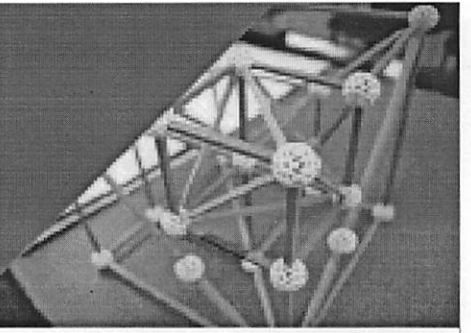


Proceeding



"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



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

Faculty of Mathematics and Science
Yogyakarta State University

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

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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. Sophia 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. Sophia 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.

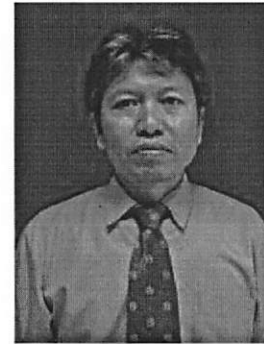
Yogyakarta, 17 May 2015

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 regular 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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DEVELOPING INTEGRATED SCIENCE, CHARACTER, AND LITERACY- BASED SCIENCE PACKAGE ASSCIENCE LEARNING MODEL

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Abstract

This study aims to investigate the appropriateness of the integration science, character, and literacy-based science learning package as learning science model in junior high school, the improvement students' science attitudes, problem solving ability, collaboration, environmental awareness attitudes and scientific literacy after they attend learning activities implementing science learning package. This was a research and development study employing the development model by Borg & Gall (1983). The research procedure consisted of: (1) preliminary study, (2) planning, (3) product draft design, (4) product validation, (5) revision and tryouts, (6) final product study, and (7) dissemination. The result of the study is a product in the form of an attitudes-based science learning package for the Acid Rain, Global Warming, and Environmental Pollution topic for Grade VII of the junior high school with appropriateness assessment was "A" and a mean score of > 3.1. The scientific attitudes, problem solving ability, collaboration, environmental awareness attitudes and scientific literacy & scientific literacy of Grade VII students of the junior high school after they learned through science learning package improved. The problem's implementing science learning package is the science teacher and student's not usually with integrated science learning and used integrated topic.

Key words: science package, problem solving ability, collaboration, environmental awareness attitude, students' scientific attitudes, science literacy, character

INTRODUCTION

The problem of education is the quality of science teaching in Indonesia is still low when compared with other developing countries, particularly the ASEAN countries. Data results of PISA (*Program for International Student Assessment*) in 2009 put learners Indonesia the tenth lower, raise questions about the quality of teachers within a period of the ten years lower, raise questions about quality of the teachers teach. Indicated that low literacy problem solving ability possessed learners low as problem solving and scientific literacy related to one another. The National Science Teachers Association (NSTA) (Toharudin, *et al*, 2011:1) explains that scientific literacy is a person's ability to use scientific concepts, have the science process skills to assess and make decisions everyday that relate to people, the environment, and understand interaction between science, technology, and society as well as social and economic developments.

Scientific literacy is essential for learners as government effort to prepare Indonesian citizens who are able to compete against AFTA (Asian Free Trade Area). In addition, the ability of solving an indication of mastery of literacy is high on someone. Abadi, *et al*. (2011: 307) defines the problem-solving is a smart way and part of the problem solving process in which there find and classify the problem. Someone who has a problem solving abilities are able to use knowledge of science and science process that is used to analyze a problem so as found a

solution. Therefore, scientific literacy is a skill that must be provided by the teacher to the learners. The second problem, the crime rate is increasing so that the students do indicate the character of learners experiencing slump. Crime committed learners in major cities in the period 2013-2014 more than ten cases of murder and other crimes cases.

The government's efforts to get a solution to the problem of education, especially science education is to make change to curriculum. As presented Noah (2013) one of the reason the government in Indonesia to revising the existing curriculum with the curriculum in 2013 based low literacy learners. The existence of curriculum change are expected to improve the quality of teacher teaching to produce an effective and efficient learning and to improve scientific literacy learners Indonesia. Additionally, curriculum 2013 recommends the implementation of character education through all subjects, including science teaching. The role of school, families, and society needs to instill character education learners (Zuchdi, *et al*, 2011). Implementation of character education through subjects that create a character that consists of the values of kindness (noble values) are formed in a self-learners so that the role of school make a real contribution. Therefore, the role of teachers not only teach science course but instill character through learning activities and learning activities outside.

