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THE DIFFERENCE OF STUDENTS' ACHIEVEMENT BY **NUMBERED HEADS TOGETHER (NHT) AND BY JIGSAW IN EXPONENTIATION AND SURDS MATERIAL** Dr. Waminton Rajagukguk, M.Pd Faculty of mathematics, medan state university Email: warajagukguk@gmail.com **ABSTRACT** This research was conducted **to find out the significant difference of students' achievement if taught by numbered heads together (NHT) and jigsaw in manner of exponentiation and surds material** which took place in senior high school students.

The observation held implementing a quasi experimental research on first semester with in contemporary academic. Sample was taken through cluster random sampling, it means that each class had the same chance to be imposed as sample. With two classifications, that is experimental class I taught by **numbered heads together (NHT) and** experimental class II taught observation sheet.

The test was in and essay test composed of 6 items of questions about **exponentiation and surds material**. Data analysis technique by analysis of differences with the t-test formula. Before the research put into action, it was discovered that the mean of pre test on experimental class I with 39 students was 14.974 and it's categorized a low (poor) achievement, and the mean of pre-test on experimental class II with 35 students was 15.143 and it was categorizes a low achievement.

After the experiment conducted using numbered head together (NHT), then mean **of the post test** was 37.103 and it was categorized 32.686 and it was categorized as medium achievement. By employing the t-test, it's assumed that student's achievement by **numbered heads together (NHT)** there was on significant different in contrast to the students with jigsaw.

Key words: number heads together (NHT), jigsaw, exponentiation and surd

INTRODUCTION Mathematics in scientific category is considerable such formidable subject to learn. Mathematical substance its indispensable get involved in any psycho test or mathematical test in recruitment of government employment or some particular companies, its taking part of overall segments blended into educational sphere and creeping into human lives' practices.

Mathematics is one of the prerequisite subject existing in all stage of academic curriculum and recognized even early age or grounds education of children as vocational or non-vocational. "susanto". The score attained of any assessed test inescapable depict of students' susceptible absorbance of learnt material. In virtue of national final exam in 2011 in light of student's attainment, which terrified the coming class who will be undergoing the same season, that they are horrified and led them being reluctant mathematical class meeting.

As quoted in that "subject (mathematics) is regarded as a matter of fact to cause the failure in the national final exam within senior high school by the scale of mathematics (57,44%), bahasa indonesia (38,43%) and english (3,27%). As stated in the article as " the ministry of national education acknowledged, that students who got under passing grade in mathematics approximately (51,44%).

The issues of failure consequence for that mathematics , caused approximately (50%) students should have put their graduation of. The considerable number of students who got low attainment on mathematics signifies the failure on overall subjects. The students run into same bugaboo when attending mathematics class meeting, tiresome, boringness, sturdy to deal with " susanto" described, by now students have perceived mathematics is unbreakable led them frightened when they are demanded to work out mathematics before the class, this scene driving them to hold back attending the class meeting, particularly when they are required to turn in mathematical assignment, in the mean time the students are feeling helpless to get an aid to carry out of mathematical solving problem, moreover that which expected and aid from parents, rather are not able to help anyway or are above just busy fighting or family sustenance. This vexation perhaps in the very concerns that needs to find the way out to break through though. Djamarah and Zain (2002:43).

That, " teachers are the grounds for making the changes in environment of studying sphere more exiting, enjoy, fascinating, and making fun. How a teacher to create or encourage the students to be interested in studying mathematics. The teacher could have prompted to embrace variational teaching as proposed by Djamarah and Zain

(2002:180), that "if teacher within learning process does not work out with some variations, will induce students into boringness, inconsiderate, sleepiness."

Where if the students are unhappy about learning the certain lessons will certainly cause disrupt the teaching-learning process, as stated by Djamarah and Zain (2002:1860, which "the symptoms of students who are less happy to absorb the lessons suppose not to happen, because it will blur the sense of learning process. Kock (1994:72), said that "the most effective teaching and high motivated students, if the difficulty of teaching tailored to students' abilities".

But of course **this is not an easy thing to do** as kock(1994:73), responded that "teaching at a suitable level of difficulty to the ability of all students in the classroom is difficult, mainly because of the ability of students are not equal. To achieve a suitable level of difficulty, teachers should teach by using suitable methods". This certainly argued by kock(1994:15).

That most important is to apply a suitable method to students and so that pupils will enjoy learning process, as well until the students as graduated". In learning process, sometimes is easier to learn with a friend. As Djamarah and Zain (2002:29) commended, "there are many times happened when a student is more receptive to information which given by the friends, so called peer tutors, and more encouraged if they **are in the same age**". This way could played as a target of strategy to form a study group that one of variational studying atmosphere, yet in under controlled.

Djamarah and Zain (2002:237), said that "master plan of the formation of study group its necessarily to think of, the group should be assigned with a certain topic and task, instructions of how long take time, how to control, how about discussion and the form of reports to be turning in, and set up objective goal to be achieved. One of the teaching models that benefits to teachers should have implemented is a cooperative learning.

Cooperative learning promotes a mutual help among students, applicable in a sense of peer tutor, the students can work together in the different extent of ability, this idea was reaffirmed by Lie (2008:32) [10] with "Some students who are quite low aptitude will not feel being alienated by their counterparts, because they also have contribution into the group, conversely they who are more intelligent will not feel be undermined for having distinct contribution part."

There **are many different types of cooperative learning** models, they are : **Student Team Achievement Division** (STAD), Teams Games Tournament (TGT), Jigsaw, Group Investigation (GI), Numbered Heads Together (NHT), Think Pair Share (TPS), Mind

Mapping (MM), Snow ball Throwing (ST), Two Lives Two Guest (DUTA-DUTI), Time Token (TITO), and others.

