

# The Effectiveness of Using Learning Media 3D Pop-Up Chemistry Assisted by Project Based Learning (PjBL) Learning Model Against Student Learning Outcomes on the Subject of Colloid Systems in SMA Negeri 12 Samarinda

Ijai<sup>1\*</sup>, Lambang Subagiyo<sup>2</sup>, Nurlaili<sup>3</sup>, Usman<sup>4</sup>

<sup>1\*</sup>(Program Studi Magister Pendidikan Kimia/ Mulawarman University, Indonesia)

<sup>2</sup>(Program Studi Magister Pendidikan Kimia/ Mulawarman University, Indonesia)

<sup>3</sup>(Program Studi Magister Pendidikan Kimia/ Mulawarman University, Indonesia)

<sup>4</sup>(Program Studi Magister Pendidikan Kimia/ Mulawarman University, Indonesia)

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## Abstract:

**Background:** Learning media is one important aspect that can affect the quality of student learning at school. Lack of use of media in the learning process can affect student motivation and learning outcomes in schools, the growth of globalization and technological advances requires teachers and students to be more creative in using technology in the learning process. 3D Pop-Up Chemistry media is a medium that provides visualization of stories or concepts in an interesting way with an image or theory display that can stand when the page is opened with the effect of several movable parts, this media is equipped with a barcode system that will automatically be connected to the learning video and test online on chemical materials, namely the colloid system, to support the learning process and student activity, the project based learning (PjBL) learning model is used, the PjBL learning model is an innovative student-centered learning model and assigns teachers as motivators and facilitators, in which involves a project in the learning process. This study aims to determine the effectiveness of the use of 3D Pop-Up Chemistry learning media with the Project Based Learning (PjBL) learning model on the subject of the colloid system in SMA Negeri 12 Samarinda.

**Materials and Methods:** This research is a type of quantitative research using pre-experimental design type one group pretest-posttest with 36 students as research subjects, the sampling technique is purposive sampling, data collection techniques are carried out through tests and observation sheets which are analyzed with the N-Gain test obtained from the students' pre-test and post-test scores.

**Results:** The results showed that student learning outcomes before and after using media 3d pop-up chemistry with a project based learning model were 40.69 for the pre-test score and 82.85 for the post-test score with an N-gain value of 0.71 ( Very effective).

**Conclusion:** Based on the research conducted, it was concluded that the learning media 3d pop-up chemistry with the project based learning (PjBL) learning model was very effective in the learning process of colloid material chemistry.

**Key Word:** Effectiveness, PjBL, 3D Pop-Up Chemistry, Colloids.

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## I. Introduction

Chemistry is a branch of the field of study of Natural Sciences which studies the composition, structure, properties and changes experienced by matter both in natural processes and in planned experiments. Through Chemistry we know the composition of substances and the use of both natural and artificial materials and recognize important processes in living things, including our own bodies. According to Munandar & Jofrisha<sup>1</sup>, complex and abstract concepts in chemistry make students think that chemistry is a difficult subject, so many students are reluctant to study chemistry. The effect is that the students' chemistry learning process tends to be passive due to the low interest and motivation of students to learn chemistry<sup>2</sup>. Colloid is a chemical material that is full of theories and concepts in learning, in general many chemistry teachers use conventional methods or lectures for learning colloids. This will cause this material to look boring because it contains a lot of theories and concepts<sup>3</sup>. If the use of this lecture method is continuously carried out on colloid material it will affect the quality of learning and student learning outcomes in chemistry learning. In the PISA program (Program for International Student Assessment) the science and reading abilities of students in Indonesia are in the lowest order, which is in the 74th position out of the 79 countries that participated in the assessment<sup>4</sup>.

The development of reading interest and scientific skills, especially our students, is very concerning. This is because the methods and textbooks given to students are generally less interesting and unpleasant. Less interesting textbooks lead to a lack of interest in learning and reading in students, this will certainly affect students' cognitive abilities, because of the lack of knowledge and insight regarding the subject matter delivered by the teacher<sup>5,6,7</sup>. In this case, media and learning models are needed which can be used to make students interested in reading and can support student activeness in learning. The active learning process carried out by each student through the learning process can build new ideas and knowledge and affect student learning outcomes<sup>8</sup>.