Implementation of character education through teaching science in SMP is supported by the nature of science are close relation to integrated character and scientific literacy that can be achieved learners. Science should be seen as a way of thinking and investigation in search of understanding natural phenomena, as a way of natural phenomena, and as a body of knowledge that is generated from the inquiry. Science deals with an attempt to understand the various natural phenomena systematically. Science has the dimensions of scientific attitude, the scientific process, and scientific products, in the form of knowledge. Therefore, the purpose of learning science process skills training, foster scientific attitude, and creativity as well as the application of science in everyday life (Carin & Yager in Kemdikbud, 2011: 1). Case (Harell, 2010: 147) explains that the integration of science includes the integration of content, process, and skills, integration of schools and learners, and the overall integration (all formal learning and practice activities informal, ongoing, methods, ruler, and school influences on learning process. NSTA (Binggeli, 2011: 4) recommends that science study should be able to provide much content to develop 21st century skills such as critical thinking, problem solving, and scientific literacy, especially when discussing the nature of science and promoting the use of science. These skills not only contribute to the development of well-prepared workforce future but also provide life skills to individuals who help them succeed. Through the science of quality education, we can support and advance the skills 21st century that are relevant, while increasing application of knowledge through the planting of 21st century skills.

Dimension scientific attitude close relation to the values of character. Bundu (2006:39) define a scientific attitude as attitudes toward objects and events in the surrounding environment that would affect a person's willingness to participate in a particular activity and the way a person responds to other people, objects, or events. Martin, *et al*. (2005: 13) that the emotional aspects of the realm of scientific attitude that needs to be developed, namely (a) curiosity, (b) diligently, (c) carefully, (d) open-minded, and (e) in cooperation with others. Aspects of the scientific attitude of intellectual realm include: (a) the desire to obtain reliable information sources, (b) the desire to present alternative ideas that can be proven, (c) the general concluded from the data/evidence is limited, (d) receive opinions, explanations or different ideas, (e) willingness to not make any conclusions until all the evidence/information is obtained and tested, (f) refuse to believe the opinions that are not based on evidence, (g) openness to change his mind changes are supported by evidence that can be trusted. Education of character in the educational unit has identified 18 values derived from religion, Pancasila culture, and national education goals, namely: (1) religious, (2) honest, (3) tolerance, (4) discipline, (5) hard work, (6) creative, (7) self, (8) democratic, (9) curiosity, (10) the national spirit, (11) love of the homeland, (12) the achievement,

(13) friends/communicative, (14) love peace, (15) like to read, (16) care about the environment, (17) social care, (18) responsibility (MONE, 2011: 8). Through scientific attitude in science teaching are expected to shape the character of which consists of the virtues of learners.

Learning science that familiarize learners to foster scientific attitude is expected to improve the achievement of scientific literacy learners. In addition, collaboration becomes a target of achieving Curriculum 2013 that achieved by learners. Collaboration is a person's ability to cooperate with other friends to complete certain task in group. Based on the theory, it is possible integration of characters in science teaching can be implemented.

Comprehensive approach used in developing the values in character education through subjects, including science. Zuchdi, *et al.* (2011: 6) said that a comprehensive approach includes four aspects. First, the contents of the value of education covers all issues related to the choice of the values of a personal nature to questions about ethics generally. Second, the value of education carried out by the method of planting value, giving the example, and preparing young people to become independent with moral decision-making in a responsible manner as well as other life skills. Third, the value of education should take place in the overall educational process in the classroom, extracurricular, guidance, and conseling, the award ceremony, and all aspects of life. Forth, the value of education should take place through the life of society.

