

## THE ING NGARSA SUNG TULADHA COOPERATIVE LEARNING MODEL AND STUDENTS' PROBLEM SOLVING ABILITIES

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### ABSTRACT

This paper describes one way that teachers as educators can face the challenges of the industrial revolution 4.0, namely by instilling and preparing creative and character-based leaders. Education as character building can be implemented using 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 emphasized exemplariness in group learning. The group leader is called tuladha and is the facilitator of 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 meeting the prerequisites of the statistical test used. The results showed that students' mathematical problem solving abilities increased significantly using the Ing Ngarsa Sung Tuladha cooperative learning model over 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, Ing Ngarsa Sung Tuladha, problem solving

### INTRODUCTION

The industrial revolution 4.0 has in fact changed the world order. Human life was 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. Other teachers consider cognitive styles of the students to map problem solving to plan their teaching in class (Appulembang, 2017).

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. Tosepu (2019) 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 Tosepu (2019), 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). Aronson (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.

## **LITERATURE REVIEW**

### **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, 2000). 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 (Syaikhudin, 2012). In other words, the teacher as an educator becomes a figure, can be the best example in front of their students, both in the family, school and community environment as stated by Alia and Irwansyah (2018) that through mentoring, parents can supervise children and direct positive content for children to use technological advancements appropriately in accordance with the child's growth and development.

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.

### **Students Mathematical Problem Solving Ability**

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 claimed by Suwanto (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.

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 cooperation as habituation. Problem solving ability is a very important ability and must be possessed by every student. Simanjuntak & Sudibjo (2019) found that problem-based learning method could increase students' problem solving ability.

This is in line with the opinion of Branca. Anggraeni & Herdiman (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, 1957) in his book "How to Solve It" suggests four steps in solving mathematical problems, namely:

1. 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

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

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

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.

## RESEARCH METHODOLOGY

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

*O1 X O2*

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

*X* : 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.

Hypothesis: There is a significant difference in the gain in students' mathematical problem-solving abilities that obtain the Ing Ngarsa Sung Tuladha cooperative learning model

## DISCUSSION

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 Parameters	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  $\alpha = 0.05$  so both data are normally distributed.

**Table 2. Test Homogeneity Tests**

	Levene Statistic	df1	df2	Sig.	Inf
Based on Median	.291	1	57	.591	$H_0$ is not rejected

From Table 2, it appears that the large p. Sig. value = .591 > 0.05, so  $H_0$  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 Solving Students	Problem Ability of	Pretest		Posttest		Gain		inf
		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

<i>t-test for Equality of Means</i>			
	<i>t</i>	<i>Df</i>	<i>Sig (2tailed)</i>
<i>Equal variances not assumed</i>	2.241	50.992	.029

From Table 4 it can be seen that the value of p. value sig.  $0.029 < 0.05$  then  $H_0$  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. This result confirmed by research conducted Thamsir, Silalahi, & Soesanto (2019) that showed peer tutoring as an example of cooperative learning can increase mathematical problem solving skills.

## CONCLUSION

Based on the results of the study, the conclusion that can be used as a reference or consideration for further research in implementing Ing Ngarsa Sung Tuladha's cooperative learning model are that in addition to cognitive abilities, students' character is formed better, and Tuladha is very concerned with the success of group members, seen from his role as facilitator together in understanding, planning a solution, implementing a solution, and re-examine so that the group members are very much expecting the presence of the Tuladha. This is in line with the research conducted by Nugrahaningsih, (2011) which states that the application of the teachings of Ki Hadjar Dewantara through Among' mathematics learning methods gained a considerable contribution in improving the moral values to be able to build students' character, being more resilient in completing a problem, obey the principle, and respect to other people. The students use of the INST cooperative learning model are quite enthusiastic and excited in following the learning process, it can be seen from the involvement and cooperation of the students during the research.

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