The PjBL learning model is an innovative learning model that is student centered and assigns teachers as motivators and facilitators, which involves a project in the learning process<sup>9,10</sup>. In this case these students are given the opportunity to investigate problem topics and build knowledge themselves so that learning becomes more meaningful by making their own pop-up projects related to colloid system material<sup>11</sup>. According to Nurfitriyanti<sup>12</sup>, the results of her research indicate that the application of the PjBL model can have a high influence on student learning outcomes, which is 39.80% higher than the class with conventional learning. In addition to using the PjBL model, this learning also uses media 3d pop-up chemistry in the learning process, media 3d pop-up chemistry is a media or a book that has 2 or 3 dimensional elements and provides an interesting visualization of a story or concept of a theory with an image display or The theory that can stand when the page is opened with the effect of several parts that can be moved, this media is equipped with a barcode system on several of its pages which will automatically be linked to learning videos and online tests on chemical materials, namely the colloid system. <sup>13</sup>Through the PjBL learning model, students are given a project task of making pop-ups in groups to support students' science activeness and skills student learning on the subject of the colloid system at SMA Negeri 12 Samarinda. The purpose of this study was to determine the effectiveness of the media 3d pop-up chemistry and the used project based learning model.

## II. Material And Methods

This type of research is a type of quantitative research using pre-experimental design type one group pretest-posttest. This research was conducted from July to October 2019 at SMA Negeri 12 Samarinda with the research subjects of 36 students of class XI IPA at SMA Negeri 12 Samarinda, the sampling technique was carried out using purposive sampling technique. This study uses media 3d pop-up chemistry and a project based learning (PjBL) model in the learning process.

Data collection techniques in this study using test and observation techniques. The learning process is carried out in two meetings and observations are made during the learning process, observation is used to determine the activities of teachers and students in the learning process, observations are made by 2 observers who will observe the teacher's activities and student activities related to the implementation of the learning process carried out. Furthermore, data collection using the test technique was carried out by giving pretest and posttest questions to students in the form of multiple choice questions which aim to determine the ability of students' cognitive learning outcomes before and after learning using media 3d pop-up chemistry with learning models project based learning (PjBL). The results of this test are used to determine the effectiveness of the use of media 3d pop-up chemistry with the project based learning (PjBL) learning model, it is said to be effective if student learning outcomes after participating in learning activities using media 3d pop-up chemistry and this project based learning model have increased learning outcomes. The increase in student learning outcomes is measured using the results of the pretest and posttest then analyzed using the N-gain formula as follows<sup>14</sup>.

$$\langle g \rangle = \frac{S_{\text{post}} - S_{\text{pre}}}{\text{Maximum Score} - S_{\text{pre}}}$$

Information:

$\langle g \rangle$  = Gain is normalized (*N-gain*)

$S_{\text{pre}}$  = Pre-test Mean Score

$S_{\text{post}}$  = Post-test Mean Score

Based on the value of the resulting N-gain earned media usage effectiveness criteria media 3d pop-up chemistry with project based learning model learning as shown in table 1 as follows:

**Table 1.** Criteria For the Effectiveness of Using Media and Learning Models

Interval	Criteria
$g \geq 0,70$	Very effective
$0,3 < g < 0,7$	Effective
$g \leq 0,3$	Ineffective

### III. Result

This research uses media 3d pop-up chemistry and a project based learning model in the learning process. This research is a quantitative research type with the pre-experimental design method type one group pretest-posttest and analyzed using the N-Gain test. Based on the results of the research, found that student scores before (pre-test) and after (post-test) using media 3d pop-up chemistry and project based learning model learning as follows:

**Table 2.** Student Scores Before (Pre-Test) and After (Post-Test) Using Media 3d Pop-Up Chemistry with Project Based (PjBL) Learning Model