Research conducted Listyawati (2012: 68) regarding science learning tools that have been developed can enhance the abilities of learners which consists of the ability of cooperation within the group, the confidence of learners, critical thinking skills, intellectual curiosity, develop appropriate response honestly, learn to balance the benefits of relying on others with responsibility for their own part, make decisions on objective, engage in discussions and oral presentations are active, and creative and innovative thinking skills well. The result of another study conducted Eko Hariadi (2009) conclude that the level of scientific literacy learners positively influenced the attitude of students towards science and educational background of parents. High-low attitude toward science learners positively influenced by the desired job learners, learning activities in the classroom, the more time spent on learning, confidence, and motivation of learners. Wahyudi & Khanafiyah (2009) conclude objective scientific attitude, critical, tenacious, humble, can cooperate with others and positive view of the failure can be upgraded with software development kit utilization of optical activity in learning. Prasetyoningsih (2013) provide information that the learning model based problems increase the activity of teachers and learners, problem solving skills, and the response of learners. So that teachers can apply the learning model based on this issues in order to increase the activity of learning and thinking skills of learners primarily in problem solving. Result of research conducted Anwari (2010) stated that it was the power of two methods on material digestive system can improve collaboration. Study abroad and student interest in MAN Paste Sleman. Increased collaborative learning ability of student can be from the increasing number of students who are active in the second cycle, and the better the value of each of the aspects which included: argue rationally, receive opinions for the right reason, care for the group, do the group, do the work, and help a friend.

RESEARCH METHODS

This type of research is research development, known as R & D. The step of R & D according to Borg and Gall (1983: 775) consists of 10 stages, namely (1) to collect information, (2) conduct research design, (3) develop a form of initial product, (4) conduct a preliminary field trials, (5) revise the main product, (6) conduct field to trials the preliminary, (7) to revise the main field test, (8) to test the operational field, (9) to revise the final product, (10) disseminate and implement the product.

RESULT AND DISCUSSION

The achievement of development result obtained from research and development complete the procedure. Explanation of development as follows. In the preliminary study stage is to prepare activities that will be developed product by conducting a preliminary study to obtain information needs. This phase includes the study of literature and learning in the school survey. Learning survey conducted in order to obtain information on the implementation of learning science at school and characteristics of learners. Characteristics of learners that includes academic achievement and learning behavior. The result of a preliminary study conducted in SMP N 1 Sleman, Yogyakarta; SMP N 1 Karangmojo, Yogyakarta; and SMP IT Insani Lampung as follows: 1) The curriculum used of all SMP is Curriculum 2013, 2) subject are taught not integrated science as a science of physics and biology science. Teacher who teach science derived from physics education graduate and undergraduate biology education and there is a master graduate teacher education, 3) science learning tool such as syllabi, lesson plans, LKPD, and assessment instrument held by the teachers, are still separated as the science of physics and biology, 4) learning science that is conducted based on domination concept, not to pay attention to the process of science, 5) integration of character education through science subjects has not been understood by the teacher so that the implementation is still difficult, 6) learning science oriented problem solving skills, have not been trained to students through innovative learning as it is made possible the cause of solving abilities of learners is still low, 7) curriculum 2013 collaboration skills equip learners through all the lessons. However, collaboration skills have not been trained to students through innovative teaching it made possible the cause of collaboration skills of students is low, 8) the topics in science subject related to the environment it is possible to facilitate learners to foster environmental awareness character, however, knowledge-oriented learning not facilitate learners to care about the environment, 9) themes/topics integration science material on contextual curriculum 2013 and the phenomenon can be experienced by learners, has not been developed by teachers, because of the book educator and students give less opportunities for the teachers to develop learning science-based theme integration, 10) scientific attitude of students is low. This may be due to the science learning without involving the active participation of learners to find concepts through experimentation, discussion, presentation. Learning centers tend teacher, 11) literacy science learners are still low. When the teacher asks a question about the topic of environmental pollution, the answer is merely conceptual learners. Not to demonstrate application of concepts to solve problems, 12) how to learn science is done by rote learners and exercises and follow the guidance of learning outside of school, 13) the concept of an integrated science teaching is not known by teachers for reason yet to be implemented and the results of science teaching workshop MGMPs deliberation and the schools do not emphasize science learning in an integrated manner,

Based on information obtained from the result of the preliminary study phase, the need for integration of research and development of science, character, and literacy as a model of learning and teaching science in junior high. The model is realized in the form of learning an instrument consisting of a syllabus, lesson plans, LKPD, and assessment instruments to develop a scientific attitude, caring environment, collaboration skills, problem solving skills and scientific literacy are packed with a theme.

