**ING NGARSA SUNG TULADHA COOPERATIVE LEARNING MODELS**

**WITH STUDENTS PROBLEM SOLVING ABILITY**

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**ABSTRACT**

This paper describes one way that teachers as educators take to face the challenges of the industrial revolution 4.0, namely by instilling and preparing creative and character leaders. Education is character building which is the implementation of Ki Hajar Dewantara's leadership concepts namely Ing Ngarsa Sung Tuladha, Ing Madya Mangun Karsa and Tut Wuri Handayani. The concept of leadership was first adopted as a Cooperative learning model, which emphasizes exemplariness in group learning. The group leader is called tuladha who is the facilitator in the group. Tuladha utilizes the Internet of Things. Before the teaching and learning process in class, information, concepts or ideas and examples are posted by the teacher to the tuladha. This study is an experimental study, with the sample used meets the prerequisites of the statistical test used. The results showed that increasing students' mathematical problem solving abilities using the Ing Ngarsa Sung Tuladha cooperative learning model differed significantly from the usual method. The category of improving students' mathematical problem solving abilities that obtain the Ing Ngarsa Sung Tuladha cooperative learning model is in the high category.

**Keywords:** Cooperative learning, leadership, Ing Ngarsa Sung Tuladha, Problem solving

**Introduction**

The industrial revolution 4.0 has in fact changed the world order. Human life is connected with technological and information sophistication. (Ristekdikti 2018) explained that world change is now entering the era of the industrial revolution 4.0 where information technology has become the basis in human life. This era of disruption, affects aspects of human life, including in the economic, political, cultural, artistic, and even to the fields of science or education.

The development of technology that is developing rapidly requires the world of education to be involved with communication as a more and all-round facility, so that teachers must innovate and utilize sophisticated facilities, in order to stimulate student enthusiasm for learning. The teacher tries to facilitate students to be able to construct their knowledge through the Internet of Things. The teacher tries to attract the attention of students with the principle of learning more creative, innovative and not boring so that students are active and willing to participate in the learning process to achieve their achievements. Not active just doing the task alone but actively involved in the learning process. This means that the teaching and learning process emphasizes the needs a From the description above, teachers should build learning innovations that are in accordance with reality, the conditions that exist to form superior human resources (HR), as well as the skills needed by society at large. For this reason, the teacher tries to plan human resources by planting creative habits and good character for each of their students. In line with the Definition of Education According to Law No. 20 of 2003 (Sudrajat 2010) that education is a conscious and planned effort to create an atmosphere of learning and learning process so that students actively develop their potential to have spiritual-spiritual strength, self-control, personality, intelligence, noble character, and the skills needed by themselves and the community.

However, please note that students have different ways and characteristics of learning. Some students prefer to study alone, while others like to study in groups. Some students like to get information by reading, some prefer to get information through various activities. (Hutagaol 2018) revealed that there is no single best way of learning, there is no way of learning that is superior to others, because everyone has different attitudes, personalities and intellectual abilities. (Yusrin 2018) revealed that none of the learning styles are better than the others, there is no learning style that encourages learning better. But all adjusted to the situation, material, goals to be achieved. (Suherman 2003) states "There can be no right way to study or best way to teach ...".

In this paper, to adapt the situation in bringing about the industrial revolution 4.0, learning is offered that is in line with the needs of the educational world today, the Ing Ngarsa Sung Tuladha Cooperative Learning Model (INST), which promotes exemplary learning in groups. This learning model was adopted from one of Ki Hadjar Dewantara's leadership concepts, namely Ing Ngarsa Sung Tuladha which means in the front set an example, (Susetya 2007).

This learning is student centered. The teacher activates the students' activities in constructing their own knowledge by giving them the opportunity to solve their own chosen problems, and provide the necessary assistance through group leaders. The teacher tries to emphasize character, morals and leadership through the exemplary group leaders. This is in line with (Yusrin 2018) which states that learning activities must focus on students and emphasize the development of student competencies, such as creativity, leadership, trust, independence, discipline, discipline, criticalness in thinking, communication skills, and working in teams as well global insight to be able to always adapt to the changes and developments of the times.

