best to make this conference a big success. However, should you find any shortcomings and inconveniences, please accept my apologies.

To conclude, let me wish you all a productive conference and enjoyable stay here in Yogyakarta State University. Also I wish you all great success and this international conference will bring us fruitful benefits in education. Thank you very much. Wassalamu'alaikum warahmatullah wabarakatuh. May peace and God's blessings be upon you all.

Yogyakarta, 17 May 2015
Rector,

Prof. Dr. Rochmat Wahab, M.Pd., M.A.

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SE -3

AN EVALUATION OF A MICRO TEACHING SUBJECT OF PHYSICS EDUCATION STUDY PROGRAM TO MEET THE INQF OF GRADE VI AT YOGYAKARTA STATE UNIVERSITY

Febrina Siska Widyaningtyas[1], Zuhdan Kun Prasetyo[2]

Science Education, Postgraduate Program of Yogyakarta State University

Abstract

This research is aimed at knowing how effective micro teaching lecture runs, as an effort of preparing the production of the expected learning outcomes according to the level 6 of Indonesian national qualification framework (INQF) or *Kerangka Kualifikasi Nasional Indonesia* of physics education. This study was an evaluation research which employed qualitative and quantitative descriptive method. The results of the research gained from the distributed questionnaire and structured interview show that the assessment of physics education micro teaching as an effort to prepare the production of learning outcomes which are appropriate to the level 6 of KKNI of physics education generally runs well. The aspects that need to be optimized are the ability to create simple tools for the continuity and smoothness of physics learning and the aspect of having ability as a physics teacher especially in arranging planning, implementation, and assessment of physics learning as well as having self-development ability.

Key words: assessment, physics education micro teaching, learning outcomes, level 6 of INQF

INTRODUCTION

Education plays a significant role in human life since the existence of education is expected to develop human life and bring human into better life. This is in line with the purpose of education, that is, to develop students' potential to become devout human who are obedient to God as well as having good character and moral, human who are noble, healthy, knowledgeable, skillful, creative, and independent as a good, democratic, and responsible citizen (Indonesian Act No 20 Year 2003 about National Education System, 2003, p. 5). If the education purpose is achieved well, thus, quality human resource will be produced.

Quality human resource can be built by empowering education system. Therefore, the role of physics teachers in school is very important in the effort of quality human resource building so that the attempt will enable Indonesia to reach brighter future, be a democratic, prosperous, and judicious country. Two learning points from UNESCO state that in addition to a popular term in education 'learning to know', people have also to understand and implement another term 'learning to do'. Physics learning is focused on students, while teachers role as facilitator as well as mediator. Considering the importance of the role of physics teachers in schools and that the ability to teach cannot be achieved instantly but has to be continually built and improved, thus, micro teaching can be a way to cultivate and improvephysics teacher aspirants'teaching skills. The direct experience in teaching has to be implemented continually. This is in accordance with Jarrett et al. (2010, p. 35) who state that direct teaching experiences given to students continually are believed to maintain and deliver understanding in a long term.

According to Remesh (2013, p. 158), "microteaching is a teacher training technique for learning teaching skills". Micro teaching is an approach to train teachers' performance (performance training method), which reflects the character of a professional teacher. KILIC (2010, p. 82) argues that:

Micro teaching is a technique that is used in teacher education where a teacher candidates teaches a small portion of a lesson to a small group of his classmates and teaching competencies are carried out under strict supervision.

The effort towards the goal of preparing quality teachers seems too far to be reached sooner. The data of unqualified teachers from the Department of National Education in 2008 (Suyanto, 2012, p. 2) are as follows: there are 78.35% in kindergartens, 79.45% in elementary schools, 27.12% in junior high schools, 12.89% in senior high schools, and 20.80% in vocational high schools. In total, of 2,837,212 teachers, there are 1,608,477 teachers who are not qualified to teach. In other words, there are 56.69% unqualified teachers. Besides, the national data of unqualified teachers in senior high school level in the year 2009/2010 show that the percentage of qualified teachers in various areas throughout Indonesia is between 63.97%-86.67%. The emergence of unqualified teachers in 2008 which reaches more than 50% and 14%-36% in 2009 is caused by the inappropriateness of learning outcomes which is achieved with qualification demand or the need of work fields.