Task analysis is undertaken steps to decide contents lesson plans/materials that include analysis of the content and structure analysis of concept and analysis of learning objectives. The results of the planning stages as follows: 1) on the content structure, based on analyzing the core competency curriculum 2013 (KI) and the basic competency potential to be combined with a theme. The results of the analysis of KI and KD junior science lesson generated theme Acid Rain, Global Warning, and Environmental translation of KI and KD are combined science lessons on curriculum 2013 on the theme of Acid Rain is number 3 and 4. Description of competence combined as follow: 2.1) demonstrate scientific behavior (having curiosity; objective; honest;

through; careful; diligently; cautious; responsible; open; critical; creative; innovative; and caring environment) in the day-to day activities as a form of implementation of the attitude in conducting experiments and discussion. 2.2) respect the work of individuals and groups in daily activities as a form of implementation carry out experiments and report the results of the experiment. 3) understanding of knowledge (factual, conceptual, and procedural) based on curiosity about science, technology, art, related cultural phenomena and events seem eyes. 4) tried, processing, and present in the realm of concrete (using, parse, compose, modify, and create) and the realm of the abstract (writing, reading, counting, drawing, and making up) in accordance with the studied in schools and other similar source in theory viewpoint.

Basic competence combined science subject in the curriculum 2013 is located at grade level VII resulted theme "acid Rain, Global warming, and Environmental pollution". Description of basic competencies that are combined as follows: 3.5) understanding the characteristics of the substance, as well as physical and chemical changes in substances that can be used for everyday life (eg separation of the mixture), 3.9) to describe the pollution and its impact on living creatures, 3.10) describe about the causes of global warming and its effects, 4.11) conduct an investigation to determinate the nature of the solution that is in the neighborhood to use artificial or natural indicators, 4.12) presenting the results of observations of the interactions of living organisms with the surrounding environment. KI and KD mapping and analysis of the concept is the integration of activities that have the potential to be used as a theme.

Analysis of learning objectives based on the KI and KD are and concepts are combined. Operationally structured learning objectives that can be measured from changes in learners' learning experience. The formulation of learning objectives that can be measured from changes in learner's learning experience. The formulation of learning objectives theme Acid Rain, Global Warming, and Environmental Pollution for VII grade as follows: 1) observing the physical changes and chemical change in the body due to the treatment of human and natural phenomena such as acid rain and to submit its observations, 2) perform resting for knowing solution characters that exist in everyday life to develop a scientific attitude of students, 3) respect for individuals and groups in discussions about the environmental effects of the number density of population, number of vehicles, the number of factories, and the effect of the eruption of Mount Merapi on rock weathering, corrosion building materials made of marble, and metal corrosion and human disturbance and growth of plants, 4) have a curiosity, objective, honest, thorough, meticulous, diligent, careful, responsible, open, critical, creative, innovative, and caring regarding environmental science concepts to design and conduct experiments on the theme of Acid Rain, 5) using acid rain scientific literacy impacts and proposed role of humans to overcome the environmental pollution that causes acid rain 6) through experimentation and discussion groups of learners can explain the causes of warming properly and global collaboration groups of learners can explain the causes of warming properly and global collaboration and instill environmental awareness, 7) through the experiment, students can explain the process of global literature studies and projects, learners can explain the various impacts and how to deal with global warning is true ambed collaboration and environment concern, 9) through group discussion participants may explain the definition of problemsf environmental pollution, the types of pollution, identify the causes of environmental pollution, explain the impact of environmental pollution, make a solution of problems of environmental pollution, and choose the best solution and the reason to ask a lot of questions or statements, using the fact presented by the phenomenon, giving reason was based on the theory.

The result of learning Integration Science draft, Character, and Literacy theme Acid Rain, Global Warming, and Environmental Pollution for students of class VII consists of syllabi, lesson plans, LKPD, and Authentic Instruments Assessment (IAA). The initial product in the form of a draft device developed, further validation to the matter experts and instructional technology,

teachers, and peers to obtain the feasibility of data products prior to testing in schools.

The results of each assessment by the validator on the theme of learning to acid rain, global warming, and Environmental Pollution as follows: Assessment by expert lecturers on the basis of learning is to make revisions and determine the feasibility of a device developed. Assessment by the validator is presented in Table 1.

