# Proceeding

## The 4th International Seminar on Science Education

Bandung, 30 October 2010

"Curriculum Development of Science Education in 21st Century"

Science Education Program
School of Postgraduate Studies
Indonesia University of Education

ISBN: 978-979-99232-3-3

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# Foreword of Chair of Science Education Program

The fourth International Seminar of Science Education is conducted to fulfill annual agenda of the School of Graduate Studies, Indonesia University of Education.

The seminar theme "Curriculum Development of Science Education in the 21st Century" is chosen emerge from many problems of science education in Indonesia. One of them is the overstuffed condition of science curriculum that affected from rapid development of information in this era. Besides, there are challenges of Indonesian people in facing against global competition. To win the competition they have to think critically. Therefore many massages have to cover by science curriculum caused it overloaded and difficult to be implemented.

We are not able to overcome the problem ourselves. We need input of information and experience from many researchers all over the world. Therefore this seminar hoped to be an exchange experience to solve the problem and lead to the discovery of science curriculum to enhance Indonesian science education quality.

I would like to express my special gratitude to Prof Dr Bruce Waldrip from Monash University, Australia; Prof Dr Russell Tytler from Deakin University, Australia; and Dr. Benny H.W.Yung from The University of Hongkong; who are specially come here to be key note speakers. Thank you for sharing the result of your latest result with us.

Finally I would like to thank to the committee who have been working hard to prepare the seminar and publish the proceedings. Last but not least thank you for all speakers and participants of your contribution today.

Bandung, 31 October 2010
Chair of Science Education Program
School of Postgraduate Studies
Indonesia University of Education,

Prof.Dr.Liliasari,M.Pd

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# Development of Assessment Isomorphic Problem Model at Subject Matter Wave

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## Abstract

The goals of this research was finding and developping a model of assessment that's hoped to able accessing (exploring) the students's concept understanding maximally. namely assessment isomorphic problem model. Special goals will be reach in this research is producted a model of assessment isomorphic problem that properest to develop and to be aplicated in assessing the students' achievement so it is more and more indicate the student's real ability or real concept understanding. This research was using Research and Development method by steps: making the beginning instrument design, validations, limited implementation, analizing the result of limited implementation, revision of the beginning instrument, making real instrumen, broad implentation, analizing the result of broad implementation, and publication. The result will be spread in this article is the result by the limited implentation that involved 28 students of Physics Departmen in Math and Science Faculty of Macassar State University. Results of this research are producted two models of assessment isomorphic problem, namely qualitative-qualitative and quantitative-quantitative isomorphic problem. At the first model, the students wave concept understanding maximally by multiple choice, but at the second by essay.

**Key Words** : assessment isomorphic problem, qualitative-qualitative, context, concept, wave.

## Background

One component that very important in learning process is assessment. Assessment has many roles. Yet, the roles that're very mportant to be attentioned now namely that assessment can increase the thinking level of the students. Hence, we need to develop an assessment model for this paradgm.

One assessment model that's proved can increase the thinking level of the students is isomorphic problem assessment model. This model is considered by Chandralekha Singh. He bases his assessment model at cognitive theory. Cognitive theory suggests that the context in which knowledge is acquired and the way it is stored in memory has important implications for whether cues in a problem statement will trigger a recall of the relevant (Bransford, et.al; Bjork, et.al; Godden et.al. in Singh, 2008). Singh's assessment model is about the isomorphic in qualitative and quantitative at basic physics in mechanics. His research result shows that the students' ability to solve the qualitative problem of mechanics that's constructed in isomorphic is better than their ability to solve the qualitative problem of mechanics but not isomorphic.

At this time, the physics learning assessment, so the assessment in basic physics learning is inclined made not attention how to increase the physics concept understanding of the students. Assessment is inclined only funtioned as an achievement to justified whether the students are rule or not the basic physics matter that they have studied without thinking how can the assessment can access the student's real ability maximally. However, all components in learning, consider the assessment should to contribute in increasing the physics concept understanding so their understanding more and more maximal.

As a researher, I invent that the problems above can be exceeded implementation the isomorprhic problem assessment model. As for the assessment model that's developped in this researh is qualitative-qualitative and quatitative-quantitative isomorphic problem by involved the essay and multiple choice. The implementation subject in this research is wave.