Microteaching is an inseparable part of the curriculum of graduate program (S1) of teacher education. Curriculum is a set of plans and settings about subjects' contents and material as well as the rules used as guidance on the implementation of teaching and learning process (Act no 20 year 2003 about National Education System article 1 paragraph 19). According to Bharvad (2010, p. 74), a good curriculum is the one that is important to children development, system development, and finally for national development. The root of the eccomplishment of curriculum goals depends on the evaluation process conducted during the development. There is a significant relation between the perceived process and the expected process for curriculum development (Hussain et al., 2011, p. 263). There is no learning without curriculum because it is curriculum which directs the learning process. Curriculum has a very strong relationship with learning. The theory is proposed based on a teacher or lecturer's researches and experiences.

According to Fajaryati (2012, p. 334), there are some important things which need to be improved in the implementation of learning activities; the process of skill learning needs to be readjusted with the real working standard; the learning setting needs to be readjusted with the working situation; the learning activities need to be oriented more on problem solving activities; learning activities need to be more directed toward student active learning; learning activities need to be emphasized more on the accomplishment of competence; the development of soft skill needs to be improved more on learning activities.

Along with period development in globalization era, curriculum is adjusted with the Indonesian National Qualification Framework (INQF) or *Kerangka Kualifikasi Nasional Indonesia*, including the curriculum in the faculty of mathematics and natural science in Yogyakarta State University (YSU). The draft of INQF-based curriculum for physics education study program at YSU has been designed and named as Curriculum 2014. The existence of INQF is positioned as the stabilizer of learning outcomes attained through formal, informal, and non-formal education with working competence which is accomplished through training. The leveling or grading of INQF is adjusted with educational level. The educational level of S1 of physics education study program employs level 6 INQF of physics education. This level 6 INQF of physics education contains the qualification descriptor of S1 physics education graduates. The descriptor is expected to be able to be used as a manual in curriculum development and the implementation of physics lectures in colleges so that the students of physical education, who are teachers soon to be, are ready to enter the profession after they graduate.

The results of pre-survey observation conducted in some colleges in Yogyakarta Special Region- Yogyakarta State University (YSU), State Islamic University of Sunan Kalijaga of

Yogyakarta, and Ahmadd Dahlan University- on February 2014 showed that the lecture activities of physics education microteaching in the three universities are still implemented variously. Other data are the data gained from the results of interview which were conducted by the researchers to some lecturers who teach the subjects of physics education microteaching. The results of the interview showed that so far, the microteaching of physics education has not been based on the learning outcomes descriptor of level 6 INQF, but it is still based on the lecturers' experiences in teaching the microteaching subject. Whereas, regarding the existence of level 6 INQF of physics education, all physics education program studies in colleges throughout Indonesia are expected to adapt with this level 6 INQF of physics education. This is intended to make all physics education study programs in Indonesia able to produce physics teachers who own good quality learning outcomes and are ready to enter the profession of teaching. This implementation is not in contrary with Government's Regulation No 66 Year 2010 about Colleges Autonomy, so that the implementation of education in colleges remains hanging on that government regulation which also does not override the level 6 INQF. Therefore, in this study, the assessment of physics education microteaching in the faculty of mathematics and natural sciences at YSU was conducted as an effort of preparing the production of learning outcomes which are appropriate to level 6 INQF.

DISCUSSION

This research aims to conduct assessment on microteaching in S1 physics education study program at YSU as an effort to prepare the production of learning outcomes suitable with level 6 INQF of physics education. The analysis results of research data from the answer of the questionnaire addressed to lecturers are displayed in Table 1, and the research data analysis from the answer of the questionnaire addressed to students are displayed in Table 2. Information of the aspects assessed in Table 1 & Table 2 is as follows: (1) Being able to operate laboratory tools/ kit of physics learning; (2) Being able to create simple tools for the smoothness of physics learning; (3) Having professional competence; (4) Having pedagogical competence; (5) Mastering the knowledge on guidance and counseling in physics learning; (6) Having ability as a physics teacher, especially in arranging plans, implementation, and assessment of physics learning as well as having self-developing capability; (7) Having social competence.

