# Comparison Of Higher Order Thinking Skills (Hots) Ability Between Students That Using Multifunctional Smart Board Media And Powerpoint Media

https://doi.org/10.22236/injope.v1i1.3839

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**Abstract**: This thesis aims to design an effective learning plan to increase the HOTS ability of students by using multifunctional smart board media and comparing it with class that using power point media, in grade 6 of Al-Azhar Syifa Budi Cibubur-Cileungsi Elementary School. The population is grade 6 students at Al-Azhar Syifa Budi Cibubur-Cileungsi Elementary School. The method used in this research is a mix method between design research with students of 6D's class as the sample and quasi experimental research with Pre-test-Post-test control group design, with 24 students for each class 6B and 6E as the samples. The Independent Sample t-test with help of the SPSS 21 program was used to analyze the pre-test score of both classes, the result of significance value (2-tailed) is 0,973. The result of the gain for significance value (2-tailed) is 0,000. The t-test sample related was used to analyze pre-test and post-test scores, the test results for the experimental class significance value (2-tailed) is 0,000 and the significance value (2-tailed) is 0,000 for the control class. Because the significance value (2-tailed) is $<\alpha = 0.05$ then $H_0$ is rejected. The learning plan with multifunctional smart board media as assisted have better improve for overall aspects of HOTS abilities of students, compared with learning assisted by power point media. Students can be actively involved in learning.

**Keywords**: Multifunctional smart boards, Higher Order Thinking Skills, Power point.

## I. INTRODUCTION

Higher Order Thinking Skills (HOTS) become intellectual capital of students to face the 21st century, when they are in productive age at that time. HOTS will make students as reliable workforce in the future. Brookhart in his book suggests, many professions in the 21st century demand the integration of higher order thinking skills in analysis, synthesis, and evaluation aspect that have not been developed yet in current learning programs, and it is our duty to habituate students with higher order thinking skills in daily life (Brookhart, 2010 )

It is the teacher's duty to be able to prepare and develop HOTS capabilities. The new education paradigm directs teachers to design learning that can deliver students to achieve higher order thinking skills (HOTS) (Cox, 2017; Jang, 2015; Jufri, 2017; Lusyana & Wangge, 2016).

Larson and Miller in his journal stated that it is very important for teachers to develop students' abilities in applying, analyzing, synthesizing, creating and evaluating (Larson and Miller, 2012).

HOTS-based learning and assessment can have a positive influence on students, including increasing student achievement. Higgins.et.al. research in Brookhart shows the averages are 0.62 has an effect on cognitive outcomes (verbal and nonverbal reasoning), 0.62 has an effect on achievement of learning outcomes (reading, math and science exams), 1.44 has an effect on affective results (attitude and motivation) (Brookhart, 2010). HOTS can increase student learning motivation, by increasing students' motivation in expressing their ideas. HOTS can develop positive attitude, emotional control, and cognitive ability. Student characters can also be built through HOTS. HOTS can build performance and moral character of students such as discipline, honesty, responsibility, and persistent (Brookhart, 2010; Hugerat and Kortam, 2014; Lusyana and Wangge, 2016; Nugroho, 2018).

The description above shows that HOTS are one of the main competencies that must be achieved in education both in curriculum and for skills that students must held for the 21$^{st}$ century. But in fact many researches show that average of HOTS students' ability is still low, 82.73% - 53.4% of students' HOTS abilities are classified as low (Aprianti, 2013; Fajriyah, 2018; Lusyana and Wangge, 2016; Shidiq, 2015). Furthermore, Purnomo (2016) in his journal suggested that student's mistakes in solving HOT questions because of their weak literacy on story questions or context-based questions.

In line with that, other research show that understanding and development of HOTS by teachers is still low (Fanani and Kusmaharti, 2018; Lestari, 2016). Retnawati, et al. (2017) stated that the knowledge and ability of teachers to develop HOTS-based learning strategies is still low. Research in America shows that HOTS-based assessment and learning is rarely done by the teachers (Brookhart, 2010; Thompson, 2008).