The goals of this research was finding and developping a model of assessment that's hoped to able accessing (exploring) the students's concept understanding maximally. namely assessment isomorphic problem model. Special goals will be

reach in this research is producted a model of assessment isomorphic problem that properest to develop and to be aplicated in assessing the students' achievement so it is more and more indicate the student's real ability or real concept understanding. In details, this research answers about: 1) how to develop two models of isomorphic problem assessment at basic physic about wave, 2) creat two asesmen isomorphic problem with their developping steps, 3) know the learning outcome of the students, 4) how are their opinion about the model.

## Method

This research was using Research and Development method by steps: making the beginning instrument design, validations, limited implementation, analizing the result of limited implementation, revision of the beginning instrument, making real instrumen, broad implentation, analizing the result of broad implementation, and publication. The subject in this research is the studens from Physics Department in Math and Science Faculty of Makassar State University.

## Result and Discussion

This research result consist of two models of isomorphic problems assessment and its development steps, test result by two models and their anayizing, and the responses of the students about both models are developped.

First, both models are producted in this research are qualitative-qualitative and quantitative-quantitative isomorphic problem. The development steps of these models are: 1) choosing the matter, 2) writing the conceps that'll be center of assessment, 3) writing the concept analyzing, 4) writing the goals of learning, 5) construct the assessment, 6) at qualitative-qualitative models, construct the assessment so it contains qualitative problems and at quantitative-quantitative models, construct the assessment so it contain quantitative problems, and 7) each model is constructed in two types: essay and multiple choice.

Second, the test result by two models and their anayizing are showed in Table 1 until Table 10 on Appendix. According to the score and value data from Table 1, Table 2, Table 5, and Table 6 (on appendix), the value average of the students from two models : 1) in qualitative-qualitative model or Model A part essay, the value average is 80.17 and in part multiple choice the value average is 87.86, 2) in quantitative-quantitative model or Model B part essay, the value average is 92.80 and in part multiple choice the value average is 77.46 . Hence, at the first model (Model A), the students wave concept understanding maximally by multiple choice, but at the second (Model B) by essay. Table 3 and Table 4 (on appendix) show that the both assessment are valid and reliable, their statuses are well, and not very difficult.

Third, the responses of the students about both models are developped are showed in Table 10 and Table 11. By the tables we know that there are 25 persons (89.29 %) said that the assessments (model A and B) are not difficult to solve and oly 3 persons (10.71 %) said difficult. All students (100 %) said that the assessments (model A and B) are interested.

## Conclusion

If we want to construct qualitative-qualitative and quantitative-quantitative isomorphic problem, we can go by these steps: 1) choosing the matter, 2) writing the conceps that'll be center of assessment, 3) writing the concept analyzing, 4) writing the goals of learning, 5) construct the assessment, 6) at qualitative-qualitative models, construct the assessment so it contains qualitative problems and at quantitative-quantitative models, construct the assessment so it contain quantitative problems, and 7) each model is constructed in two types: essay and multiple choice.

At Model A, the students wave concept understanding maximally by multiple choice, but at Model B by essay. The responses of the students about both models are developped are : 1) 25 persons (89.29 %) said that the assessments (model A and B) are not difficult to solve and oly 3 persons (10.71 %) said difficult and all students (100 %) said that the assessments (model A and B) are interested.

## References

Borg, W.R., & Gall, M.D. (2003). Education Research: An Introduction, 7th-ed. Boston: Pearson Education, Inc.

Borg, W. R., & Gall. M.D. (1983). Educational Research An Introduction. New York: Longman.

Bransford, J.D., et.al. (1999). How People Learn: Brain, Mind, Experience and School. Washington DC: National Academy Press.

Chang. S.N & Chiu. M.H. (2005). The development of authentic assessment to investigate ininth graders' scientific literacy: in the case of scientific cognitive concerning the concepts of chemistry and physics. International Journal of Science and Mathematics Education. 3, 117-140.

Depdiknas. (2003). Pedoman Khusus Pengembanagan Silabus dan Penilaian: Mata Pelajaran Fisika. Depdiknas Ditjen Dikti.