Table 1
The results of lecturers' questionnaire data

No.	Aspect	Percentage (%)
1	(1)	100.00
2	(2)	100.00
3	(3)	100.00
4	(4)	100.00
5	(5)	100.00
6	(6)	100.00
7	(7)	100.00
Average Percentage (%)		**100.00**

Table 2
The results of students' questionnaire data

No.	Aspect	%	Category
1	(1)	61.46	Good
2	(2)	33.33	Less good
3	(3)	84.17	Very good
4	(4)	94.17	Very good
5	(5)	90.00	Very good
6	(6)	59.19	Fairly good
7	(7)	93.05	Very good
Average %		**73.62**	**Good**

Table 3
The results of lecturers' interview

Lecturers Interview in General
Lecturers asked students to use laboratory tools/ kit of physics learning in micro teaching. Before the lecture of physics, lecturer did not always create the tools for physics experiment by themselves. Before the lecturing of physics education micro teaching, lecturers did not create the tools because they role as advisers in micro teaching. Lecturers did not always ask the students to create their own tools for physics experiment which were used in micro teaching. Students were allowed to create or not to create the tools, but more importantly, they are expected to use visual aids or tools during the physics education micro teaching. Lecturers did not compel the students to utilize recycled objects for the visual aids or tools in physics learning, but the tools had to be proper to be used in the practice (it was optional for the students to utilize new or recycled objects). There were some students who created their own visual aids or tools, but the lecturers seemed they were not sure that the students made the tools by themselves. They might cooperate or discussed with their friends. According to the lecturers, the micro teaching students' concept mastering of physics had been getting close to the right one. However, the way they deliver physics material was still less precise. This was due to the poor time management. When there were students of micro teaching lecturing who could not comprehend the material and concept of physics subject correctly, lecturers gave explanation/ comments and directed them to the correct physics concept. Besides, lecturers asked the students to look for literature or references whose correctness was justifiable (because most printed books presented the wrong concept and they were used as manuals or guidance). Lecturers always conveyed the competence standard/ abstract competence and basic competence of physics subject to the students and the students were asked to create a set of learning equipment which contained the competence standard/ abstract competence and basic competence of physics subject.

Table 4
The results of students' interview

Students Interview in General
Students did not experience difficulties in understanding the quantitatively presented concept in various laboratory tools which were used during physics learning. This is because they had learned the material first before the practice in the laboratory, they liked reading literature or references related to the material, and sometimes there was a guidance or manual book of the employed tools. Students found difficulties when there was ravage in the employed tools (such as the clarity of scale) because on the tools which were used in long term, the scale was not clearly visible. Another factor was that because the students feel the difference on the concept they learned theoretically and the concept which were presented quantitatively in various laboratory tools. Students liked to string up the laboratory tools in a package of physical experiment because the activity was fun, preoccupying, and able to develop their creativity. In stringing up the laboratory tools in a package of physical experiment, students were helped by their friends. They worked together and helped each other. They chose the laboratory tools which were suitable to the purpose of the physical experiment. Students create their own tools for the physical experiment if the tools which would be used in micro teaching performance were not available in the laboratory, or were being used by other students. Sometimes students utilized recycled objects for the visual aids or tools in physics learning if the needed tools were simple or not too complicated. The utilization of the recycled objects was due to the lower cost and the learning targets were still able to be accomplished. Students fairly mastered the material and concept of physics subject. If they found difficulties in comprehending the material and concept of physics subject, they asked directly to their friends, lecturers, and looked for some

related literature. According to the students, it was important for physics teachers to understand the competence standard / abstract competence and basic competence of physics subject because a teacher had to know what was needed to be attained and mastered by the students. Students were sometimes diligent in accessing physics subject materials. When they were about to perform in micro teaching, they were usually diligent in accessing the materials (depending on their needs). Sometimes, they were lazy to access the materials, too. For them, learning strategy should be adjusted to the characteristics of the students. This is because not all the students possessed the same capability, so that their levels of comprehension in physics material were also various. Students performing in micro teaching were able and always tried to provide guidance for the students who experienced difficulties in physics learning, help the students by providing appropriate solutions for the students who faced problems/ difficulties in learning physics, treat the students equally, and give motivation to all students.

The data in Table 1 shows that the percentage of the seven aspects is same, which is, 100% with 'very good' category. It represents that lecturers have striven to make their students experience micro teaching, to make their students have capability to use laboratory tools/ kit of physics learning, able to create simple tools for the smoothness of physics learning process, have professional competence, have pedagogical competence, master the knowledge of guidance and counseling in physics learning, have the ability as physics teachers especially in arranging plans, implementation, and assessment of physics learning as well as able to develop themselves and have social competence.