These things become research background on Comparison of Higher Order Thinking Skills (HOTS) 6$^{th}$ Grade Students Ability between Using Multifunctional Smart Board Media and Power point Media on Plant and Animal Reproduction Subject at Al-Azhar Syifa Budi Cibubur-Cileungsi Elementary School.

**Instructional Media**

Learning Media stimulates attention, stimulates the thoughts, feelings and interests of students in learning, so that it can encourage the creation of learning processes in students to achieve learning goals more maximum (Arsyad, 2017; Juliardi, 2010). On learning, media is supporting tools that important to achieving learning goals. The importance of learning media makes learning media included in the curriculum and becomes the material of research at various universities in the world (Fedorov, 2014; Jenkins, et. Al., 2007).

**Higher Order Student Thinking Skills (HOTS)**

Higher Order Thinking Skills is a way of thinking that includes the ability to apply knowledge to new conditions to solve unpredictable problems, skills and values in making reasoning, interpretation, analysis and reflection in solving problems, making decisions, and being able to create something innovative, which is done through process skills.

Based on Fajriyah (2018), Goodson and Rohani (2018), Kasturi (2015), Krathwohl (2002), Lewis et. al. (20090, Nugroho (2018), Shidiq (2015), Thompson (2008), Utari (2011), Yu (2015) HOTS consists of:

1. Analysis is breaking up material into its constituent parts and detecting how the relationships between these parts and their relationship to the overall structure or purpose.
2. Evaluation is making decisions based on criteria and standards, consisting of checking and criticizing. Checking is the process of finding inconsistencies or errors in a process or product, by observing this consistency, the effectiveness of a procedure being carried out will be obtained. Criticizing is a form of evaluation of various ideas that can be used to solve a problem, the process of assessing opinions or results based on a set of predetermined criteria.
3. Creating is combining various elements to form something new, coherent or making original products, consisting of formulating, planning, producing.

**Multifunctional Smart Board Media**

A multifunctional smart board is a rectangular media made of wood / styrofoam or other strong thin objects that contain images and learning materials and possess various tasks and functions.

The multifunctional smart board referred to in this study is a board made of impraboard which contains subject matter and has more than one function, namely to increase the attractiveness of students towards subject matter, increase student motivation, engage students

actively in learning, facilitate the teacher in delivering subject matter, makes it easier for teachers to get information about students 'initial mastery of subject matter, makes it easier for teachers to get information about students' absorption of the subject matter that has been delivered, increases student absorption of subject matter, can be easily modified according to the subject matter to be delivered, the scope of its development is broad, it can cover all subject matter, all subjects and all grade levels.

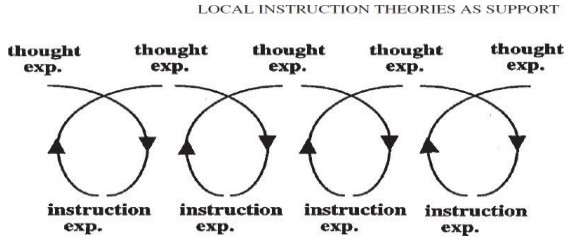
**Media PowerPoint**

PowerPoint media is software that helps presentations effectively and professionally so that they are more interesting and clear (Arsyad, 2017; Yaumi, 2018). PowerPoint displays visually with digital projections involving computer aids and projector (Juliardi, 2010; Muliono, 2013; Yaumi, 2018).

## II. RESEARCH METHODS

### A. Research Design

The method used is a combination of qualitative and quantitative methods. The qualitative method is using design research to get most effective learning design and multifunctional smart board media design that will be used as treatment in the experimental class. Data collection uses observation sheets, Likert scale to capture student responses, interviews to capture teacher responses and video recording of learning.




