THE IMPLEMENTATION OF BRAIN BASED LEARNING TO IMPROVE STUDENTS' CRITICAL THINKING ABILITY IN ISLAMIC EDUCATION PHILOSOPHY COURSE IN PAI STUDY PROGRAM STAIN CURUP

Asri Karolina

State Collage for Islamic Studies, Curup
e-mail: asrikarolina@gmail.com

Abstrak: *Kegelisahan akademik dalam makalah ini adalah lemahnya proses berpikir peserta didik dalam proses pembelajaran. Maka penelitian ini bertujuan untuk menganalisis perbedaan kemampuan berpikir kritis mahasiswa kelas eksperimen sebelum dan setelah diterapkan Brain Based Learning, menganalisis perbedaan kemampuan berpikir kritis mahasiswa kelas kontrol sebelum dan setelah diterapkan pembelajaran konvensional, dan menganalisis perbedaan kemampuan berpikir kritis mahasiswa kelas eksperimen dan kelas kontrol. Penelitian ini menggunakan metode penelitian kuantitatif. Populasinya adalah mahasiswa semester 3 Program Studi Pendidikan Agama Islam STAIN Curup. Teknik samplingnya yaitu cluster sampling. Teknik pengumpulan datanya menggunakan tes, observasi, dan dokumentasi. Sedangkan teknik analisis datanya menggunakan uji t (Independent-Sample T Test). Hasil penelitiannya pertama, terdapat perbedaan kemampuan berpikir kritis mahasiswa kelas eksperimen sebelum dan setelah diterapkan Brain Based Learning. Kedua, terdapat perbedaan kemampuan berpikir kritis mahasiswa kelas kontrol sebelum dan setelah diterapkan pembelajaran konvensional. Ketiga, hasil uji hipotesis pre-test tidak terdapat perbedaan yang signifikan antara kemampuan berpikir kritis mahasiswa kelas eksperimen dan kelas kontrol. Sedangkan hasil pengujian hipotesis post-test terdapat perbedaan yang signifikan antara kemampuan berpikir kritis mahasiswa kelas eksperimen dan kelas kontrol.*

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ملخص: يجري هذا البحث في تخصص التربية الإسلامية في الجامعة الإسلامية الحكومية بجورب لتحليل فرق كفاءة التفكير النقدي بين المجموعة التجريبية والمجموعة الضابطة. طريقة البحث المستخدمة في هذا البحث هي الطريقة الكمية. ونوع الطريقة المستخدم هو طريقة التجريبية بتصميم شبه التجريبي مجموعة الضابطة غير معادل. نتائج البحث تدل على أولا، الإختبار القبلي عن تفكير نقدي الطلاب في المجموعة التجريبية هو كاف. وقيمة متوسطة في الإختبار البعدي هي جيد جداً. ثانيا، الإختبار القبلي عن تفكير نقدي

الطلاب في المجموعة الضابطة هو كاف. والإختبار البعدي هو جيد. ثالثا، نتيجة اختبار الفرضي للإختبار القبلي عن تفكير نقدي الطلاب في المجموعة التجريبية والمجموعة الضابطة بعينة مستقبلة اختبار ت تحصل على قيمة ت $_{حساب}$ > ت $_{جدول}$ (١٥٤،٠ > ٢،٣٠٣) لذلك الفرض الصفري هو مقبول و الفرض المباشر هو غير مقبول. ونتيجة اختبار الفرضي للإختبار البعدي عن تفكير نقدي الطلاب في المجموعة التجريبية والمجموعة الضابطة تحصل على قيمة ت $_{حساب}$ > ت $_{جدول}$ (٢٤٣،٨ > ٢،٣٠٣) لذلك الفرض الصفري هو غير مقبول و الفرض المباشر هو مقبول.

Keywords: Brain Based Learning, Critical Thinking Skill, Islamic Education Philosophy.

INTRODUCTION

Educators have long been aware of the importance of critical thinking skills as an outcome of student learning. More recently, the Partnership for 21st Century Skills has identified critical thinking as one of several learning and innovation skills necessary to prepare students for post-secondary education and the workforce. In addition, the recent created Common Core State Standards reflect critical thinking as a cross-disciplinary skill vital for college and employment.[1] In everyday life, people cannot be separated from the activities of thinking. According to Plato thinking is an act of speaking in our heart. So, it can be concluded that thinking is a psychological process that connects or compares the situation between facts, ideas or events with facts, ideas or other events. After thinking process, a person gets a conclusion of its. According to Dewey in Komalasari thinking is begun when a person is faced with a problem (perplexity) and face with something that desires a way out that situation that confronts people to able to use their knowledge, understanding, or skills. That process is called as a thinking.[2]

Many beginning college students regard to study and learning as mechanized assimilation processes. Their goal is to memorize as many facts as possible. Research by W. G. Perry[3] on the cognitive development of college students identified nine levels or stages of cognitive functioning. At the first level, at many college students begin, their attitude toward learning is described as passive participation: Learning means working hard, reading every word, and learning correct answers. Perry's scheme

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[1] Emily R. Lai, "Critical Thinking: Literature Review dalam Pearson's Publications [Online], Research Report. [19 Maret 2017], h. 4.," Research Report, 2011, Pearson's Publications, 4.

[2] Kowiyah, "Kemampuan Berpikir Kritis," *Jurnal Pendidikan Dasar* 3 (5) (2012): 175.

[3] Kathleen T. McWhorter, *Instructor's Manual and Test Bank to Accompany Study and Critical Thinking Skill in College (seventh edition)* (United State of America: Pearson Education Inc, 2011), 3.

describes various stages that gradually lead to a realization that learning is an active thinking process in which the goal is no longer "right answers." Instead, it is a process of thinking, reacting to, and evaluating ideas. Students come to realize that they must interpret and integrate information, support their opinions with data, and assess the relative worth and merit of ideas. The cognitive development of college students, then, involves their growing awareness of the importance and necessity to think and become actively involved in the learning process.

Although active and critical thinking is an integral part of the cognitive development of college students until recently little or no effort has been made to teach students how to become active learners and critical thinkers. In fact, thinking skills as was once true for study skills as well were regarded as something every college student should have already developed. It is now widely accepted that students can and should be taught how to learn, and there is a growing awareness that thinking skills instruction is also necessary and appropriate. Credit courses in critical thinking skills are being developed at numerous colleges; many colleges and even state university systems, most notably California's, have instituted thinking skill requirements as part of their general education programs.[4]

Critical thinking is not one activity; rather, the term refers to a collection of thinking skills that advance intellectual focus, motivation, and engagement with new ideas. These thinking skills include the ability to recognize patterns; to solve problems in practical, creative, or scientific ways; to engage in psychological reasoning, and to adopt different perspectives when evaluating ideas or issues. Teaching students to think critically in or outside the classroom improves their abilities to observe, infer, question, decide, develop new ideas, and analyze arguments.[5]

According to Beyer, critical thinking process involves the assessment of two things: the accuracy and feasibility of information, as well as the flow of reasoning. Critical thinking can consist of many forms, depending on the context.[6]

Student's thinking skill is needed in a learning process because some subjects are offered in every semester need interpretation and analysis from a student in order to get problem-solving from the problem and question asked by a lecturer. One of the subjects that desperately need critical ideas from students

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[4] *Ibid.*, 3.

