The Effect of Cooperative Learning Model, Language and Natural Science Ability on Students' Mathematic Achievement (An Experimental Study on Senior High School Students of Kendari in Southeast Sulawesi Province).

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Abstract:
This 3x3 factorial experimental study aims at investigating the effect of cooperative learning model, language and natural science mastery on Senior High School students' mathematic achievement. Through variance analysis on 540 students as research sample as a result of F-Test statistical analysis, it can be concluded that: (i) the average of students' Maths achievement for each cell formed by cooperative learning model factor, language and natural science mastery has significant effect, (ii) the average of students' Maths achievement among factor levels of cooperative learning model in each language and natural science mastery level has significant effect, (iii) eight conditional hypothesis tested through t-test resulted that four hypothesis have significant effect: specifically for students with Indonesian mastery, cooperative learning type of Jigsaw and STAD have significant effect on students' Maths' achievement. The rest four conditional hypothesis have insignificant effect on students' Maths achievement: especially students who have mastery of English, cooperative learning type of TSTS and STAD have insignificant effect on students' Maths achievement.
Key Words: Jigsaw, TSTS, STAD, language and natural science, mathematic's achievement.

INTRODUCTION

Nowadayas, Maths has been a bitter subject for many students. It is because this subject has relative complex structure for those who do not enjoy learning it. However, for some gifted students, they tend to not go through difficulties when learning this subject, but they are just fewer students than those who hate it. Maths should be taught by professional teachers in all level of education in order to recognize their students' obstruction easily. A profesional teacher is expected to enhance students' interest and encouragement in learning Maths. Interest of something plays crucial role to encourage students to improve students' learning behavior as stated by Maonde (2010:55-68). Improving students' achievement is not apart from teachers' role as determiner and main factor in conducting instruction in the classroom. Teachers must have some following roles: (i) as students' servant, (ii) as new leader's determiner, (iii) as friend, (iv) as students in which they

become humble since they consider their students as their reflective self. The limitation of their students is reflecting their weakness as well. The advantageous things happened to their students encourage the teacher to commit something better in the future. This condition is similar to what we have read on some comics that a hero is seen by who her/his teacher is (Aziz, 2012: 30-37).

The teachers have many key positions in determining students' achievement. The teacher in this matter is the one who makes students believe in themselves that they are able to do manythings, and they will keep growing and developed as their natural seed. Teachers should, hence, recognize it through positive attitude and behavior in class, in, and outside school. Therefore as a teacher, she/he presents good behavior in commiting her/his main or complemented job. There are a bunch of ways need to be known by teachers in ordet to increase and encourage students to enhance their achievement, which are (i) curiousity to obtain and desire to investigate the world, (ii) creativity as one of human characters and desire to always go one step forward, (iii) desire to get sympathy from their parents, teachers, and friends, (iv) willingness to recover their failure, either cooperatively or competitively, (v) willingness to perceive comfortability when they have mastered certain subjects, and (vi) reward or punishment as learning outcome (Frandsen, 1961 (Suryabrata, 2002 :236-237)).

Learning is a proceed activity and a fundamental unsure in conducting every type and level of education. In other words, be able to pass or fail in achieving education goals does rely on learning process undertaken by students either at home or school (Syah, 2004: 63). According to Suryabrata (2002, 232-233), related main points on this are (i) learning can result changes (in term of behavioral, actual, or potential change), (ii) those changes basically are the discovery of new proficiency (as Kenntnis and Fertingkeit), (iii) those changes occur as a result of some efforts (on purpose). It is further explained that there are many factors influencing learning, as follows: (1) external factors including (a) non social factors and (b) social factors; (2) internal factors: (a) physiological factors, and (b) psychological factors.

Learning is a change happened in maturity, growth which refers to behavior existed by characteristics of learning are: (1) a change happens consiously, (2) continuous and functional change, (3) positive and active change, (4) untemporary change, (5) a change with clear objectives and direction, (6) all aspect of behavioural change (Slameto, 2003: 3-4). Although all factors have certain shortcomming, we actually realized that those were obtained from many previous studies done by: (i) Thorndike, (ii) Pavlov, (iii) Bruner, (iv) Piaget, (v) Gagne, etc.

