

# IMPROVING THE ORGANIC CHEMISTRY TEACHING LEARNING PROCESS AND THE STUDENTS' ENGLISH READING COMPREHENSION

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**Abstract:** This study was aimed at the improvement of the Organic Chemistry II teaching learning process and the students' English reading comprehension. The design was a two cycled classroom action research whose activities are: in Cycle I the Learning Cycle was implemented using topics taken from an Indonesian Organic Chemistry textbook (Parlan, 2003), and also the Reciprocal Teaching Method using topics taken from an English Organic Chemistry textbook (Wade Jr, 1987). In Cycle II both models were implemented with a slight modification. The results: (1) Learning Cycle was ineffective which might be the effect of the class size (52 students), (2) the students' English reading comprehension was improved which is in accordance with the questionnaires responses.

**Keywords:** learning cycle, reciprocal teaching method, organic chemistry achievement, English comprehension.

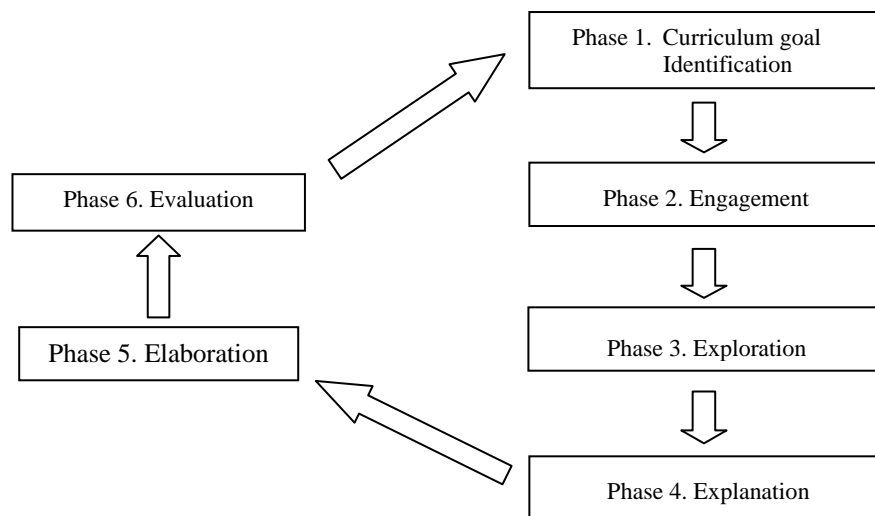
Gabel (1994) stated that in the last decades, researchers and science educators have become increasingly interested in the learning cycle as a model of instruction and procedure for curriculum development. The learning cycle is not a new concept in science education, its origins stemming from (1) the development of the Science Curriculum Improvement Study (SCIS) program in the 1960s; (2) the work of Atkin and Karplus (1962) related to "guided discovery" teaching, and (3) the research of Lawson, Abraham, and Renner (1989) leading to the development of a theory of human learning compatible with the basic elements of the learning cycle. It has traditionally been described as a "method" or "theory" of instruction that centers on investigative activity preceding any formal introduction to scientific concepts.

Since its introduction in the 1960s, the learning cycle has been referred to alternatively as exploration-invention-discovery or exploration-concept introduction-concept application (Karplus & Thier, 1967), exploration-conceptual invention-expansion of idea (Renner, Abraham & Birnie, 1985); d) ex-

ploration-conceptual invention-conceptual expansion (Abraham & Renner, 1986), and exploration-term introduction-concept application (Lawson, 1988). This model is popularly known as the "do-talk-do" approach.

Science educators describe the phases of learning cycle essential to the development of concepts in terms of Piagetian theory: the exploration phase parallels the ideas of assimilation and disequilibrium, the conceptual invention stage is analogous to the principle of accommodation, and the conceptual expansion phase facilitates organization (Renner & Marek, 1988).