Depdiknas. (2003). Kurikulum 2004, Standar Kompetensi Mata Pelajaran Sains. Depdiknas Ditjen Dikti.

Direktorat PMPTK. (2008). Strategi Pembelajaran MIPA. Depdiknas.

Gioka, O. (2006).Assessment for learning in physics investigations: assessment criteria, questions and feedback in marking. Physics Education. 41, (4), 341-346.

Gronlund, N.E. (1982). Construction achievement test. Englewood Cliffs, N.J.: Prentice-Hall.

Gronlund, N.E. (1990). Measurement and Evaluation in Teaching. New York: Macmillan.

Haladyna. (1997). Writing Test Items to Evaluate Higher Order Thingking. Boston: Allyn and Bacon A Viacom Company.

Kumano, Y. (2001). Authentic Assessment and Portofolio Assessment-Its Theory and Practice. Japan: Shizuoka University.

Lowe, J.P. (2007). Assessment That Promotes Learning [Online], Tersida: www.schreyerinstitite.psu.edu (24 Maret 2008).

Maloney, D., (1994). Research in Problem Solving: Physics, in Handbook of Research on the Teaching and Learning of Science, London: MacMillan.

Meltzer, D.E. (2002). the relationship between mathematics preparation and conceptual learning gain in physics: a possible hiddeen variable in diagnostic pretest scort. Am. J. Phys. 70(2). 1259-1267. Tersedia dalam http:www.physics.lastate.edu/per/ does/Addendum_on_normalizedgain.pdf.

Newell, A. (1990). Unified Theories of Cognition. Cambridge: Harvard University

Nurkancana, Wayan dan Sumartana, PPN (1986). Evaluasi Pendidikan. Surabaya : Usaha Nasional

Perrie, Y. (2003). Effective Use of Assessment Methods [Online], 3 halaman, Tersedia: http:www//pharmj.org.uk (27 Maret 2008).

Pusat Kurikulum, Balitbang Depdiknas. (2004). Ringkasan Penilaian Berbasis Kelas. Depdiknas Ditjen Dikti.

Ratumanan, T. G. & Laurens, T. (2003). Evaluasi Hasil Belajar yang Relevan dengan Kurikulum Berbasis Kompetensi. Surabaya: Unesa University Press.

Roedinger, H.L. & Marsh, E.J. (2005). The positive and negative concequences of multiple choice testing. Journal of Exsperimental Psychology. 31, (5), 1155-1159.

Sardiman, A. M. (2001). Interaksi dan Motivasi Belajar Mengajar. Jakarta : PT. Rajagrasindo Persada.

Simkin, M. G & Kuechler, W. L. (2005). Multiple choice test and student understanding: what is te connection?. Decision Science Journal of Innovative Education. 3, (1), 73-97.

Singh, C. (2008). Assessing student expertise in introductory physics with isomorphic problem.i. perfomance nonintuitive problem pair from introductory physics. The American Physical Society. 4, 010104, 1-9.

Singh, C. (2008). Assessing student expertise in introductory physics with isomorphic problem.ii. effect of some potential factors on problem solving and transfer. The American Physical Society. 4, 010105, 1-10.

Sudjana, Nana. (2002). Dasar-dasar Proses Belajar Mengajar. Bandung: Sinar Baru Algesindo.

Sukamdinata, N.S. (2004). Kurikulum dan Pembelajaran Kompetensi. Bandung: Kesuma Karya Bandung.

Sutikno, Sobary, (2004). Model Pembelajaran Interaksi Sosial, Pembelajaran Efektif dan Retorika. Mataram: NTP Press.

Troup. J. (2006). Assessment Procedures [Online]. Tersedia: http://www.chace.org.au/Documents/Microsoft%20Word%20-%20Assessment%20Procedures%20_Rev%202.pdf.

Tuncay & Salih. (2006). Relation between science teachers' assessment tools and students' cognitive development. Academic Journal. 1, (7), 222-226.

Willis, J. (2007). Assessment for Learning-Why the Theory Needs the Practice [Online], Vol 3 (2), 8 halaman, Tersedia: http://www.apacall.org (5 Maret 2008).