Based on previous elaboration, it might be concluded that learning is basic and vital need for individuals to be through the life in this earth, either they are aware or not it is spiritual and physical need. Our spiritual needs knowledge through learning, because it might fulfill our soul and in turn feel satisfied. Satisfaction is our spiritual symptom. Our physics also will be healthy if its need is fulfilled; by knowledge. In conclusion, learning is our necessity, either teacher-centre or students-centre which is known as cooperative learning.

Cooperative learning is students-centered instructional model. In its implementation, cooperative learning is divided into some heterogenous groups in terms of cognitive aspect, race, sex, knowledge ability, etc so that it enables students to share knowledge to others which in turn will be known and mastered by each member of group.

Grand theory underlying cooperative learning is social contsructivism developed by Lev Semyonovich Vygotsky (1896-1934). He considered that culture, society, language, and interaction are important to understand how people learn. Vygotsky assumed that knowledge is cultural; he had

used socio-cultural approach in his study using children as sample. This approach is briefly explained as "cooperative" and "cultural". Vygotsky asserted that the development of individuals, including their thoughts, languages, and reasoning processes, is a result of culture. These abilities are developed through social interactions with others (especially parents and teachers); therefore, they represent the shared knowledge of a given culture. Vygotsky studied the growth of children from their environment and through their interaction with others, he found that what are given and what happens in the social environment (e.g., dialogues, actions, and activities), help children learn, develop, and grow.

One of the most important and popular theories of Vygotsky involves the zone of proximal development. He proposed that children, in any given domain, have actual developmental levels, which can be assessed by testing them individually. He further contended that there is an immediate potential for development within each domain. The difference between the two is called the zone of proximal development. It is suggested that the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or incollaboration with more capable peers. This implies the idea that tasks, which are too difficult for children to master alone, can be learned with guidance and assistance from adults, more-skilled children, or more knowledgeable others. Vygotsky explained that the upper limit in the zone of proximal development cannot become fruits without social interactive support from peers and teachers. Vygotsky suggested that if in the course of study, one can be assisted by more skilled persons, such as peers and teachers, his/her support level is changed. Also, as his/her peers and teachers adjust their support towards his/her guidance needs, he/she may advance in terms of his/her zone of proximal development. The process of adjusting the support is called scaffolding. Scaffolding refers to the assistance given to students in completing tasks that they cannot complete by themselves. Examples of effective scaffolding can be found in Constructivist Learning and Teaching (Johnson, D.W & Johnson, R, 2009).

In Vygotsky's social constructivism, social interaction is an important way in which children learn knowledge available in their culture without needing to reinvent it by them. Parents, adults, caregivers, teachers, and peers play important roles in the process of appropriation in children's learning. Teachers and adults give direction and instructions, comments, and feedback to students. These are not passively received by students because they also communicate with teachers, conveying them their problems or their answers in an interactive manner. Children also use conversations in working with their peers in handling exercises, projects, and problems. In this way, they exchange ideas and receive information, thereby generating understanding and developing knowledge. This process of learning is regarded as important because knowledge itself is developed through history, and it should go through appropriation in a social environment. Learning is achieved through the process of development; hence, learners should be active participants in the process of learning. Activity is important in learning; it is also a key concept in socio-cultural theories that explain the importance of doing. By engaging in meaningful activities, learners interact with peers and more knowledgeable people. Through interaction, children develop dialogues within the structure of activities; as a result, learning and development occurs. To Vygotsky, language plays an important role in learning.