An alternative learning cycle model that is important to be considered was developed by Bybee *et al* in the Biological Sciences Curriculum Study (Bybee *et al*, 1989) which has five phases that have been incorporated into curriculum resources developed by the group. The phases are engagement, exploration, explanation, elaboration, and evaluation. The special quality of these phases is the focus on student actions. Bybee *et al* define each phase in terms of what students must do in a science



**Figure 1. Six Phased Learning Cycle (Johnston, 2001)**

activity. For example, the evaluation phase is described in terms of students assessing their knowledge, skills, and abilities.

Another outgrowth of the learning cycle was developed by Johnston (2001) who added one more phase to the Bybee’s learning cycle, hence becomes: identification of the curriculum goal, engagement, exploration, explanation, elaboration, and evaluation. The following diagram depicts the Johnston learning cycle.

The implementation of the six phased LC model involves the instructor’s questions in all phases except in phase 1. The following is an example of the model’s lesson plan.

Phase 1 : the instructor mentions the standard of competence of an instruction, *e.g.* the students are able to explain about the Kinetic Theory.

Phase 2 : the instructor asks the following questions, “What do you know about the Kinetic Theory?”

He/She gives the opportunity to the students to answer the question without consulting a textbook. The students answer the question.

Phase 3 : the instructor asks the following question, “ Is your answer correct or incorrect?”

He/She allows the students to explore the textbook, then answer the question whether their answers are correct or incorrect.

Phase 4 : the instructor asks the following question, “ Can you explain why you said that your answer was correct? Incorrect?”

The students explain by comparing their answers with the textbook.

Phase 5 : the instructor asks the following question, “Can you apply your knowledge about the Kinetic Theory by giving an example of natural phenomena in your daily lives which can be explained using the Kinetic Theory?”

The students answer the instructor’s question. If the students still have difficulties in following the phases, then the instructor may repeat the process from any phase where the problems start.

Phase 6 : Evaluation can be conducted by giving the students a test which may be a pencil and paper test or an oral test.

Palincsar (1986), Mayfield (1995), Hart and Speece (1995), Lysynchuck *et al* (1990), and Jones (2001) were educators who interested in improving students’ reading comprehension or performance. Palincsar defined the Reciprocal Teaching Method as the following: a teaching learning activity in the form of dialogues between the instructor and the students, or between the students and the students about a passage or a text. The dialogues were structured in four activities, *i.e.* (1) to predict, in this phase the student was asked to make a prediction about the content of a passage based on the title of the passage or the content of the following passage based on the content of the previous passage; (2) to clarify, in this activity the students was asked to clarify the difficult words or concepts which made the passage difficult to understand; (3) to question,

in this activity the student was asked to pose question as many he/she could from the passage; (4) to summarize, in this activity the student was asked to make a summary from the passage. It is important for the instructor to give each student the chance or opportunity to experience all four activities of the Reciprocal Teaching Method. In addition to that, it is better for the instructor to be familiarized with the Cooperative Learning before implementing the Reciprocal Teaching Method, as the latter is the development of the former.

As a consequence, the four elements and the seven rules of the Cooperative Learning emphasised by Johnson *et al* (1984) were also applicable for the Reciprocal Teaching Method. The four elements were: (1) face to face interaction: students worked in four-membered groups; (2) positive interdependence: students worked together to achieve the group goal; (3) individual accountability: students must show that they had individually mastered the material; (4) interpersonal and small group skills: students must be taught effective means of working together and of discussing how well their groups were working to achieve their goals. The seven rules were: (1) I am critical of ideas, not people; (2) I remember that we are all in this together; (3) I encourage everyone to participate; (4) I listen to everyone's ideas, even if I do not agree with them; (5) I restate what someone said if it is not clear; (6) I try to understand both sides of the issue; (7) I first bring out all the ideas, then I put them together.