**PICTURE 1**

Design research, the accumulation of the cycle process
(Gravemeijer, 2004)

Quantitative method with quasi experimental design research design Pre-test - posttest control group design. Data collection uses pretest and post-test questions, each of which consists of 10 HOTS-based description questions.

**Table 1**

Research design

| **Group** | ***Pre-test*** | **Treatment** | ***Post-test*** |
|---|---|---|---|
| Experiment Class 1 | $O_1$ | $X_1$ | $O_2$ |
| Experiment Class 2 ( Control ) | $O_3$ | $X_2$ | $O_4$ |

Source: (Ghani, A. 2018; Agustina, 2014; Sugiyono, 2017)

Information :

Experiment class 1:

The experimental group given learning uses multifunctional smart board media

Experimental class 2:

Control group given learning using PowerPoint media

O1: Pre-test value of experimental class 1 before treatment

O2: Post-test value of experimental class 1 after treatment

X1: Treatment variables in the experimental class 1 using multifunctional smart board media

O3: Pre-test value of experimental class 2 (control class) before treatment

O4: Post-test value of experimental class 2 (control class) after treatment

X2: Treatment variable in experimental class 2 (control class) that uses PowerPoint media.

## B. Implementation of Research

### 1. Planning Phase

Observations to several schools that have the same characteristics as the study population, conducted interviews with 6$^{th}$ grade teachers representatives from each school, conducted literature studies on learning media and developed HOTS abilities of students, compiled the Learning Trajectory (HLT) and discussed it with 6$^{th}$ grade science teachers.

Designing multifunctional smart board media and PowerPoint media and holding media feasibility validation by experts, making Pre-test and Post-test questions based on Higher Order thinking skills and conducting validation by experts and 3 students of 6th grade, making instruments to capture supporting data, in the form of Likert scale, guidance on observation and interviews with teachers and students. The last is to conduct an instrument trial and conduct an instrument prerequisite test.

**2. Preparation of Learning Design through Design Research methods.**

Learning is designed using multifunctional smart board media to develop HOTS abilities of students through design research. The implementation of learning is done on classes that are not used in the experimental method. The phase started by selecting 6 students for the implementation of the initial learning experiment (preliminary teaching experiment / pilot experiment) which represented the high, medium and low in science learning achievement with the help of consideration of 6th grade science teacher. The phase continue with preliminary teaching experiment pilot experiment on 6 students. Followed by HLT improvements and learning design through discussion with 6th grade science teacher.

The Learning Experiment Phase (Teaching Experiment) is carried out until the learning design can stimulate the HOTS abilities of students including aspects of analysis (selecting, correlating, classifying), evaluating (criticizing, comparing, directing), creating (categorizing, formulating, generalizing). This phase followed by the Retrospective Analysis phase which was carried out at the end of each meeting teaching experiment. Discussions were held with science teacher, implementing learning to design learning improvements and learning media at the next meeting. Finally, formulate Local Instruction Theory (LIT) as a result of the design research phase.

**3. Experimental Phase**

The experimental method was carried out using LIT as a treatment in the experimental class with the following phase: Arranging the syllabus in accordance with LIT, carrying out 6 meetings, the first meeting taking the pre-test scores to 24 students in the experimental class 1 and 24 students in the experimental class 2 the second to fifth meeting is giving treatment. At this meeting the experimental class 1 was treated with learning using multifunctional smart board

media and experimental class 2 (control class) were treated with learning using PowerPoint media. Learning is done by 6th grade science teacher while the researcher observes and records learning activities, the sixth meeting of post-test value taking and capture teacher responses by interviewing and student responses by filling in the Likert scale.

**4. Analysis Phase**

The research analysis was carried out with the following phase: composing a learning plan using multifunctional smart board media that effectively improved students' HOTS skills, statistical analysis of the data after analysis prerequisite testing, drawing conclusions from the results of statistical research and processing.