Today cooperative learning model has been widely used, tried out, developed, and observed which proves that cooperative learning is an educational approach which aims to organize

classroom activities into academic and social learning experiences. There is much more to Cooperative Learning than merely arranging students into groups, and it has been described as "structuring positive interdependence (Slavin, 1990), (Kagan, 1990). Students must work in groups to complete tasks collectively toward academic goals. Unlike individual learning, which can be competitive in nature, students learning cooperatively can capitalize on one another's resources and skills (asking one another for information, evaluating one another's ideas, monitoring one another's work, etc.). (Chiu, E.G., 2000), (Chiu, E.G. 2008). Furthermore, the teacher's role changes from giving information to facilitating students' learning Cohen, E.G., (1999), Chiu, M. M (2004). Everyone succeeds when the group succeeds. describe successful cooperative learning tasks as intellectually demanding, creative, open-ended, and involve higher order thinking tasks (Ross & Smythe, 1995). Five essential elements are identified for the successful incorporation of cooperative learning in the classroom.The first and most important element is Positive Interdependence. The second element is individual and group accountability. The third element is (face to face) promotive interaction. The fourth element is teaching the students the required interpersonal and small group skills. The fifth element is group processing Brown, H., & Ciuffetelli, D.C. (Eds.). (2009).

In this 3x3 factorial designing research, the researcher used three models of cooperative learning, namely (i) Jigsaw, (ii) TSTS and (iii) STAD. These three models have advantages and weaknesses, but overall they have significant benefits to improve students' understanding especially for students who are not interested in maths and strengthen students' knowledge for those who are gifted in maths. The research results done by researcher from 2012 to 2014 found that students' math achievement is varied among students from all level of education (Maonde, F. (2012a), (2012b), (2013a), 2013b), (2014a) & (2014b)).

Indonesian, English, and natural science ability become the level in this study, to distinguish students' group achievement under jigsaw, TSTS, and STAD. This study indicates that maths has significant and positive effect on Indonesian, English, and natural science achievement. In this matter, the higher maths' achievement of students, the better result of Indonesian, English, and natural science learning students earn. In level analysis of this factorial research, those three levels become measurement to determine dependent variable (Maonde, F, et.al, 2015).

METHOD

This study is a part and continuance of previous research entitled The Discrepancy of Students' Maths Achievement Based on Language and Natural Science Mastery (an experimental study at Senior High School in Kendari of Southeast Sulawesi province in 2014). 540 students sample (table 1) is analyzed through 3x3 factorial analysis of variance under *Randomized Control Group Design* to test ten proposed hypothesis. These hypothesis are analyzed through F-test and T-test with significant value (α=5%), noted that if alpha value 5% is less (<) so, H_0 will be rejected, otherwise it is accepted.

Data in table 1 consists of nine cells in which each cell contains 60 students as respondents and the whole is 540 students with the following details: (i) a group of students taught by Jigsaw as many as 180 students, (ii) a group of 180 students taught by TSTS, (iii) a group of 180 students treated under STAD method, and (iv) a group of 180 students with the mastery of language

(Indonesian and English), and natural science. All the data is descriptive data research of Maonde, F. et.al (2015).

Table 1. The design of sample total under research of students' math achievement (Y) under cooperative learning model (factor Ai) and language (Indonesian, English) and Science ability (factor Bj)

Factor Ai / Factor Bj	A1 (Jigsaw)	A2 (TSTS)	A3 (STAD)	∑
B1 (Indonesian)	60	60	60	180
B2 (English)	60	60	60	180
B3(Natural Science)	60	60	60	180
∑ :	180	180	180	540

To test some proposed hypothesis through analysis technique using model (1), (2) and (2a) is as follows:

$Y_{ijk} = \mu + (AB)_{ij} + \varepsilon_{ijk}$ … (1)

$\mathbf{Y_{ijk}} = \mu + B_j + (AB)_{ij} + \varepsilon_{ijk}$ … (2)

Where Y_{ijk} = observation of k in cell (A=i, B=j) = (i,j), μ = variable Y average measures, Ai = measurement of i level effect from A factor and (AB)ij = measurement of interaction factor in cell (i,j), to i=1, … I; j = 1, … J, k = 1, … N by condition: $\sum_j B_j = \sum_i (AB)_{ij} = 0$, ∀ (for all j) Agung (2014:62-66).

