



## The Influence of Lewis Bond Media on Student Learning Outcomes of Chemical Bond Materials

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**Abstract: The Influence of Lewis Bond Media on Student Learning Outcomes of Chemical Bond Materials.** The research aim is find out the influence of Lewis Bond media on student learning outcomes after participating in the learning process of chemical bonding materials. This research is a pre-experimental study with a one-group pretest-posttest design. The sample of this research was 30 students of 10<sup>th</sup> grade of computer network engineering class II at SMK Muhammadiyah II Yogyakarta. The instrument of data collection was in the form of learning outcome test questions on chemical bonding materials. The data of student learning outcomes were analyzed by using paired sample t-test with SPSS 24.0. The analysis results obtained a sig value  $< 0.05$ , which means that there is a difference in student learning outcomes after using Lewis Bond media. It shows that the use of Lewis Bond learning media on chemical bonding materials can improve student learning outcomes.

**Keywords:** Lewis Bond media, chemical bonds, learning outcomes

**Abstrak: Pengaruh Media Lewis Bond Terhadap Hasil Belajar Siswa pada Materi Ikatan Kimia.** Penelitian ini bertujuan untuk mengetahui pengaruh media Lewis Bond terhadap hasil belajar siswa setelah mengikuti proses pembelajaran pada materi ikatan kimia. Penelitian ini merupakan penelitian pre-eksperimen dengan desain one group pretest-posttest. Sampel penelitian ini adalah siswa kelas X Teknik Komputer Jaringan II SMK Muhammadiyah II Yogyakarta sebanyak 30 orang. Instrumen pengumpulan data berupa soal tes hasil belajar pada materi ikatan kimia. Data hasil belajar siswa dianalisis menggunakan paired sample t-test dengan SPSS 24.0. Hasil analisis diperoleh nilai sig  $< 0,05$  yang artinya terdapat perbedaan hasil belajar siswa setelah penggunaan media Lewis Bond. Hal ini menunjukkan bahwa penggunaan media pembelajaran Lewis Bond pada materi ikatan kimia dapat meningkatkan hasil belajar siswa.

**Kata kunci:** Media Lewis Bond, ikatan kimia, hasil belajar

## ▪ INTRODUCTION

Education is an important aspect to improve the quality of human resources. The education in the 21<sup>st</sup> century emphasizes the ability to integrate literacy, knowledge, skills, and attitudes, as well as mastery of technology. By the existence of the ability, it is expected that students are able to have some competencies to deal with and solve problems in daily life. However, the efforts to increase students' competencies can be done through schools. School is one of the formal educational institutions and a place for the learning process to take place with supporting facilities and infrastructure as well as environmental conditions. Therefore, it is required the quality of learning process in schools so that students can achieve their competences or learning objectives which are expected.

The learning process is a booster to achieve the quality of education. It is established since there is an interaction between teachers, students, and learning resources in a supportive learning environment (Fathurrohman, 2017). Chemistry learning at vocational school aims to prepare students' abilities in order to be able to develop their expertise programs in daily life and higher levels of education. By mastering chemistry subjects, vocational students are able to analyze chemical processes easily in order to support the competencies of the expertise program. However, the learning process at SMK is not running optimally due to the lack of learning media (Wahono, 2014).

Learning media is an important requirement to create interactive learning. Learning media is defined as a device used to improve learning effectiveness and efficiency in the learning process in order to achieve the learning objectives (Nurrita, 2018). The learning media can facilitate teachers to deliver materials and help students in understanding the learning materials. The use of the learning media can create a more interesting atmosphere to learn and it is able to improve student learning outcomes in chemistry lessons (Jumadil, Gonggo, Rahmawati, 2013). Based on research by Anisa & Yulianto (2017), it is stated that some chemistry teachers are less to use learning media in the learning process. Chemistry teachers only use student worksheets (LKS) and textbooks. They do not use any other media to support chemistry learning. As a result, many students feel bored and they do not gain any understanding of chemistry materials.