No.	Students	Pre-Test (Before)		Pre-Test Average Value	Post-Test (After)		Post-Test Average Value
		Pre-Test 1	Pre-Test 2		Post-Test 1	Post-Test 2	
1.	CCC001	35	50	42,5	80	95	87,5
2.	CCC002	50	45	47,5	95	85	90
3.	CCC003	30	45	37,5	75	85	80
4.	CCC004	40	40	40	85	80	82,5
5.	CCC005	25	25	25	80	75	77,5
6.	CCC006	30	35	32,5	80	85	82,5
7.	CCC007	55	35	45	90	75	82,5
8.	CCC008	50	40	45	80	80	80
9.	CCC009	35	30	32,5	75	80	77,5
10.	CCC010	55	50	52,5	100	90	95
11.	CCC011	40	35	37,5	75	85	80
12.	CCC012	35	30	32,5	80	75	77,5
13.	CCC013	50	40	45	95	85	90
14.	CCC014	45	55	50	80	100	90
15.	CCC015	35	40	37,5	85	80	82,5
16.	CCC016	30	45	37,5	75	80	77,5
17.	CCC017	45	25	35	85	75	80
18.	CCC018	50	55	52,5	90	100	95
19.	CCC019	55	30	42,5	85	80	82,5
20.	CCC020	45	45	45	85	85	85
21.	CCC021	50	45	47,5	100	80	90
22.	CCC022	30	40	35	80	85	82,5
23.	CCC023	50	35	42,5	80	85	82,5
24.	CCC024	55	25	40	85	75	80
25.	CCC025	30	25	27,5	75	70	72,5
26.	CCC026	35	30	32,5	75	85	80
27.	CCC027	55	45	50	85	80	82,5
28.	CCC028	45	60	52,5	90	95	92,5
29.	CCC029	50	45	47,5	85	80	82,5
30.	CCC030	55	30	42,5	100	75	87,5
31.	CCC031	35	55	45	80	100	90
32.	CCC032	45	50	47,5	85	90	87,5
33.	CCC033	45	25	35	80	75	77,5
34.	CCC034	50	40	45	70	80	75
35.	CCC035	30	30	30	70	70	70
36.	CCC036	35	25	30	75	75	75
Total		Pre-Test = 1465			Post-Test = 2983		
Average		Pre-Test = 40,69			Post-Test = 82,85		
N-gain Score		0,71					
Criteria		Very effective					

This research was conducted with two learning meetings on colloid chemistry, based on the results obtained as shown in table 2, it can be seen graphs of student learning outcomes before (pre-pretest) and after (post-test) using media 3d pop-up chemistry and project based learning model learning as follows:

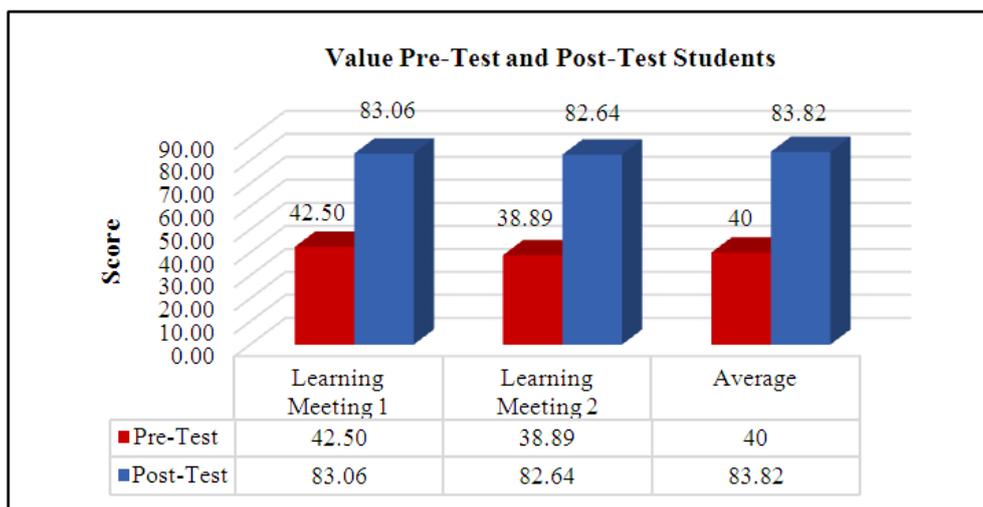


Figure 1. Graphs Value Pre-Test and Post-Test Students

During the learning process, observations were made of the learning process by an observer team consisting of 2 observers to determine the activities of teachers and students during the learning process:

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Table 3. Percentage of Teacher Activity and Students Activity

No.	Activity	Learnig Meeting	Observer 1	Observer 2
1.	Teacher's Activity	Meeting 1	94,11	94,11
		Criteria	Very Good	Very Good
		Meeting 2	100	100
		Criteria	Very Good	Very Good
Average Teacher's Activity			97,05	
Criteria			Very Good	
3.	Students Activity	Meeting 1	93,75	88,23
		Criteria	Very Good	Very Good
4.	Students Activity	Meeting 2	100	100
		Criteria	Very Good	Very Good
Average Students Activity			95,49	
Criteria			Very Good	