$Y_i = \beta_0 + \beta_1[B1] + \beta_2[B=2] + \beta_3[A=1]*[B=1] + \beta_4[A=1]*[B=2] + \beta_5[A=1]*[B=3]$

$+ \beta_6[A=2]*[B=1] + \beta_7[A=2]*[B=2] + \beta_8[A=2]*[B=3] + \varepsilon_i$ … (2a)

Table 2. The Coefficient of Non Hierarchical Measures Based on Model (2a)

Factor Ai / Factor Bj	A1 (Jigsaw)	A2 (TSTS)	A3 (STAD)	Differences	
				A1-A3	A2-A3
B1 (Indonesian)	$\beta_0 + \beta_1 + \beta_3$	$\beta_0 + \beta_1 + \beta_6$	$\beta_0 + \beta_1$	$\boldsymbol{\beta_3}$	$\boldsymbol{\beta_6}$
B2 (English)	$\beta_0 + \beta_2 + \beta_4$	$\beta_0 + \beta_2 + \beta_7$	$\beta_0 + \beta_2$	$\boldsymbol{\beta_4}$	$\boldsymbol{\beta_7}$
B3 (Natural Science)	$\beta_0 + \beta_5$	$\beta_0 + \beta_8$	β_0	$\boldsymbol{\beta_5}$	$\boldsymbol{\beta_8}$
Differences B1-B3			$\boldsymbol{\beta_1}$		
Differences B2-B3			$\boldsymbol{\beta_2}$		

Complement:

$\boldsymbol{\beta_1}$ is average difference of students' maths achievement (Y) for Indonesian mastering students and natural science students, especially a group taught under STAD model.

$\boldsymbol{\beta_2}$ is average difference of students' maths achievement (Y) for English mastering students and natural science students, especially a group taught under STAD model.

$\boldsymbol{\beta_3}$ is average difference of students' maths achievement (Y) for students who are taught under jigsaw method (A1) and STAD method (A3), especially for Indonesian mastering students (B1).
$\boldsymbol{\beta_4}$ is average difference of students' maths achievement (Y) for students who are taught under jigsaw method (A1) and STAD method (A3), especially for English mastering students (B2).
$\boldsymbol{\beta_5}$ is average difference of students' maths achievement (Y) for students who are taught under jigsaw method (A1) and STAD method (A3), especially for natural science mastering students (B3).
$\boldsymbol{\beta_6}$ is average difference of students' maths achievement (Y) for students who are taught under TSTS method (A2) and STAD method (A3), especially for Indonesian mastering students (B1).
$\boldsymbol{\beta_7}$ is average difference of students' maths achievement (Y) for students who are taught under TSTS method (A2) and STAD method (A3), especially for English mastering students (B2).
$\boldsymbol{\beta_8}$ is average difference of students' maths achievement (Y) for students who are taught under TSTS method (A2) and STAD method (A3), especially for natural science mastering students (B3).

RESULTS

Empirically, students' maths achievement after being treated under cooperative learning models (Jigsaw, TSTS and STAD), the mastery of language (Indonesian, English) and natural science as shown in table 3 lists that the higher average goes to students' group taught by Jigsaw and Indonesian mastery (A1B1) followed by group taught under TSTS method and Indonesian mastery (A2B1) and STAD model group and Indonesian mastery (A3B1), each has deviation standard as 5.45898, 4.19950, 5.73164, respectively.

Table 3. Descriptive Analysis Result of Students' Maths Achievement after Being Treated in Senior High School in Kendari of Southeast Sulawesi Province

Descriptive Statistics
Dependent Variable: Y

A	B	Mean	Std. Deviation	N	A	B	Mean	Std. Deviation	N
1.00	1.00	80.0375	5.45898	60	3.00	1.00	76.5833	6.73038	60
	2.00	74.6500	8.10069	60		2.00	62.8767	15.96849	60
	3.00	72.6417	8.69412	60		3.00	53.9217	15.14680	60
	Total	75.7764	8.13458	180		Total	64.4606	16.18427	180
2.00	1.00	77.1792	4.19950	60	Total	1.00	76.5833	6.73038	60
	2.00	65.7933	15.38853	60		2.00	67.7733	14.45451	60
	3.00	53.9217	15.14680	60		3.00	60.1617	15.95199	60
	Total	65.6314	15.81632	180		Total	68.6228	14.76147	540

