

# Deskripsi Kemampuan Berpikir Formal XI IPA SMAN 4 Padang

## Description Of Formal Thinking Ability For XI IPA SMAN 4 Padang

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### ABSTRACT

The Formal thinking ability is the ability to think in the face of hypothetical situations abstractly and reason logically. When students reach formal thinking skills, they will have no difficulty understanding the concept of hydrolysis which is abstract. Based on the daily test scores for class XI IPA SMAN 4 Padang, it is known that 30% of students have not achieved completeness in hydrolysis. The incompleteness of some students indicates that there are still students who have not reached the level of formal thinking skills. Therefore, it is necessary to describe the level of students' formal thinking skills. This research was conducted to describe: the level of students' formal thinking skills, and the type of research is descriptive. The research sample was students of class XI IPA at SMAN 4 Padang, who were obtained using cluster random sampling. The research instrument was a formal thinking ability test (Buney test). The results of the study showed that: 63.79% of class XI IPA SMAN 4 Padang students had reached the formal thinking skills.

### KEYWORDS

Formal Thinking Ability, Abstract Concept

### ABSTRAK

Kemampuan berpikir formal adalah kemampuan berpikir dalam menghadapi situasi hipotetis secara abstrak dan dapat menalar secara logis. Ketika siswa mencapai kemampuan berpikir formal, mereka tidak akan kesulitan memahami konsep hidrolisis yang bersifat abstrak. Berdasarkan nilai ulangan harian kelas XI IPA SMAN 4 Padang diketahui 30% siswa belum mencapai ketuntasan hidrolisis. Belum tuntasnya sebagian siswa menunjukkan masih adanya siswa yang belum mencapai taraf kemampuan berpikir formal. Oleh karena itu, perlu digambarkan tingkat kemampuan berpikir formal siswa. Penelitian ini dilakukan untuk mendeskripsikan: tingkat kemampuan berpikir formal siswa, jenis penelitian adalah deskriptif. Sampel penelitiannya adalah siswa kelas XI IPA SMAN 4 Padang yang diperoleh dengan menggunakan cluster random sampling. Instrumen penelitiannya adalah tes kemampuan berpikir formal (buney test). Hasil penelitian menunjukkan bahwa: 63,79% siswa kelas XI IPA SMAN 4 Padang telah mencapai kemampuan berpikir formal.

### KATA KUNCI

Kemampuan Berpikir Formal, Konsep Abstrak



## 1. INTRODUCTION

Chemistry is one of the compulsory subject groups that must be studied by students in high school [1]. Chemistry is the study of the composition, properties, and changes that occur in matter[2]. The relationship between the three is inseparable. For example, in salt solutions, the properties of matter are determined by the composition of the H<sup>+</sup> and OH<sup>-</sup> ions in the solution. Salt solutions come from reactions between acidic and basic compounds. The reaction of both will produce salt solutions with certain properties. So, the changes that occur in matter affect the nature of the matter and also the composition of matter determines the nature of matter.

Chemistry is difficult for most students. One of the things that makes chemistry difficult is that most concepts in chemistry are abstract[3]. In addition, chemistry covers a very wide range of matter consisting of facts, concepts, rules, laws, principles, and theories[4]. From the scope of chemical materials, most consist of abstract concepts. Because of the abstract characteristics of chemical concepts, it requires students' thinking skills at the formal operational stage based on Piaget's theory of cognitive development. Herron[5] suggests that students can understand abstract chemical concepts when students have reached the stage of formal thinking. Based on some of these expert opinions, studying chemical characteristics that have abstract concepts requires a level of formal thinking skills.

The level of formal thinking ability is the ability to think that students can think abstractly, without the help of concrete objects or events[6][19]. The formal thinking stage is the ability to think where students can deal with hypothetical situations abstractly and can reason logically. The need for the level of formal thinking skills in understanding chemistry is shown by the strong correlation between the stage of formal thinking and chemistry learning achievement. As Enterpinar[8] researched the formal thinking stage can predict the success of studying chemistry. By the time the student is at the level of formal thinking, he can master abstract chemical concepts. Understanding the concept will have an impact on student learning outcomes. That is, students will have good learning outcomes if they have reached the level of formal thinking skills. To achieve a balance between students' conceptual and algorithmic understanding, a level of students' thinking skills in formal operations is needed. By the time the student reaches the level of formal thinking ability, he will have no difficulty in understanding the concept of hydrolysis material that is abstract. This is because students have been able to think abstractly and logically.

This is consistent with what Piaget expressed in[6] that by approximately 11 years of age, the child has reached a formal operational level. From the results of the study, it was also found that a small percentage of students are still at the level of transitional and concrete thinking. In line with research conducted by Ardhana[11] which reports that 22.5% - 47.5% of secondary school students in Kodya Malang have not reached the level of

formal thinking skills. Likewise, Lawson[12] in his research states that children who reach the level of formal thinking skills are as much as 43%.