[5] Dana S. Dunn, *Teaching Critical Thinking in Psychology: A Handbook of Best Practices* (United Kingdom: Blackwell Publishing Ltd, 2008), xvii.

[6] Jeanne Ellis Ormrod, *Psikologi Pendidikan: Membantu Siswa Tumbuh dan Berkembang (Edisi Keenam)* (Jakarta: Erlangga, 2008), 409.

in the course of Islamic Education Philosophy which the study of how to solve the problems of Islamic education in the perspective of philosophy by thinking deeply to the roots so that the problem is resolved. The standard of competence that must be possessed by students is able to understand the background and development of Islamic philosophy of education, the basic concepts of Islamic education philosophy and its relation to Islamic education as a system.

Moreover, the condition of learning in the study program or university is still quite diverse. Colleges that have run the quality assurance systems at both the institutional level to study programs have generally been implementing learning-based outcomes of learning, but from the experience of Curriculum Development of Higher Education, Directorate of Higher Education conducted training curriculum development throughout KOPERTIS in Indonesia with a major issue:[7]

1. Lack of understanding of the essence of the curriculum in the education system;

2. Lack of preparation of lecturers in preparing learning tools before learning;

3. Unclear formulation of learning achievement;

4. Unclear strategies and learning methods;

5. Unclear whether the choice of strategies and methods of learning is the right choice to elicit predetermined learning achievements;

6. Assessment activities tend to score to students rather than provide guidance to unlock their potential;

7. Instruments for assessing tend to characterize summative judgments rather than formative assessments.

The learning system is an important part in order to produce highly competitive graduates. A good learning system can provide learning experiences to students to unlock their potential in internalizing knowledge, skills, and attitudes as well as previous learning experiences. With the issuance of Permendikbud no. 49 at 2014 on National Standards of Higher Education, Study Program is required to produce graduates in accordance with the qualification of the Indonesian National Qualification Framework (KKNI). Similarly, the education quality assurance system should be able to control

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[7] Tim Kurikulum dan Pembelajaran Direktorat Pembelajaran dan Kemahasiswaan Direktorat Jenderal Pendidikan Tinggi Kementerian Pendidikan dan Kebudayaan, *Buku Kurikulum Pendidikan Tinggi* (Jakarta: Direktorat Pembelajaran dan Kemahasiswaan Direktorat Jenderal Pendidikan Tinggi Kementerian Pendidikan dan Kebudayaan, 2014), 49.

the educational process by appropriately referring to the qualification level of KKNI.[8]

In addition, the learning materials are generally organized not following the taxonomy of the knowledge dimension to be achieved and the cognitive sequence process dimension and the way of delivery. Therefore, mostly the practice of learning process today is in a form of lecturing, or direct delivery (from lecturers to students). And the fact in the feild that when students attending lectures or listening to lectures, they difficult to follow or capture the meaning of the essence of learning materials, so that their activities are limited to make notes that the truth is in doubt. In addition, there is another tendency that the students are currently less able to listen. This happens as a result of the dependence on the live material and the photocopy of the lecture material of the lecturer.

Thus, learning process in the classroom need a renewal or innovation. This is because to improve the quality of lectures, as well as to adjust the lectures with the development of a new curriculum. Lecturers must have creativity in developing the learning process and can think critically implement innovations in the lecture process well. Innovation should be realized in a tangible and systematic way, not just being a delusion and a hidden plan. And the orientation of innovation should always prioritize the students, one of them is through the application of learning-based ability of the brain.

However, the lessons learned over the years seem to be less concerned about the most important organs for learning. Meanwhile, the current learning, more likely to entrust the function of the left hemisphere alone by ignoring the function of the right hemisphere. In fact, if learning is packed with the functionality of the two hemispheres of the brain, theoretically the student will have the double brain power because it utilizes all the capacity of his brain. Moreover, students are emphasized to analyze the problems that arise in the lecture process so that students can solve the problems caused.

A brain-based approach is a learning that is aligned with the way the brain is naturally designed to learn. This "brain-based approach" is a multidisciplinary approach built on a fundamental question, "What is good for the brain?". This question comes from various disciplines, such as chemical reactions, neurology, psychology, sociology, genetics, biology, and computational neurobiology. This is a way of thinking about learning.[9]

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[8] *Ibid.*, 50.

[9] Eric Jensen, *Brain Based Learning (Pembelajaran Berbasis Kemampuan Otak Cara Baru dalam Pengajaran dan Pelatihan)* (Yogyakarta: Pustaka Belajar, 2008), 11 - 12.

The right brain is a large part of the brain that is on the right. The right brain has an important role in the development of human intelligence. The right brain is also called the cerebral hemispheres that have a role as the center of imagination, creativity, art and music, color, recognition or form of space, intuition, tone, rhythm, and spontaneity. The right hemisphere puts the concrete and holistic mind in the face of problems and puts forward an intuitive and artistic thinking style. The right brain is superior in spatial orientation (visual), such as space or images.[10]

In the 1860s, French neurologist Paul Broca discovered that the left hemisphere's part of the brain controls the ability to speak the language. This was agreed by a German neurologist named Carl Wernicke in the next decade. Meanwhile, in 1950, professor of psychology at the California Institute of Technology, Roger Sperry expressed a different opinion. According to him, the right brain is not inferior to the left brain. The left hemisphere thinks sequentially, superior in the analysis, and handles words. While the right hemisphere is thinking holistically, recognizing patterns, as well as interpreting nonverbal emotions and expressions. The study led Sperry to get the Nobel Prize in medicine.[11]

Right hemisphere thinking is random, irregular, intuitive, and holistic. The way of thinking is in accordance with ways to know nonverbal, such as feelings and emotions, awareness of feelings (sensing the presence of an object or person, spatial awareness, recognition of shapes and patterns, music, art, color sensitivity, creativity, and visualization.[12] The dominant processes of the left hemisphere differ from the right hemisphere, the left hemisphere dominates with words, logic, numbers, sequence, linearity, analysis, and lists. While the right hemisphere is more likely to rhythm, spatial awareness, gestalt (whole image), imagination, wishful thinking, color, and dimension.[13] The right cerebral hemisphere relies less on words and languages, the right hemisphere more able to see the whole picture by noticing and combining it into a general picture. The right brain plays an important role in the ability intuitive (spontaneous), creative thinking, art feel, see the big picture, body expression, and unite words.

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[10] Tri Gunadi, *Optimalkan Otak Kanan Kiri, Otak Tengah, Otak Kecil* (Jakarta: Penebar Plus, 2010), 130 - 131.

[11] Daniel H. Pink, *Otak Kanan Manusia* (Yogyakarta: Think, 2010), 21 - 22.

[12] Bobbi DePorter dan Mike Hernacki, *Bobbi DePorter & Mike Hernacki, Quantum Learning Membiasakan Belajar Nyaman dan Menyenangkan* (Bandung: Kaifa, 2003), 38.

[13] Tony Buzan, *Use Both Sides of Your Brain Teknik Pemetaan Kecerdasan dan Kreativitas Pikiran Temuan Terkini tentang Otak Manusia* (Yogyakarta: Ikon Teralitera, 2003), 13.

