

## ENVIRONMENTAL PROBLEM SOLVING IN LEARNING CHEMISTRY FOR HIGH SCHOOL STUDENTS

MUNIR TANRERE

Chemistry Department, Faculty of Mathematics and Natural Sciences, Makassar State University,  
Kampus Parang Tambung Jalan Daeng Tata, Makassar, Indonesia  
Phone: +62 411 86493; Fax: +62 411 872594; E-mail: [tanrere\\_munir@yahoo.co.id](mailto:tanrere_munir@yahoo.co.id)

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**Abstract:** This case study was a classroom action study, implemented in SMA Negeri 3 Makassar Indonesia, which was aimed at improving the chemistry learning through implementation of environmental problem solving learning model. The study was executed on the collaboration work among researcher lectures and chemistry teachers. The study was carried out in two cycles, where each cycle consists of planning, action, observation, and reflection. The data was gathered through an observation, questionnaire, and a test. The results of the study showed that environmental problem solving learning model could improve learning quality of chemistry and created students to improve motivation, activity, creativity, reasoning, and interdependence each other.

**Keywords:** Environmental-based chemistry, learning quality improvement, student-centered approach

### INTRODUCTION

The demand of competency-based curriculum in changing learning paradigm from teacher-centered approach to students-centered approach has just commenced in Indonesia. The best way for the students to learn science was by giving them challenge problems and forcing their mind, stimulating habituation to think and doing action related to problem solving [1]. The momentum was enhanced by introducing green school program that provides recognition and focus to take environmental action and build a strong school image in the community. The program encouraged students to be environmentally responsible and to take personal action at school and with their families as well. Incorporating green school program into competency-based curriculum was an approach in science education. Students engaged in issues pertaining to the impact of science on everyday life and made responsible decisions about addressing an issue [2-5]. Students would also understand the practical relevance of science rather than just concentrate on theories that seemed distant from realities [6-7]. There were a variety of ways in which those can be approached in the classroom by integrating other curricular areas such as history,

geography, social studies and language arts [8]. Since environmental education has been considered an additional or elective subject at school, it could take the form of science enrichment curriculum, a focused subject within the sciences or is a part of student interest groups or clubs. One of the current trends within environmental education seeks to allow students to make informed decisions and take action based on experience as well as data. Asbat [9] reported that using the concept map in learning of environmental radioactive chemistry could improve the understanding of students. Tanrere [10] studied that concept-mapping strategy on atomic and molecule structures instead of stoichiometric computation was more effective to improve test results of students. Besides, Lutfi [1] demonstrated that problem solving based learning which was intervened through the concept map was more effective compared with learning by problem solving approach and concept mapping approach. Therefore, this study was aimed to observe whether environmental problem solving on chemistry improves the understanding of students in learning chemistry as pure science, engaging students in examining a variety of real world issues and grounding scientific knowledge in such realities. In today's world, such issues might include the impact on society of global warming and deforestation practices.

## **METHODOLOGY**

The subject of this research was the second year students of high school, particularly SMA Negeri 3 Makassar who studied chemistry in the odd semester 2006/2007. There were 42 students, consisted of 15 males and 27 females. The research was executed using Classroom Action Research paradigm with steps: planning, action, observation, and reflection [11] for two cycles. The first cycle addressed chemistry on topic of purely scientific condensation and the second cycle was for environmental perspective of condensation.

Each cycle consisted of meeting with partner teachers to prepare learning materials and arrange research instruments, covering lesson plan, teaching materials, observation and test instruments. The teaching plan was executed that guide students to: 1) read and comprehend the content of the lesson material, 2) specify the relevant concepts, 3) arrange concepts from the most inclusive concept to the concept, which was not inclusive. 4) correlate the concepts with word or conjunction words, 5) finalize the concept map. Observations were carried out that consisted of filling observation check list, observing important events in the class of learning process, and applying test at the last.

Issues-based approach was applied to stimulate an understanding of the science behind issues, and the consequences to society and the environment. A multi-faceted approach to examining issues highlights the complexities of real-life debates. Students also become aware of the various motives for decisions that address environmental issues. Example was real life events within the community, at the national or international level, can be examined from ethical and social perspectives through presentations and narratives. Real life events might include the impact of environmental legislations, industrial accidents and the influence of particular scientific or technological innovations on society and the environment. Each cycle run for eight times meeting of two hours.

## **RESULTS AND DISCUSSION**

Observation results on student responses were evaluated at the end of the second cycle. It showed that improvements of students learning were actually demonstrated at the second cycle (Table 1), representing environmental problem solving was effective in learning condensation.

This fact was confirmed by test results (Table 2), showing higher score for environmental problem solving than for purely scientific condensation.