The observer had chosen this cooperative learning for promulgating academic study skills, as well as social skills, including interpersonal communication skills, which commented by Riyanto (2009:271) [33], that " Cooperative learning is a learning model designed for making better academic study skills, as well as a social skills, including interpersonal communication skills".

In manner of understanding an Exponentiation and Surds material is not too complicated to students, but when the problems are a bit tricky modified, the students will baffle in solving the problem. A trial test conducted, when the conveyed test get change the exponent to zero, in fact, 50% students were absurd and stranded. When at times an interview held over a teacher, admittedly recognized that there never work out with any kind of teaching variation, so no wonder that happened , and the observer is vehemently interested to unfold and develop the variational learning.

Researcher tried to implement two types of cooperative learning model they are Numbered Heads Together (NHT) and Jigsaw. Due a teacher Training Practice where researcher had tried to implement Numbered Heads Together (NHT) and jigsaw and actually took an affect in increasing student's achievement rather when students are taught by lecturing method.

Both types of Numbered Heads Together (NHT) and Jigsaw have slightly different learning process, but they have common goal of carrying out the process of learning by working together. II. THEORITICAL STUDY 2.1 Definition of Learning There are many definitions of learning and also a lot of experts who elucidate the definition of learning.

But from various definitions, there is a core that cannot be separated such the change behavior of people from a particular experience. As noted by Cronbach in his book Educational Psychology (In Suryabrata, 2002:231) [26] that "Learning is marked by a change of behavior as the effect of experience". Mc Geoh (In Suryabrata, 2002:231) [26] defined "Learning is a change of performance by practice".

In accordance with Burton (In Usman, 2004:5) [29] that "Learning is a change in an individual by instruction and environment, who feels a need and makes him more capable in dealing with a adequate environment". Meanwhile, Winkel (in Riyanto, 2009:5) [34] that "learning is an activity of mental/psychic that goes in active interaction with the environment, occuring in changes in knowledges, understandings, skills, attitudes an values. That change is relatively constant and trace".

In this sense there is a word "changed" which means that somebody after undergoing a process of learning will experience changes in behavior, both aspect of knowledge, skills, and attitude aspects. So learning is a **process that occurs in** a person that involves interaction with the environment that produces behavioral changes, both in knowledge, skills, and attitudes. 2.2

Achievement Achievement is something that is obtained after doing the act of learning, where achievement is a change ensued after experiencing the learning process. Dimiyati (2002:3) [4], commended "At the end of a process of learning, the students gain an achievement. Achievement is the sequel of an interaction act and an act of teaching and learning".

One opinion with Sudjana (2009:220) [21] that "achievement is the ability that which students deserve after the learning experience". The achievement can be suited to another field, proposed Makmun (2004:159) [11], "So the achievement in a particular field, according to this theory, will be transferred (transferable) into other areas".

Achievement might be distinguishable by an emerging impact, one is the impact of teaching and the second is an impact of accompaniment, as proposed by Dimiyati (2002:4-5) [4], that "The achievement of proficiency level can be distinguished by an immediate impact, the impact of teaching and the impact of accompaniment. The impact of teaching is measurable, manifested with engraved number or character on a grade slip or transcript.

Impact accompaniment is an applied knowledge and skills in or other fields, a transfer of learning." 2.3 Learning Mathematics Learning process according to the dictionary of Bahasa Indonesia (in

<http://syarifartikel.blogspot.com/2008/11/pe,belajaran-matematika-di-sd.html>) [28], "Learning is a noun defined as process, ways of making people or being learning". By Gagne and Briggs (in <http://syarifartikel.blogspot.com/2008/22/pembelajaran-matematika-di-sd.html>) [28] denoted, "Learning is an endeavor to set the goal and the goal as a means to help people to learn". More specifically described by Gagne (in <http://syarifartikel.blogspot.com/2008/11/pembelajaran-matematika-di-sd.html>) [28] that, "learning is a process where someone deliberately manage environment **to allow him to** participate in the special conditions.

Learning is a special subset of education". Of the four insights suggests that learning is a student-centered, not teacher-centered. Mathematics came from the Greek word

meaning the study size, structure, space, and change (in <http://id.wikipedia.org/wiki/matematika>) [30]. Many experts are trying to define the math.

Hudojo (1998:3) [7] that "it can be said also, mathematics related to ideas, structures and relationships that are logically arranged that mathematics is related to an abstract concepts. A mathematical truth is developed based on logic reasons by using deductive evidentiary". Learning mathematics needs teacher's participation as facilitator. Goldin (in [http://hafismuaddab.wordpress.com/2010/01/13/pengertian Belajar-matematika](http://hafismuaddab.wordpress.com/2010/01/13/pengertian-Belajar-matematika)) [14] that, "Mathematic is founded and built by man to be fostered by students and implanted by teacher.

Learning math becomes more active when teachers can help students to discover and solve problems". Heuvel-Panhuizen and Verchaffel-De Corte (in <http://hafismuaddab.wordpress.com/2010/01/13/pengertian-belajar-matematika>) [14], that "mathematical education should allow students the chance to reinvent by doing mathematics. Learning mathematics **should be able to** furnish students with an imaginable situational problem that virtually related to the real world."

Hudojo (1998:3) [7] "Studying the concept B **is based on the** concept A, someone needs to understand first concept A. Without understanding the concept A, nobody may understand the concept B. This means, learning mathematics should be gradual and sequential, and based on past learning experiences".

Learning mathematics is a continuous process, Hudojo (1998:4) [7] that "Because of the hierarchical math, if learning mathematics is discontinuous will disrupt the learning process. This means that the process of learning mathematics will be going on smoothly when the study it self is conducted continuously". School of mathematics which that math is taught **in primary and secondary** education.