There were seven steps taken by the instructor to implement the Reciprocal Teaching Method, i.e. (1) the students were divided into groups of four and assigned the task of the predictor, the clarifier, the questioner, and the summarizer; (2) the instructor distributed the material, explain the job description for every task, and gave the students the opportunity to ask question; (3) the students worked in their groups according to the task assigned for them; (4) the instructor monitored every group to check how well the process went; (5) the instructor gave the opportunity to the groups to present/communicate their work; (6) the instructor gave the opportunity to the other groups to respond to the presentation; (7) the students and the instructor together drew the conclusion of the activities (adopted with modification from the Ministry of Education, Wellington, New Zealand, 1998).

Organic Chemistry II is offered at the even semester at the Chemistry Department, Faculty of Mathematics and Science, The State University of Malang, East Java, Indonesia. Based on the re-

searcher's observation as the instructor of the course, the students who enrolled in the Organic Chemistry class faced difficulties in attending the lecture. The indicators of the problem were the students' low learning achievement and unenthusiastic attitude (Iskandar, 2002). They were two reasons causing the above mentioned problem, i.e. the mediocrity of the Organic Chemistry II teaching learning process, and the students' poor English language mastery. In higher education, proficiency in English is a key element as the books provided in the libraries are mostly written in English. Further analysis of the situation called for an improvement in the Organic teaching learning process as well as the students' reading comprehension.

The six phased learning cycle model (Johnston, 2001) was planned to be implemented in the Organic Chemistry II class to improve the teaching learning process as the model's effectiveness was proved by the Chemistry Piloting team (2002) and by Iskandar & Tjahjawati (2001), while the Reciprocal Teaching Method was planned to be implemented to improve the students' reading comprehension as the effectiveness of the method was proved by Palincsar (1986), Hart & Speece (1995), and Iskandar (2003).

The research question was written as the following: can the Organic Chemistry II teaching learning process and the students' poor English reading comprehension be improved using the Learning Cycle Model and the Reciprocal Teaching Method? As a corollary the hypothesis of the research was: the Organic Chemistry II teaching learning process and the students' poor English reading comprehension can be improved using the Learning Cycle and the Reciprocal Teaching Method, hence the objectives of the research were to improve the Organic Chemistry II and the students' poor English reading comprehension.

## METHOD

The design of this research was a two cycled classroom action research. The subjects were the 52 students who enrolled in the Organic Chemistry II class, Faculty of Mathematics and Science, The State University of Malang, during the even semester in the 2004-2005 academic year.

The activities which were carried out in Cycle I were: (1) The planning of administering the English pre test for the students before implementing the Reciprocal Teaching Method, the pre test material was taken from the "Understanding Nutrition"

book entitled "The Vitamins", dividing the students into groups of four, explaining the tasks for the Reciprocal Teaching Model; and preparing the material for the Learning Cycle from the Indonesian Organic Chemistry textbook (Parlan, 2003) as well as material for the Reciprocal Teaching Method from the English Organic Chemistry textbook (Wade Jr, 1987). (2) The execution of the English pre test using the short passage "The Vitamins" taken from the book "Understanding Nutrition" (Whitney, Hamilton, and Rolfes, 1997). The students were asked to write a free translation from the text, and to pose questions from the text as many as they could; the pre test score was 55.2; the implementation of the Learning Cycle and Reciprocal Teaching Method. During the implementation of the Learning Cycle the students working in the same group as in the Reciprocal Teaching Method. The questions in Phase 2 till Phase 5 of the Learning Cycle were done by the students who took turn to lead the activities instead of the instructor; at the end of Cycle I the students were give the mid semester test. (3) Observation was done by the instructor during the activities were in progress, and the answers of the test was graded. The mean of the mid semester test was 43.3. Based on the instructor's fieldnote who was also the researcher, almost all

students were active in the teaching learning process. During the Learning Cycle implementation they were active in the discussion, and during the implementation they tried to speak English as much as they could. (4) Reflection: because the mid test score was still below the passing grade (56), then both models were still implementation with a slight modification.