Table 1
The Result Of Validation Products

Product	Tema			Category
	Acid Rain	Global Warming	Environment careness	
Syllabus	3,6	3,1	3,6	very good
RPP	3,6	3,2	3,6	very good
LKPD	3,7	3,1	3,7	very good
IAA	3,4	3,1	3,7	very good

In addition to expert lecturers, given by a science teacher assessment. Assessment by a science teacher for learning tools are the basis for the revision and determine the feasibility of a device developed. Assessment by a science teacher is presented in Table 2.

Table 2
Average Rating Product By Science Teachers

Assessed Product	Theme			Category
	Acid Rain	Global Warming	Care environment	
Syllabus	3,5	3,6	3,3	very good
RPP	3,4	3,8	3,5	very good
LKPD	3,6	3,6	3,2	very good
IAA	3,5	3,8	3,3	very good

Assessment of the device involves peers. Assessment by peers on the basis of learning is to make revisions and determine the feasibility of a device developed. Assessment by peers is presented in Table 3.

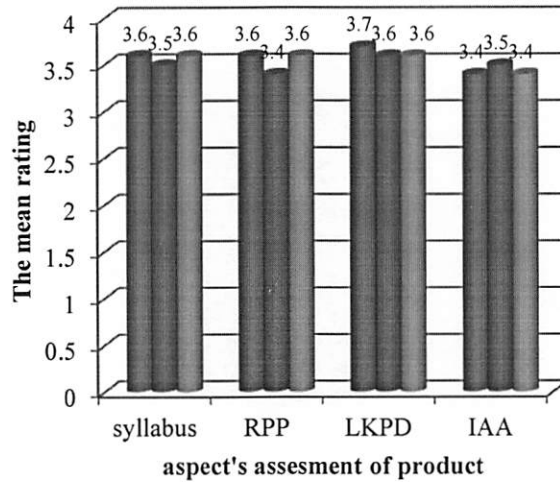
Table 3
Average Rating Product By Fellow Friends

Assessed Product	Assessed Product			Category
	Acid Rain	Global Warming	Care environment	
Syllabus	3,6	3,4	3,4	Sangat Baik
RPP	3,6	3,4	3,5	Sangat Baik
LKPD	3,6	3,1	3,3	Sangat Baik
IAA	3,4	3,2	3,4	Sangat Baik

The mean rating for the component validator syllabi, lesson plans, LKPD and IAA did not have a big difference. (Level of agreement) obtained from calculating the difference in assessment scores validator. The magnitude of the difference in valuation as a benchmark for the level of agreement feasibility of the tools provided by the validator. Increment ≥ 1 can be said low

levels of agreement and difference feasibility assessment ≤ 1 said the feasibility of high-level agreement.

Increment of 0.33 syllabus validator that can be said feasibility level agreement "high" given by the validator to the syllabus. RPP revaluation increment of 0.66, 0.33 LKPD valuation difference, and the difference IAA 0, 6 so that it can be said feasibility level agreement "high" given validator to the RPP, LKPD, and IAA. Average ratings validator is presented in Figure 1.



Description: assessment by expert blue, red by the teacher, and the green color by peers.

Figure 1
Average of assesment by Validator

Limited testing done in class VII B SMP N 1 Sleman with six test subjects learners using the second draft of the Acid Rain Theme learning which is a revision I. Experimental results limited form of information LKPD legibility of the content aspect, graphics, and language. Limited trial results are presented in Table 1 Sleman limited 4.1.Uji try also done in SMP 1 Karangmojo using learning tools with a focus Theme Global Warming sample observations 10 students. Samples were selected based on science achievement of students. The achievement data retrieved from a data value IPA The details of the first semester students are high capability 3 people, being 4 people, and the low 3 people. The trial results are limited in the form of student learning, collaborative inquiry, and environmental awareness questionnaire. Limited trial results are presented in Table 4.

