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Reading Concept Map-Think Pair Share (Remap-TPS) Learning Model on Cognitive Ability and Scientific Attitude

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Abstract: The recent integration of learning models in the learning process has become the focus of science education experts, especially in Indonesia, such as the adoption of the Reading-Concept Map Think Pair Share (Remap TPS) learning model. This study aims to improve the students' cognitive abilities, and scientific attitudes through the Reading-Concept Map Think Pair Share model. The study was conducted to junior high school students by employing Quasi-experimental with Non-equivalent Control Group Design. The instruments used were multiple choice tests and observation sheets. The result of the research shows that the students' cognitive ability is in the medium category with an N-gain value of 0.47. Based on this result, it can be concluded that the Remap TPS learning influences the students' cognitive ability. The obtained average percentage score of the students' scientific attitudes is 81.76% which belongs to the very good category. Thus, it can be concluded that this study provides important implications for educators to be more creative in designing learning models in order to improve the students' cognitive abilities and scientific attitudes.

INTRODUCTION

The education in Indonesia is facing 21st century challenges. An effective learning process is one of the ways to overcome those challenges (Darmawan, Islami, & Yennita, 2018; Makhrus, Harjono, Syukur, Bahri, & Muntari, 2018; Matsun, Ramadhani, & Lestari, 2018). By learning, students can obtain discoveries based on development over time (Barus & Sani, 2017; Karwono & Mularsih, 2012). Learning outcomes are new abilities, which produce changes in attitudes and measurable knowledge and skills (Aldila, Tapilouw, & Sanjaya, 2018; Nur, Salam, & Hasnawati, 2016).

One of the abilities that must be possessed by students is cognitive ability. Cognitive ability is considered important in learning outcomes (Arimbawa, Santyasa, & Rapi, 2017). This is because the cognitive learning process is more concerned with the learning process, not only involves stimulus and response but rather the behavior of situations related to goals of learning (Barus & Sani, 2017; Kamelia, Ahmad, & Novitasari, 2017; Yusro & Sasono, 2016). Besides, the attitudes need to be considered as a tendency to respond to conditions in a norm (Damanik & Bukit, 2014). Scientific attitudes can affect student achievement in both cognitive and affective aspects (Rohmani, 2015). The higher the students' scientific attitude, the learning behavior will surely get better.

Every student has different abilities in absorbing learning material (Himawan & Yunus, 2016). In science learning, physics is considered the most difficult lesson among other science lessons (Rosdianto, 2017). This assumption is because physics contains difficult to understand formula, lack of access to references, and not all students are able to work together in groups (Irwandani, Latifah, Asyhari, Muzannur, & Widayanti, 2017; Yaqin, 2018). Thus, an active learning model is needed as a supporter of physics learning so that the students could be assisted in the learning process.

Active learning models are very important in physics learning to help to minimize the students' difficulties (Ariyani, Nayana, Saregar, Yuberti, & Pricilia, 2018; Balta & Sarac, 2016). Physics is one of the scientific disciplines that not only involve qualitative measurement but also quantitative (Akcay & N. Doymus, 2012). The main purpose of physics learning is to teach problem-solving skills and to understand natural phenomena (Komikesari, 2016; Niss, 2018). Physics is considered as a set of basic knowledge in solving problems. Therefore, a learning model is needed to help to solve the problem in learning physics.

Several models to overcome learning problems have been used by previous researchers such as Guided Inquiry Learning Model, Cooperative Learning, Problem Based Learning (PBL), Discovery Learning and Reading-Concept Map model (Damawiyah, 2015; Husen, 2017; Shalihah, 2016; Zulfa, 2016). In this study, researchers used the Reading-Concept Map Think Pair Share (Remap TPS) learning model by combining reading (reading), drafting a concept map (concept map), and cooperative learning (cooperative learning) using a cooperative model Think Pair Share (Lutfia Kurniawati, 2016; Siti Zubaidah, Tendrita, Ramadhan, & Mahanal, 2018).

Remap TPS learning model is effective for giving different experiences to students as an effort to improve interest in the lessons, then emphasizes science and knowledge transfer, in improving student learning outcomes, and the potential to train students' scientific attitudes (Linda Tri Antika, 2018; Badar Al-Tabrany, 2014; Handayani, Tapilouw, & Wulan, 2018; Harum, Tarmizi, & A, 2017; Yerdelen & Ali, 2016).