Inferential analysis to test ten hypothesis by applying model (1), (2) and (2a) with the following details:

Hypothesis-1, The average of students' maths achievement (Y) for all cells formed by factor of cooperative learning model (Ai) and language and natural science ability has significant effect. Statistical hypothesis used is H_0: (AB)ij = 0 versus H_1: not H_0 (at least there should be one combination pair (i,j) which is not same as zero). The analysis result on SPSS/PC in table 2, row

A*B shows F-test = 45.165, df = (df1;df2) = (8;531) with p=0.000 < α=0.05 therefore H_0 is rejected. Rejecting H_0 can be concluded that the average of students' maths achievement (Y) for all cells formed by factors of cooperative learning model (Ai) and language and natural science ability (Bj) has significant effect.

Table 4. Analysis of Variance Result Based on Model (1)

Tests of Between-Subjects Effects

Dependent Variable: Y

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	47557.553(a)	8	5944.694	45.165	.000
Intercept	2542906.240	1	2542906.240	19319.841	.000
A * B	47557.553	8	5944.694	45.165	.000
Error	69891.012	531	131.621		
Total	2660354.805	540			
Corrected Total	117448.565	539			

a R Squared = .405 (Adjusted R Squared = .396)

Hypothesis-2, The average of students' maths achievement (Y) between all factors level of cooperataive learning model (Ai) for every factors level of language and natural science ability (Bj) has significant effect. Statistical hypothesis used is H_0: (AB)ij = 0 versus H_1: not H_0 (at least there should be one combination pair (i,j) which is not same as zero). The analysis result on SPSS/PC in table 4, row A*B shows F-test = 23.980, df = (df1;df2) = (6;531) with p=0.000 < α=0.05 therefore H_0 is rejected. Rejecting H_0 can be concluded that the average of students' maths achievement (Y) between all factors level of cooperataive learning model (Ai) for every factors level of language and natural science ability (Bj) has significant effect.

Table 5. Analysis of Non Hierachical Variance Result Based on Model (2)

Tests of Between-Subjects Effects

Dependent Variable: Y

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	47557.553(a)	8	5944.694	45.165	.000
Intercept	2542906.240	1	2542906.240	19319.841	.000
B	28619.712	2	14309.856	108.720	.000
A * B	18937.840	6	3156.307	23.980	.000
Error	69891.012	531	131.621		
Total	2660354.805	540			
Corrected Total	117448.565	539			

a R Squared = .405 (Adjusted R Squared = .396)

Hypothesis-3, the average of students' maths achievement (Y) for Indonesian ability students compared with natural science students, especially the group taught under STAD method has significant effect. Statistical hypothesis used is: H_0: $\beta_1 = 0$ vs H_1:$\beta_1 \neq 0$. Analysis result on row [B=1] in Table 5 presents t-test value = 10.819 with p = 0.000 < α=0.05, so H_0 is rejected. Rejecting

H_0 can be concluded that average of students' maths achievement (Y) for Indonesian ability students compared with natural science students, especially the group taught under STAD method has significant effect.

Hypothesis-4, the average of students' maths achievement (Y) for English ability students compared with natural science students (B3), especially the group taught under STAD method has significant effect. Statistical hypothesis used is: H_0: $\beta_2 = 0$ vs H_1:$\beta_2 \neq 0$. Analysis result on row [B=2] in Table 5 presents t-test value = 4.275 with p = 0.000 < α=0.05, so H_0 is rejected. Rejecting H_0 can be concluded that the average of students' maths achievement (Y) for English ability students compared with natural science students (B3), especially the group taught under STAD method has significant effect.