School of mathematics that is selected in order to: (1) Develop abilities, (2) Mould students personality and (3) Develop both science and technology. 2.4 **Cooperative Learning Model In** light of learning process entails a learning model. In terms it self has four special characteristics which are not included a strategy nor learning method. (in [http://nsant.student.fkip.uns.ac.id/files/2009/05/makalah- model pembelajaran1.doc](http://nsant.student.fkip.uns.ac.id/files/2009/05/makalah-model-pembelajaran1.doc)) [34]: Theoretical, rational, logical, compiled by educators. **Learning objectives to be** achieved.

The steps necessary to teach the learning model can be implemented optimally. The learning environment necessary for learning objectives can be achieved. Another terms of

learning model, Sudrajat (in <http://akhmadsudrajat.wordpress.com/2008/09/12/pendekatan-strategi-metode-teknik-dan-model-pembelajaran/>) [22] "These terms are (1) learning approach, (2) learning strategies, (3) teaching methods, (4) learning techniques, (5) learning tactics, and (6) learning model". These terms are explained as follows: Learning approach has a sense of a perspective of a learning process. In accordance with Sudrajat (in <http://akhmadsudrajat.wordpress.com/2008/09/12/pendekatan-strategi-metode-teknik-dan-model-pembelajaran/>) [12], "learning approach can be interpreted as a point of view on learning, which refers to the view of the occurrence of a process that is still very common in nature, in which include, inspiration, strengthen, and the underlying learning methods with particular theoretical coverage". Learning strategies according to Kemp (in <http://akhmadsudrajat.wordpress.com/2008/09/12/pendekatan-strategi-metode-teknik-dan-model-pembelajaran/>) [22] is

"an activity of learning which teachers and student do for the purpose learning can be achieved effectively and efficiently". Methods of learning referred to Antara (in <http://akhmadsudrajat.wordpress.com/2008/09/12/pendekatan-strategi-metode-teknik-dan-model-pembelajaran/>) [22] is "the way that used to implement the plans that are constructed in the real form and practical activities to achieve learning objectives". Learning techniques by Antara (in <http://akhmadsudrajat.wordpress.com/2008/09/12/pendekatan-strategi-metode-teknik-dan-model-pembelajaran/>) [22] "the way that person do for implementing a specific method". This tactic is more related to the individual learning of each teacher.

Where more precisely the style of each teacher in teaching, as defined by Sudrajat (in <http://akhmadsudrajat.wordpress.com/2008/09/12/pendekatan-strategi-metode-teknik-dan-model-pembelajaran/>) [22] is the "personal style in carrying out certain teaching methods or techniques that are of individual". Learning model is a combination of approaches, strategies, methods, techniques, and learning tactics. Referred to Sudrajat (in <http://akhmadsudrajat.wordpress.com/2008/09/12/pendekatan-strategi-metode-teknik-dan-model-pembelajaran/>) [22], "If the approaches, strategies, methods, techniques and learning tactics even been strung into a single coherent whole is formed what is called a model of learning". There are several types of learning model: (1) direct, (2) cooperative, and (3) problem-based.

In this case the model of cooperative learning will be explained more deeply. The model was initially used in cooperative learning in school in the United States to instill positive elements of dependency. As stated Lie (2008:19) [10], "One of the methods of cooperative learning, Jigsaw, initially introduced in school where there is racial tension

between student of European descendant, African, and Hispanic.

These student are taught to be behind the strong sense of individualism they interact positively with other student with very different backgrounds in academic activities. Indeed, after a time of conflict racist successfully reduced drastically and became increasing academic achievement." There is some sense a model of cooperative learning as stated by Slavin (in <http://nsat.student.fkip.uns.ac.id/files/2009/05/makalah-model-pembelajaran1.doc>) [34] that, "cooperative learning, is learning model with student working in groups that have heterogeneous abilities." According to Nur and Wikandari (in <http://nsat.student.fkip.uns.ac.id/files/2009/05/makalah-model-pembelajaran1.doc>) [34] that, "Cooperative learning refers to the teaching model, student **work together in small groups** of mutual help in learning".

Riyanto (2009:271) [33] that, "Cooperative learning is a learning model that is design for making learning academic skills, as well as social skills, including interpersonal skills". Assumed **that cooperative learning is** a learning model that promotes cooperation among members of his group, in which cooperation is expected to develop a positive dependence.

Then **the cooperative learning model** is expected to increase the students' acedemic skill, increasing students' skills in socializing and able to receive diversity in the group. The model has a philosophy of cooperative learning. Riyanto (2009:269) [33] philosophy that became the basis for cooperative learning are: Humans as social beings. Mutual aid.

The collaboration is an essential requirement for human life. This is similar to the expression of lie (2008:28) [10] that "the underlying philosophy of mutual aid the learning model of education is the philosophy of homo hominisocius. Contrary to Darwin's theory, philosophy emphasizes that humans are social creatures. Cooperation is avery important means for survival.

Without cooperation, there is no individual, family, organization, or school. Without the cooperation this book will no be published. Without cooperation, this life is full". Riyanto (2009:269-270) [33], elements of cooperative leranig are: Developing interactive succesive teasers, compassion penance, penance and foster peer as an exercise of community. Positive interdependence among individuals (individuals have contributed in achieving the goal). Individual responsibility.

Meeting face **in the learning process**. Communication between group members. The evaluation process of group learning. The statement was almost indential to that

expressed by Roger and David Johnson that not all work can be considered cooperative learning groups. There are five elements that must be applied learning model (in Lie, 2008:31) [10], they are: Positive interdependence. Individual responsibility. Face to face.

Communication among members. Evaluate group process. Riyanto (2009:270) [33] there are five underlying principles of cooperative learning, included: Positive independence of positive interdependence means that group members recognize the importance of cooperation in achieving goals. Face to face means among members interact with each other.

Individual accountability means that each group member must learn and actively contribute to achieving the group's success. Use of collaborative / social skills means must use the skills to cooperate and socialize. Those students are able collaborate needs guidance from teacher. Group processing means students need to assess how effectively they work.