Reading-Concept Map Think Pair Share learning model could help students to concentrate on solving problems, to carry out tasks that are considered difficult, and can help someone to estimate the magnitude of the difference in cognitive learning outcomes (Rahmatiah, H, & Kusairi, 2016; Saregar et al., 2018; Miswandi Tendrita, Mahanal, & Zubaidah, 2017). The difference between this study and the previous one is that this research focused on the application of the Reading-Concept Map Think Pair Share learning model to help students to improve their cognitive abilities and scientific attitudes.

METHOD

The method of this research is Quasi-experimental with Non-equivalent Control Group design. This research was implemented in 2 class of Islamic Junior High School in Gisting District, Lampung Province, which involved 58 selected students using a random sampling technique (Sugiono, 2012). The instruments of this research were multiple choice tests consisted of 20 valid and reliable items to measure the students' cognitive abilities as well as an observation sheet to measure the students' scientific attitude.

The increase of students' cognitive abilities can be calculated by the N-Gain test to determine the difference between the score of pretest and posttest (Rahmawati, 2016). S_{max} is the maximum score (ideal score) from the initial test and the final test. $S_{pretest}$ is the initial test score, while the $S_{posttest}$ is the final test score (Sundayana, 2014). Then to answer the hypothesis, the t-test was used (Siregar, 2012). The high and low normalized gain (N-Gain) can be classified in Table 1. (Simbolon & Tapilouw, 2015).

Table 1. The Criteria for N-Gain Test

Category	Criteria
g > 0.70	High
0.30 ≤ g ≤ 0.70	Moderate
g < 0.30	Low

The observation sheet is used to observe the feasibility of the learning model and the students' scientific attitude during the learning process. The result of observation can be calculated as follows (Hamzah, 2014).

$$\% = \frac{\text{total score obtained}}{\text{maximum score}} \times 100\%$$

The following are the criteria for the implementation of the observation sheet (Anwar, 2013).

Table 2. Criteria for Observation

Range Score	Criteria
p > 90%	Excellent
80% < p ≤ 90%	High
70% < p ≤ 80%	Fair
60% < p ≤ 70%	Low
p ≤ 60%	Poor

RESULT AND DISCUSSION

The result of pretest was used to determine the students' initial cognitive abilities, and the result of posttest was used to determine whether there was an increase in the students' cognitive abilities. The increased students' cognitive abilities can be analyzed in Table 3.

Table 3. The Description of Cognitive Ability Improvement in the Experimental Class and Control Class

Class	Pretest		Posttest	
	Highest	Lowest	Highest	Lowest
Experimental	45	10	95	60
Control	60	10	95	60
Average score of the experimental class	31.03		76.70	
Average score of the control class	29.10		71.40	

Based on Table 3, it can be seen that the experimental class and control class show significant differences in cognitive abilities before and after the treatment. The increase in the students' cognitive abilities was analyzed based on the cognitive level namely remembering (C1), understanding (C2), applying (C3), analyzing (C4) (Anderson & Krathwohl, 2010). The following is the recapitulation of the average pretest and posttest scores for each cognitive level.

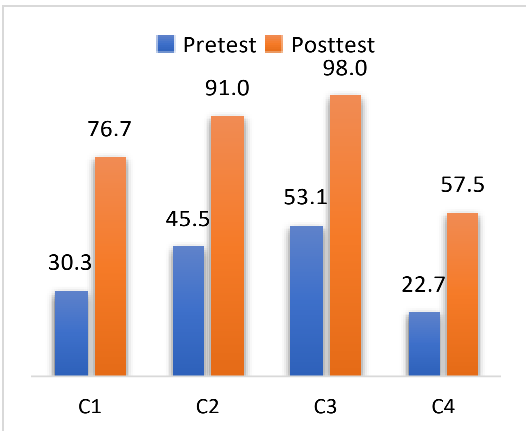


Figure 1. The Percentage of the Learning Outcomes improvement for Each Cognitive Level of the Experimental Class