Hypothesis-5, the average of students'maths achievement (Y) for those who are taught under jigsaw method (A1) compared with those who are taught under STAD method (A3) specifically for students who have ability in Indonesian (B1) has significant effect. Statstical hypothesis used is H_0: $\beta_3 = 0$ vs H_1:$\beta_3 \neq 0$. Analysis result on row [A=1]*[B=1] in table 5 indicates t-test value = 1.649 with p value = 0.100 > α=0.05, so H_0 is accepted. Accepting H_0 can be concluded that the average of students'maths achievement (Y) for those who are taughtunder jigsaw method (A1) compared with those who are taught under STAD method (A3) specifically for students who have ability in Indonesian (B1) doesn not have significant effect.

Hypothesis-6, the average of students'maths achievement (Y) for those who are taught under jigsaw method (A1) compared with those who are taught under STAD method (A3) specifically for students who have ability in English (B2) has significant effect. Statstical hypothesis used is H_0: $\beta_4 = 0$ vs H_1:$\beta_4 \neq 0$. Analysis result on row [A=1]*[B=2] in table 5 indicates t-test value = 5.621with p value = 0.000 < α=0.05, so H_0 is rejected. Rejecting H_0 can be concluded that the average of students'maths achievement (Y) for those who are taughtunder jigsaw method (A1) compared with those who are taught under STAD method (A3) specifically for students who have ability in English (B2) has significant effect.

Hypothesis-7, the average of students'maths achievement (Y) for those who are taught under jigsaw method (A1) compared with those who are taught under STAD method (A3) specifically for students who have ability in natural science (B3) has significant effect. Statstical hypothesis used is H_0: $\beta_5 = 0$ vs H_1:$\beta_5 \neq 0$. Analysis result on row [A=1]*[B=3] in table 5 indicates t-test value = 8.937 with p value = 0.000 < α=0.05, so H_0 is rejected. Rejecting H_0 can be concluded that the average of students'maths achievement (Y) for those who are taught under jigsaw method (A1) compared with those who are taught under STAD method (A3) specifically for students who have ability in natural science (B3) has significant effect.

Hypothesis-8, the average of students'maths achievement (Y) for those who are taught under TSTS method (A2) compared with those who are taught under STAD method (A3) specifically for students who have ability in Indonesian (B1) has significant effect. Statstical hypothesis used is H_0: $\beta_6 = 0$ vs H_1:$\beta_6 \neq 0$. Analysis result on row [A=2]*[B=1] in table 5 indicates t-test value = 0.284 with p value = 0.766 > α=0.05, so H_0 is accepted. Accepting H_0 can be concluded that the average of students'maths achievement (Y) for those who are taught under TSTS method (A2) compared with those who are taught under STAD method (A3) specifically for students who have ability in Indonesian (B1) does not have significant effect.

Hypothesis-9, the average of students'maths achievement (Y) for those who are taught under TSTS method (A2) compared with those who are taught under STAD method (A3) specifically for students who have ability in English (B2) has significant effect. Statstical hypothesis used is H_0: $\beta_7 = 0$ vs H_1:$\beta_7 \neq 0$. Analysis result on row [A=2]*[B=2] in table 5 indicates t-test value = 1.392 with p value = 0.164 > α=0.05, so H_0 is accepted. Accepting H_0 can be concluded that the average of students'maths achievement (Y) for those who are taught under TSTS method (A2) compared with those who are taught under STAD method (A3) specifically for students who have ability in English (B2) does not have significant effect.

Hypothesis-10, the average of students'maths achievement (Y) for those who are taught under TSTS method (A2) compared with those who are taught under STAD method (A3) specifically for students who have ability in natural science (B3) has significant effect. Statstical hypothesis used is H_0: $\beta_8 = 0$ vs H_1:$\beta_8 \neq 0$. Analysis result on row [A=2]*[B=3] in table 5 indicates t-test value = 0.000 with p value = 1.000 > α=0.05, so H_0 is accepted. Accepting H_0 can be concluded that the average of students'maths achievement (Y) for those who are taught under TSTS method (A2) compared with those who are taught under STAD method (A3) specifically for students who have ability in natural science (B3) does not have significant effect.