The leader / teacher should be a quality person in personality and spirituality, then only prepare to be a hero in preparing students to become defenders of the nation and the nation. This means that as a leader / teacher, the priority is to function as a model or role model, then only as a facilitator or teacher. The teacher (leader) is someone who has advantages, in addition to the cognitive and psychomotor domains, they should have a high ability in character concerning the affective domain, (Dewantara 1977). (E. Efe, H. A R. 2011) add (Aronson, et al. 1978) which states that the role of group leaders is the seamen abilities of students and is balanced with character education, so that the students form very wisely in using the in its importance to the role of the teacher, namely as a facilitator. The success of learning in the cognitive and psychomotor domains is strongly influenced by students' affective conditions. To achieve optimal learning outcomes, a learning model is considered, the Ing Ngarsa Sung Tuladha cooperative learning model.

**Ing Ngarsa Sung Tuladha Cooperative Learning Model (INST)**

Soedjadi in the Mathematics Education Tips book writes and questions: Is it not possible to develop a model or method of learning that is based on the philosophy of the Indonesian nation? Furthermore, Soedjadi conveyed that it was not impossible that new developments in the learning model in Indonesia, that model would have an effect on learning in Indonesia (Soedjadi 1999). Soedjadi's question was answered with the emergence of the Ing Ngarsa Sung Tuladha (INST) cooperative learning model, and the writing team felt supported in designing a learning model that breathed on the concept of Ki Hadjar Dewantara's leadership.

The concept of leadership of the national figure Ki Hajar Dewantara has bequeathed a very important philosophy in national education, namely Ing Ngarsa Sung Tuladha, Ing Madya Mangun Karsa, Tut Wuri Handayani. Ing Ngarsa Sung Tuladha which means Ing Ngarsa means in front, Sung means "I", Tuladha means be a role model. So the meaning of Ing Ngarsa Sun Tuladha is to be a leader must be able to provide be a role model and for the people around him (Syakhudin A 2012). In other words, the teacher as an educator becomes a pigur, can be the best example in front of their students, both in the family, school and community environment

In the INST teaching and learning process the initial stage begins with the selection of a learning group leader. The leader of the chosen group is called Tuladha. Tuladha became a role model, a role model. The selection of group leaders is based on cognitive and character criteria. Tuladha became a facilitator for her group, (Hutagaol et al 2018). The teacher directs and guides and leads the Tuladha in utilizing the Internet. Before the teaching and learning process in the classroom, on the advice and direction of the teacher, the tuladha-tuladha looking for information, and make a summary of teaching materials that will be discussed from the internet. The teacher is involved in posting the concepts, ideas and examples of material to be learned through the internet.

**Steps in the Ing Ngarsa Sung Tuladha Cooperative Learning Model**:

1. Determination of Tuladha meets the criteria of Ing Ngarsa Sung Tuladha. The highest score will be chosen as Tuladha. The amount of Tuladha is the same as the number of groups of students formed in the class.

2. Formation of groups with heterogeneous cognitive abilities consisting of 4-5 students. To form heterogeneous groups of students, ranking of each student is based on cognitive abilities, from highest to lowest. Furthermore students who have been sorted, divided according to rank in the same number of groups with a number of students planned in one group. The learning group that is formed consists of one student from each ranking group. Each group member uses the thumb or open hand to the top.

3. The learning process begins with prayer, then the teacher distributes the worksheet. Each group of students gets a worksheet to solve, and tries to solve the problem given to them based on their understanding of the material, wisely utilizing time, wisely utilizing sophisticated technology for its good in social life. which was discussed.

4. The teacher explains the concept/subject matter in front of the class

5. Every Tuladha go in front of the class clarifies the material given by the teacher.

6. Every Tuladha returns to her group, helps and explains the concept or example given by the teacher and invites her friends to come back together to solve the problems found in the worksheet.

7. In the event that a problem cannot be solved, Tuladha will again ask the teacher and explain it back to his group of friends.

8. The teacher goes around, ready to give scaffolding to each member of the study group.

9. The teacher gives the opportunity for group representatives to discuss the questions in the worksheet in front of the class.

10. Tuladha sent a group of friends to come to the front of the class.

11. The teacher and students together conclude the subject matter.

Tuladha works together to be a teammate, in understanding problems, in planning solutions to solutions and making solutions to problems, and in re-examining answers to avoid mistakes and whether they have really provided solutions to problems that occur. Thus each group member is expected to be able to express his creative ideas, be able to make and answer questions given to him.