**C. Location and Time of Research**

This research was conducted at Al-Azhar Syifa Budi Cibubur-Cileungsi Elementary School, Gunungputri District, Bogor, in the 2018 - 2019 academic year, namely in January-February 2019.

**D. Population and Study Samples**

The study population was 157 students and sixth grade students at Al-Azhar Syifa Budi Cibubur-Cileungsi Elementary School, in the 2018-2019 academic year. The sample was 24 students for experimental class 1, and 24 students for experimental class 2 (control class). The sample is determined by Probability sampling (random sampling) technique that is by cluster sampling (Kusdiwelirawan, 2014; Sugiyono, 2017).

**E. Analysis techniques**

**1. Test Requirements Analysis**

Normality Test of pre-test and post-test Data Kolmogorov-Smirnov test with SPSS 21, Homogeneity Test Pretest and post test data using One-way Anova test with the help of SPSS 21 application.

**2. Hypothesis Testing**

Descriptive analysis of the pre-test, post-test and gain scores of the two research classes obtained calculated average, variance and standard deviation, with the help of SPSS 21 application. Inferential Analysis Test The difference in the average pre-test data with the help of SPSS 21 application using the Independent Sample T-test. Significance level: $\alpha = 0.05$.

Normality test of Gain score data is analyze by Kolmogorov-Smirnov test with the help of SPSS 21 and Homogeneity Data Gain Score using One-way Anova test with the help of SPSS 21.

To find out whether there is an increase in HOTS abilities of students through science learning using multifunctional smart board media, the pre-test and post-test data were tested using the related sample t-test (Sugiyono, 2017. p. 273) with the help of the SPSS 21 application. To find out whether there is an increase in HOTS abilities of students through science learning using PowerPoint media. Then the pre-test and post-test data were tested using the related sample t-test (Sugiyono, 2017. p. 273) with the help of the SPSS 21 application. To find out whether there were significant differences in the ability of HOTS students who did science learning with using multifunctional smart board media and science learning using PowerPoint media, the average Gain score data was tested using the Independent Sample t-test with the help of SPSS 21 application.

Supporting data from the Likert scale, interviews, observations sheets and recapitulated learning videos to support the results of statistical analysis.

## 5. RESULTS

HOTS indicators which include analytical skills, namely selecting, correlating, classifying, evaluating, criticizing, comparing, directing, creating, categorizing, formulating, generalizing can emerge after four meetings in the experimental teaching stage and retrospective analysis, the research design research stage is considered complete this fourth meeting and the fourth learning design was used as a syllabus for the experimental class.

Statistical analysis of experimental research data is presented in table 2 as follows:

**Table 2**

Data from research results

| Class | | Range | Average | Conversion Range In Hundreds | Standard Deviation | Median | Modes |
|---|---|---|---|---|---|---|---|
| Control | *Pre test* | 2,5 - 11 | 6,083 | 28,293 | 1,857 | 6 | 6 |
| | *Post test* | 3 - 18 | 8,917 | 42,462 | 3,479 | 8,5 | 6 |
| Experiment | *Pre test* | 3 - 11 | 6,104 | 28,391 | 2,331 | 5,75 | 4 |
| | *Post test* | 14 - 21 | 17,687 | 84,224 | 2,084 | 17,5 | 16 |

The analysis prerequisite test results showed both the pre-test, post-test and gain of the control class and the normal experimental class in table 3 below

**Table 3**

Data on normality test results

| Type of test | Kolmogorof-Smirnof (Significance) | Shapiro-Wilk |
|---|---|---|
| Control Class Pre-test | 0,200 | 0,670 |
| Pre-test experimental class | 0,200 | 0,135 |
| Control class post-test | 0,073 | 0,057 |
| Post-test experimental class | 0,200 | 0,135 |
| Pre-test Gain | 0,200 | 0,477 |
| Post-test Gain | 0,730 | 0,570 |

The test results of the homogeneity of the pre-test data, the post-test and gain of the control class and the experimental class show that the data comes from populations that have homogeneous variance as presented in table 4 below.

