



# Implementing the Powerpoint 2010 and Phet Simulation Media with Modification of Reciprocal Teaching Approach in Inorganic Chemistry Materials

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**Abstract.** This study aims to improve the learning outcomes and responses of undergraduate students in implementing the *PowerPoint* 2010 and *PhET Simulation* media with *modification of reciprocal teaching* approach. This study was conducted on classroom action research. The subjects were forty-four undergraduate students of the Chemical Education Department of the University of Bengkulu who took the Inorganic Chemistry course in academic year 2016/2017. This research was addressed in three cycles, where each cycle consisted of four stages: plan, action, observation, and reflection. Quantitative data was gathered from the test, while the qualitative data were from the observation sheets. The results showed an increase in learning outcomes of the students from the first to the third cycle, which were 72.1, 73.6, and 80.7. On the other hand, the responses to the media and approach used in this study for three cycles were in good categories. Thus, it showed that the improvement of the knowledge of undergraduate students in Inorganic Chemistry materials.

**Keywords:** power point 2010 · phet simulation · modification of reciprocal teaching · chemistry materials

## 1 Introduction

Educators (lecturers) at universities have very strategic functions and roles in development in education, so they need to be developed as dignified professions. Law No. 14 of 2005 concerning Teachers and Lecturers in article 4 confirms that lecturers as learning agents function to improve the quality of national education. Therefore, lecturers are required to have certain conditions, one of which is competence. Competence is a set of knowledge, skills, and behaviours that lecturers must possess, internalize, and control in their professional duties [1].

The teaching ability of a lecturer which is professional in using appropriate and varied models, approaches, teaching methods, and media as well as practical and efficient teaching can foster student motivation to be more active in teaching and learning activities. The learning methods applied to the Inorganic Chemistry II course at the Chemical

**Table 1.** Final grades for Inorganic Chemistry II course

No.	Academic year	Average score
1.	2014/2015	75.8
2.	2013/2014	72.0

Education Department of University of Bengkulu were generally still monotonous or less varied. Inorganic Chemistry II is a compulsory subject, which can be taken every odd semester with a weight of 2–1 credit (3 credits). This course contains the study of concepts about solutions and solvent systems, chemical equilibrium, thermochemistry, electrochemistry, acids and bases, reaction kinetics, colloidal systems, organometallic compounds, and nuclear chemistry. Lecture material is understanding and analytical so that in the learning process, innovation in learning is needed in its delivery in the class.

Based on our experiences in teaching the courses and interviews with several students in each batch, several problems in teaching and learning process in Inorganic Chemistry II courses can be identified: (1) lecturers did not vary in the learning process, (2) lack of student creativity in the teaching and learning process, (3) the lack of students' ability to ask and answer questions in learning process, and (4) the lack of computer-based learning facilities owned by the students.

Data on the final grades for Inorganic Chemistry II course from students in Chemical Education Department of University of Bengkulu in the last two (2) years are shown in Table 1. Table 1 shows the average percentage score, more than 20% of students get a C grade, 58% get a B grade, and only 21% get an A grade. For this reason, efforts were needed in teaching and learning process so that no student gets a grade of low (C).

In order to facilitate the learning process to be more attractive, computer-based learning media are used. The learning system has involved technological support in the form of multimedia content so that the material presented is not just writing and speech from the lecturer but is further developed into a more exciting form, animation or moving images (movie) and sound (audio) [2]. The development of this computer-based learning media using Microsoft PowerPoint 2010 and PhET (Physics Education Technology) Simulation programs. PhET is a simulation media created by University of Colorado that has designed the minimal text which can be easily to understand the material [3]. The advantages of PhET Simulation were more practical, easy to use because it only needed to be installed and can be run with Java applications, as shown in Fig. 1.

Based on the background of the existing problems, an effort is needed to improve students' understanding of the Inorganic Chemistry II material given so that the quality of learning increases. The proposed effort to overcome these problems is the application of the modification of reciprocal teaching approach with learning media tools such as Microsoft PowerPoint 2010 and PhET Simulation.