Teachers and tuladha are always ready to help group members to direct understanding information, concepts or mathematical ideas that are not yet known by group members, this is in line with the statement (Suwarto 2018), that in the learning process, students are not always able to understand and develop their own potential without the help of others, this is the role of a teacher as a facilitator always ready to help, to tell through examples.

The Ing Ngarsa Sung Tuladha Cooperative Learning Model is designed based on Vygotsky's constructivist learning theory, Jerome Bruner's learning theory, Jean Piaget's cognitive learning theory, which emphasizes social interaction as a mechanism to support cognitive development. In addition, this model is also supported by David Ausubel's meaningful learning theory. In the design of Ing Ngarsa Sung Tuladha's cooperative learning model helps students to more easily accept the information obtained, because the information process or concept will be supported by the interaction that occurs in the study group.

**Students Mathematical Problem Solving Ability**

In preparing leaders who are highly needed characterizing habituation to always be patient to find solutions to problem solving, innovating with technology, creativity, honesty, curiosity, and prioritizing the process of creativity and coo peration as habituation. Problem solving ability is a very important ability and must be possessed by every student. This is in line with the opinion of Branca (A. Herdiman, I R. 2018) who revealed that the importance of mathematical problem solving ability because it is an important goal in mathematics learning is even the heart of mathematics. (Polya, G 1973) in his book "How to Solve It" suggests four steps in solving mathematical problems, namely:

1. Understanding the problem (Understanding the problem)In this first stage students must be able to understand and identify the main problems given, what information is obtained and what problems must be resolved, whether the conditions in the problem are sufficient to determine the results of what is unknown.

2. Develop a problem solving plan (Devising a plan)

At this stage, students know the outline of the problem, calculation strategies, interpretation of the solution, relevant concepts in order to form a mathematical problem solving model.

3. Carry out the plan (Carrying out the plan)

 At this stage, the predetermined plan provides a general outline in solving the problem. Students write in detail each step that is correct. For example, perform a calculated operation correctly in applying the problem solving model and strategy to get the problem solved.

4. Re-checking answers (Looking back)

In this final stage, students must re-examine the correctness of the answers obtained with various mathematical problem solving strategies and examine the steps that have been taken to avoid mistakes and whether to provide a solution to the problem.

**Methodology**

This research is directed at experimental research with the following designs:

 O1 O2

O1 : The initial test is a student's mathematical problem solving ability

: Learning with the INST cooperative learning model

O2 : The final test is the same as O1

The study was conducted at a junior high school in Cimahi, West Java. The population subjects of this study were all students of class VIII in the junior high school. Two classes were chosen from the subject as research objects.

**Research Result**

To find out the initial conditions of each class, the results of the normality test and the homogeneous test of mathematical problem solving are presented between students who obtain the cooperative learning model of Ing Ngarsa Sung Tuladha and the usual methods as shown in Table 1 below.

| **Tabel 1. One-Sample Kolmogorov-Smirnov Test** | | | | |
| --- | --- | --- | --- | --- |
|  | |  | Pretes\_Ordinary | Pretes\_INST |
| N | | | 29 | 30 |
| Normal Parametersa | | Mean | 8.0000 | 9.8000 |
| Std. Deviation | 3.27327 | 3.52723 |
| Most Extreme Differences | | Absolute | .247 | .186 |
| Positive | .247 | .186 |
| Negative | -.180 | -.107 |
| Kolmogorov-Smirnov Z | | | 1.328 | 1.021 |
| Asymp. Sig. (2-tailed) | | | .059 | .248 |
| a. Test distribution is Normal. | | |
|  |

From Table 1, it appears that p. sig. values ​​respectively, 0.59 and 0.248 are more than ∝ = 0.05 so both data are normally distributed.

**Table 2. Test Homogeneity Tests**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *Levene Statistic* | df1 | df2 | Sig. | Keterangan |
| *Based on Median* | .291 | 1 | 57 | .591 | H0tidakditolak |

From Table 2, it appears that the large p. Sig. value = .591 > 0.05, so H0 is not rejected. This means that the variance of group population data has homogeneous variance.

