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Concept map learning strategy, with a guided discovery approach to metacognitive skills IPA biology on primary school biology at Siau Island sitaro regency

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Abstract
Science learning in elementary school should be an opportunity for students to naturally cultivate curiosity because science is not just a collection of knowledge about things or living things, but concerns how to work, how to think, and how to solve problems (problem solving). Research has been conducted to obtain scientific data on the influence of learning strategy of concept map with guided discoveri approach to metacognitive science skill of SD Biology in Siau Island of Sitaro. This research was done by using quasi experiment approach with pre-post nonequivalent control group design design with factorial pattern 4 x 3. The data obtained were analyzed using ANACOVA inferential statistic type and followed by LSD test at 0.05 significance level. The results show that the Discovei + learning strategy concept map is more effective in improving students' metacognitive skills in Biology Science lessons in elementary school in Siau Island. Although the score of students 'metacgonitive skills on the Discoveri + learning strategy was a higher concept map, the results showed that the average metacognitive skills of the students on the Discoveri + learning strategy of concept map were not significantly different from the students' metacognitive skills in conceptual learning learning strategies.

Keywords: concept map, gioded discovery, IPA biology, Sitaro

Introduction

The meaningfull learning concept that Ausubel initiated in 1963 can be an alternative as a basis for learning planning. Dahar (1988) [13] explains that meaningful learning is a process of linking new information to relevant concepts contained in a person's cognitive structure. Furthermore, Corebima (2006) [10] explains that any learning strategy used during learning should generally lead to meaningful learning, so that the end result obtained later on is also meaningful. Meaningful learning involves assimilating new concepts and linking them to existing cognitive structures (Erdem *et al.*, 2008) [16]. With meaningful learning, the learning can support the empowerment of high-level thinking components. One of the most empowered thinking-level components is metacognitive skills.

Metacognition refers to the conscious learners' abilities and monitors the learning process (Peters, 2000) [37]. Metacognitive can also be interpreted as thinking about one's own thingking which means thinking about own personal thinking (Darling, No years), or thinking about learning yourself (Nur, 1998) [33]. Metacognitive is a broad term and includes knowledge and regulation of cognitive processes (Duque *et al.*, 2000) [15]; Lonie & Dolinsky, 2002) [25]. Metacognitive skills are generally divided into two types: self-assessment or self-assessment skills or self-management skills or self-managing cognitive development (Rivers, 2001) [39]. According to Peters (2000) [37] metacognitive skills are useful for making students develop independent learners, encouraging them to become classroom managers, themselves and assessing their own thinking and learning. The metacognitive benefits of cognitive development can be demonstrated from the results of the 7-12-year-old study, conducted by Piaget through demonstrations, children's abilities in a verbal process, tasks, consciously performed (Darling, No-year).

One type of learning strategy included in meaningful learning is the concept map. Concept maps are based on meaningful learning principles, when the learner constructs a hierarchy of knowledge and seeks relationships between concepts (Novak & Gowin, 1984, in Tsai *et al.*, 2001) [1]. Novak & Canas (2008) [8] defines concept maps as a tool in the form of graphs to organize and represent knowledge. Thus, the concept map is a representation of the learner's learning structure with its emphasis on the relationship between concepts. Concept maps are strategies that can help students to organize their cognitive structure into more powerful (Kinchin, 2005 in Chiou, 2008). McClure *et al.* (1999) [27] explains that concept maps have broad functions, including: 1) learning strategies, 2) learning strategies, 3) curriculum planning strategies and 4) tools for evaluating student mastery. Meanwhile, the Sitaro Islands Regency consists of 3 island clusters namely Siau Archipelago, Tagulang Island and Biaro Islands with an area of about 70 Km2 and the district capital located at Ondong Siau. Institutionally, the District of Sitaro Islands consists of 10 sub-districts, of which 6 districts are located in the Siau archipelago, 3 sub-districts are located in the Tagulandang archipelago and 1 sub-district are on the Biaro archipelago. Sitaro district also oversees 4 urban villages and 80 villages. Geographically, the Sitaro archipelago consists of 47 large and small islands, where the inhabitants only inhabit 10 islands, while the remaining 37 islands are uninhabited islands

Research Methods

1. Research Subject

Subjects in this study were all teachers of IPA SD in Sitaro Archipelago District of North Sulawesi.

2. Research Instruments

The instrument used in this study is a questionnaire for teachers. According to Singarimbun and Efendi (1987) [43] that in survey research, the use of questionnaires is the principal for data collection. The questionnaire before it was given to the teacher, has been validated by the expert as well as the Promoter.