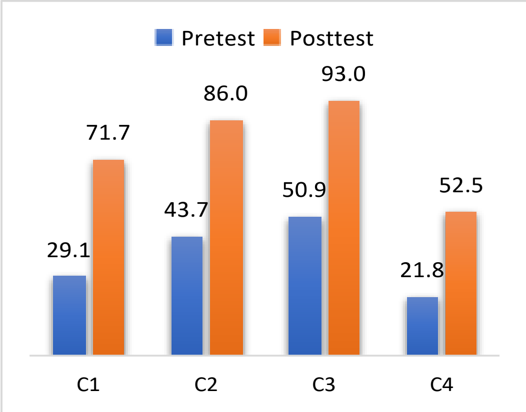


Figure 2. The Percentage of the Learning Outcomes improvement for Each Cognitive Level of the Control Class

The observed students' scientific attitude included the aspects of curiosity, accuracy in doing individual work, accuracy and caution in group work, perseverance and responsibility in working individually or in groups, communication skills in group discussions. The following is a recapitulation of the percentage of students' scientific attitudes.

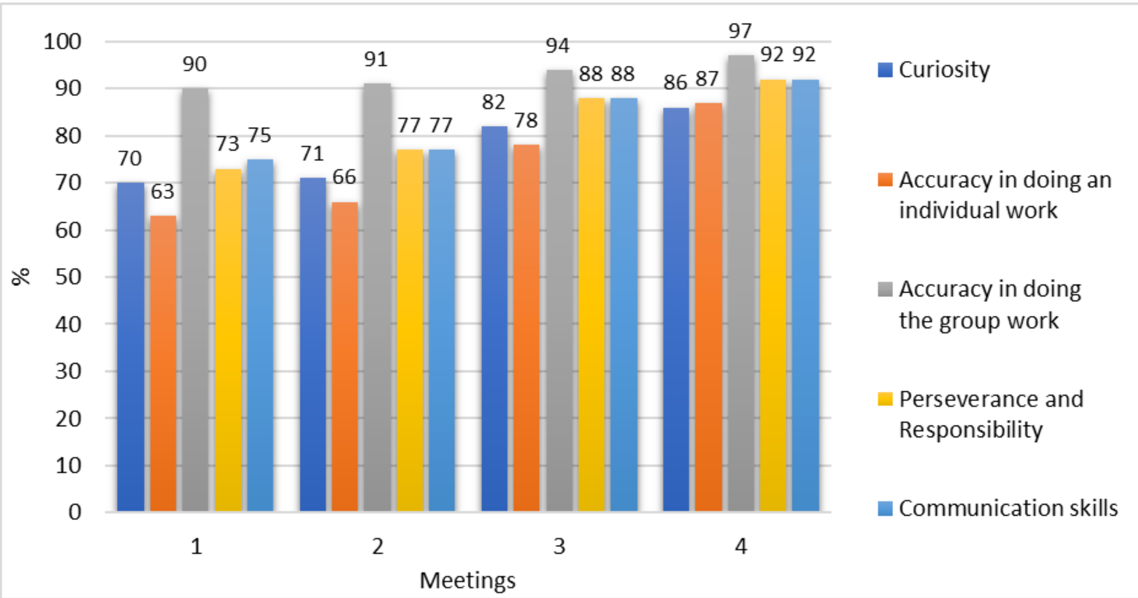


Figure 3. Recapitulation of the Students' Sientific Attitudes

Figure 3 shows an increase in the average score of each aspect of the students' scientific attitudes at each meeting. The obtained average percentage score of the students' scientific attitudes is 81.76% which belongs to the very good category. The increase was due to the implementation of the learning model in accordance with the stages in which participants were able to recognize the initial material and master the concept so that they began to get used to conducting discussions. Each meeting activity was evaluated, and the students could work together in their respective groups.

Hypothetical testing was done to determine the effect of the learning model. Lilliefors test was used to determine the normal distribution (Budiyono, 2009). After the data was determined to be normally distributed, it was then tested for its homogeneity to find out whether the experimental class and the control class had the same variance or not (Saregar, Latifah, & Sari, 2016).

Furthermore, hypothetical testing was done to test whether there was a difference in the effect of several treatments (application of the learning models) on the students' cognitive abilities. The test results can be seen in Table 4.