**Table 3. Mean, Std. Deviation, Pretest, Posttest and Gain**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Mathematical Problem Solving Ability of Students | *Pretest* | | *Posttest* | | *Gain* | |
| Mean | Std. Deviation | Mean | Std. Deviation | Mean | Std. Deviation |
| Understanding Problems | 1.3448 | .72091 | 9.1379 | 2.41608 | .9016 | .26974 |
| Develop Compilation Plan | 3.0000 | 1.48805 | 9.1724 | 1.10418 | .8781 | .16975 |
| Problem Resolution | .1379 | .44111 | 7.1379 | 1.88460 | .7123 | .18960 |
| Re-checking | .1000 | .40258 | 7.0667 | 1.38796 | .7059 | .13834 |

The results in Table 3, show that there was an increase in the test results before and after each indicator of students' mathematical problem solving abilities. Increased ability (Gain) mathematical problem solving of students was seen from the change in the mean pretest and posttest. The increase was also supported by changes in std. Deviation Gain as shown in Table 3.

The gain for each indicator is included in the high category. The gain of students' mathematical problem solving abilities is normally distributed, so that the two average tests can be done by t-test. The average two different test results using the SPSS program as shown in Table 4 below.

Table 4. Difference Test Results of Two Normalized Normalized Gains

|  |  |  |  |
| --- | --- | --- | --- |
| *t-test for Equality of Means* | | | |
|  | *t* | *Df* | *Sig (2tailed)* |
| *Equal variances not assumed* | *2.241* | *50.992* | *.029* |

From Table 4 it can be seen that the value of p. value sig. 0.029 < 0.05 then H0 is rejected, meaning that there is a significant difference in the gain in students' mathematical problem-solving abilities that obtain the Ing Ngarsa Sung Tuladha cooperative learning model. In other words, that the improvement of students' mathematical problem solving abilities is significantly different than the normal way.

**Conclusion**

In the end the findings can be concluded as follows**:**

First, the improvement of students' mathematical problem solving abilities is significantly different than how they are used. This finding was corroborated by previous researchers who stated that the implementation of Ki Hajar Dewantara's teachings in mathematics can improve students' academic abilities, (Natalia, I. G. A. K. 2015).

Second, the gain of the ability to understand problems, make a plan of resolution, solve problems and check the mathematical problem solving of students who obtain the model of Ing Ngarsa Sung Tuladha cooperative learning (INST) is in the high category, this is supported by students and tuladha who play an active role in the discussion group, tuladha shows good character, his example shows success in each group member. His role as a facilitator, directs in understanding what is being faced. Next, together plan a solution to the existing problem, and respect each other in carrying out the solution to solve the problem, and direct in giving opinions to be able to re-examine the solution of the solution that has been done.

Third, the character of students looks good through attitudes and speech, curiosity appears through student participation in discussions, in sharing knowledge. This is supported by research conducted by Ningsih, (Anggreini 2011) which states that the application of Ki Hadjar Dewantara's teachings through the Among methods in mathematics learning has contributed significantly in improving the content of values ​​to be able to build student character, and students become tough in solving a problem, obedient, and very respectful of others.

Fourth, students are creative in answering questions and presenting their results to the class. This finding is supported by (Natalia, I. G. A. K. 2015) that by implementing Ki Hajar Dewantara's view in mathematics learning can form student's personality that is strong in solving problems, independent, trustworthy, creative, effective, disciplined, diligent.

**Discussion**

The findings that there are obstacles in efforts to support the smooth INST cooperative learning model, which is oriented to improve students' mathematical problem solving abilities, so that they can achieve better learning outcomes and character, among others: Lack of student handbooks, generally only using LKS; Lack of prerequisite knowledge students should have; Lack of time spent on the INST cooperative learning model; Internet network is still an obstacle for some students.

A positive thing that supports in using the INST cooperative learning model is that students are quite enthusiastic and look happy in following the learning seen from the low absence of students during the study.

**Suggestion**

Based on the results of the study, suggestions that can be used as a reference and consideration for further researchers in implementing the Ing Ngarsa Sung Tuladha cooperative learning model include: 1. Piaget's theory of constructivism learning. Piaget (Hamzah 2003) argues that a person's knowledge is not obtained passively, but rather is obtained through a person's activity in taking action in learning. 2. The learning process occurs and is successful because of the emphasis on scaffolding. Vigotsky (Slavin, R E 1994) argues that by giving emphasis to scaffolding which means providing a large amount of assistance in the form of questions when congestion occurs, then reducing aid gradually and providing opportunities for students to take over again in continuing to solve the problems encountered. Thus students are able to be independent and tough so they can survive and compete.

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