The data in Table 1 reveal that the percentage of aspect (1), which is, being able to operate laboratory tools/ kit of physics learning are 100%. This indicates that lecturers have striven to make the students use laboratory tools/ kit of physics learning in micro teaching. In accordance with the data of the lecturers' interview results in Table 3, it is known that lecturers asked the students to use laboratory tools/ kit of physics learning in micro teaching. However, data in Table 2 show that aspect (1) belongs to "good" category at 61.46%. This is because there were only a part of students who used laboratory tools/ kit of physics learning in micro teaching. Students found difficulties if the tools used in physics laboratory were damaged (such as scale clarity) because on the long-term used tools, the scale is not visible clearly. In addition, some students recognized the difference between the concept which they learned theoretically and the concept presented quantitatively in various physics laboratories. Thus, these things triggered students not to use laboratory tools/ kit of physics learning in micro teaching.

Aspect (2) is being able to create simple tools for the smoothness and continuity of physics learning. The percentage of this aspect in Table 1 is 100%. The capability to create simple physics tools can be trained by the lecturers' order for the students to utilize recycled subjects in their surroundings for the creation of simple visual aids or laboratory tools to achieve continuity and smoothness of physics learning. This is in line with the expected competence in Curriculum 2014 in YSU, which is, being able to repair basic tools and being able to complete or replicate the incomplete equipment or depending on the needs in physics learning.

Data in Table 3 show that lecturers did not always asked the students to create the tools by themselves for the physics experiment included in micro teaching. Students were free to create or not to create their own tools, because the more important thing was that students were expected to always use visual aids or tools during the implementation of physics education micro teaching. The tools should be proper and sufficient for the practice (it was optional to use recycled objects as the tools or the new ones). Therefore, not all students created new simple tools for the smoothness of physics learning which are shown by the percentage of aspect (2) in Table 2 which belongs to "less good" category, with the percentage 33.33%. This is relevant to the research data of students' interview presented in Table 4, which is, students felt it was not necessary to create their own tools or equipment for physics experiment because the tools used to perform in micro teaching was provided in the laboratory. Students would create their own tolls or equipment if the tools used for their micro teaching were not provided in the laboratory or being used by other students. Students sometimes utilized recycled objects as the visual aids or tools in physics learning

if the required tools were simple and not too complicated. The utilization of recycled objects as the visual aids or tools are due to the lower cost that should be paid by the students and the targets or purpose of the learning can still be accomplished. In line with the essence of physical science, in collecting the observation and experiment results data to study natural phenomena, scientific process and attitude or scientific methods were employed.

The point of aspect (3) is having professional competence. According to Table 1, the percentage is 100%. This is because lecturers asked the students to master the material and concept of physics subject. Besides, lecturers asked them to develop the material of physics subject creatively and relate the concept of physics subject easily, correctly, and precisely. This is very helpful in developing a pre-service physics teacher's professional competence, and is able to support the accomplishment of level 6 INQF of physics education.

The data in Table 2 present that the percentage of aspect (3) is 84.17%, with "very good" category. This is because the students developed the material broadly. The material which was developed was related to various scientific concepts, and the scientific concept was applied in daily life by relating the material which would be delivered with phenomena which occur in daily life.

The point of aspect (4) is having pedagogical competence. As presented in Table 1, the percentage is 100%. Lecturers gave example on the strategy or technique of implementing physics learning which was educating and conducive by employing student-characteristics-based learning strategy, and they also explained that a physics teacher had to be able to communicate in well manner effectively and emphatically with students if their position was not too far from the students, so that the communication with students can be effective and the relation did not seem separated by any distance.

According to Table 2, aspect (4) belongs to "very good" category at 94.17%. Students implemented physics learning which were educating and they were capable to manage the class, employ many student-characteristics-based physics learning strategies, communicate in a well manner effectively and emphatically toward students, conduct assessment of physics learning process and results, and also involve students in physics learning. The points that need to be optimized in the implementation of micro teaching are as follows: The process of skill learning needs to be more adjusted to the real working standard. The learning setting needs to be more adjusted to the working situation. Learning needs to be more oriented to problem solving activities. Learning needs to be more directed to student active learning. Learning needs to be more emphasized on competence accomplishment. Soft skill development in learning activities needs to be improved.