Based on analysis result obtained in this 3x3 factorial research, it devotes its completeness in solving any problems, noted: there is no doubt to discuss whether this analysis result is significant or not. If certain cell or treatment has relative high difference with control group, the result will reject H_0 or otherwise accept H_0. Accepting or Rejecting null hypothesis is nothing to do with whether the research undertaken well or not, but it depends on our honesty to undertake the research, employ sampling technique, appropriate analysis technique with the problems and objectives, used references, and discuss and conclude the results.

Table 6. Analysis of Non Hierachical Variance Result Based on Model (2)

Dependent Variable: Y

Parameter		B	Std. Error	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	$\boldsymbol{\beta_0}$	53.922	1.481	36.406	.000	51.012	56.831
[B=1.00]	$\boldsymbol{\beta_1}$	22.662	2.095	10.819	**.000**	18.547	26.776
[B=2.00]	$\boldsymbol{\beta_2}$	8.955	2.095	4.275	**.000**	4.840	13.070
[B=3.00]		0(a)	.	.	.	.	.
[A=1.00] * [B=1.00]	$\boldsymbol{\beta_3}$	3.454	2.095	1.649	.100	-.661	7.569
[A=1.00] * [B=2.00]	$\boldsymbol{\beta_4}$	11.773	2.095	5.621	**.000**	7.659	15.888
[A=1.00] * [B=3.00]	$\boldsymbol{\beta_5}$	18.720	2.095	8.937	**.000**	14.605	22.835
[A=2.00] * [B=1.00]	$\boldsymbol{\beta_6}$	.596	2.095	.284	.776	-3.519	4.711
[A=2.00] * [B=2.00]	$\boldsymbol{\beta_7}$	2.917	2.095	1.392	.164	-1.198	7.031
[A=2.00] * [B=3.00]	$\boldsymbol{\beta_8}$	-3.02E-014	2.095	.000	1.000	-4.115	4.115
[A=3.00] * [B=1.00]		0(a)	.	.	.	.	.
[A=3.00] * [B=2.00]		0(a)	.	.	.	.	.
[A=3.00] * [B=3.00]		0(a)	.	.	.	.	.

a This parameter is set to zero because it is redundant.

DISCUSSION

Interaction Factor Effect Based on Model (1), A*B Design and Model (2), A A*B Design.

Interaction factor is interdependence between one factor and others. In cooperative learning, interaction factor holds importan function in instructional process in the classroom, especially group discussion to accomplish their academic task given by teachers to enhance uninterested and interested students' understanding on maths. Interested students might share their mathematicexperience to those who are not interested. In this case students will earn several benefits, as like (i) through this kind of interaction, the interested students will add their knowledge or if it has been existed, they will understand deeper while teaching the other students, (ii) for uninterested students, they will get new knowledge from the interaction which in turn makes them understand, interested, and have a fancy on maths. These are all why interaction among students are crucial among teamworks. This interaction should be encouraged by the professional teachers in classrooms.

A professional teacher understand well what to do to encourage students' interest and motivation so as to lead to the interaction among students under teachers' guide by giving questions to all group in order that the members of group can discuss how to solve the problems or clarify unclear things. Two factors interaction in this study are interaction among cooperative learning models; Jigsaw, TSTS, and STAD as first factor (Ai) and the mastery of Indonesian, English, and Natura Science as second factor (Bj). Analysis result between these two factors based on model (1) and (2), there has been significant effect on students'mathematic achievement in Senior High Schools in Kendari of Southeast Sulawesi. Likewise the average of students' maths achievement in terms of Indonesian and Englisg mastery while natural science mastery acts as control has significant effect. The significance between control and experiment groups on cooperative learning model and mastery level for every three assessed subject among cells formed by those two factors; Ai and Bj has relative high difference (more than 3 numbers).

Interaction factors of cooperative learning model and the mastery of Indonesian, English, and Natural science towards students' maths achievement based on *Adjusted R Squares* value as much as 39.6%. This means that 60.4% variance of students' maths achievement average in population after this 3x3 factorial research is determined by other factors. In other side, it is found that there is variance component in model (1) for interaction factor A*B as much as 68% and in model (2) for main factor of language and natural science mastery as much as 40.95% with interaction A*B variance component as much as 27.1% with corrected model variance component as much as 68%, which are calculated based on each component score divided by error score and multiplied by 100. This research result is not supported by Ajaja & Eravwoke study (2010: 1-18).