Riyanto (2009:270) [33] there are characteristics of cooperative learning, included: The group was formed by students of high ability, medium, low. Students in the group lively as dead. Students see all the members have similar goals. Dividing the same duties and responsibility. Will be evaluated for all. Various leadership and skills to work together. Asked to account for material that is handled individually.

This suggests that cooperative learning was developed with three important goals, as defined by Abraham (in <http://nsant.student.fkip.uns.ac.id/files/2009/05/makalah-model-pembelajaran1.doc>) [34] that "cooperative learning model was developed to achieve at least three important goals of learning, called the results of academic learning, acceptance of diversity, and social skills development".

Riyanto (2009:271) [33] categorize the goals of cooperative learning: Individual: a person's success is determined by the people themselves are not influenced by others. Competitive: the success of a person to achieve because of the failure of others (there is a negative dependency) Cooperative: a person's success because the success of others, one cannot achieve success with solitude.

General step Cooperative learning (Syntax) (in Riyanto, 2009: 271) [33] Provide information and convey the goals and learning scenarios. Organize student / learners in cooperative groups. Lead student / learners to perform activities / cooperatively. Evaluation. Reward. There are several examples of skills in cooperative learning (in Riyanto, 2009:271-272) [33] Sharing the task. Take part. Remains in the tasks. Ask

questions.

Active listening. Cooperative. Helping a friend. 2.5. Cooperative Learning in Mathematics Cooperative learning can also be applied in mathematics. Suherman (in <http://dou-dena.blogspot.com/2011/03/pengaruh-penerapan-pembelajaran-melalui.html>) [15] about cooperative learning in mathematics, that "students individually construct the confidence of his ability, to solve mathematical problems, which will reduce and even eliminate anxiety toward mathematics (math anxiety), which many experienced students, by emphasizing the interactions with in the group".

In the cooperative learning that emphasizes the importance of working together shows the importance of peer influence. So peer influence is very important as a partner to cooperate in improving student academic achievement. Then assumed that cooperative learning mathematics can improve better academic achievement. 2.6.

Cooperative Learning Model with Numbered Head Together (NHT) Cooperative learning model type Numbered Head Together (NHT) developed by Spencer Kagan in 1992 (in Lie, 2008: 59) [10]. The advantages of cooperative learning model type Numbered Heads Together (NHT) according to Lie (2008:59) [10] is " This technique provides the opportunity for students to give each other ideas and consider the most appropriate answer. In addition the technique also encourages students to enhance their spirit of cooperation".

Cooperative learning model type Numbered Head Together (NHT) is one of the cooperative learning models that are suitable for use in math. This is consistent with the expressed by Lie(2008:59) [10] that " This technique could be used in an subjects and for all age levels" , which implies that the cooperative learning model type Numbered Head Together (NHT) matches used in mathematics courses.

Step-by-step cooperative learning model type Numbered Head Together (NHT) is as follows (Riyanto, 2009:277) [33] : Students are divided into groups, each students in each group gets number. The teacher gives the task and each group does it. The group discussed the correct answer and make sure each member of the group can do / find out the answer.

Teacher calls one of the numbers of students with the called number report the results of their cooperation. The response from another friend, then the teacher pointed to another number. Conclusion In implementation, the type of Numbered Head Together (NHT) and the teacher assigns just students numbered is entitled to answer, it intended to prevent the domination of particular student in answering the question.

From the steps of cooperative learning model like Numbered Head Together (NHT) above can be determined step by step learning cooperative model like Numbered Head Together (NHT) which will be implemented in the research, as follows : Step 1
_Delivering the purpose of learning and motivate students Teacher conveys the purpose of learning, by motivating students are more expected to be focused in the learning process.

_Step 2 _Informing Teacher informs the cooperative learning model with Numbered Head Together (NHT). Proactively sharing each other ideas and work more actively and vibrant. _Step 3 _Numbering (Numbered) By this step the teacher designated a number to each students. By labeling with a number will represent identity of each students.

_Step 4 _Ask questions or provide task Teacher turn in Student Activity Sheet (LAS) which containing some questionnaires that will be carried out in each group. _Step 5 _Thinking Together (Head Together) The students within the group discuss about the material. Each group reciprocally discuss the answer from one of each other.

_Step 6 _Providing Answer Teacher calls one by number to present of what was discussed and pointing out of another group with the same number to answer the question and students and teacher are ultimately involved to resolve the problems. _

_Step 7 _Awards Teacher give awards away to any groups that provide the best answer.

_The advantages of cooperative learning model like Numbered Heads Together (NHT) (in

<http://blognyaadolfbastiansimbolon.blogspot.com/2011/05/model-pembelajaran-kooperatif-nht.html>) [18] is : Each students always get ready May have an earnest discussion Students are good intelligent to teach students who are lesser Then the disadvantages of cooperative learning model like NHT is (in

<http://blognyaadolfbastiansimbolon.blogspot.com/2011/05/model-pembelajaran-kooperatif-nht.html>) [18] The headed number may be called over and over by teacher. To yell the number may be overlooked by teacher 2.7

Cooperative learning Model Jigsaw Cooperative learning model with Jigsaw was developed by Aranson, Blaney, Stephen, Sikes, and Snapp in 1978 (in iyanto, 2009:275) 33 . Cooperative learning model like Jigsaw was developed during the racial tension in america, between the races of European descendants, Africa, and Hispanic Also effected in racial tension between students from the descendants of the race.

With Jigsaw cooperative learning model students are taught under the strong sense of

individualism they interact positively with other students with very different backgrounds (Lie,2008:19) 10 . **Cooperative learning model of** this like Jigsaw is a suitable model of cooperative learning in math. This is consistent with that expressed by lie (2008:69) 10 that, " this approach could also be used in some subjects, such as natural sciences, mathematics, religion and Language. This technique is suitable for all classes / levels". **On the other hand** jigsaw cooperative learning model is suitable also when applied in mathematics.