Chemistry is the science that deals with the structure of substances and the transformations that they undergo through natural processes and planned experiments (Keenan, 1984). Chemistry is a difficult subject for students because it has abstract materials. Chemical bonding is a material with an abstract concept so that it has a high enough level of difficulty to be understood by students (Mezia, Cawang, Kurniawan, 2018). Based on the research of Nurbaity and Mustikasari (2012), shows that students' mastery of chemical bonding materials is just weak. Some students still learn chemical bonding materials by memorizing so that their conceptual skills are just weak. Student learning outcomes on chemical bonding materials are also unsatisfactory with a percentage of more than 50% of students who do not reach the minimum completion criteria (KKM) (Rusdiana, 2010). One of the chemical bonding materials which is difficult are the Lewis structure.

Lewis's structure is the fundamental material in chemical bonds. It is applied to explain the formation process of chemical bonds. The Lewis structure explains the formation of covalent bonds by using the Lewis symbols where the electron pair is

represented by a line or pair of dots which are placed between two atoms and the lone pair is represented by the dots on each atom (Chang 2005). Writing Lewis structure by students uses a trial-and-error system because the Lewis structure material is abstract. Therefore, it is required media or props to facilitate the representation of Lewis structures.

A prop is teaching aids to facilitate in delivering the abstract or difficult concepts so that the subjects being taught are easily able to be understood by students (Widiyatmoko & Nurmasitah, 2013). The use of teaching aids in the learning process in schools is not optimal because the facilities and infrastructure are just less in schools (Depdikbud, 2011). Chemistry teachers are demanded to be creative and innovative to create learning media in the form of teaching aids so that the learning process becomes delightful. The teaching aid to be used in this research is Lewis Bond. Lewis Bond is used to making Lewis structures and explains the formation process of covalent and ionic bonds. Teaching aids in the chemistry learning process are demanded to explain abstract materials which are very difficult for students to understand (Juwairiyah, 2013). Hopefully, by using learning media in the form of Lewis Bond teaching aids, it can improve students' comprehension and student learning outcomes on chemical bonding materials.

## ▪ METHOD

This research is a pre-experimental research design with one-group pretest-posttest design. The research design can be found in Table 1.

**Table 1.** One-Group Pretest-Posttest Design

Pretest	Treatment	Posttest
O <sub>1</sub>	X	O <sub>2</sub>

Description:

O<sub>1</sub>: students' pretest score

O<sub>2</sub>: students' posttest score

X: chemistry learning by using Lewis Bond learning media

In this research, the population is students of 10th grade at SMK Muhammadiyah II Yogyakarta. The sampling technique used in this research was the purposive sampling technique. The sample in this research was 10th-grade students of computer network engineering II consisting of 30 people.

The research instrument used in this research was 25 multiple choice questions about chemical bonding materials. The questions of learning outcomes were developed by using Bloom's taxonomy which consisted of questions of C1-C4 type. The data of student learning outcomes were analyzed by using paired sample t-test with SPSS 24.0. The Shapiro-Wilk test was applied to find out whether the data distribution is normal or not.

## ▪ RESULT AND DISCUSSION

This research was conducted by using Lewis Bond learning media. The Lewis Bond media is a teaching aid to deliver chemical bonding materials. It is used to explain the Lewis structures and the formation process of covalent and ionic bonds. The teaching aid of Lewis Bond is three-dimensional media consisting of a magnetic board; electrons; atoms; and symbols of certain chemical elements which are made of acrylic and equipped with magnets as well as instructions for use. How to use Lewis Bond

media is by attaching the symbols of the chemical elements and their electrons to the magnetic board. Lewis Bond media can facilitate students to describe the form of bonds in molecules so that students are able to learn the concept of describing Lewis structures more easily. The learning media of Lewis Bond has previously been developed by using the model of Borg and Gall development. Lewis Bond media has also been validated by material experts, media experts, and high school chemistry teachers in the very good category.