Table 4
Results Trial Limited

Aspects	Academic Achievement Learners			advisors
	low	medium	high	
construction	Easily understood instructions obeyed expement in	Easily understood instructions obeyed expement in	Easily understood instructions obeyed expement in	Given information about the function of experimental tools and materials and given a glossary of terms elusive

graphics	LKPD Images in LKPD clearly seen	LKPD Images in LKPD clearly seen	LKPD Images in LKPD clearly seen	learners. magnified image size make learners more clearly .
language	language used in LKPD easy to understand	language used in LKPD easy to understand	language used in LKPD easy to understand	sentence of “daun berguguran” replaced only

Table 5
Data Testing Limited

Code of students	Learning ourcome	collaboration	Questionnaire	Environmental concern
	Difference	Gain	Difference	Difference
A	28	0,47	-4	-5
B	20	0,71	-1	0
C	16	0,67	2	3
D	8	0,50	7	2
E	20	0,71	7	0
F	20	0,62	2	-2
G	12	0,75	-2	4
H	40	1,0	-4	-1
I	0	0,00	-1	10
J	16	1,00	0	1
mean	18	0,67	10,1	13,9

The next trial is done in junior IT Human disposition. Limited test conducted to obtain data effectiveness of learning tools developed themes of Environmental Pollution. Indication of the effectiveness of the device can be seen on the achievement of learning outcomes. Student learning outcomes assessment of the ability of science literacy and problem-solving skills acquired from pretest and posttest was done in class VIIB junior IT disposition Human Bandar Lampung .. limited trial results presented pda Table 6.

Table 6
Learning Outcomes of Students SMP IT Fitrah Insani

Number of Students	Average Literacy Gain score	Average problem solving gain score	Category
25	0,33	0,49	Sedang

The trial results more widely in SMP 1 Sleman using pre-experimental designs with models of one-group pretest-posttes design. The reason for using the model of one-group pretest-posttes design, to determine the effectiveness of science teaching tools are developed. More extensive trials conducted in class VII F SMP N 1 Sleman the number of learners 33 people. Larger trials to study the effectiveness of the information that was developed to increase the scientific attitude and scientific literacy of students from the state before and after the device applies applied science learning. Data wider trial results include competency assessment before and after the knowledge domain of learning, competence assessment realm of attitudes in the form of a scientific attitude during the study, a questionnaire scientific attitude of learners, and the feasibility sheet RPP. Data broader test results as follows:

Learning outcomes realm of knowledge are gained from the pre-test and post-test. Knowledge domain of test instruments to measure learning outcomes is based on KI, KD,

indicators, and dimensions of scientific literacy. Dimensions of literacy includes the content, process, and application of scientific literacy so that it can be assumed the achievement of learning outcomes is the knowledge domain of scientific literacy achievement. Thoroughness of student learning outcomes of achievement criteria specified (KKM). KKM science subjects in SMP N 1 Sleman of 75. The results are presented in Table 7.

Table 7
Results Learning SMP N 1 Sleman

The number of students	Average yield learning outcomes Pretest	Number of students who reach KKM Pre test	Average yield learning outcomes Posttest	Number of students who reach KKM Post test	Average yield gain scores	Category
32	63,3	6	80,0	31	0,52	sedang

The results of pre-test there were six learners achieve KKM and post-test results are 31 learners achieve KKM. Achievement of learners gain scores are presented in Table 8. Attainment of learning outcomes and gain scores are presented in Figure 2 and 3.

Table 8
Gain scores Achievement of Students

Interval	Frequency	Category
$(g) \geq 0,7$	7	Tinggi
$0,7 > (g) \geq 0,3$	22	Sedang

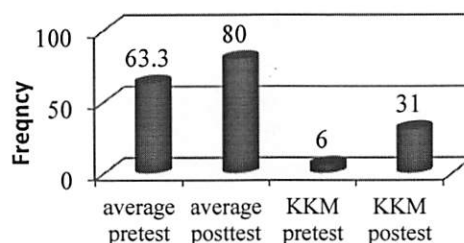


Figure 2
Achievement Student Results SMP N 1 Sleman

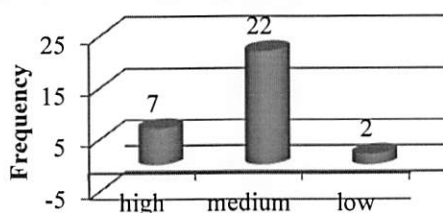


Figure 3
Achievement Gain Score SMP N 1 Sleman

Achievement test realm of attitudes in the form of a scientific attitude aktualiasi learners during the learning and measured using observation sheet instruments attitude. The value obtained is then converted using 4 according Mardapi scale. The average results of learning domains are presented in Table 9.