Steps **cooperative learning model like** jigsaw are as follows (Riyanto, 2009:275) [33]: Students are grouped into ± 4 team members. Each person in the team is given a different part of the material. Everyone on the team is given the assigned material. Members from **different teams who have studied** part / section of the same meet in the new group (expert group) **to discuss their section.**

Having completed the discussion as a team of experts each member back to the home group and take turns teach their teammates about their section control and every other member listened intently. Each team of experts presented the results of the discussion. Teacher evaluation. Cover From the **steps of cooperative learning model with** jigsaw can ascertain as follows: Steps 1 Delivering the purpose of learning and motivate students Teacher conveys the purpose of learning, where learning goals by conveying the students needs to recognize the goals to be achieved **in the learning process.**

By driving students motivation are expected to become more focused **in the learning process.** Steps 2 Informing **Teacher informs the type of** jigsaw cooperative learning model. Where by using the jigsaw is expected that students can work together well in both groups of origin and in expert groups.

Steps 3 The division of the group Teacher grouped students within group who has 4 or more heterogeneous, in which each student **in each group have** different teaching materials, but all students in the group who has same serial number of material. Then the teacher distributed the card to each group member with the serial number from one to four.

Step 4 Ask questions or give task and discuss The teacher distributed worksheets to each student. Teacher encourages students in each group (home group) to resolve the issues contained in the worksheets with the respective group members. **The teacher asks students to** discuss in a group of experts. Then the students return to home group and explain the material learned in the expert group.

The teacher asks for the work at the home group. Step 5 Evaluation Teachers guide

students to summarize the subject matter. There are several things that must be considered in the type of jigsaw cooperative learning model, (in Riyanto, 2009:275-276) [33]: Using peer tutoring strategies. Organize students into groups of origin (Home) and the Expert Group.

In the expert group cooperative learning students complete the same topic until they become "EXPERT". Within each group of students from each other "teach" their respective expertise. Jigsaw has an outstanding according to Ibrahim (in <http://aadesanjaya.blogspot.com/2011/01/pembelajaran-kooperatif-tipe-jigsaw.html>) [16]: Offered an opportunity to students to collaborate with each other Student enabled to master the lessons presented Each student has the right to be an expert in his group In the process of learning teaching student a positive interdependence Each student can complement each other While the weakness of the cooperative learning model like jigsaw according to Ibrahim (in <http://aadesanjaya.blogspot.com/2011/01/pembelajaran-kooperatif-tipe-jigsaw.html>) [16]: It will take a long time Students who are smart tend to avoid to combine with less smart. III. RESEARCH METHOD 3.1

Population The population in this study involved class X of Senior High School students that divided into 7 classes. 3.2 Sample For sampling preferred cluster random sampling which treating the same chance to be sampled, and split off into two classes that the first is Experimental Class I which taught with Numbered Heads Together (NHT) and the second is Experimental Class II taught with jigsaw.

According to Wikipedia that "Cluster sampling is a sampling technique applied when its "natural" groupings are obvious in a statistical population". Took place two classes as samples they were class X-2 consisted of 35 students and class X-3 consisted of 39 students. 3.3 Research Variables As for the variables in this study were: Independent variable The independent variable is manipulated variable, which was hypothesized to influence the dependent variable. The independent variable.

The independent variables which cooperative learning model like Numbered Heads Together (NHT) (?? 1) and Jigsaw (?? 2) Dependent variables The dependent variable is the variable that is simply measured by researcher. It reflected the influence of independent variable. The independent variable is the students' achievement of both classes (Y). 3.4

Research Instruments Research instrument of the data collection in the study were test and observation sheet. This test composed an essay of the 6 items of questions. Is about Exponentiation and surds material. The validity of the instrument relied on experts consensus. In this regard might be sought through a consideration of the expert

panelists to see the instrument that would meet the level of study by statistical analysis.

If the expert's consensus was high in these considerations it is said that the validity of the contents of the instrument are adequate and can be used in research. Referred to Guion that "content validity is dependent on the specialist's judgement". 3.4.2. Observation Sheet Observation is a process to observe a condition systematically. According to Arifin that "Observation is a process to observe and record in a systematic, logical, objective, and rational about the various phenomena, both in the actual situation and in an artificial situation to achieve certain goals".

Tools used in conducting the observation called guidelines observation then the guidelines observation is also called observation sheet. For doing an observation is needed a guidelines, so the observation is not deviated from the observation point. It is in line with Arifin that "It means that observation does not deviate from the observation point.

Therefore, in actual evaluator must use a tool called guidelines observation". Observation is an activity that always be done daily. It is according to Arifin that "Observation is an activity that is often done either consciously or unconsciously in daily life, where the observation is identical to look and observe".

So the observation is an activity that need process to look into, observe and recording in a systematic, logical, objective and rational about various phenomena that is often done either consciously or unconsciously in daily life". According to Arifin the main purposes of observation are 1. To collect data and information about phenomena, events and actions, both in real situations and in artificial situations. 2.

To measure the behavior of the class (both teacher and learners the interaction between the teacher and learners and all factors that can be observed more especially social skills. 3.5. Mechanism and Design Research This research mechanism carried out with quasi experimental research, which involved two classes, they were experimental class I and class experimental class II.

Experimental research conveyed causal connection, Sukardi reaffirmed that "experiment research at principal can be defined as systematic method to build the relationship that consist causal effect relationship". In education the subjects were naturally formed intact group. It is in line with Maulidina that "However, in education especially in teaching, conducting research is not always possible to conduct a random selection of subjects, because subjects were naturally formed intact group, such as groups of students in one class". These groups are also often the number of member is very definite.