The human brain has nine bits of intelligence. All these intelligence can be optimized by means of many exercises on different things.[14]

Each of the left and right cerebral hemispheres is responsible for different ways of thinking and specializes in certain abilities, although crossing does occur.[15] It can be interpreted that each brain has a different way of thinking and has a tendency to certain abilities according to the processes of its dominance. In addition, the learning process that sustains both parts of the brain function can improve students' critical thinking skills. Because thinking is closely related to the utilization of both hemispheres. Because the left-brain learning pattern relies on words, logic, numbers, sequence, linearity, analysis, and lists. While the pattern of learning in the right brain is visual, then the learning should be packed by using the keyword and visualize the lecture material so that impressed interesting, easy to understand, and fun. The material to be taught can be explained in explanatory form with keywords, charts, drawings, maps and so on.

Thinking in images not only stimulates creativity but also enriches high-level thinking processes. Rudolf Arnheim, Professor of Art Psychology at Harvard University states that practically all forms of thought, no matter how abstract or theoretical, are visual in character. In other words, the more we teach our students to train their visual-spatial intelligence and think visually, the easier it will be for him to develop his high-level thinking and problem-solving skills.[16] It may come to our mind why small children soak up information so easily but as they grow older their memory declines. And middle-aged people often complain of poor memories. Not the passage of time that causes memory to decline, but a decline in the use of perceptive power, imagination, and visualization of a person. To remember things well, it should pay attention to what is being seen, pay attention to more detailed trinkets, generally ignored by others.[17]

The learning process will be more effective if the lecturer delivered various learning materials using images (visual). Students more easily understand the ideas presented through pictures, maps, diagrams, charts, and modeling in the subject matter. With visually packaged learning, students will remember the

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[14] Martha Gemilang, *Percepat Kesuksesan dengan Mengoptimalkan Otak Kanan* (Yogyakarta: Pinang Merah, 2011), 11.

[15] Bobbi DePorter & Mike Hernacki, *Quantum Learning Membiasakan Belajar Nyaman dan Menyenangkan*, 39.

[16] May Lwin et. al., *How to Multiply Your Child's Intelligence Cara Mengembangkan Berbagai Komponen Kecerdasan* (Jakarta: Indeks, 2008), 79.

[17] *Ibid.*, 78.

course materials that have been delivered. As Confucius has revealed over 2400 years ago that what I heard, I forgot, what I saw, I remembered, and what I did, I understood.[18]

The lectures presented visually are typical ways of Brain Based Learning. Brain Based Learning can also improve students' critical thinking skills. This will actually happen if Brain Based Learning is applied optimally. Brain Based Learning in Islamic Philosophy Education is one form of effort that can be done to improve the critical thinking ability of students in explaining and analyzing the lecture material because it is assumed that Brain Based Learning is in accordance with the needs of the students of Islamic Religious Studies Program (PAI). Because students are difficult to explain the material with the results of his own analysis, in other words, the critical thinking skills of students have not been trained in explaining the lecture materials.

Seeing these conditions, then conducted experimental research on the application of Brain Based Learning. In addition, the application of Brain Based Learning in Islamic Education Philosophy courses is directed to improve students' critical thinking skills by looking at the effectiveness of their implementation. This study will be piloted in the PAI Program of State Islamic High School (STAIN) Curup with the title The Implementation of Brain Based Learning to Improve Students' Critical Thinking Ability in Islamic Education Philosophy Course in PAI Study Program STAIN Curup.

RESEARCH METHODS

A. Types of Research

This research used quantitative research method. Quantitative research is looking for theories, concepts and generalizations of the results of research that can be used as a theoretical basis for the implementation of research.[19] The method which is used in this study is experimental with Quasi-Experimental Nonequivalent Control Group Design. In this design is formed a group of experiments and control groups that are not selected by random.[20] One of the most commonly used quasi-experimental designs in educational research can be represented as:[21]

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[18] Mel Silberman, *Active Learning* (Jakarta: Yappendis, 1996), 1.

[19] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, dan R & D* (Bandung: Alfabeta, 2012), 52.

[20] *Ibid*., 79.

[21] Louis Cohen, *Research Methods in Education (5th Edition)*, 5 ed. (New York: Routledge Falmer, 2000), 215.

Experimental	O_1	X	O_2
Control	O_3		O_4

Picture 1 Quasi-Experimental Design

Note: The dashed line separating the parallel rows in the diagram of the non-equivalent control groups have not been equated by randomization-hence the term 'non-equivalent'.

B. Population and Sample

The population is the totality of all objects or individuals that have certain characteristics, clear and complete to be studied. While the sample is part of the population is taken through certain ways that also have certain characteristics, clear, and complete that are considered to be representative of the population.[22] The population is also a generalization area consisting of objects/subjects that have certain qualities and characteristics set by the researchers to be studied and then drawn conclusions.[23] Population in this research is a student of third (3) grade at study program of Islam Religion which amounted to 181 students consist of local 3A, 3B, 3C, 3D, 3E, and 3F. Third (3) is determined as the population of this study because the course of Islamic education philosophy is scheduled in this odd semester of 2017. Clearly can be seen in the table 1:

Table 1
Research Population

NO	Class	Amount
1	3A	30
2	3B	30
3	3C	31
4	3D	30
5	3E	30
6	3F	30
TOTAL		181

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[22] M. Iqbal Hasan, *Pokok-Pokok Materi Statistik 2 (Statistik Inferensif)* (Jakarta: Bumi Aksara, 2003), 84.

[23] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, dan R & D* (Bandung: Alfabeta, 2011), 80.

Sample is part of population.[24] While the sample of this research are two (2) classroom which is determined by cluster sampling technique. The Cluster Sampling technique selects the object of the research based based on the group, region, or group of subjects that naturally gather together.[25]After the drawing using cluster sampling technique then obtained local 3D as an experimental class and local 3A as control class. In detail can be seen in table 2:

Table 2
Research Sample

NO	Class	Variable	Amount
1	3D	Experiment	30
2	3A	Control	30
TOTAL			60

C. Research Variables

This study consists of experimental variables which include:

1. Independent variable (free)   : Application of Learning Brain Based Capabilities (Brain Based Learning)

2. Dependent Variables (bound)   : Critical Thinking Ability of College Student

D. Operational Definition

Operational definition is a definition based on the properties of things that are defined and can be observed.[26] The position of operational definition in a research is very important because with the definition will facilitate the readers and researchers themselves in providing an overview and operationalize the discussion of each variable. The application in this study is intended as an attempt to implement an effective and meaningful learning. In this case, apply Brain Based Learning. Implementation of learning Brain Based Learning is to see the effectiveness of its application.

Brain Based Learning is a learning that aligns with the ability of the brain and is able to utilize both hemispheres in analyzing learning materials. Brain Based Learning includes seven stages of brain-based planning outline that are pre-exposure, preparation, initiation and acquisition, elaboration, incubation

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[24] Sutrisno Hadi, *Statistik 2* (Yogyakarta: UGM, 1984), 340.
[25] Sukardi, *Metodologi Penelitian Pendidikan* (Jakarta: Bumi Aksara, 2013), 61.
[26] Sumadi Suryabrata, *Metodologi Penelitian* (Jakarta: Raja Grafindo Persada, 2003), 29.

and memory insertion, as well as verification, confidence checking, celebration, and integration. Critical thinking ability in this research is the ability to solve the problems in learning materials. And the students are able to find the right solution to solve the problems.

Islamic Education Philosophy in this research is subjects offered to students of PAI Study Program Tarbiyah STAIN Curup in semester 3. This course examines the science of learning how to solve the problems of Islamic education in the perspective of philosophy.