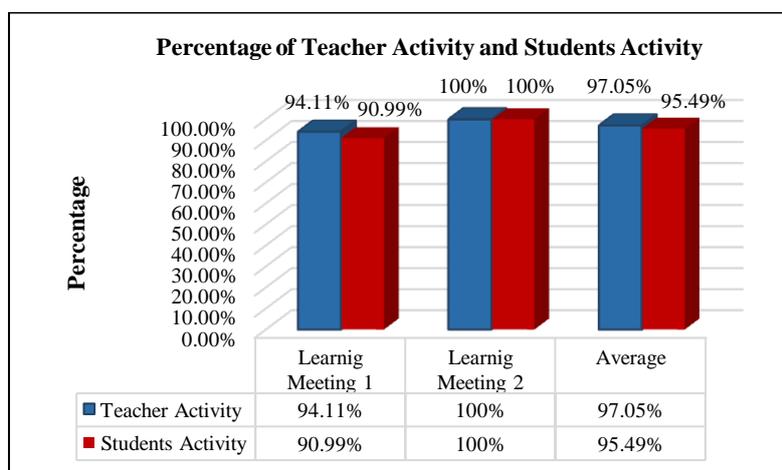


Figure 2. Graphs Percentage of Teacher Activity and Students Activity

#### IV. Discussion

Media 3d pop-up chemistry is a media or a book that has a 2 or 3 dimensional element and provides an interesting visualization of a story or concept of a theory with an image or theory that can stand when the page is opened with the effect of several parts that can be moved, this media is equipped with with a barcode system on some of its pages that will automatically link to video lessons and online tests on colloid system chemistry. This study uses a project based learning (PjBL) learning model in the learning process. The project based learning model consists of several stages consisting of essential questions, planning project work rules, making activity

schedules, monitoring the development of student projects, assessing student work results and evaluating students' learning experiences. The learning process with the project based learning model is carried out where students are given a project or task to make their own pop-up media in groups on the colloid system material, in this case students are divided into 5 groups and asked to make project assignments to make pop-up media together, the results of pop-up media that have been made are presented and collected according to the time limit given.

This PjBL learning model is an innovative learning model that is student centered and assigns teachers as motivators and facilitators and involves a project in the learning process<sup>15</sup>. In this case students are given the opportunity to investigate problem topics and build their own knowledge for learning. to be more meaningful through pop-ups that are made, in this case students have a more interesting learning experience and produce a work based on problems that occur through concepts and personal thoughts<sup>16</sup>. In this learning process students are conditioned in a learning atmosphere that can develop skills critical thinking and problem solving, creativity and innovation, collaboration, and communication<sup>17</sup>.

The results of the research conducted showed that the N-gain value of the XI-IPA class students at SMA Negeri 12 Samarinda = 0.71 with very effective criteria. Based on the results of the N-gain test analysis, it is concluded that the use of media 3d pop-up chemistry with the project based learning (PjBL) learning model is very effective in using colloid chemistry learning. Based on the research data, there was an increase in student learning outcomes before and after using media 3d pop-up chemistry with this project based learning model, namely from 40.69% (pre-test average score) and 82.85% (post-test average score) this shows that the learning media 3d pop-up chemistry used in learning has reached the expected competencies and has a positive influence on student learning outcomes. Giving project assignments to make pop-ups to students is also one of the supporting factors for an increase in student learning outcomes, where there is a positive influence and relationship between student learning activities and learning outcomes in chemistry subjects<sup>18</sup>, it can be seen from the results of observations of teacher and student activities which is very good, namely 97.05% for teacher activities and 95.49% for student activities with very good categories. In this case students have knowledge of learning experiences obtained from student activities during learning such as problem solving skills, decision making, critical thinking and creative thinking<sup>19</sup>. This skill can be obtained by students through learning using media 3d pop-up chemistry and the task of making pop-up projects.

Learning using media 3d pop-up chemistry with a project based learning (PjBL) learning model is active learning that involves students actively in the learning process, the active learning process carried out by students through learning activities can build new ideas and knowledge<sup>6,20</sup>. Student involvement In learning, learning is done by applying the use of learning media 3d pop-up chemistry with the PjBL model through the project assignment of making pop-ups, in this case students explore and develop their own acquired knowledge and build social interaction relationships with other students through the group assignment project given. Through this student learning activity, there was an increase in student learning outcomes before and after using learning media 3d pop chemistry with a project based learning model.

## V. Conclusion

The results showed that the learning outcomes of students before and after using the media 3d pop-up chemistry is 40.69 (pre-test) and 82.85 (post-test) with N-gain value by 0.71 (very effective). It can be concluded that the media 3d pop-up chemistry with learning model project based learning (PjBL) is very effective used to improve the learning outcomes of students in colloid chemistry at SMAN 12 Samarinda.

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