## 2. METHOD

The type of research conducted is quantitative descriptive[9]. The purpose of this study is to describe the formal thinking ability of students. The population in this study was all students of grade XI IPA SMAN 4 Padang. The sample in this study was determined by cluster random sampling technique[10]. The instrument used to collect data in this study was the Formal Thinking Ability Level Test

Tests of the level of formal thinking ability are used to measure the level of development of individual thinking skills based on Piaget's theory of cognitive development. In this study, the formal thinking ability test used was Burney's formal ability test developed by Ardhana [11]. The reasons for using Burney's standard test instrument according to Ardhana are as follows: 1) The time required is relatively short, which is 30-60 minutes. 2) Its implementation does not require special skills. 3) The reliability and validity indices of the original test were high at 0.85 and 0.85.

### 2.1 Data Collection Technique

Burney's standard test materials are divided into 4 groups: (a) the angle of reflection of the ball, (b) the balance in the scale, (c) the water surface in the corresponding vessel, and (4) the projection of the shadow on the screen. This formal thinking ability test is piloted on students before being used to measure the formal thinking ability of the sample. The trial was conducted to see the validity and reliability of the test. The data collection technique used in this study was a test technique.

The test of the level of formal thinking skills used is the Burney test developed by Ardhana[11]. Each correct answer choice is given a score of 1, and the wrong answer is given a score of 0. The highest score was 24.

Data on students' level of formal thinking ability are obtained in the following way: 1) Giving a score of 1 if the student gives the correct answer and a score of 0 if the student's answer is wrong. 2) Next, the student's total correct answer score is calculated and classified into the Burney test criteria, according to the score.

**Table 1. Criteria for Student Thinking Ability Test Score Results**

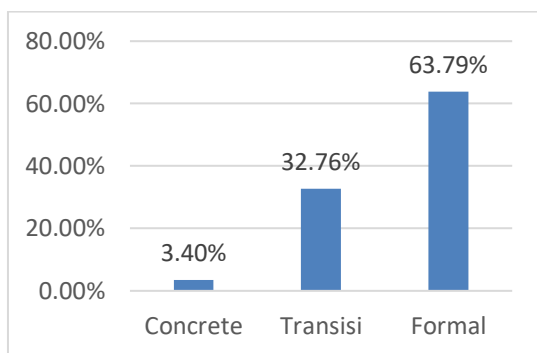
Grade	Criteria
17-24	Formal
11-16	Transit
0-10	Concrete

(source : Ardhana[11])

3) The percentage of students' answers is calculated from the frequency distribution for each group

### 3. RESULT AND DISCUSSION

The description of the research data was obtained from data on the level of formal thinking skills of students. This is done to obtain an overview of the distribution of data frequency and determine the level of achievement of respondents. Data on students' thinking ability levels were collected after giving the Burney test to grade XI science students. Based on the results of the analysis, students with a score of 0-10 obtained the ability to think concretely as much as 3.45%, while students with a score of 11-16 who were categorized as having transitional thinking skills as much as 32.76%, and students who obtained formal thinking skills with a score of 12-24 as much as 63.79%. This is illustrated in **Figure 1**.



**Figure 1. Students' thinking ability scores**

Based on the distribution of formal thinking stage scores of SMA Negeri 4 Padang students presented in the frequency list in Table 2, the lowest score analysis results were 17 and the highest score was 24, with a score range of 7. Calculations of the distribution of students' formal thinking skills resulted in a total score of 701, an average score of 18.9459, a standard deviation of 1.6987, and a median of 19.

**Table 2. Frequency distribution of students' formal thinking ability levels**

No	Formal Thinking Stage Score	Frequency	Relative Frequency (%)
1	17	9	24,32
2	18	8	21,62
3	19	7	18,92
4	20	6	16,22
5	21	5	13,51
6	22	1	2,70
7	24	1	2,70
Total		37	100

Based on **Table 2**, it can be known that the number of students who obtained scores below the average of 17 students or 45.94%, students who obtained an average score of 7 students or 18.92%, and students who obtained scores above the average of 13 students 35.13%.

**Table 3. Summary of Basic Statistical Calculation Results**

	Formal Thinking Stage
Number of students	37
Average	18,9459
Median	19
Standard deviation	1,69879
Score range	7
Minimum Value	17
Maximum Value	24

The results showed that as many as 37 people (63.79%) had reached the formal thinking skills. Based on the data obtained on this test of the level of formal thinking ability, it can be said that most students have reached the level of formal thinking according to Piaget's theory of cognitive development. Each basic element of formal operational thought has been represented at least twice in the various tasks. These elements are hypothetico-deductive reasoning, combinatorial logic, and proportional logic [15][16]. Hypothetico-deductive reasoning is the type of reasoning required to study science [16][17][19].

There are still students who have not reached the level of formal thinking skills because, in addition to age, students' cognitive development is also influenced by other factors. Piaget [13] stated that there are several other factors such as physical experience, maturity, logical-mathematical experience, and transmission. Social and self-regulation/balance affect an individual's cognitive development.

However, every child in the development of their thinking goes through the four stages of thinking, although at different speeds, where the structure for the previous level is integrated and is part of the next levels of thinking [20] so that each stage is entered by the child when it is mature enough to allow for a new type of logic or operation [21].

### 4. CONCLUSION

Based on the results of research, discussion, and statistical analysis, the following conclusions can be drawn. Most students have reached the level of formal thinking ability. This will help students more easily understand chemicals that require higher-order thinking skills and abstract.

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