Table 4. The Results of Normality Test, Homogeneity Test, and Hypothetical Test

	Pretest		Posttest	
Normality Test	$L_{observed}$	L_{table}	$L_{observed}$	L_{table}
Experimental Class	0.149	0,161	0,126	0,161
Control Class	0,150	0,164	0,158	0,164
Homogeneity Test	$F_{observed}$	F_{table}	$F_{observed}$	F_{table}
	0,18	0,185	0,127	0, 185
Result	H_0 is accepted			
Hypothetical Test (t-test)	$T_{observed}$	T_{table}	Sig (0,05)	
	2,088	1,67	0,04	
Result	H_0 is rejected			

The analysis of the normality test in the pre-test and post-test of the experimental class and control class showed that the significant level of 0,05 with $L_{observed} < L_{table}$ so that it can be concluded that the data were normally distributed. Furthermore, the result of the homogeneity test on the pretest and posttest showed that at a significant level of 0.05 with $F_{observed} < F_{table}$, so that it can be concluded that the data was homogeneous. The results of the t-test with a significant level of 0.05 with $T_{observed}$ 2.088 > T_{table} 1.67 with sig 0.04 < 0.05, so that it can be concluded that Remap TPS model affects the students' cognitive abilities.

The results of the analysis of the increase of students' cognitive abilities can be seen in Table 5.

Table 5. Students' Pretest-Posttest N-Gain Score

Class	N-Gain	Criteria
Experimental	0.47	Moderate
Control	0.39	Moderate

Based on table 5, it can be seen that the results of the N-Gain of the experimental class and the control class have different significance in improving student learning outcomes.

Observation sheet was used to determine the application of Remap-TPS model conducted by researchers and supported by the observer. The result of the analysis of the implementation of the Remap-TPS model shows that there was an improvement in each meeting and the model has been implemented well, as shown in Table 6.

Table 6. Percentage of Model Implementation

Meetings	Percentage	Categories
First	84.82%	High
Second	91.07%	High
Third	93.75%	High
Fourth	96.42%	High

There were improvements in each meeting based on the result of the analysis of the implementation of the Remap-TPS.

Remap TPS learning model was proven to be able to improve the students' cognitive abilities and scientific attitudes in motion material. The stages of the model can be seen in Table 7.

Table 7. Stage of Reading Concept Map-Think Pair Share Learning Model

Stages	Students	Scientific Attitudes
Reading	Ask students to read the material determined by the teacher and to understand its contents.	Curiosity, perseverance and responsibility
Concept Map	Ask the students to make concept maps based on reading results.	Curiosity, accuracy in doing an individual work
Think	Ask some questions to the students then ask them to think of answers to the questions given.	Accuracy in doing an individual work, perseverance and responsibility
Pair	Ask the students to pair up and discuss. It is hoped that this discussion can deepen the meaning of the intersubjective answers with their partner.	Accuracy in doing the group work, communication skills
Share	The results of intersubjective discussion are then discussed with all of the members of the class. In this activity, teachers are expected to be able to guide the activities by closing the discussion and helping the students to summarize the discussion with a short question and answer.	Perseverance and responsibility, communication skills

The activity begins with reading to train the students' to understand the meaning of reading material and to expand their knowledge (M Tendrita, 2017). At this stage, the students are able to recognize the initial material and master the concept gradually. Reading is the process of transferring printed information to speak and understand (Lestari, 2016). Reading comprehension is an active process that involves the reader, the text, and activities or goals in order to understand the text or parts of the text, such as using background knowledge to understand the author's messages (Elsinta, 2017; Jian, 2015).

The next activity is to make a summary in the form of concept maps. In making the concept maps, the students are trained to be able to connect one concept with another concept to form a wholesome and interrelated concept (Rosyida, 2016). The concept map is students' cognitive structure for both the developed to dig into and to recognize the students and teacher as well as to see what students have known (Dahar, 2011). Concept maps are schematic devices to represent a set of conceptual meaning embedded in the framework of propositions (Marzetta, 2018).