3. Data Collection

Data collection in survey research was conducted by distributing questionnaires of science teachers to SD in Sitaro Islands. To complete the data obtained through the questionnaires, interviews were conducted with several SDA teachers in Sitaro Islands. To obtain the data of each varaibel, the data collection steps are described as follows: 1. Initial test (pretest), conducted to determine the level of metacognitive skills of students before applied learning strategies. 2. The final test (posttest), conducted to determine the metacognitive skills of students after following all learning activities. 3. Retention test, to determine retention power after an interval of two weeks after the implementation of learning 4. Observation, conducted through observation of cooperation during learning activities with observation sheet, conducted by researchers and teachers during facilitating student learning. 5. Questionnaire, given to teachers and students to find out their response to the implementation of learning strategies. 4. Data Analysis the data collected will be analyzed using the following statistics: 1. Descriptive analysis, to see the picture related to the percentage of metacognitive skills of students before and after the learning and retention of students. 2. Analysis of Covariance, to see the effect of learning strategies and geographical position on the metacognitive skills of students and retention of ssiwa. If there is a significant effect, proceed with Least Significance Difference (LSD) different test. To facilitate the process of data analysis then used the program SPSS 16 for Microsoft Windows.

Results and Discussion

Student's Metacognitive Skills Profile

Measurement of students' metacognitive skills is done before (pretes) and after learning (postes). The collected data is then analyzed by using descriptive statistics to find out the mean mastery of concept on each independent variable and moderator. The results of the complete analysis can be seen in the Appendix (....), while the summary is presented in the following table.

Table 1: Average Metacognitive Skills Scores before learning (pretes) and After Learning (postes)

Variabel	Pretest	Keterangan	Postest	Keterangan
Concept Map	6,42	Very Less	71,71	Good
Guided Discovery	7,08	Very Less	66,94	Good
Disc. + Concept Map	6,61	Very Less	75,37	Good
Convensional	7,20	Very Less	62,32	Good
School in	7,61	Very Less	68,84	Good
District (Kab)	6,54	Very Less	71,26	Good
Village (Desa)	6,40	Very Less	66,44	Good
Concept Map * Kab	6,91	Very Less	69,82	Good
Guided discovery * Kab	9,17	Very Less	65,67	Good
Disc + concept map * Kab	6,95	Very Less	74,36	Good
Convensional * Kab	7,92	Very Less	61,00	Good
Concept Map * Kec	6,45	Very Less	72,14	Good
Guided discovery * Kec	6,62	Very Less	69,96	Good
Disc + concept map * Kec	6,29	Very Less	79,21	Good
Convensional * Kec	6,82	Very Less	63,23	Good
Concept Map * Desa	5,92	Very Less	72,67	Good
Guided discovery * Desa	6,00	Very Less	61,67	Good
Disc + concept map * Desa	6,64	Very Less	69,00	Good
Convensional * Desa	7,20	Very Less	61,90	Good

The result of the descriptive analysis of the students' concept, concept on the pretest and posttest above shows that the average mastery of the students concept on the implementation of pretest is in very less category while in postes implementation is in good category. The above results also show that the average mastery of student concepts in schools in villages learning with conventional learning strategies lies in the sufficient category. Visualization, students' mastery profile is presented in the following figure.