In these circumstances the rules is purely eksperimental research unfulfilled, because controlling variables related to research subjects cannot be settled so research should be resolved using intact group (class). The study with involved two classes, experimental class I and experimental class II imposed different treatment. In experimental class I treated with **Exponentiation and Surds material** employed cooperative learning model with Numbered Heads Together (NHT), while the experimental class II aplied Jigsaw Type.

To see the students achievement with both classes proposes pre-test, pos-test, or class randomized, pre-test, pos-test control group design. Table 3.1 Randomized classes, pretest **posttest control group design** Group _Pre-test _Treatment _Post-test _
_Experimental I _ ?? 1 _ ?? 1 _ ?? 2 _ _Experimental II _ ?? 1 _ ?? 1 _ ?? 2 _ _ Direction : ?? 1
: Pre-test ?? 2 : Post-test ?? 1 : **Cooperative learning model like** Numbered Heads
Toether ?? 2 : **Cooperative Learning model like** Jigsaw As for the variablls in this study
is Independent variables Treatment variables : **the type of cooperative learning** models
like NHT and Jigsaw.

Controlled variables such as the time dUaration, module, teaching materials, teacher for both classes are absolutely the same. Uncontrolled variables such as stUdents intelligence, the environment, how to learn and parental education. Dependent variable : The students' achievmnt after teaching **cooperative learning model like NHT and Jigsaw** 3.6 The Procedure of Resea 1.

Preparation Phase Researcher served school's lessons schedule Reseaqrcher prepared lesson plan for experimental class I with **cooperative learning model of Numbered Heads Together (NHT)** in exponentation and Surd material , in three sessions, in which one sessions took two times of fortyfive minutes. Reseaqher prepare lesson plans for the experimental class II with **cooperative learning model of** Jigsaw in Expentation and surd material, in two session , in which one session took two times of forty- five minute. Researcher prepared data collective tools **in the form of** pretest and psttest. 2.

Implementation Phase Implementation cluster random sampling for both classes (Experimental Class I and II) Initial students ability could be seen by giving a pretest (T 1) to the experimental class I and experimental II Researcher conducted learning for both classes with the same materials and time , but different learning model , whereas experiment I with NHT and experimen II with jigsaw Provide post-test (T2) to the both class to see the progress of students' competence after learning and then calculated the average test.

Analyzed hypothesis test t statistics to determine whether any significant different scores, or had the difference is large enough to reject the null hypothesis. 3.7 The Technique of Analyzing Data Data analysis technique employed t test formula. Before doing the – t- test at first follow these steps : 3.7.1. Determine Average Value and Standard Deviation Determine the average score by formula $\bar{x} = \frac{\sum x_i}{n}$ Determine the standard deviation by formula $s^2 = \frac{\sum (x_i - \bar{x})^2}{n-1}$ Determine the variance by formula $s^2 = \frac{\sum x_i^2 - (\sum x_i)^2}{n-1}$ Where : S^2 = Variance X_i = The Value of the class n = Sample size 3.7.2. The Normality Of The Test Normality test intended to see the samples from the population that was normally distributed or not.

To test the normality used test Liliefors Observations $X_1, X_2, X_3, \dots, X_n$ were presented with new figures that Z_1, Z_2, Z_3, Z_n using the formula: $Z_i = \frac{X_i - \bar{x}}{s}$ By: X_i = table data into-1

\bar{x} = arithmetic mean S = standard deviation For each raw figures used the normal distribution list, then calculated the $F(Z_i) = P(Z = Z_i)$ Calculate the proportion of $F(Z_1), F(Z_2), F(Z_3), \dots, F(Z_n)$ Calculate the absolute difference in prices of $F(Z_i) - S(Z_n)$ Take the greatest absolute value among the absolute value (L_0) to accept or reject the hypothesis used significant level $\alpha = 0,05$ with the following criteria: $L_0 < L_{table}$ then the sample is normally distributed $L_0 > L_{table}$ then the sample is not normally distributed. 3.7.3.

The Homogeneity Of The Test If the normality test data indicated normal distribution, we then conducted tests of homogeneity. Suppose two normal population with variance s_1^2 and s_2^2 will be tested two tailed for testing the null hypothesis H_0 and H_1 unmatch able. $H_0 : s_1^2 = s_2^2$ $H_1 : s_1^2 \neq s_2^2$ Based on random samples that independently drawn from the population.

If a sample of the first population sized n_1 by S_1^2 as the variance and the sample of the second population sized n_2 by S_2^2 as the variance then to test the hypothesis on the used statistical $F = \frac{S_1^2}{S_2^2}$ With the following criteria: If $F_{observe} = F_{table}$ then H_0 is rejected If $F_{observe} < F_{table}$ then H_0 is accepted Where is F_{table} is $F_{\alpha}(v_1, v_2)$ can be viewed on the F distribution list with a chance of α , where v_1 is the numerator $df = (n_1 - 1)$ and $v_2 =$ is df denominator $= (n_2 - 1)$ with the significant level of $\alpha = 0,05$. 3.7.4.

Hypothesis Test According to Sudjana the hypothesis to be tested is: $H_0 : \mu_A = \mu_B$ said students achievement that taught with a model of cooperative learning NHT types differed significantly with students who Would have been taught by Jigsaw Cooperative learning model. $H_a : \mu_A \neq \mu_B$ Said student achievement that **taught by cooperative learning model type** NHT differed significantly with student who would have been taught by

Jigsaw cooperative learning model. the type of Jigsaw cooperative learning model.

If the analysis of data obtained by the data normally distributed and homogeneous so that the t statistic used is the t-test differences as follows: $t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{S^2_{1,2} \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}}$
Description: t = The area is achieved n_1 = number of student as the sample in experimental class I n_2 = number of students as the sample in the experimental class II S_1 = standard deviation in the experimental class I S_2 = standard deviation in the experimental class II $S_{1,2}$ = standard deviation S_1 and S_2 combined = average differences scores of student in the experimental class I = average differences scores of student in the experimental class II Testing criteria obtained from a list of student t distribution with degrees of freedom $df = (n_1 + n_2 - 2)$ and $\alpha = 0,05$ with the testing criteria is Accepted H_0 if $-t_{(1-1/2\alpha)} < t < t_{(1-1/2\alpha)}$ For other values rejected H_0 .
RESULTS AND DISCUSSION 4.1. Results 4.1.1.