Reciprocal teaching is a constructive approach, and knowledge is constructed by the students themselves. Students learn together in small groups, work in solving a problem to achieve a common goal. In this case, the improvement in the quality of student learning is obtained from the results of their understanding and discoveries due to interactions with other group members. A modification of reciprocal teaching approach is an approach that

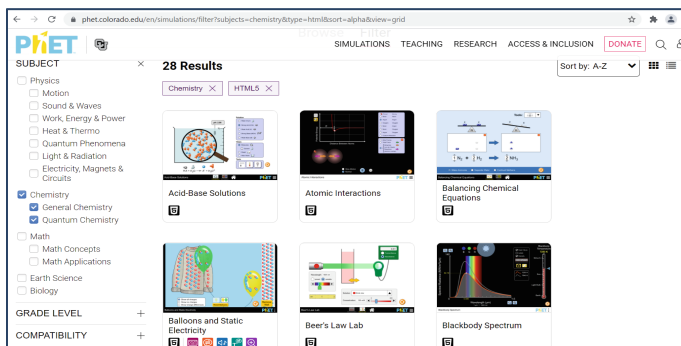


Fig. 1. PhET Simulation

combines conventional learning with reciprocal teaching and is presented in the form of small groups. Conventional learning intended in this study is classical learning that runs as usual. The lecturer provides material, then provides examples and practice questions using discussion and question and answer methods. Learning turn (reciprocal teaching) itself is a model of learning in which students are trained for independent study, that students should be more active with reading material, studying, summarizing, asking questions, discussing or when students apply as a lecturer in front of classroom deliver material like the real lecturers [4].

The objectives of this study to improve the learning outcomes and responses of undergraduate students in implementing the *PowerPoint* 2010 and *PhET Simulation* media with *modification of reciprocal teaching* approach in Inorganic Chemistry material.

## 2 Method

This study was classroom action research. This research conducted by lecturers in their class by designing, implementing, and reflecting on collaborative and participatory actions to improve lecturer performance and increase the ability or professionalism of lecturers in the learning process [5]. The purpose was also to improve pedagogical practices for the lecturers [6].

The subjects were forty-four undergraduate students of the Chemical Education Department of University of Bengkulu who took the Inorganic Chemistry course in academic year 2016/2017. This study was carried out in the Joint Lecture Building III Room 16, starting from June to November 2016. The media used were PowerPoint 2010 and PhET Simulation with a modification of reciprocal teaching approach.

Student learning activities were observed from the level of participation or student activity in expressing opinions, asking questions, group discussions, class discussions, and discussing and solving problems given individually and in groups.

Data collection techniques were collected from observation, essay test and questionnaires. Observations were made to observe the teaching and learning process conditions, changes in student behaviour during the teaching and learning process, activity, creativity, and ability to express known concepts in solving problems. The test was conducted

to measure student learning outcomes in a final test in an essay. And questionnaires were used to determine student responses and attitudes towards PowerPoint 2010 and PhET Simulation media as teaching aids and determine the suitability and appearance of multimedia presentations made as chemistry learning aids. The assessment tool used in the assessment of this attitude aspect was an attitude scale.

The instruments used were using observation sheet and learning outcomes test [7]. There were two observation sheets in this study: 1) lecturer activity observation sheets and 2) student activity observation sheets used to observe student activities in learning processes. The observations are used as guidelines for improving the teaching and learning process in the next cycle. Furthermore, the learning outcomes test or achievement test is used to assess learning outcomes that lecturers have given to their students within a certain time [8, 9]. The test carried out in this study was in the form of an essay test.

### 3 Results and Discussion

#### 3.1 Cycle I

There were four stages in the first cycle: plan, action, observation, and reflection. The initial reflection (plan) has been carried out, and then the research team prepared an action plan for this cycle as follows: 1) updating the syllabus and course units, 2) preparing PowerPoint 2010 and PhET Simulation media, 3) preparing observation sheets for lecturers and students' activities, and 4) preparing an evaluation tool in the form of post-test essay questions.

The media used was PowerPoint 2010 and PhET Simulation. The lecturer explained the material in outline about the types of Solvent Systems, namely water, ammonia, and sulfuric acid. The lecturer conducted questions and answers with students. In learning process, the total number of students were forty-four people with a total of nine groups. Furthermore, students were asked to summarize, formulate questions, explain, predict a problem about the solvent systems. They discussed the material and did the exercises in their respective groups. In group discussions, students would support each other to solve the given practice questions. Until each group member could understand the solution of the problem, several students would be selected to act as lecturers who play an active role with their friends in discussing the exercises and assignments given the lecturer [4].

The result of learning outcomes of Cycle I was shown in Table 2. The learning outcomes has not reached the indicators of study success as expected with average value of 72.1 (Table 2). Twenty-five of students have achieved mastery learning who got grade higher than 70 with the classical percentage of 72.05% and mastery learning classically of 56.82%. Therefore, lecturer still needed to gather information about teaching and learning problems in the classroom to solve the problem and improve the learning outcomes [10].

Observations in this cycle were carried out to observe the activities of lecturers and student activities during the teaching and learning process and were shown in Table 3. Table 3 showed the activities of lecturers were in a good category. Meanwhile, student activities were in the moderate category.