Table 9
Average of Learning Domains Attitude

The number of students	Average Acquisition Test Attitude of students			Category
	1 th -meeting	2 th meeting	3 th meeting	
31	3,26	3,49	3,57	very good

Scientific attitudes such as curiosity, honest, critical thinking, and collaboration owned learners has increased from meeting to I, II and III and get an A (Excellent). Increasing scientific attitudes of learners can be assumed as a learning tool to facilitate learners to have curiosity by presenting the phenomenon with the video demonstrations and activities. In addition, the device of learning tools facilitate learners to have an attitude of honesty to write and deliver data from experimentation. Courage to criticize and present the results of experiments by students facilitated the presentation and assessment of the activities of the experimental results. Learning outcomes realm of attitudes presented in Figure 4.

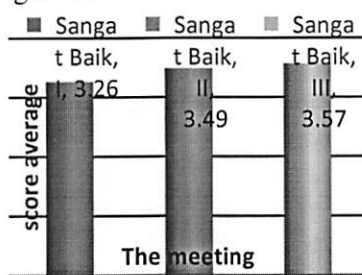


Figure 4
Learning Outcomes Domains Attitude

Questionnaire responses learners used to obtain information about the achievement of scientific attitude after learning to follow. Questionnaires are given to students at the end of the questionnaire pembelajaran. Learners respond calculated by formula 4 page 36. Results of studying the realm of attitudes that learners achieved, then converted using a scale of 4 by Mardapi (2008, p.163). Questionnaire responses of learners are presented in Table 10.

Table 10
Scientific Attitude Questionnaire Response

The number of Students	Interval	Frequency	Category
31	$X \geq 3,1$	27	very positive
	$3,1 > X \geq 2,5$	4	positive
	$2,5 > X \geq 1,9$	0	negative
	$X < 1,9$	0	Very negative

Questionnaire response was very positive learners assumed for learning activities as outlined in the device is capable of facilitating learners to develop a scientific attitude through experimentation, discussion, reporting the results of experiments, group work and presentations provide learners experience to be honest, collaboration, and critical thinking. and curiosity. Questionnaire responses of learners SMP N 1 sleman presented in Figure 6.

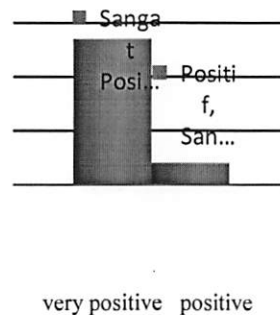


Figure 6
Questionnaire Responses Students

Enforceability of the RPP in SMP N 1 Sleman, SMP N 1 Karangmojo, and junior IT Human disposition obtained from the percentage level of achievement. Observations using RPP feasibility sheet instruments. RPP feasibility data presented in Table 11.

Table 11
Implementation of RPP

Percentage feasibility of RPP			Average feasibility of RPP RPP
Learning I (%)	Learning II (%)	Learning III (%)	
100	100	100	100

More extensive trials in junior IT disposition Human provide information that the competence of knowledge of learners, the average acquisition value of knowledge competencies learners VIIa and VIIC class increases. A number of 24 students in the class VIIa acquire literacy skills IPA gain scores by an average of 0.07 with the category of "low" and gain problem-solving skills scores an average of 0.28 with the category of "low". A number of 25 students in the class VIIC acquire literacy skills IPA gain scores by an average of 0.10 with the category of "low" scores gain problem-solving skills by an average of 0.42 with the category of "moderate". Peningkatan gain scores of students in the category low and medium assumed devices developed, teachers and students not accustomed to using integrated learning. Difficulty in understanding the

concept of integration to be one of the obstacles faced by teachers.

The average value of the competence of learners attitudes VIIa class of the meeting to the I to III of 2,82 2,92 3,19. VIIC grade of 2.62 2.91, 3.20. Attitudes such as curiosity, critical thinking, creative thinking, and care for the environment has increased from the first meeting, second, and third and earn a grade of B with the criteria of "good". Increasing the value of the competence of learners attitude assumed for science learning device arranged to facilitate learners to develop curiosity, critical thinking, creative thinking, and caring environment with an explanation as to which the increase in the value of the competence of the attitude of learners.