The point of aspect (5) is mastering the knowledge of guidance and counseling in physics learning. In Table 1, the percentage is 100%. This is in line with the interview results data presented in Table 3 which show that lecturers gave explanation to the students about a physics teacher's obligation to provide guidance or advice to students who experienced difficulties in learning physics. In addition, lecturers gave example on how to treat students equally, for example, by giving questions to all students then giving motivation and reward to those all students. This might help students to master and comprehend the guidance and counseling in physics learning more. If those things are formed optimally, the attainment of the indicators of level 6 INQF will be supported.

Data in Table 2 show that aspect (5) belongs to "very good" category as its percentage is 90%. According to the data in Table 4, students implementing micro teaching were capable to give advice and guidance to their students or the learners who experienced difficulties in learning phyiscs, give proper solutions for the learners who faced problems in the process of physics learning, motivate and treat the learners equally, and also give direct assessment to the success of every step taken by all students equally. Those were done by students implementing micro teaching by assessing the success of students who answered the given questions correctly by giving compliment. Subject teachers, especially physics teachers, have to be able to understand as well as implement the service of guidance and counseling like how they should do in performing their duty and function as physics teachers. Physics teachers as advisers are assigned as facilitators for the students to give briefing and direction, guidance, and also helps either in individual or group. The role of guidance and counseling in the process of physics learning is a determinant of the success of students' physics learning in the form of a personal result. Class environment which

performs interaction involving the learners in the process of physics learning will optimize the process. The process will lead to the emergence of meaningful learning for the students or learners.

The point of aspect (6) is having ability as a physics teacher, especially in arranging plans, implementation, and assessment of physics learning as well as having self-developing capability, in which its percentage as shown in Table 1 is 100%. This is because lecturers asked the students to arrange the planning of physics learning in the form of Learning Implementation Plan (LIP) or *Rencana Pelaksanaan Pembelajaran*, Students Activities Sheet (SAS) or *Lembar Kegiatan Peserta Didik*, and assessment tools. However, lecturers did not ask the students to create syllabus since it had already arranged. By arranging the learning plan, students are expected to be able to implement learning according to the planning that had been arranged. This is a supportive step to achieve level 6 INQF.

Based on the data in Table 2, the percentage for aspect (6) is 59.19% which makes it belong to "fairly good" category. This is because students arranged the physics learning plan in the form of LIP, SAS, and physics learning assessment tools without being asked by the lecturers, but they fully recognized that it was their responsibility as a pre-service teacher to arrange the learning plan first. Students did not develop syllabus because it had been developed. They implement physics learning according to the arranged plan.

The percentage of the data in Table 1 for aspect (7), which is, having social competence,is 100%. In line with the data presented in Table 3, lecturers explained that physics teachers had to be able to communicate effectively to the learners, educators, and even supervisors. This is a very important point to be trained during micro teaching to prepare pre-service physics education students to be ready when they enter the profession in the future. Lecturers' advice and guidance in micro teaching drive students to develop their social competence which are considered as as an effort to prepare the production of learning outcomes that suit to level 6 INQF of physics education.

Data in Table 2 show that aspect (7) belongs to "very good" category, and its percentage is 93.05%. Students communicated effectively with the learners, fellow educators, and supervisors. In this case, the learners and fellow educators are their friends in the same group of micro teaching, while the supervisors are the lecturers who handle micro teaching lecturing.

CONCLUSION AND SUGGESTION

Conclusion

Based on the aforementioned discussion, it can be concluded that the assessment of physics education micro teaching as an effort of preparation to produce learning outcomes which are suitable to the level 6 INQF of physics education is generally good. The aspects that should be optimized are the capability of creating simple tools or equipment for the smoothness of physics learning and the aspect of having capability as physics teachers especially in arranging plans, implementation, and assessment of physics learning as well as ability to perform self-development.

Suggestion

Based on the conclusion of the research results, there are some suggestions which are presented for the implementation of physics education micro teaching lecturing in S1 physics education study program at Yogyakarta State University to produce learning outcomes which were based on level 6 INQF of physics education. The suggestions are stated as follows:

1. In micro teaching, the creation of simple tools or equipment in physics learning should be more emphasized.
2. The capability as physics teachers especially in arranging the plans, implementation, and assessment of physics learning as well as their ability to perform self-development should be stressed in micro teaching.

The study program of physics education of S1 at YSU needs to reconsider the time allocation for the implementation of micro teaching lecturing.

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ISBN 978-979-96880-8-8