E. Research Hypothesis

The hypothesis in this research as follows:

H_a : There is a significant difference between the critical thinking skills of experimental class students applied with Brain Based Learning and the critical thinking skills of control class students who are not applied Brain Based Learning (Brain Based Learning).

H_0 : There is no significant difference between the critical thinking skills of experimental class students applied with Brain Based Learning and the critical thinking skills of control class students who are not applied Brain Based Learning (Brain Based Learning).

F. Research Instruments

Generally, instrument is a tool that meets academic requirements, so it can be used as a tool to measure an object or collect data about a variable. In the field of research, the instrument is defined as a tool for collecting data on research variables for research needs.[27] In this study the instrument to measure students' critical thinking skills were tests. The critical thinking skills test in this study was developed independently. Types of tests used are essay tests. Preparation of students' critical thinking skills test tools based on critical skills skill elements with indicators and sub-indicators. Elements, indicators, and sub-indicators of critical thinking ability adapted to the taught material of human status and human relationships with education in Islam.

In the description test, the scoring generally based on the weight which is given for each item, on the basis of the level of difficulty, or on the basis of many elements that must be contained in order to get the best or correct answer.[28]

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[27] Djaali dan Pudji Muljono, *Pengukuran dalam Bidang Pendidikan* (Jakarta: Grasindo, 2007), 6.

[28] Anas Sudijono, *Pengantar Evaluasi Pendidikan* (Jakarta: Raja Grafindo Persada, 2007), 301 - 302.

In addition, the truth of the answer in the essay test was stratified according to the degree of conformity of the student's answers with the key answer. For example, on an essay item with a maximum score of 5, A student can answer 40% according to the key. Therefore, on the point A obtained a score of 40% x 5 = 2.[29] If students can answer with the correct answers (most perfect) given the score 10 and 20 depending on the level of difficulty of the problem. Problem test 1 to 4, the weight of the score is 10 and the test 5 to 7, the weight of the score is 20. If only half is given a score of 5, and if almost entirely given a score of 9. And if answering the problem without any relation to test questions or wrong, then score given 0. So, maximum score 100 and minimum 0.

This critical thinking test will be tested for validity and reliability. Testing instrument research aims to ensure that the measuring tool used is really precise and shows the correct results, before the use of both tests the ability of critical thinking students tested first. Implementation of the instrument test is done in the form of quantitative test that is the test of validity and reliability test by using SPSS program.

1. Validity test

A valid instrument means that the measuring instrument used to obtain the data is valid. Valid means the instrument can be used to measure what should be measured.[30] The internal validity of the test instrument must satisfy the validity of the construct and content validity. Sutrisno Hadi as quoted by Sugiyono equate construct validity with logical validity and validity by definition. Instruments that have construct validity, if they can be used to measure symptoms as defined.[31] For test-shaped instruments, content validity testing can also be done by comparing the contents of the instrument with the subject matter that has been taught.[32]

Validity test in this research used constructs validity. To test the validity of the construct, it can be used by experts' opinions (judgment experts). In this case, after the instrument is constructed about the aspects to be measured with a particular theory, then further consulted with the expert. The experts were asked his opinion about the instruments that have been prepared. Perhaps experts will give an opinion: the instrument can be used without repair, there are improvements, and may be completely overhauled. After testing the constructs of experts finished then passed the test of the instrument. Instruments

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[29] Purwanto, *Evaluasi Hasil Belajar* (Yogyakarta: Pustaka Belajar, 2011), 188.

[30] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, dan R & D*, 2011, 121.

[31] Sugiyono, *Statistika untuk Penelitian* (Bandung: Alfabeta, 2013), 350.

[32] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, dan R & D*, 2011, 182.

approved by the experts were tested on the samples from which the population was taken. The number of members used is about 30 people. After the data tabulated, then the test of construct validity is done by factor analysis, that is by correlating between scores of instrument items.[33] To determine whether or not the research instrument is valid, consult the value r- table. In the interpretation of the correlation coefficient, the degree of free is used (N - Nr).

The valid criteria or not a variable as follows:[34]

a.   r arithmetic > r table, then the data declared valid.

b.   r arithmetic < r table, then the data is declared invalid.

The instrument of this research has been consulted with experts, Sugiatno, M.Pd.I. is a philosopher of Islamic education, Masudi, M.Fil.I. is a philosopher, Drs. Benny Azwar, M.Pd. Cons. who is an expert in guidance and counseling, and Dr. Idi Warsah, M.Pd.I. is an expert in the field of educational psychology. After consulting instruments are consulted, critical thinking skills test instruments can be used for improvement. After validation of the test instrument of students' critical thinking skills by experts, after that, the test is tested to a population of 30 students. The 30 students were drawn from the 3 F classroom as population of this study after that the test is interpreted. Giving an interpretation of correlation coefficient is used a degree of freedom equal to (N - Nr), that is 30 - 2 = 28. The degree of freedom equal to 28 consulted to r-table value product moment, at significance level 0,05 and level of significance 0,01 that is:

rt at the 0.05 significance level is 0.374.

rt at the 0.01 significance level is 0.478.

Based on the results of the analysis of the calculation of research instruments, it turns out that from 7 items about the essay test that has been formulated and tested its validity, 7 items item test is declared valid. Because the result r count > r table, then the data declared valid. Clearly can be seen in the following table:

[33] Sugiyono, *Statistika untuk Penelitian*, 352.

[34] Yohanes Anton Nugroho, *It's Easy Olah Data dengan SPSS* (Yogyakarta: Skripta Media Creative, 2011), 24.

Table 3
The result of Test Validity Instrument Test of Student Critical Thinking Ability Test

Number of Question	r count	r Tabel	
		0,05	0,01
1	0,806	0,374	0,478
2	0,705	0,374	0,478
3	0,906	0,374	0,478
4	0,797	0,374	0,478
5	0,501	0,374	0,478
6	0,965	0,374	0,478
7	0,943	0,374	0,478

2. Test Reliability

Reliable instruments are instruments that, if used multiple times to measure the same object, will produce the same data.[35] The reliability of the instrument indicates how large an instrument can be trusted and used as a data collection tool. The higher the instrument reliability, the more reliable the measuring result. The more reliable an instrument, the instrument will get the same result, if used multiple times measure on the same object. The most commonly used method of reliability measurement is the Alpha Cronbach (□) method. Alpha Cronbach's coefficient shows the extent to which the respondent's consistency in answering the assessed instruments.[36] Reliability testing with Cronbach Alpha technique is done for the type of interval data/essay.[37] Measurement of reliability using alpha Cronbach method will produce alpha value on a scale of 0-1, which can be grouped in five classes. The value of each class and its level of reliability as shown in the following table:[38]

Table 4
Reliability Level

Alpha	Reliability Level
0,00 – 0,20	Less Reliable
0,201 – 0,40	Somewhat Reliable
0,401 – 0,60	Quite Reliable
0,601 – 0,80	Reliable

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[35] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, dan R & D*, 2011, 121.
[36] Nugroho, *It's Easy Olah Data dengan SPSS*, 28.
[37] Sugiyono, *Statistika untuk Penelitian*, 365.
[38] Nugroho, *It's Easy Olah Data dengan SPSS*, 32 - 33.