**Table 4**

Data from homogeneity test results using SPSS 21 application.

| Type of test | Significance Value |
|---|---|
| *Pre test* | 0,190 |
| *Post test* | 0,159 |
| Gain | 0,552 |

Hypothesis test result show a significance value (2-tailed) is 0.973> 0.05, then $H_0$ is accepted $H_1$ is rejected. This means that there is no difference in the average pre-test value between the experimental class and the control class as presented in Figure 2 below

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| pre test | Equal variances assumed | 1.772 | .190 | -.034 | 46 | .973 | -.02083 | .60840 | -1.24548 | 1.20381 |
| | Equal variances not assumed | | | -.034 | 43.812 | .973 | -.02083 | .60840 | -1.24713 | 1.20546 |

**Figure 2**

The output of the test results are independent sample t-test pre-test control class and experiment using the SPSS 21 application.

The output of the hypothesis 2 test shows the significance value (2-tailed) is 0,000 <0,05, then $H_0$ is rejected $H_1$ is accepted. This means that there is an increase in the ability of HOTS students through science learning using multifunctional smart board media as presented in Figure 3 below

**Paired Samples Test**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 95% Confidence Interval of the Difference | | | | |
| | | Mean | Std. Deviation | Std. Error Mean | Lower | Upper | | | |
| Pair 1 | Pre test kelas eksperimen - Post test kelas eksperimen | -11.58333 | 1.63299 | .33333 | -12.27289 | -10.89378 | -34.750 | 23 | .000 |

**Figure 3**

The output of the t-test sample related pre-test and post-test experimental class using the SPSS 21 application.

The output of the hypothesis 3 test results show the significance value (2-tailed) is 0,000 <0,05, then $H_0$ is rejected $H_1$ is accepted. This means that there is an increase in HOTS abilities of students through science learning using PowerPoint media, as presented in Figure 3 below

**Paired Samples Test**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 95% Confidence Interval of the Difference | | | | |
| | | Mean | Std. Deviation | Std. Error Mean | Lower | Upper | | | |
| Pair 1 | Pre test kelas kontrol - Post test kelas kontrol | -2.83333 | 2.18028 | .44505 | -3.75399 | -1.91268 | -6.366 | 23 | .000 |

**Figure 4**

The output of the t-test sample related pre-test and post-test control class using the SPSS 21 application.

The output of the hypothesis 4 test shows - t count is (-13,158) <- t table is (-2,013) then $H_0$ is rejected. This means that the increase in HOTS abilities of students who do science learning using multifunctional smart board media is higher than those who do science learning using PowerPoint media, as presented in figure 5 below

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| gain | Equal variances assumed | .358 | .552 | -13.158 | 46 | .000 | -.56792 | .04316 | -.65480 | -.48104 |
| | Equal variances not assumed | | | -13.158 | 41.389 | .000 | -.56792 | .04316 | -.65506 | -.48077 |

**Figure 5**

The output of the test results are independent sample t-test gain of the control class and experimental class using the SPSS 21 application.

In general, the responses of students and teachers netted through Likert scale questionnaires and interviews as well as from process observations and learning video are provide better responses in improving their abilities in HOTS Indicators developed with multifunctional smart board media than PowerPoint media. The HOTS indicator in question includes analysis capabilities, namely selecting, correlating, classifying, evaluating, namely criticizing, comparing, directing, creating, namely categorizing, formulating, generalizing.

## 6. DISCUSSION

The pre-test showed no different results in the two classes, this was because the class distribution system at Al-Azhar Syifa Budi Cibubur-Cileungsi Elementary School was carried out evenly for the regular class, both in terms of academic ability and activeness. This is also reinforced by the value of the average semester 1 report book which shows it is not much different. The initial conditions of students that are relatively similar have a positive impact on research. This will facilitate the control of variables from the influence of other factors that can affect internal validity which is feared to later affect the results of the study.