The Effect of Conditional Interaction Factor Based on Model (2a)

Conditional interaction factor as found in social life of our society is a kind of condition to obtain something for eaxample (i) to be recruited as a soldier, they have to be healthy spiritually and physically, have 160 cm heights and others, (ii) to enroll as medico, they have to gain score as much as 800 and others, (iii) to be pilot, they have to achieve pilot certificates and flying experience as certain hours, (iv) to be successful businessman, they have to have big capital and be gifted to maintain company, and many others.

Conditional analysis result in accordance of A A*B design by focusing on model (2) and (2a) while paying attention to table 2 and analysis result in table 6 obtains eight conditional hypothesis noting that four hypothesis reject H_0 and the rests accept it. Two of four rejected hypothesis are (i) the average difference of students' maths achievement (Y) for students with Indonesian ability (B1) and natural science ability (B3), especially for the groups taught under STAD model (A1), and the result indicates that 95% Confidence Interval namely {18.547 < $\boldsymbol{\beta_1}$ < 26.776} meant the difference of students' maths achievement measurement is approximately 18.547 in minimum and 26.776 in maximum score among population, (ii) the difference of students' mathematic achievement average (Y) for those who have ability in English (B2) and natural science (B3), especially for them who are treated under STAD method (A3), and the result shows that 95% Confidence Interval namely {4.840 < $\boldsymbol{\beta_2}$ < 13.070} meant measurement difference of students' maths achievement average is 4.840 in minimum and 13.070 in maximum score among population.

Two of four accepted hypothesis are (i) the average difference of students' maths achievement (Y) for students taught under Jigsaw (A1) compared with those who are taught by STAD method (A3), especially for the students who have ability in Indonesian (B1), and the result indicates that 95% Confidence Interval namely {-0.666 < $\boldsymbol{\beta_3}$ < 7.569} meant the difference of students' maths achievement measurement is approximately -0.666 in minimum and 7.569 in maximum score among population, (ii) the average difference of students' maths achievement (Y) for students taught under TSTS (A2) compared with those who are taught by STAD method (A3), especially for the students who have ability in Natural science (B3), and the result indicates that 95% Confidence Interval namely {-4.115 < $\boldsymbol{\beta_8}$ < 4.115} meant the difference of students' maths achievement measurement is approximately -4.115 in minimum and 4.115 in maximum score among population.

This result is greatly supported by some previous research through 2x2, 2x3, 3x2 and 3x3 factorial experimental research with varied levels: (i) level of parents' employment status, (ii) level of parents' education status, (iii) level of parents' income, etc, and internal factors level of students, as like (i) level of students' interest, (ii) level of students' motivation, (iii) students' background knowledge, (iv) level of students' attitude in learning mathematic, etc.

CONCLUSION AND SUGGESTION

Conclusion: empirically, the average of students' maths achievement after conducting this experimental research on cooperative learning model; Jigsaw, TSTS and STAD with the level of language and natural science mastery has difference realtively to support the proposed hypothesis. The average difference of students' maths achievement for all cells formed by cooperative learning models (Jigsaw, TSTS and STAD) and mastery level of Indonesian, English, and natural science has significant effect. The average difference of students' maths achievement among level factors in Indonesian, English, and natural ability for every cooperative learning model has significant effect. Analysis of conditional level of Indonesian, English, and natural science ability for students who are taught under Jigsaw, TSTS and STAD models from six hypothesis (Hypothesis related to measurement from $\boldsymbol{\beta_3}$to $\boldsymbol{\beta_8}$); two hypothesis reject H_0 and four hypothesis accept H_0. **Suggestion:** It is really expected that specifically for mathematic teachers and all teachers generally to always implement students-centered teaching method in order that discussion will be appear among

students, and between teacher and students. Analysis with factorial design is really exemplary and complete to be applied in other research using level as second, third, fourth factor, and so on.

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