Test and Instruments The test instruments were consisting of 6 items of questions given to students that was valid and worthy to be tested into students. 4.1.2. Pretest Score of Experimental Class I and Experimental Class II Before implementing cooperative learning like NHT in experimental calss I and t Jigsaw in experimental class II, firstly performed a pre test to find out initial ability of both classes. Students in the experimental class I Consisted of 39 students.

The average mean value of students in the expremetel class I after the implementation of the pre test were 14,974,. Bar chart showing the score of pre test in class experiment I. Figure 4.1 Bar Chart Frequency Score of Pre Test in Experimental Class I From the data above exhibited experimental clas I was low (poor).

After taking analysis it was caused by five mistakes including: In completing the form $(\sqrt{a-b})^2$ into $(\sqrt{a})^2 - (\sqrt{b})^2$, the result became inappropriate. The number of students who did this mistake were 16 students out of 39 students. Figure out each degrees and roots in simplest form. $(6 - 10)^2$ Unable to figure out the conjugate, so the process or simpllling fractions by ratiolizing the denominator became wrong.

The number of students who did this mistake was 17 students out of 39 students
Problems : Simplify with rationalizing denominator $\frac{5}{11} + 4$ Simplifying the denominator in the fraction. The number of students who did this mistake were 23 students from 39 students. Problem: Simplify with rationalize denominator! $6 + 2$ $6 - 2$ Students did not simplify the fractions in the root.

The number of students who did this mistake were 15 students from 39 students.
Problem: The period of T is worked out by formula: $T = 2\pi\sqrt{\frac{L}{g}}$ Figure out T in a

simplest root, when $L = 40$ cm and $g = 980$ cm / s^2 . Then the students answered the question such as Figure below. The next other mistake that students were not able to answer the question at all, or left it blank unanswered.

Then in experimental class II consisted of 35 students and resulted 15,143. Bar chart showing the score of pre test in experimental class II. From the data above it is assumed that the score in experimental class II was low. After taking analysis it was found that four mistakes were: In completing multiplication, because students directly multiplied the base, but the base were different and multiplying the exponent. The students who did this mistake were 19 students out of 35 students.

Problem: Simplify and write down in a form of positive degree! $7^{-3} \cdot 3^{-4} \cdot 3^{-2} \cdot 7^{-5} \cdot 5^{-2}$
Then the students answered questions such as the Figure below. In completing the form $(a-b)^2$ into a^2-b^2 , result inappropriate. The number of students who did this mistake were 15 students from 35 students. Problem : Figure out each degrees and root in a simplest way.

_ Then the students answered question such as the Figure below 3. Did not write the notation root in the problem solving process. The number of students who did this mistake were 15 students from 35 students. Problem : The period of T worked out by formula : _ Figure out T in a form of root which simplest way, when $L = 40$ cm and $g = 980$ cm / s^2 .

Then the students answered the question such as the Figure below 4. Mistake other than mentioned above was unable to fill the answer or left it blank. From the pre-test data in class experiment I and class experiment II demonstrated that the initial ability both classes were almost same. 4.1.3.

Post Test Score Experimental Class I and Experimental Class II. Otherwise after pre-test given for both classes and seen the initial ability of students were the same, then conducted learning with cooperative learning model with NHT and Jigsaw. From the result of post test, the average mean of post test in experimental class I is 37,103.

Swayed to student's achievement after post-test given, in fact there was a progress but still there was four mistakes incurred: Did not write the negative sign on the problem solving process. The number of students who did this mistake were 28 students from 39 students. Problem: Figure out $36 \cdot 1^2 \cdot 49 \cdot 1^2$. Then the students answered question such as the figure below. Did not simplify the form of root. Number of students who did this mistake were 29 students from 39 students. Problem: Period T worked out by formula: $T^2 = \frac{L}{g}$. Figure out T in a form of root which simplest way, when $L = 160$ cm and g

= 980 cm / det2.

Then the students answered question such as the figure below 3. Cannot simplify fractions. The number of students who did this mistake were 16 students from 39 students. Problem: Period of T worked out by formula: $T = 2\pi \sqrt{\frac{L}{g}}$ Figure out T in form of root which simplest way, when $L = 160\text{cm}$ and $g = 980\text{cm/det2}$. Then the students answered question such as the figure below 4. Another mistake due students not are not able to answer at all.

After pre-test given for the both classes and got result that the initial ability of student were the same, then reconducted learning with cooperative learning model with NHT and Jigsaw. From the result of post test, the average mean of post test in experimental class II was 32,686. Bar chart showing the score of the post test in experimental class II. The mean of post test in the experimental class I which employed cooperative learning model like NHT was higher, that was 37,103 compared to the mean post test on experimental class II that used the cooperative learning model with Jigsaw was 32,686.

When looking into students' achievement after being given a different treatment, that learning process with cooperative learning model of like Jigsaw, there was an increase in students' achievement. When taking analysis of mistake on post test questions, then there were three mistake such as: 1. Did not able to simplify the form of root. The number of students who did this mistake were 18 students from 39 students.

Problem: Figure out each form of degree and root in a simplest way. $5 + 20^2$ Then the students answered question such as the Figure below 2. Did not write the negative sign in the process. The number of students who did this mistake were 15 students from 39 students. Problem: Figure out: 36_{-} . 49_{-} Then the students answered the question such as figure below 3. The other mistakes that students were not able to fill out the answer at all. 4.2.