0,801 – 1,00	Very Reliable

Furthermore, the interpretation of the test reliability coefficient (r11) of the essay test form is generally used as follows:[39]

1) If r11 equals or greater than 0.70 means that the test being tested is reliably assumed to have a high reliability (reliable).

2) If r11 is smaller than 0.70 means that the test being tested is not reliably tested to have high reliability (unreliable).

The result of test reliability test instrument test of student's critical thinking ability is known alpha value equal to 0,794. The result of the statistical test of instrument reliability test of critical thinking ability can be seen in the table 5.

Table 5
Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0,794	0,935	8

So it can be stated that essay form test by presenting 7 item items and followed by 30 students have reliable that is at the level of reliability 0,601 - 0, 80. Or it has a high reliability because Alpha Cronbach or r11 is greater than 0.70.

G. Data Collection Technique

The way of collecting data in this research is done through the test, observation, and documentation.

1. Test

The test is a series of questions or exercises and other tools used to measure the skills, knowledge of intelligence, abilities or talents possessed by individuals or groups.[40] Anastari, as quoted by Sugiyono, stated that the test is an objective and standard measurement. Cronbach added that the test is a systematic procedure for observing and describing a number or more of a person's traits with the help of a numerical scale or a categorical system. Thus it can be stated that the test is a systematic procedure. It means that the test items are arranged according to specific ways and rules, the scores must be clear and done in detail, and the individuals taking the

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[39] Sudijono, *Pengantar Evaluasi Pendidikan,* 209.
[40] Suharsimi Arikunto, *Prosedur Penelitian Suatu Pendekatan Praktik* (Jakarta: Rineka Cipta, 2006), 150.

test should receive the same test item and under comparable conditions. Collecting data by the test is done by giving a number of questions to the subject under study to be answered. The answer to the test instrument is "right and wrong" not "good and bad". Data test results in the form of quantitative data/numbers.[41] The test used in the study is an essay test. Essay tests are used to obtain students' critical thinking skills.

2.   Observation

According to Nasution as quoted by Sugiyono observation is the foundation of all science. Scientists can only work on the data, i.e. facts about the real world obtained by observation. The data is collected and often with a variety of highly sophisticated tools, so that very small objects (protons and electrons) as well as very distant (space objects) can be clearly observed. Marshall states that "through observation, the researcher learns about behavior and the meaning attached to the behavior". Through observation, researchers learn about the behavior, and the meaning of the behavior.[42] Observation in this research is used to obtain data on the objective condition of the learning process of Islamic Education Philosophy course in PAI Study Program STAIN Curup and data related to research.

3.   Documentation

Documentation is a technique of collecting data by recording, recording or duplicating data needed in research.[43] Documentation in research is used to get syllabus, Semester Learning Plan (RPS), and Lecture Unit of Learning (SAP) of Islamic Education Philosophy in PAI STAIN Curup Study Program and data related to the research.

H. Data Analysis Technique

The technique of data analysis in research is done by quantitative approach. The quantitative data is analyzed quantitatively with Statistical Product and Service Solution (SPSS) Version 21 program with t-test and performs a prerequisite test of normality and homogeneity.

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[41] Sugiyono, *Metode Penelitian & Pengembangan: Research and Development* (Bandung: Alfabeta, 2015), 208.

[42] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, dan R & D*, 2011, 310.

[43] Danang Sunyoto, *Analisis Regresi dan Uji Hipotesis* (Yogyakarta: Caps, 2011), 190.

1. Testing Pre-requisites

    a. Normality Test

        One of the requirements for Parametric Statistics analysis is that empirical data are normally distributed. The use of parametric statistics works with the assumption that the data of each research variable to be analyzed form a normal distribution. If the data is not normal, then pparametric statistical techniques cannot be used for analysis tools. Instead, other statistical techniques are used which should not assume that the data are normally distributed. The statistical technique is Nonparametric Statistics. For that, before the researchers will use parametric statistical techniques as the analysis, then the researcher must prove first, whether the data will be analyzed it is normally distributed.[44] If the researchers test the data normality using SPSS, then it will be available Kolmogorov-Smirnov Test.[45] In SPSS also available features for testing the distribution of data by using graphical display, the menu are called P-P PLOTS, and Q-Q PLOTS. This menu not only tests whether the distribution of data follows a normal distribution (therefore called data normality), but can also be used to test whether a data follows a certain data distribution.[46] In this study, the normality test was performed using Kolmogorov-Smirnov Test. Normality test is used to determine whether the data is eligible for analysis test with the parametric statistic that is t-test.

        To know whether or not normal is if sig > 0, 05 then data is declared normal. And If sig < 0, 05 then data can be told not normal. If the data being tested is normally distributed or close to the normal distribution, then with the data can be done various inference or decision making with the parametric statistical method. However, if the data is not normally distributed or distant from the normal distribution criteria, the parametric method cannot be used, for inference activities should be used non-parametric statistical methods.[47] If the data in this study is normally distributed, it will use a parametric statistic that is t-test. Whereas, if the data in this study is not normally distributed, so it will use nonparametric statistic that is a test by Mann Whitney.

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[44] Sugiyono, *Statistika untuk Penelitian*, 75.

[45] Partino H.R. dan H.M. Idrus, *Statistik Inferensial* (Yogyakarta: Safiria Insania Press, 2010), 141.

[46] Singgih Santoso, *Panduan Lengkap SPSS Versi 20* (Jakarta: Elex Media Komputindo, 2012), 194 - 195.

[47] *Ibid.*, 242.

b.   Homogeneity Test

Homogeneity test is a requirement for all hypothesis test differences intended to test whether two samples taken have the same variance. Homogeneity test was performed with One Way ANOVA Homogeneity of Variance Test (Levene Statistic Test). The decision-making guidelines as follows:[48]

1)   The value of significance or probability value < 0.05, the data comes from populations having unequal variance.

2)   The value of significance or probability value > 0.05, the data comes from populations having the same variance.

2.   Hypothesis Testing

Hypothesis testing in this research is only analyzed quantitatively by using SPSS program. If the tested data is normal and homogeneous distributed then it can be analyzed with parametric statistic t test i.e. Independent-Sample T-Test. The average hypothesis test was conducted to determine whether or not differences in critical thinking ability of experimental class students applied Brain Based Learning and control class not applied Brain Based Learning. Hypothesis test in this research using two-party test, that is in testing is applicable provisions, that if the price t arithmetic, is in the acceptance area H_0 accepted and H_a rejected. Thus if the price t count smaller or equal to ($\leq$) of the price table then H_0 accepted. Price t arithmetic is the absolute price, so not seen (+) or (-) it.[49] The pair of null hypotheses and their counterpoints to be tested are H_0: $\mu 1 = \mu 2$ and H_a: $\mu 1 \neq \mu 2$.[50] Accept H_0, if $-$ t-table $<$ t-(coll.) arithmetic $<$ t-tabel. After hypothesis testing by using Independent-Sample T-Test, it then consulted on table value "t" significance level of 0.05 with df (Degrees of Freedom).

RESEARCH RESULTS AND DISCUSSION

A. Research Results

In the results of this study will be presented as data that has been collected from the experimental results that researchers do. Statistical activities in principle can be divided into two stages:[51]

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[48] *Ibid.*, 193.
[49] Sugiyono, *Statistika untuk Penelitian*, 97.
[50] Sudjana, *Metoda Statistika* (Bandung: Tarsito, 2005), 239.
[51] *Ibid.*, ix.