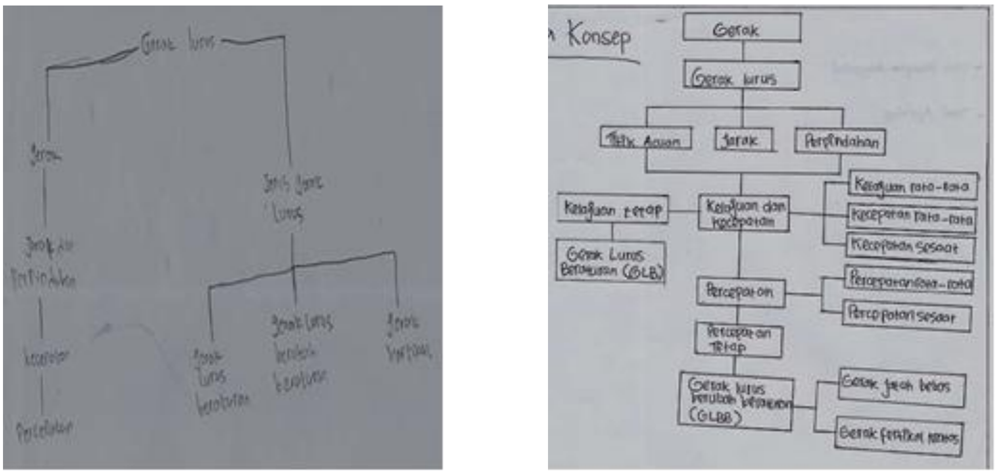
The next stage is the implementation of Cooperative Learning, namely the Think-Pair-Share (TPS) learning model. The TPS model provides an opportunity for students to think independently and share ideas to help them to get new ideas. The existence of cooperation in pairs can improve students' learning outcomes.

The think component in learning helps students to think of theoretical concepts that must be learned from the process of answering the questions asked so that they are able to develop ideas. This activity is combined with the reading process to help students to think of concepts that will be developed later.

The pair component encourages students to compare and differentiate understanding with their partner by training their responses in a small scope before expressing their opinions in front of the class. The opportunity to practice comments with partners tends to increase the readiness to respond to larger groups. At this stage, the activity is combined with making concept maps in pairs so that more opportunities for each pair to form ideas in making concept maps. Finally, the share component helps to generalize ideas delivered in front of the class by giving each other responses.

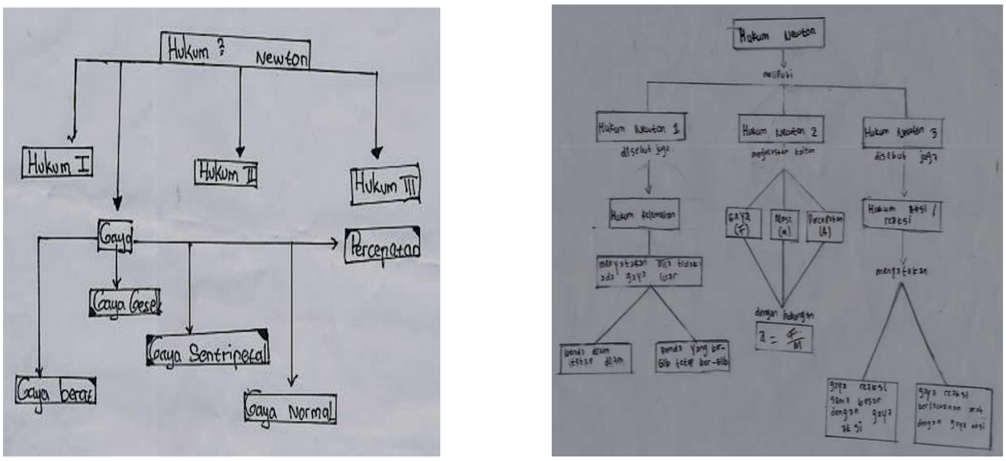
Besides the cognitive learning outcomes that have been increased, the affective domain has also been increased. Affective domain is related to students' attitudes, one of which is scientific behavior that is closely related to science. Students have different attitude abilities. Motivated students have very high independence, while students with low motivation need more support.

In the process of making concept maps, the students are trained to develop drawing patterns and important points on the material. At the first meeting, the students did not yet know how to determine the main topic ideas in the material then they were helped to develop the main ideas into a wider collection of points. The following are examples of concept maps made by students.



(a) (b)

Figure 4. (a) An Initial Example of Concept Map in Straight Motion Material, (b) Example of Concept Map After the Treatment.