Research findings 4.2.1. Prerequisite Test Data Prio to do the examined hypothesis, firstly examine prerequisite data in order to get the normality and homogeneity data.

4.2.1.1 The Normality of The Test The major analysis requirement that must work out with parametric statistical t-test normally distributed.

In order to find that it was normal or not was applied liliefors, it was normal if $L_{\text{observe}} < L_{\text{table}}$. The level of significance is $\alpha = 0,05$. Pre Test Data Table 4.5 The Data of Normality Test on Pre Test Cooperative Type_N_Lobserve_Ltable_Conclusion_NHT_39_0, 108_0, 142_Normal_Jigsaw_35_0, 092_0, 150_Normal_ Based on the table 4.5 can be seen $L_{\text{observe}} < L_{\text{table}}$, concluded that the data score of the data score of

the pre test was normal Post Test Data Table 4.6

The Data of Normality Test on Post Test Cooperative Type _N _Lobserve _Ltable
_Conclusion __NHT_39_0,091_0,142_Normal __Jigsaw_35_0,140_0,150_Normal _
_Based on the table 4.6 can be seen Lobserve < Ltable, **concluded that the data** score of
the data **score of the post test** was normal. 4.2.1.2. The homogeneity of Test The
homogeneity of the test is performed to find out on the two groups as samples.

To test the homogeneity of the sampling variance the common test applied if Fobserve
< Ftable. The level of significance $\alpha=0,05$ and df (38,34). Calculation results obtained
the following results: Pre Test Data Table 4.7. The Data of Homogeneity Test on Pre Test
Cooperative Type _Average _Variance _Fobserve _Ftable _Conclusion __NHT_14,97436
_69,60459_1,124_1,752_Homogeny __Jigsaw_15,14286_61,94958 _____ Based on
the table 4.7

can be seen Fobserve < F_table , so **it can be concluded that the data** score of the pre
test was homogeneous or can represent the entire population. Post Test Data Table 4.7.
The Data of Homogeneity Test on Pre Test Cooperative Type _Average _Variance
_Fobserve _Ftable _Conclusion __NHT_37,10256_296,6734_1,082_1,752_Homogeny _
_Jigsaw_32,68571_321,0454 _____ Based on the table 4.7

can be seen Fobserve < F_table , so **it can be concluded that the data** score of the pre
test was homogeneous or can represent the entire population. 4.2.1.3. Hypothesis Test
In view of hypothesis test the post test of each sample, so the hypothesis to be tested is
 $H_0:\mu_A=\mu_B$ Stated students' achievement that were taught with a model of cooperative
learning NHT types is not differed significantly with students who werw thought by the
type of the Jigsaw cooperative learning model.

$H_0:\mu_A\neq\mu_B$ Stated students' achievement that were taught **by cooperative learning
model like NHT** differed significantly with students who thought by the type of the
Jigsaw cooperative learning model. Hypothesis Test That Depicts Students' Achievement
To ascertain to significant range existence of students' achievement by implementing
cooperative learning model like NHT and Jigsaw, in Exponentiation and Surds material
doing hypothesis by t-test. Appropriate testing criteria such as, H_0 is accepted if
 $-t_{table} < t_{observe} < t_{table}$.

Table 4.9 Hypothesis Test on Students' Achievement Cooperative Type _Average
_Variance _tobserve _ttable __NHT_37,103_296,6734_1,081_1,996 __Jigsaw_32,686
_321,0454 _____ It is typically set at 0,05 (5 out of 100 times).

This means that 5 out of 100 times an extremely low probability value will actually be observed if the null hypothesis is true. It was found that α meant that students' achievement that were taught by cooperative learning model with NHT is not differed significantly with students who were taught by Jigsaw cooperative learning model. V. CONCLUSION AND SUGGESTIONS 5.1.

Conclusion There was no significant difference of students' achievement by cooperative learning model like NHT and Jigsaw in Exponentiation and Surds material. The observer point of view, that the cooperative learning model like Jigsaw is better than the type of NHT in terms students' activity. Students were taught by cooperative learning model like Jigsaw, is more willingly to help their friends who do not quite understand the subject and also more willingly to listen the explanation provided by their friend because the situation was more condusive or convenient among students, then students pulled in one group inclined not hesitate to ask each other within group.

If contrast to students who were taught by NHT, who felt indifferent to ask each other within the group, especially for students who have a low ability. In Jigsaw, the ability of students present their work before the class meeting and summarize what has been learned. 5.2. Suggestion 1. For teachers In applying the cooperative learning model like NHT, teachers should have been more frequently to remind students to work in teams, especially for students who have low ability that often feel less self-confident get into discussions within group, and students of high ability sometimes looked up themselves smarter than the other, so he/she does not want to share with his/her friends.

In applying the model of the type of Jigsaw cooperative learning, teachers must have been more creative in managing the classroom activity, especially when the students are transfered out of the expert group into the group where they were. In addition, the teachers also should have anticipated about the student's absence, which has an impact to the lack expert students in the class 2.

For Students In case of pre-test, students must have improved their basic skills, related to the multiplication of two tribes, simplifying fractions, conjugate, as well as the basic concept of fraction exponents. In addition, students also must have been conscientious about the process of construction, to avoid the minor mistake which caused wrong answer.

In the process of post test, students must have improved their basic skills, linked to multiply two tribes and the conjugate. In It was found that α meant that students' achievement that were taught by cooperative learning model with NHT is not differed significantly with students who were taught by Jigsaw cooperative learning model. V.

CONCLUSION AND SUGGESTIONS 5.1.

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In the process of post test, students must have improved their basic skills, linked to multiply two tribes and the conjugate. In Addition the level of students' accuracy work be turned up and the answer should be simplified, and perfect. Entailed more excercies into. The students' activity in learning process has been good, but must be perfected be more diciplined in terms of cooperation among the members. VI.

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