1. Descriptive Statistics, relating to the recording and summary of data, with the aim of describing the important things in a group of data, such as how many averages, data variations, and so on.

2. Inference Statistics, which relates to the decision making of the data already recorded and summarized.

The data of this research include a description of data both pre-test and post-test value as well as inferential statistics relating to the conclusion of data obtained. So, there are three findings in this study, namely:

1. Differences in Critical Thinking Skills of Experimental Class Students before and After Implemented Brain Based Learning.

    Based on the pre-test and post-test the critical thinking skills that must be achieved by the students is the maximum score of 100 and the minimum 0. So that the range is = 100 - 0 = 100, many class categories = 5 (very good category, good enough, less, and less once). While the interval class length = 100/5 = 20. So that can be made interpretation as follows:[52]

Table 6
Data Interpretation

Score	Interpretaion
0 – 19	Less Once
20 – 39	Less
40 – 59	Enough
60 – 79	Good
80 – 99	Very well

Data descriptions of students' critical thinking skill test include description of pre-test and post-test as follows:

a. Value of Pre-Test Critical Thinking Skill of Experiment Class Students. In the pre-test of critical thinking ability of experimental class students obtained mean value (mean) equal to 41.72 including enough category.

b. Post-Test Value of Critical Thinking Skills of Experimental Class Students in contrary, the mean value in the post-test of critical thinking ability of the experimental class students, which is 91,03 including the excellent category. The results can show that the mean value of the post-test is greater than the mean in the pre-test. The value of

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[52] Suharsimi Arikunto, *Prosedur Penelitian Suatu Pendekatan Praktik* (Jakarta: Rineka Cipta, 2007), 289.

students' critical thinking skills increased significantly by 49,31 after applied Brain Based Learning. Thus, there is a difference in critical thinking skills of experimental class students before and after applied Brain Based Learning.

2. Differences in Critical Thinking Skills of Classroom Students before and After Applied the Conventional Learning. Description of test result data of critical thinking ability of control class students includes a description of pre-test and post-test value as follows:

    a. Pre-Test Value of Critical Thinking Skills of Control Class Students
        In the pre-test of critical thinking ability of control class students, the average value (mean) was 41,21, including enough category.

    b. Post-Test Value of Critical Thinking Skills of Control Class Students
        While the mean value in post-test of critical thinking ability of control class student, that is 70,34 including good category. The results can show that the mean value of the post-test is greater than the mean in the pre-test. The value of students' critical thinking skills increased by 29,13 after applied conventional learning. Thus, there are differences in critical thinking skills of control class students before and after applied conventional learning. However, the increase has not reached an average value above 70.

    3. Differences in Critical Thinking Ability of Experimental Classroom Students Accompanied by Brain Based Learning and Critical Thinking Skills of Unmatched Control Class Students Brain Based Learning.

The difference of critical thinking ability of experimental class and control class students will be tested by hypothesis t-test. But before testing hypotheses, the data must go through prerequisite testing of analysis with normality and homogeneity tests.

a. Testing Prerequisite Analysis

    The prerequisite analysis test is performed before performing the data analysis. One of the requirements of parametric statistical analysis is that of empirical data. The prerequisite used in this study is by normality and homogeneity test.

    1) Pre-Test Normality Test

        Normality test is performed to test whether the data is normally distributed or not. Normality test by using Kolmogorov Smirnov test

in the calculation using SPSS 21 program. To know whether or not normal is sig > 0,05 then the data is declared normal. And If sig < 0,05 then data can be told not normal. The calculation results obtained are shown in the table 7.

Table 7
Normality Test Pre-Test Critical Thinking Skill of Experiment Classroom and Control Class
Two-Sample Kolmogorov-Smirnov Test

		Pre-Test Critical Thinking Skill of Experiment Classroom and Control Class
Most Extreme Differences	Absolute	,207
	Positive	,138
	Negative	-,207
Kolmogorov-Smirnov Z		,788
Asymp. Sig. (2-tailed)		,564

a. Grouping Variable: class code

Based on the calculation result of normality test pre-test students' critical thinking ability both experiment class and control class have sig value > 0,05. In the pre-test of students' critical thinking ability, the significance value obtained is 0,564 > 0, 05. It was concluded that the group of pre-test data of critical thinking ability of the experimental class and control class students was normally distributed.

2) Post-Test Normality Test

The result of post-test normality test of students' critical thinking ability and control class can be seen in the table 8.

Table 8
Post-Test Normality Test the Ability of Critical Thinking of Experiment Class and Control Class Students
Two-Sample Kolmogorov-Smirnov Test

		Post-Test Normality Test the Ability of Critical Thinking of Experiment Class and Control Class St udents
Most Extreme Differences	Absolute	,241
	Positive	,000
	Negative	-,241
Kolmogorov-Smirnov Z		,919

Asymp. Sig. (2-tailed)	,367

a. Grouping Variable: Kode Kelas

Based on the result of post-test normality test of students' critical thinking ability, both experimental and control class have sig > 0,05. In the post-test of students' critical thinking ability, the significance value obtained is 0.367 > 0.05. It was concluded that the group of post-test data of critical thinking ability of experimental class and control class students was normal distribution.

3)   Pre-Test of Homogeneity Test

After the data is known to normal distribution group or not, then the homogeneity test is done. Homogeneity test is a requirement for all hypothesis test differences intended to test whether two samples taken have the same variance. Homogeneity test was performed with One Way Anova Homogeneity of Variance Test (Levene Statistic Test). The decision-making guidelines as follows:[53]

a)   The value of significance or probability value < 0.05, the data comes from populations having unequal variance.

b)   The value of significance or probability value > 0.05, the data comes from populations having the same variance. The homogeneity test of pre-test students' thinking ability of experimental class and control class can be seen in the table 9.

Table 9
Homogeneity of Pre-Test Critical Thinking Skills of Experimental Class and Control Class Students
Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
1,499	1	56	,226

Based on the homogeneity test of pre-test of critical thinking ability of experimental class and control class is obtained significance 0,226. Apparently the significance value of 0.226> 0.05, thus the pre-test data critical thinking ability of the experimental class and control class students are declared homogeneous. So it can be said the data come from populations that have the same variance.

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[53] Santoso, *Panduan Lengkap SPSS Versi 20*, 193.

4) Post-Test Homogeneity Test

The result of homogeneity test of post-test of critical thinking ability of experiment class and control class students can be seen in the table 10.

Table 10
Homogeneity of Post-Test Critical Thinking Skills of Experimental Class and Control Class Students Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
2,028	1	56	,160

Based on the result of post-test homogeneity test of critical thinking ability of experiment class and control class students is gained significance 0,160. It turns out the significance value of 0.160 > 0.05, thus the post-test of critical thinking ability of the experimental class and control class students is stated homogeneous. So it can be said the data come from populations that have the same variance.

b. Hypothesis Testing

With the fulfillment of normality and homogeneity test, then the hypothesis testing is done by using t-test that is Independent Sample T-Test. To prove the hypothesis in this study, the basis of decision making is if t-count> t-tabel then H0 rejected and Ha accepted and if t count <t-table then H0 accepted and Ha rejected. After hypothesis testing by using Independent-Sample T-Test, it then consulted on table value "t" significance level 0,05 with do (Degrees of Freedom) N1 (29) + N2 (29) - 2 = 56. It turns out in t-table not found df of 56 because it is done data interpolation with Microsoft Excel that is FX = TINV (0.025, 56) then ENTER. The value of t-table for ⊡ = 0.05 with df 56 obtained t (½ ⊡, 56) = 2,303. In addition, it can also take the nearest df is df 60. With DF of 60 obtained table at a significance level of 0.05 of 2,000. The results of hypothesis testing include pre-test data and post-test data critical thinking ability of experimental class and control class.