The increase in HOTS abilities of students and at the frequency of occurrence of HOTS activities in the experimental class experienced a higher increase in ability compared to the control class due to the advantages of multifunctional smart board media. These advantages are related to aspects that can support the development of HOTS capabilities, namely the ability of multifunctional smart board media in providing physical forms of information received as stimulus by students not only in the form of visual images but in the form of light from lights that are lit. The image on the cards received by the receptor and transformed into an impulse form. The physical form of this information causes learning activities to be carried out by involving more sensory tools than control classes that will benefit information processing so that it can be more easily understood and maintained in memory.

The inclusion of lights that can ignite when the correct answer on a multifunctional smart board, besides functioning as a physical information delivery technique, is also one of the motivational techniques in learning, namely the use of unique and unexpected links to apply concepts and principles because of something unique, unexpected and strange more remembered by students. The application of scaffolding makes it possible for teachers to build students' strengths and pursue their shortcoming, scaffolding is done when giving stimulus in the form of questions and chain statements. Student creativity when choosing a possible pair of cards, creativity will help students understand information better and improve their understanding. The availability of various problem solving alternatives presented on cards is one of the strategies for using operational verbs that can develop HOTS. Multifunctional smart board media actively involve students in learning, the learning mode acquired in learning is not only iconic but also direct experience (enactive) so that information can be better stored. The activity of displaying

the results of solving problems in the future is one form of giving students the opportunity to show their skills in public, this is one of the motivational techniques in learning that can lead to a sense of pride and respect, thus increasing students' learning motives. At the end of the learning process, multifunctional smart board media increasing evaluation ability by allows students to provide a series of instructions in the form of questions and chain statements that can lead their partner groups to correct answers.

In this activity students are stimulated to compile questions, relate concepts, direct, criticize and compile material generalizations, these activities are part of the HOTS development strategy. Learning by using multifunctional smart board media uses simulation and games as motivational techniques in learning, so that it can attract students and make the learning process affective and emotionally meaningful, the results will be more remembered, understood and appreciated by students.

Meanwhile, using PowerPoint media, the results of observations indicate the activity of students is limited to observing the PowerPoint and discussing answers. Students pay attention to the first 10 minutes, then 5 students seem to talk, 3 students play guesses using pictures and paper, 3 students draw and 1 sleepy. The teacher operates the media and students observe and work on the task. Two meetings during the study ($2^{nd}$ and $4^{th}$ meetings) was occurred termination of electricity so learning is constrained. The results of the Likert scale questionnaire show students' responses both related to their involvement in operating the PowerPoint media, learning that is fun and not boring. This is reinforced by teacher responses where PowerPoint can increase student activity but not as active as learning using multifunctional smart boards media. PowerPoint media can increase student motivation but monotonous and learning will not be attractive, students will tend to be passive.

The description above provides an explanation of various activities that are difficult to do in learning with PowerPoint media, thus causing an increase in HOTS's ability in the experimental class that learning with multifunctional smart board media are higher than HOTS's ability in the control class learning with PowerPoint media.

## 7. CONCLUSION

Based on the results of research and discussion, it can be concluded that learning with the help of multifunctional smart board media can improve HOTS students' abilities. Students can be actively involved in learning, the operation of the media is carried out actively by students and learning is possible in groups. Learning with the help of multifunctional smart board media can develop the whole aspect of HOTS.

Learning with the help of PowerPoint media is able to increase HOTS but is limited in activating students in learning, so learning is carried out classically with teachers dominating media operations. Based on the results of the study, several aspects of HOTS's ability to create and direct (evaluation) are difficult to develop.

Learning assisted by multifunctional smart board media can better improve students' HOTS capabilities compared to learning assisted by PowerPoint media.

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