Through the teaching aid, students are expected to no longer erase many times in making Lewis structures, the formation process of covalent and ionic bonds in their notebooks. Students can create Lewis structures, covalent bonds, and ionic bonds simply by moving/shifting atoms and valence electrons on the magnetic board while playing. The teaching aid of Lewis Bond is also easy to be installed, used, and it is able to make abstract material more concrete. In addition, the teachers feel pleased with the Lewis Bond media because they do not undergo difficulties to explain the Lewis structure materials, the formation process of covalent bonds, and ionic bonds that are abstract. The display of Lewis Bond learning media is shown in Figure 1 and Figure 2.



**Figure 1.** The Teaching Aid of Lewis Bond



**Figure 2.** The Display of Lewis Bond Teaching Aid

The data of student learning outcomes are obtained from the pretest and posttest scores. The grade results of students' pretest and posttest are listed in Table 2.

**Table 2.** The Results of Students' Pretest and Posttest

Data	Average Score
Pretest	68,6
Posttest	78,9

Table 2 shows that the average score of students' posttests in the amount of 78.9 is higher than the score of students' pretests which is in the amount of 68.6. It shows that after learning by using Lewis Bond teaching aid, student learning outcomes have a higher average score. The normality of the pretest and posttest data of student learning outcomes are then analyzed by using the Shapiro Wilk test. The results of the normality test are listed in Table 3.

**Table 3.** The Results of The Normality Test

Score	Test of Normality		
	Shapiro Wilk		
	Statistic	df.	Sig.
Pretest	0,969	30	0,540
Posttest	0,938	30	0,081

Based on table 3, shows that the pretest and posttest data of student learning outcomes are normally distributed. Those are indicated by the significance score of the normality test resulting in  $> 0.05$  which is in the amount of 0.540 (pretest score) and 0.081 (posttest score). After conducting the normality test, furthermore, the test of the paired t-test is conducted by using SPSS 24.0. It is conducted to determine the difference of students' average scores in pretest and posttest in order to be able to be known whether there are differences or not in student learning outcomes after using Lewis Bond teaching aid. The results of the paired t-test are presented in Table 4.

**Table 4.** The Results of the Paired T-test

	Paired Differences						t	df	Sig(2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Pre Score- a Post Score	-60.25000	7.20243	1.31498	-62.93943	-57.56057	-45.818	30	0.000	

Based on Table 4, shows that the significance score of paired t-test of 0.000  $< 0.05$ , which means that there is a difference between score of and pretest of student learning outcomes. After learning by using Lewis Bond teaching aid, student learning outcomes are higher than before. This signifies that the learning media in the form of Lewis Bond teaching aid can improve student learning outcomes on chemical bonding materials.

The use of Lewis Bond teaching aid in the learning process makes students actively participate in the chemistry learning process in the classroom. The teaching aid of Lewis Bond also has an attractive shape and so that students feel pleased and they

don't get bored immediately when learning chemical bonding materials. In addition, learning by using Lewis Bond teaching aid also to have understanding of the formation process of chemical bonds so that it can improve student learning outcomes and students' understanding. Based on the research data obtained, it is in line with the research conducted by Saleh, Nurhayati, Jumadi (2014) which states that the use of teaching aids can effect on student learning outcomes. The use of learning media can make learning more meaningful and improve student learning outcomes (Lubis & Ikhsan, 2015). Student learning outcomes can increase if it is accompanied by a better learning process (Izzudin, Masugino, & Suharmanto, 2013).

## ▪ CONCLUSION

Based on the research results, it can be concluded that there is a difference in student learning outcomes after participating in chemistry learning by using Lewis Bond teaching aids. The use of learning media in the form of Lewis Bond can influence student learning outcomes in learning chemistry. Therefore, Lewis Bond learning media can improve student learning outcomes.

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