Based on the test results that have been achieved by students and the results of observations of lecturers and students' activities, although the category was good, it still

**Table 2.** Results of learning outcomes of students

Learning outcomes of students	Score (mean)
Cycle I	72.1
Cycle II	73.6
Cycle III	80.7

needed improvements to increase the learning process to be carried out in the next cycle, namely, Cycle II. The reflection of the cycle I were: 1) lecturers were more assertive in determining the time allocation for the student discussion process and 2) lecturers were expected to be more optimal in implementing learning using PowerPoint 2010 and PhET Simulation media with modification of reciprocal teaching approach.

### 3.2 Cycle II

We prepared an action plan for Cycle II, which was as follows: 1) preparing the PowerPoint 2010 and PhET Simulation media about Aqueous Solutions, 2) dividing students into nine groups, 3) preparing the observation sheets for lecturers and students' activities, then 4) preparing an evaluation tool in the form of post-test questions in essay form.

The implementation of the actions for cycle II was similar to Cycle I. Reciprocal teaching approach was implemented in the class where students should be more active with reading material, studying, summarizing, asking and answering some questions, discussing about the material when students applied as a lecturer in front of classroom.

Assessment of learning outcomes was carried out at the end of the course by giving a post-test in essay questions. The results of the analysis of post-test scores in cycle II can be seen in Table 2. Table 2 shows that the learning outcomes in the second cycle have increased from the first cycle. The learning outcomes of this cycle have an average value of 73.6 with a classical absorption of 73.6%. The learning processes have not been completed, therefore the modification of reciprocal teaching approach with PowerPoint 2010 and PhET Simulation media as an innovative learning were still needed.

Observations in cycle II were carried out to observe the teaching activities of lecturers and student activities. Observations focused on the condition of the teaching and learning process, changes in student behaviour during the teaching and learning process, activity, creativity, ability to express the concepts in solving problems. The results of this observation can be seen in Table 3. Table 3 shows the activities of lecturers and students have been categorized as good. The category of student activity has increased from the previous cycle.

Based on the test results that have been achieved by students and the results of observations of lecturer and student activities, there were still needed to improve the learning process to be carried out in the next cycle, namely, cycle III.

**Table 3.** Results of lecturer and student's activities during learning processes

Type of observation	Score	Category
Cycle I		
Activity of lecturer	25	Good
Activity of students	22	Moderate
Cycle II		
Activity of lecturer	28	Good
Activity of students	26	Good
Cycle III		
Activity of lecturer	31	Good
Activity of students	29	Good

### 3.3 Cycle III

We prepared an action plan for Cycle III, which was as follows: 1) preparing PowerPoint 2010 and PhET Simulation media about Acid-Base Chemistry, 2) dividing students into nine groups, 3) preparing observation sheets for lecturers and students' activities, and 4) preparing an evaluation tool in the form of post-test essay questions.

The implementation of the actions for this cycle was almost similar to the previous cycle. However, the difference was the discussion on Acid-Base Chemistry material. Students were divided into nine groups where for each group consisted of four to five students.

The results of the analysis of post-test scores in Cycle III can be seen in Table 2. It is known that the learning outcomes in Cycle III have increased from Cycle I and Cycle II (Table 2). None of the students got a score of 70. In the learning outcomes of Cycle III, students had an average score of 80.7 with classical absorption of 80.7%. Classically, the cycle III learning process has been completed.

Furthermore, the observations in cycle III were carried out to observe the teaching activities of lecturers and student activities in the teaching and learning processes. The results of these observations can be seen in Table 3. Table 3 shows the activities of lecturers and students have been categorized as good. Those categories increased from the previous cycle.

### 3.4 Questionnaires

Questionnaires used to determine student responses and behaviours of PowerPoint 2010 and PhET Simulation media used in learning processes can be seen in Table 4. Table 4 shows the results of the students' questionnaire responses to the media have a range percentage of 80–100% with a very good category [11].

This high percentages showed that the media of PowerPoint 2010 and PhET Simulation used in learning process have positively responses for the students. The statements in the questionnaire about PowerPoint 2010 and PhET Simulation media were interesting

**Table 4.** Results of effective assessment

Student's questionnaire responses	Percentage	Category
Media of PowerPoint 2010 and PhET Simulation used in learning process	84.1	Very good
Learning process with the media	83.8	Very Good

for students, easier to understand the material, the media has enrichment, and increasing the motivation in learning inorganic chemistry material [12].

## 4 Conclusion

The results of this study have shown that the use of PowerPoint 2010 and PhET Simulation media with modification of reciprocal teaching approach might improve the learning outcomes and very good responses of undergraduate students in learning Inorganic Chemistry.

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