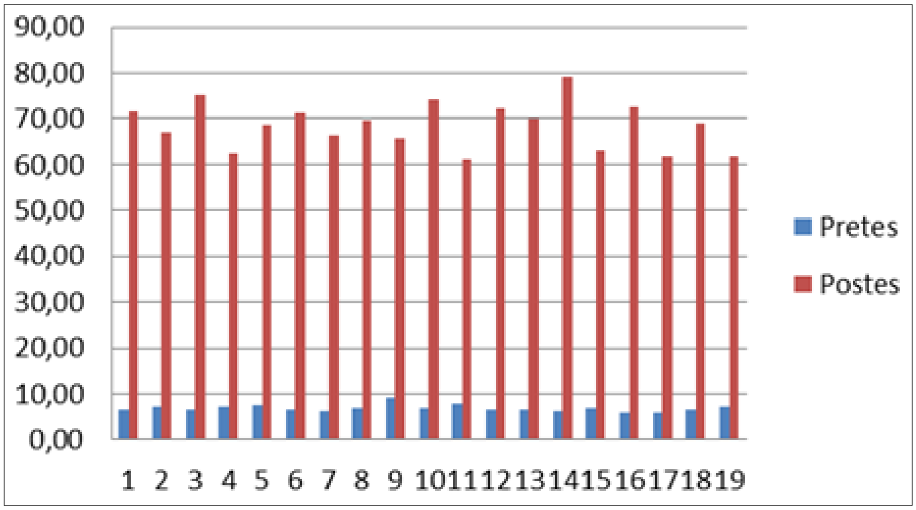

Fig 1: Average Profile Mastery of student concepts Before and After Learning

Explenation

1.	= Concept Map (CM)	11.	= Kab * Konvensional
2.	= Guided Discovery (GD)	12.	= Kec. * CM
3,	= Disc. + CM	13.	= Kec. * GD
4.	= Conventional	14.	= Kec * GD + CM
5.	= School in	15.	= Kec. Konvensional
6.	= District	16.	= Desa * Peta konsep
7.	= Village	17.	= Desa * GD
8.	= Kab. * CM	18.	= Desa * GD + CM
9.	= Kab * GD.	19.	= Desa Konvensional
10.	= Kab. * GD + PK		

B. Profile of Retention Score Mastery of Student concepts

Retention scores were obtained through retention tests conducted 2 weeks after postes. Retention test is conducted to determine the retention of students on learning materials that have been taught with learning strategies used in this study. The instrument used to determine student retention is similar to the instrument used in the final cognitive learning outcome test (postes). The data obtained are then analyzed descriptively to find out the retention student profile. The results of the complete analysis can be seen in the summary of the results of the analysis can be seen in the following table.

Table 2: Average Score Retention Concept Mastery Before (pretes) and After Learning (postes)

S. No.	Variabel	Postes	Retensi	% peningkatan	% daya retensi
1.	Concept Map	74,13	78,49	5,88	105,88
2.	Guided Discovery	71,12	78,52	10,40	110,40
3.	Disc. + Peta konsep	75,82	83,75	10,46	110,46
4.	Conventional	65,18	70,34	7,91	107,91
5.	School in	71,21	78,19	9,81	109,81
6.	District	73,91	80,32	8,66	108,66
7.	Village	68,33	73,78	7,97	107,97
8.	CM * Kab	73,82	81,00	9,73	109,73
9.	GD. * Kab	70,17	76,92	9,62	109,62
10.	Disc + CM * Kab	74,68	82,18	10,04	110,04
11.	Konvensional * Kab	63,50	69,58	9,58	109,58
12.	CM * Kec	75,23	77,82	3,44	103,44
13.	GD. * Kec	73,69	82,46	11,90	111,90
14.	Disc + CM * Kec	79,50	88,08	10,80	110,80
15.	Konvensional * Kec	66,77	71,82	7,56	107,56
16.	CM * Desa	72,42	77,42	6,90	106,90
17.	GD. * Desa	66,50	71,58	7,64	107,64
18.	Disc + CM * Desa	70,09	77,45	10,51	110,51
19.	Konvensional * Desa	63,70	68,00	6,75	106,75

Based on the results of descriptive analysis, it is known that generally mastery of the concept of students have increased in retention tests. The highest increase of students' conceptual mastery in the retention test was seen in the group of students residing in the district school and the learning strategy Disc + + concept map that increased by 9.51% so that the retention capacity was 109.51%. In the meantime, the descriptive analysis result also shows that the most low level of students' concept of comprehension on the retention test is seen in the group of students residing in the school in the village and the conventional learning strategy has increased by 4.37% so that the retention capacity becomes 104.37%.

C. Test Result Consistency of Implementing Learning Strategy

Consistency testing of the application of learning strategy is done to know the consistency of applying the learning strategy on the SD Biology science lesson in Siau Island. Consistency test is conducted on the learning strategy that becomes the treatment in this research. The consistency of learning test was done by using regression analysis using pre concept score score, mid and post score as independent variable and metacognitive skill score data of pre, mid and post as dependent variable. A summary of the results of the consistency of learning test on each learning strategy is described as follows:

1. Consistent implementation of learning strategy Disc + concept map

The result of consistency test of application of learning strategy Disc + concept map can be seen in Figure 4.4. From result of regression analysis assisted by program of SPSS for windows yield regression equation as follows:

Y1 (prates) = 1.1834x + 8.7041 R2 = 0.0766

Y2 (prates) = 1.3571x + 3.976 R2 = 0.857

Y3 (pascates) = 0.7149x - 21.968 R2 = 0.7244

Y = mastery of concepts and x = metacognitive skills

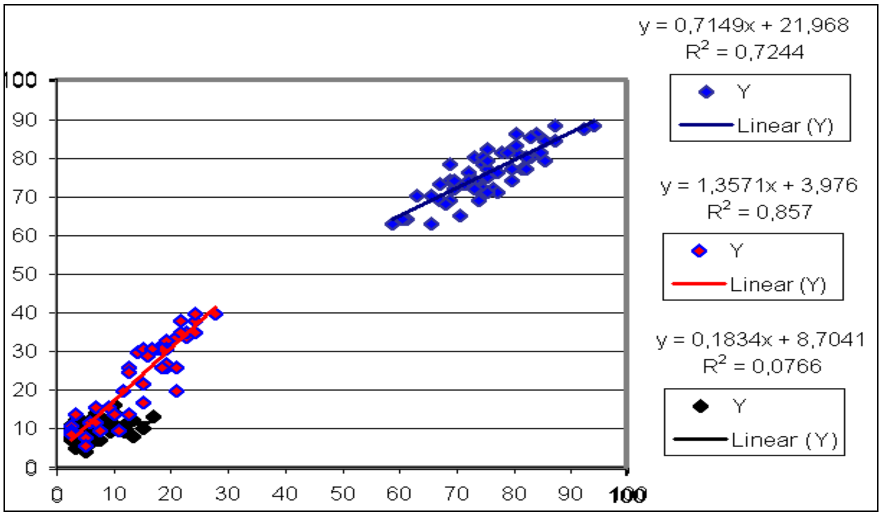

Fig 2: Results of Analysis of Alignment and Constraints of Regression Lines On Application of Disc Learning Strategies + concept maps

The equation of the regression line obtained results: Ypra, and Ymid: not parallel; Ypra and Ypasca: not parallel; Ymid and Ypasca: not aligned. It can be interpreted that the implementation of Disc + concept map strategy has not been done consistently from the beginning to the end of learning.

2. Consistency of application of conceptual learning mapping strategy

The result of consistency test of conceptual concept learning strategy can be seen in Figure 4.5. From result of regression analysis assisted by program of SPSS for windows yield regression equation as follows:

Y1 (prates) = 0.1832x + 9,975 R2 = 0.0665

Y2 (prates) = 0,122x + 32,616 R2 = 0,0176

Y3 (pascates) = 0,5388x -35,476 R2 = 0,5971

Y = mastery of concepts and x = metacognitive skills

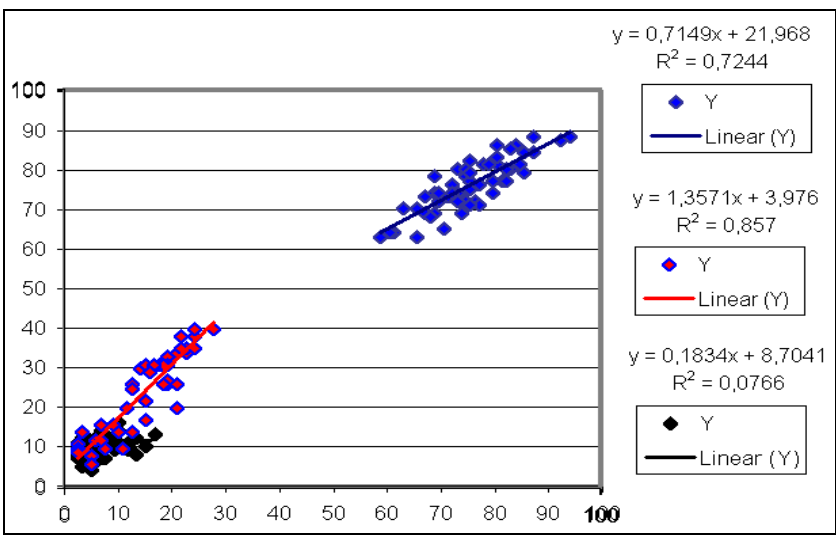

Fig 3: Results of Analysis of Alignment and Constraints of Regression Lines On Implementation of Learning Strategy concept map.

The equation of the regression line obtained results: Ypra, and Ymid: not parallel; Ypra and Ypasca: not parallel; Ymid and Ypasca: not aligned. It can be interpreted that the implementation of the concept map strategy has not been done consistently from the beginning to the end of the lesson.