Table 1: Check list of students responses

No	Description	1 <sup>st</sup> Cycle	2 <sup>nd</sup> Cycle
1	Pleasant of learning	60.0	92.5
2	Active in the class such as discussion	60.0	80.0
3	Occasions to discuss real world	50.0	82.5
4	Discover new cases	47.5	80.0
5	Difficulties to arrange the concept map	67.5	27.5
6	Task arrangement improves the creativity	85.0	92.5
7	Difficulties in answering problems rised by the teacher	75.0	30.0
8	Difficulties to formulate hypothesis	67.5	47.5
9	Get less occasion to express idea in the cycle work	75.0	25.0
10	Easily find out new cases to be investigated	62.5	80.0
11	Difficulties to draw conclusion for discussion	67.5	32.5
12	Improve their learning motivation	77.5	92.5
13	Difficulties to correlate between one concept and the other concept in arranging the concept map	55.0	30.0
14	Problem solving learning that intervened by the map concept will be more easy to comprehend the lesson.	67.5	77.5

Table 2: Frequency distribution of test score

No	Score	Category	Percentage of students	
			1 <sup>st</sup> Cycle	2 <sup>nd</sup> Cycle
1	90 – 100	Very high	4.8	11.9
2	80 – 89	High	23.8	35.7
3	65 – 79	Intermediate	61.9	50.0
4	55 – 64	Low	9.5	2.4
5	0 – 54	Very low	0.0	0.0

Implementation of problem solving learning model which were developed in this research has straight comparison with the implementation of students learning result. This was confirmed with Learning Trapeze Theory of Dale [1] that learning which makes students active such as participation in discussion, narrating, presenting, simulating experience, and doing something real, tend to recall material which has been learned 70% - 90%, compared with passive students who have tending just to recall material 50%. Interventions of the map concept in the problem solving learning, helping students to realize and control the cognitive process to the task, and helping students to develop the integrated conceptual work braid. Students collaborating in the learning of the map concept were getting better meaningful learning than students working individually [12]. Learning through cooperative work in the problem solving learning could improve students activity [13] that one of factors supporting the development of problem solving performance was collaboration among students who have immeasurable experience background, who have contribution in problem solving. The above findings require teachers to research and gather information from a variety of sources. At the same time, teachers need to develop a sound understanding of issues from various disciplines. This is so that students' knowledge base can be

appropriately scaffolded to enable them to effectively engage in discussions. However, most science teachers are specialized in a particular field of science. Lack of time and resources may affect teachers and students performances in examining issues from multiple perspectives. Nevertheless, environmental problem solving approach to chemistry education enables students to gain a more rounded perspective on the dilemmas, as well as the opportunities, that science presents in our daily lives.

## CONCLUSIONS

Implementation of environmental problem solving learning model was able to improve learning quality. This case was proofed in the change of learning orientation from the teacher-centered learning to the student-centered learning. Teacher conducted teaching as mediator or facilitator whereas students actively found out problems solving that created students creativity. This suggests teachers to develop a sound understanding of issues from various disciplines, particularly in environmental sciences.

## REFERENCES

1. Lutfi, 2003. Pembelajaran Berbasis Problem Solving yang Diintervensi dengan Peta Konsep dan Pengaruhnya Terhadap Berfikir Kritis Mahasiswa dalam Mata Kuliah Perkembangan Hewan. Malang, Jurnal Penelitian Kependidikan 13 (2): 212-228.
2. Solomon, J., 1993. *Teaching Science, Technology & Society*. Philadelphia, CA: Open University Press.
3. Aikenhead, G.S., 1994. What is STS science teaching? In Solomon, J. & G. Aikenhead (eds.), *STS Education: International Perspectives in Reform*. New York: Teacher's College Press.
4. Aikenhead, G.S., 2003. STS Education: a rose by any other name. In *A Vision for Science Education: Responding to the world of Peter J. Fensham*, (ed.) Cross, R.: Routledge Press.
5. Hodson, D., 1998. *Teaching and Learning Science: Towards a Personalized Approach*. Buckingham: Open University Press.
6. Fensham, P.J., 1985. Science for all. *Journal of Curriculum Studies*, 17: pp 415-435.
7. Fensham, P.J., 1988. Familiar but different: Some dilemmas and new directions in science education. In P.J. Fensham(ed.), *Developments and dilemmas in science education*. New York: Falmer Press pp. 1-26.
8. Richardson, G. and D. Blades, 2001. *Social Studies and Science Education: Developing World Citizenship Through Interdisciplinary Partnerships*.
9. Asbat, 1998. Pengaruh Penggunaan Peta Konsep dalam Kegiatan Belajar Mengajar Kimia terhadap Prestasi Belajar Kimia SMU. Skripsi tidak dipublikasi. Ujung Pandang: FPMIPA IKIP UP. 64 halaman.
10. Tanrere, M., 2003. Pengembangan Strategi Pemetaan Konsep untuk Meningkatkan Kualitas Pembelajaran Ikatan Kimia. Makassar, *Jurnal Chemica* 4(2): 31-39.
11. Kemmis, S and R. Mc. Taggart, 1988. *The Action Research Plannet*. Victoria: Deakin University Press.
12. Roth, W. M. and A. Roychudhury, 1993. The Concept Maps as a Tool for the Collaborative Construction of Knowledge. *Jurnal of Research in Science Teaching*. 3(5): 503-534.
13. Hart, L.C., 1993. Some Factor that Impede or Enhance Performance in Mathematical Problem Solving. *Journal for Research in Mathematics Education*, 24 (1): 167-171.