The activities in Cycle II were the same as in Cycle I except for the materials and a change of mode of discussion. The students were asked to work in a different group, and the speaking of English was more emphasized. At the end Cycle II the students were given the Final Test, the post test and questionnaires concerning Cycle and The Reciprocal Teaching Method. The mean score of the Final Test was 37.0; the post test score was 73.3.

## RESULTS

The results of the classroom action research can be summarized in the following tables: Table 1 depicts the students' learning achievement, table 2 depicts the students' opinion about the Six Phased Learning Cycle (Johnston, 2001), and table 3 depicts the students' opinion about the Reciprocal Teaching Method.

**Table 1. Students' Learning Achievement**

Description	Cycle I (Mean score)	Cycle II (Mean score)
Test of English reading comprehension	55.2	73.3
Test of Organic Chemistry topics	43.3	37.0

**Table 2. Students' Opinion about Six Phased Learning Cycle**

Description	% SA	% A	% N	% D	% SD
This model makes students active and independent.	17.4	32.6	41.3	4.4	4.4
This model makes students read and study Organic Chemistry textbooks.	10.9	45.7	39.1	2.2	2.2
I like this model because it makes me alert.	21.7	52.2	13.0	13.0	

Note: SA = Strongly Agree  
 A = Agree  
 N = Neutral  
 D = Disagree  
 SD = Strongly Disagree

**Table 3. Students' Opinion about Reciprocal Teaching Method**

Description	% SA	% A	% N	% D	% SD
This model makes students understand teaching materials.	6.5	34.8	45.7	13.0	2.2
This model makes students industrious in using English dictionary.	24.0	47.8	26.1	-----	4.4
I like this model because it enables me to check my English ability.	8.7	50.0	32.6	10.9	-----

Note: SA = Strongly Agree  
 A = Agree  
 N = Neutral  
 D = Disagree  
 SD = Strongly Disagree

## DISCUSSION

There were two objectives of this classroom action research, i.e. to improve the Organic Chemistry II teaching learning process and the students' English reading performance. For the case of the Organic Chemistry II teaching learning process, the learning achievement was the quantitative indicator using the test as the instrument, and the students' enthusiasm was the qualitative indicator using the instructor's observation list as the instrument. The results concerning the teaching learning process, showed the uneffectiveness of the Learning Cycle as a decrease on the learning achievement occurred during Cycle I – Cycle II. The mean score of the Organic Chemistry test given at the end of Cycle I was 43.3 and at the end of Cycle II was 37.0 Interestingly the qualitative indicators showed the opposite evidence. According to the instructor's field-note the students were very active and enthusiastic during the teaching learning process, therefore the quantitative indicator did not coincide with the qualitative indicators. A possible reason for this situation was the big size of the class (52 students). This fact calls for another classroom action research.

The students' English reading comprehension was monitored during the implementation of the Reciprocal Teaching Method in Cycle I dan Cycle II. The quantitative indicator was the difference between the mean pre test score and the mean post test score. The courage to speak English and the

questionnaires about the teaching method were used as the qualitative indicators. The results of the research on terms of students' English reading comprehension showed that the Reciprocal Teaching Method was effective, because there was an increase between the mean pre test and post test scores (the mean pre test score was 55.2 and the mean post test score was 73.3). This quantitative data was supported by the qualitative data as the students' courage to speak English at the end of Cycle II increased and the responses of the questionnaires said that the students enjoyed the Reciprocal Teaching Method.

## CONCLUSION AND SUGGESTION

### Conclusion

The results of this classroom action research had led to the conclusion of the uneffectiveness of the Six Phased Learning Cycle though it was not supported by the qualitative data, and the effectiveness of the Reciprocal Teaching Method.

### Suggestion

Further classroom action research is suggested to be undertaken to examine the influence of size class variable has contributed to the uneffectiveness of the Six Phased Learning Cycle.

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