(a) (b)

Figure 5. (a) Initial Example of Concept Map in Newton's Law Material, (b) Example of a Concept Map After the Treatment

At the first meeting, the concept map was only limited to parts or kinds of main points. Then after being guided, the concept maps were developed by adding understanding, types, similarities, and the applications of the material. Students were also able to explain the results obtained in front of the class.

The increase of the students' cognitive abilities and scientific attitudes cannot be separated from the influence of the applied learning model. In cognitive ability, the students were able to master each indicator of cognitive aspects from Remap-TPS learning model. Cognitive abilities involve collective intelligence in the form of procedures used to achieve more concepts. This collective intelligence can be improved through the intervention of certain groups (Venisari, Gunawan, & Sutrio, 2015). Ability in the cognitive domain is an ability that restates learned concepts or principles and intellectual abilities (Zulfa, 2016). In cognitive abilities, aspects of C1 involve low-level cognitive skills in the form of recognizing and recalling (Sugiana, Harjono, & Sahidu, 2016).

The results of the pretest and posttest analysis of the students' cognitive abilities have increased from the initial ability with the moderate category of the N-Gain. This increase occurs at every level of cognitive aspects. The students' low initial ability occurs because they have not mastered the learning material. The highest increase occurred in the aspect of understanding (C2) and applying (C3), while the lowest increase occurred in the analyzing aspect (C4).

In the aspect of understanding (C2), the students worked on the problem well. While in the aspect of applying (C3), the students were able to apply and use procedures in certain circumstances, including formulas, theories, and principles of the material that has been studied.

This is supported by previous research by Linda Tri Antika that states there is a relationship between reading interest and learning outcomes by the Remap-TPS model (L.T. Antika, 2017). Siti Zubaidah shows that Remap Coople can improve the discovery skill in the scientific approach (S Zubaidah, 2014).

This cognitive ability is related to the process of reading and making concept maps. Reading is a complex linguistic process that requires cognitive processes. When reading, visual information enters continuously and can be recognized (Latanov, 2016). There will be many ways to develop an understanding of knowledge and information by reading (Diass, 2014). From the process of remembering and understanding, the students can master and recall the meaning of reading and find the main ideas in terms of terms, definitions, and formulas then they will be able to apply them in everyday phenomena and analyze from the discussion process to create concept maps assisted by the teacher.

Each student has different attitude abilities. Motivated students have very high independence while students with low motivation need more support (Kyuk, 2011). Research on the students' scientific attitude is based on the analysis of the observation sheet at each meeting (Purwanti & Manurung, 2015). The difference in students' non-monotonicity lies in the normal development of scientific attitudes (Utami, 2017). The highest improvement was aimed at the experimental class. This was seen during the study. Remap TPS learning model has an important role in improving the students' scientific attitude.

The aspect of students' curiosity can be seen from enthusiasm, motivation, activeness, attention, and responses from each task/group discussion carried out from the process of reading and making concept maps. On aspects of accuracy in carrying out individual work, Remap learning model helps students in managing time and is critical in doing the assignments given. The students are not in a hurry and are very careful in making concept maps. Aspects of accuracy and perseverance in group work experienced the highest increase compared to other aspects because this aspect was considered quite influential in group discussions. The process of creating a concept map trains students to carry out tasks well and according to procedures, work together, creative and innovative as well as satisfying work results. Perseverance and responsibility in working individually or in groups by students is enhanced through submitting assignments on time, returning the tools in place, seriousness in carrying out tasks, and diligent in the activities carried out including reading material.

Finally, the guiding process in the discussion trains the communication skill in group discussions in the form of asking, respecting others, and using polite language when expressing opinions/ criticizing friends' opinions. Students can be active in conducting discussions because students are required to work together in solving problems, dare to take risks in solving problems, honest, confident, and critical. Students show greater curiosity and can develop communication activities between groups by providing feedback on learning. Cognitive abilities and scientific attitudes are very closely related because they can increase self-confidence and basic learning independence.

CONCLUSION

This study concluded that the application of the Reading-Concept Map Think Pair Share (Remap TPS) learning model influences the students' cognitive abilities and scientific attitudes. The application of this learning is very helpful in the process of science learning activities, especially physics compared to conventional models. Therefore, this learning model can be used as an alternative in the teaching and learning process in the classroom. This learning model can help teachers to achieve national education goals in Indonesia, especially the one related to the cognitive abilities and scientific attitudes.

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