1) Pre-Test Hypothesis Testing

The result of hypothesis testing of pre-test of critical thinking ability of experiment class and control class students can be seen in the table 11.

Table 11

**Hypothesis Test of Pre-Test of Critical Thinking Skill of Experiment
Classroom and Control Class**
Group Statistics

	Kode Kelas	N	Mean	Std. Deviation	Std. Error Mean
Pre-Test of Critical Thinking Skill of Experiment Classroom and Control Class	Experiment Class	29	41,72	13,315	2,472
	Control Class	29	41,21	12,222	2,270

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pre-Test of Critical Thinking Skill of Experiment Classroom and Control Class	Equal variances assumed	1,499	,226	,154	56	,878	,517	3,356	-6,206	7,241
	Equal variances not assumed			,154	55,595	,878	,517	3,356	-6,207	7,242

In the table can be seen the results of hypothesis testing pre-test critical thinking skills of experimental class students and control classes obtained t count of 0,154. While t-table value for $\alpha = 0,05$ with df 56 obtained t ($\frac{1}{2}$ α, 56) = 2,303, mean t-count < t-table (0,154 < 2,303), thus H_0 accepted and H_a rejected. Thus, it can be interpreted that there is no significant difference between the pre-test of critical thinking skills of experimental class students prior to the application of Brain Based Learning and control classes prior to the application of conventional learning. So it can be concluded that there is no significant difference between critical thinking skills of experimental class students applied with Brain Based Learning and

students' critical thinking skills that are not applied Brain Based Learning.

2) Testing of Post-Test Hypothesis

The result of post-test hypothesis testing of students' critical thinking ability and control class can be seen in the table 12.

Table 12
Hypothesis Test of Post-Test of Critical Thinking Skill of Experiment Classroom and Control Class
Group Statistics

	Kode Kelas	N	Mean	Std. Deviation	Std. Error Mean
Post-Test of Critical Thinking Skill of Experiment Classroom and Control Class	Experiment Class	29	91,03	8,170	1,517
	Control Class	29	70,34	10,768	2,000

Independent Samples Test

|		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	*Sig.*	*t*	*Df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	95% Confidence Interval of the Difference	
									Lower	Upper
Post-Test of Critical Thinking Skill of Experiment Classroom and Control Class	*Equal variances assumed*	,095	,759	8,243	56	,000	20,690	2,510	15,662	25,718
	Equal variances not assumed			8,243	52,213	,000	20,690	2,510	15,654	25,726

In the table can be seen the results of hypothesis testing post-test critical thinking ability of experimental class students and control classes obtained t count of 8,243. While ttable value for α = 0, 05 with DF 56 obtained t (½ α, 56) = 2,303, mean t-count > t-table (8,243 > 2,303), thus H0 refused and Ha accepted. Thus, it can be interpreted that there is a significant difference between the post-test of critical thinking ability of experimental class students after the application of Brain Based Learning and control class after the

application of conventional learning. So it can be concluded that there is a significant difference between the critical thinking skills of experimental class students applied with Brain Based Learning and students' critical thinking skills that are not applied.

c.   Different Test of Post-Test Average Ability of Student Critical Thinking Skills

The difference test of the post-test average of students' critical thinking ability is implemented in order to know whether or not there is a difference of the mean value of post-test of critical thinking ability of experimental class and control class students. Based on the result of the calculation on the post-test of critical thinking ability of experimental class and control class, the price of tcount is bigger than ttable (8,243 > 2,303), meaning H_0 is rejected and Ha accepted or hypothesis that there is a significant difference between students' experiments applied with Brain Based Learning and critical thinking skills of control-class students not applied Brain Based Learning.

Differences between the average post-test scores of students' critical thinking ability and control class can be seen in the Independent Sample Test table in the mean difference of 20,690. This result is obtained from the mean of post-test of critical thinking ability of experiment class student is 91,03 less with mean of post-test value of critical thinking ability of student of control class equal to 70,34. The difference of the average post-test value of critical thinking ability of experiment class and control class students can be seen in the following graph.
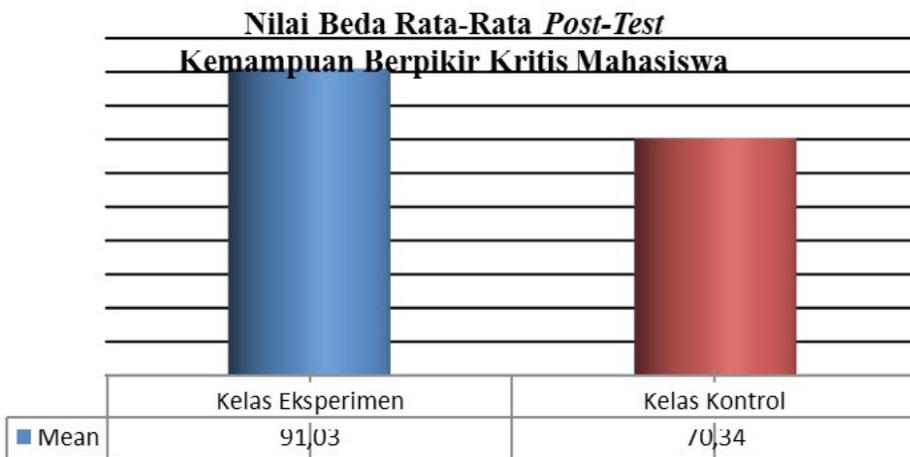
Graphic 1 Average Post-Test Mean Differential Ability of Student Critical Thinking Skills

B. Discussion

1. Differences in Critical Thinking Skills of Experimental Class Students Before and After Implemented Brain Based Learning

   Based on data analysis of mean value of pre-test of critical thinking ability of experiment class student, that is 41,72 while mean value in post-test of critical thinking ability of experiment class student is 91,03. The results can show that the mean value of the post-test is greater than the mean in the pre-test. These data indicate that there are differences in critical thinking ability of experimental class students before and after applied Brain Based Learning. The value of students' critical thinking skills improved significantly after Brain Based Learning was applied.

   The increase in the post-test average of critical thinking ability is in accordance with the theory that explains that "critical thinking is potentially increasing students' critical analytical power. The improvement of students 'critical analytical power is closely related to the improvement of students' intellectual abilities. Therefore, developing the students 'critical thinking skills in learning is an effort to improve students' learning results".[54] It can be understood that improving students' critical thinking skills in the learning process is an attempt to improve learning outcomes obtained by students with Brain Based Learning. Left brain and right brain has different tendencies from each other. The left brain is more closely related to emotional Intelligence Quotient (IQ), rational, cognitive, logical, realistic, analytical, quantitative, arithmetic, serial, linear, planned, causal, segmental, focused, verbal, explicit, intrapersonal, self-centric, and right motor. While the utilization of the right brain is more dominant in emotional, associated with Emotional Quotient (EQ), effective, intuitive, imaginative, artistic, qualitative, spatial, parallel, lateral, unplanned, impulsive, holistic, diffuse, visual, implicit, interpersonal (other- centric), and left motor.[55]

   In the 1860s, French neurologist Paul Broca discovered that the left hemisphere's part of the brain controls the ability to speak the language. This was agreed by a German neurologist named Carl Wernicke in the next decade. Meanwhile, in 1950, professor of psychology at the California Institute of Technology, Roger Sperry expressed a different opinion.