Data collaboration of students of SMP N 1 Karangmojo obtained using questionnaires and observation sheets. The results of the questionnaire showed that the class collaboration VIIa as an experimental class get pretest scores at posttest score of 8.6 6,5dan. In the control class or classes VIIE, obtained a score of pretest posttest scores of 10 and 13.13. Experimental class and control class had elevated scores obtained by the gain in the low category for the experimental class and category are for classroom control with selisi 0.05. This may be due to the element of guessing (guessing) that is higher than the control class class collaboration eksperimen.Berbeda with the results of the questionnaire, the results of the experimental observation of a higher class collaboration of acquisition than the control class .Berdasarkan it can be concluded that the experimental class has a higher kolaborasi compared to the control class. CTL learning models are used it is possible to facilitate learners to mengembangkan collaboration. The advantages of the model CTL learners are able to develop CTL (Arends, 2008). Studying in groups, dividing tasks, spell everything together will train students to have collaboration.

Data environmental awareness of students of SMP N 1 Karangmojo obtained using questionnaires and observation sheets. The results of the questionnaire showed that environmental concern in the class as a class experiment VIIa get pretest scores of the pretest posttest scores of 13.6 and amounted to 15.67. In the control class or classes VIIE, obtained a score of 16 and a value pretest posttest 16.17. Experimental class and control class had elevated scores obtained by the gain in the category of experimental class and lower category to a class of control by a margin of 0.28. The results of the experimental observation of environmental awareness class higher than the control class with a difference of 31.3. This may be due to the experimental class pembelajaran pda device used by a character-based workshops menambulkan wisdom "ching-ching roll". Local knowledge is integrated in the learning derived from Gunung Kidul ritual purposes in the form of natural preserve local village. It is presumed capable memumbuhkan character eco learners.

The results obtained menggunakan learners test instrument. Before and after learning the theme of Global Warming given a test to determine the increase. VIIa class as a class experiment pretest scores of 72.33 and posttest score of 88.83. VIIE class, a score of 73.74 pretest and posttest value of 86.09. Gain scores experimental classes and control classes in the medium category. Difference in learning outcomes and classroom control classroom experiment is very small. This may be due to students of SMP N 1 Karangmojo average intelligence junior high because the first international school (RSBI) which requires learners to have a good performance in order to be accepted at the school.

CONCLUSION AND SUGGESTION

Product feasibility assessment model learning device Integration, character and literacy as a model of learning and teaching science in junior high school on the theme of Acid Rain, Global Warming, and Environmental Pollution VII class junior scored a very good category and the average total score ≥ 3.1 . Scientific attitude, collaboration, environmental awareness, the ability to solve problems and literasi sains learners who follow the model of learning by applying Integration, character and literacy as a model of learning and teaching science in junior high school on the theme of Acid Rain, Global Warming, and Environmental Pollution class VII SMP N 1 Sleman, SMP N 1 Karangmojo, and Junior IT disposition Human increased. Constraints faced

in implementing the device that teachers and students are not accustomed to applying science learning that uses the theme *keterpaduan*.

The advice obtained from this study include: 1) Device Integration models of learning, character and literacy as a model of learning and teaching science in junior high school on the theme of Acid Rain, Global Warming, and the Environment Pencemara junior class VII can be utilized to the maximum recommended by the science teachers and provide guidance to formulate and develop learning tools with different themes, 2) test results provide information products that device models Integration, character and literacy as a model of learning and teaching science in junior high school on the theme of Acid Rain, Global Warming and Pollution class VII SMP environment can improve the scientific attitude, collaboration, environmental awareness, problem-solving skills and scientific literacy learners, the need for cooperation between the principal, who is a science teacher tutor teacher, a science teacher at a junior, and other relevant parties to utilize and implement Integration pembelajaranperangkat device models, character and literacy as a model of learning and teaching science in junior high. In addition, the fulfillment of teaching aids and monitoring and evaluation of learning that emphasizes the character needs to be done by the parties implementing the school.

Development of learning tools only do the models Integration, character and literacy as a model of teaching and learning science in junior high school in the material Acid Rain, Global Warming, and Environmental Pollution for further product development is done and developed by a science teacher with a different material. Therefore, the preparation and development of the training should be given to science teachers.

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