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[54] Henny Setiawati dan Aloysius Duran Corebima, "Empowering Critical Thinking Skills Of The Students Having Different Academic Ability in Biology Learning of Senior High School through PQ4R - TPS Strategy" 4, no. 5 (Mei 2017): 3521.

[55] Ippho Santosa, *7 Keajaiban Rezeki* (Jakarta: Elex Media Komputindo, 2010), 50 - 51.

According to him, the right brain is not inferior to the left brain. The left hemisphere thinks sequentially, superior in the analysis, and handles words. While the right hemisphere is thinking holistically, recognizing patterns, as well as interpreting nonverbal emotions and expressions. The study led Sperry to get the Nobel Prize in medicine.[56]

Thinking in images not only stimulates creativity but also enriches high-level thinking processes. Rudolf Arnheim, Professor of Art Psychology at Harvard University states that practically all forms of thought, no matter how abstract or theoretical, are visual in character. In other words, the more we teach our students to train their visual-spatial intelligence and think visually, the easier it will be for him to develop his high-level thinking and problem-solving skills.[57] Maximizing left and right brain function in learning becomes very important. That is, not only emphasis on the ability of the left brain, but also develope the ability of the right brain. Empowering the brain in the learning process needs to be done and intensified. Empowerment of brain capability is very important in building student's intelligence. For students who are intellectually and emotionally intelligent have a greater chance of success in college. Therefore, for the educational process to be successful, then education should refer to the learning of both hemispheres in a balanced and comprehensive.

2. Differences in Critical Thinking Skills of Control Class Students Before and After Applied Conventional Learning

Based on data analysis of the mean value of pre-test of critical thinking ability of control class student, that is 41,21 while mean value in post-test of critical thinking ability of a student of control class, that is 70,34. The results can show that the mean value of the post-test is greater than the mean in the pre-test. These data indicate that there are differences in critical thinking skills of control class students before and after applied conventional learning. The value of students' critical thinking skills increased after applied conventional learning. However, the increase has not reached an average value above 70.

The mean values of post-test students' critical thinking skills of the control class were not greatly increased as the average score had not reached above 70. Because the control class learning was applied conventionally, Brain Based Learning was not applied. The opinion about the learning process

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[56] Pink, Otak Kanan Manusia, 21 - 22.

[57] May Lwin et. al., How to Multiply Your Child's Intelligence Cara Mengembangkan Berbagai Komponen Kecerdasan, 79.

will be more effective if the lecturer delivered various learning materials by using images (vis u al). Students more easily understand the ideas presented through pictures, maps, diagrams, charts, and modeling in the subject matter. With visually packaged learning, students will remember the course materials that have been delivered. As Confucius has revealed over 2400 years ago that what I heard, I forgot, what I saw, I remembered, and what I did, I understood.[58]

3. Differences in cr i tical thinking ability of experimental class students applied with Brain Based Learning and critical thinking ability of control class students not applied Brain Based Learning

Before explaining the results of the hypothesis testing data, this discussion first explains the prerequisite analysis test by performing the normality and homogeneity test. Based on the analysis of test data of pre-test normality and post-test of stu d ents' critical thinking skill both experiment and control class obtained that the data is normally distributed. The result of data analysis of pre - test of critical thinking ability of experimental class and control class is sig > 0, 05 (0,564 > 0, 05). While the result of post-test data analysis o f critical thinking ability of experimental class and control class is sig > 0, 05 (0,367 > 0, 05).

The result of data a nalysis of homogeneity test of pre-test of critical thinking ability of experimental class and control class students obtained significance is 0,226 . So the significance value 0,226 > 0, 05, thus the data of pre-test of critical thinking ability of experiment class and control class student is stated homogeneous. So it can be said the data come from populations that have the same variance. While the result of data analysis of homogeneity test of post-test of critical thinking ability of experimental class and control cl a ss students obtained significance is 0,160. So the significance value is 0,160 > 0, 05, thus the post-test of critical thinking ability of the exper i mental class and control class students is stated homogeneous. So it can be said the data come from populations that have the same variance.

The result of a hypothesis test of pre-test of critical thinking ability of experimental class and control class with Independent Sample T-Test obtained t-count < t-table (0,154 < 2,303) thus H0 accepted and Ha rejected. Thus, it can be interpreted that there is no significant difference between the pre-test of critical thinking skills of experimental class students prior to the application of Brain Based Learning and control classes prior

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[58] Silberman, *Active Learning*, 1.

to the application of conventional learning. So it can be concluded that there is no significant difference between the critical thinking skills of experimental class students applied with Brain Based Learning and critical thinking skills of control class students not applied Brain Based Learning. While the result of post-test hypothesis testing of critical thinking ability of experimental class and- control class with Independent Sample T-Test obtained t-count > t-table (8,243 > 2,303), thus H_0 rejected and H_a accepted. Thus, it can be interpreted that there is a significant difference between the post-test of critical thinking ability of experimental class students after the application of Brain Based Learning and control class after the application of conventional learning. So it can be concluded that there is a significant difference between the critical thinking skills of experimental class students applied with Brain Based Learning and students' critical thinking skills that are not applied Brain Based Learning.

CONCLUSION

Based on the results of research and discussion, it can be concluded, in the pre-test of critical thinking ability of experimental class students obtained an average value (mean) of 41,72 including enough categories. While the mean value in the post-test of critical thinking ability of the experimental class students that is 91.03 including the excellent category. The results can show that the mean value of the post-test is greater than the mean in the pre-test. The value of students' critical thinking skills test increased significantly by 49,31 after applied Brain Based Learning. Thus, there are differences in critical thinking skills of experimental class students before and after applied Brain Based Learning.

In the pre-test of critical thinking ability of control class students obtained the average value (mean) of 41,21 including enough categories. While the mean value in post-test of critical thinking ability of control class student, that is 70,34 including good category. The results can show that the mean value of the post-test is greater than the mean in the pre-test. The value of students' critical thinking skills increased by 29.13 after applied conventional learning. Thus, there are differences in critical thinking skills of control class students before and after applied conventional learning. However, the increase has not reached an average value above 70.

The result of hypothesis testing of pre-test of critical thinking ability of experiment class and control class with Independent Sample T Test obtained t-count < t-table (0,154 < 2,303) thus H0 accepted and Ha rejected. So it

can be concluded that there is no significant difference between the critical thinking skills of experimental class students applied with Brain Based Learning and critical thinking skills of control class students not applied Brain Based Learning. While the result of post-test hypothesis testing of critical thinking ability of experimental class and control class with Independent Sample T-Test obtained t-count > t-table (8,243 > 2,303), thus H_0 rejected and H_a accepted. Thus, it can be concluded that there is a significant difference between the critical thinking skills of experimental class students applied with Brain Based Learning and critical thinking skills of control class students not applied Brain Based Learning.

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