3. Consistent implementation of learning strategy Diskovery

The result of consistency test of application of learning strategy of Diskovery can be seen in Figure 4.5. From result of regression analysis assisted by program of SPSS for windows yield regression equation as follows:
Y1 (prates) = 0,5205x + 8,234 R2 = 0,2911
Y2 (prates) = 0.9877 + 14.452 R2 = 0.749
Y3 (pascates) = 0.7385x + 21.67 R2 = 0.8705
Y = mastery of concepts and x = metacognitive skills

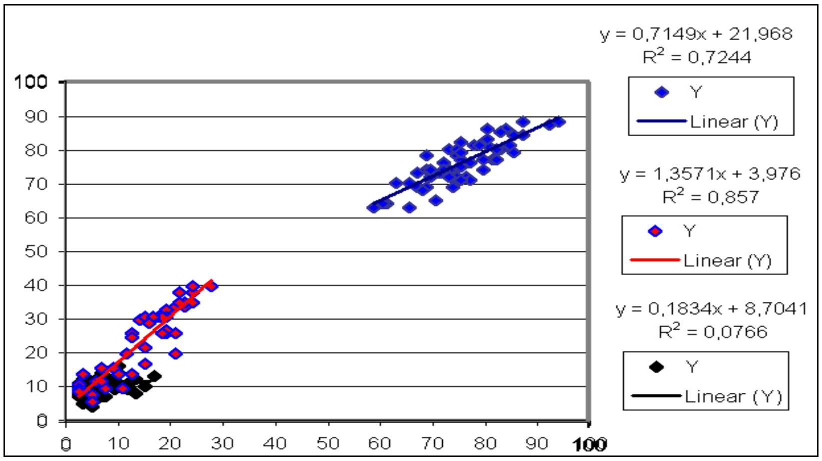

Fig 4: Results of Analysis of Alignment and Constraints of Regression Lines On Application of Discovery Learning Strategies.

The equation of the regression line obtained results: Ypra, Ymid and Ypost: not parallel; Ymid and Ypost: parallel; Ypre, Ymid and Ypost: not aligned. It can be interpreted that the implementation of discovery strategy has not been done consistently from the beginning to the end of learning.

4. Consistent application of conventional learning strategies

The result of consistency test of application of conventional learning strategy can be seen in Figure 4.5. From result of regression analysis assisted by program of SPSS for windows yield regression equation as follows:
Y1 (prates) = 0.4726x + 7.6532 R2 = 0.2624
Y2 (prates) = 0.9188 + 13.516 R2 = 0.7596
Y3 (pascates) = 0.8452 x + 21,514 R2 = 0.8794
Y = mastery of concepts and x = metacognitive skills

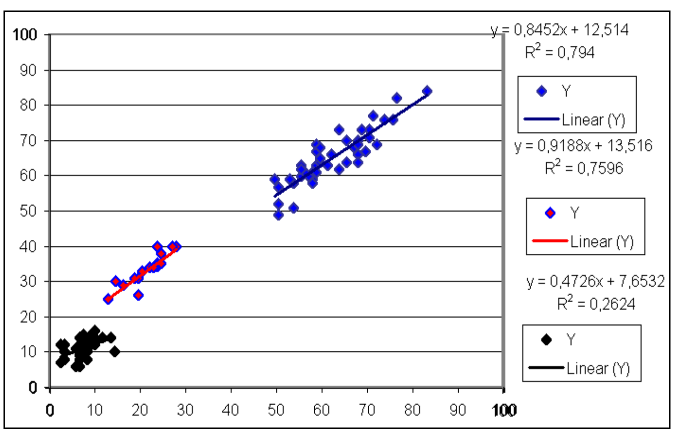

Fig 5: Results of Analysis of Alignment and Constraints of Regression Lines On Application of Conventional Learning Strategies.

The equation of the regression line obtained results: Ypra, Ymid and Ypost: not parallel; Ymid and Ypost: parallel; Ypre, Ymid and Ypost: not parallel. It can be interpreted that the application of conventional strategies has not been done consistently from the beginning to the end of learning.

Discussion

The results of this study also found that learning strategies affect students' metacgonitive skills. Learning strategy Discovei + concept maps are more effective in improving students' metacognitive skills in Biology Science lessons in elementary school in Siau Island. Although the score of students 'metacgonitive skills on the Discoveri + learning strategy was a higher concept map, the results showed that the average metacognitive skills of the students on the Discoveri + learning strategy of concept map were not significantly different from the students' metacognitive skills in conceptual learning learning strategies. Furthermore, it is also seen that the average metacognitive skills of students on the Discoveri + learning strategy concept map differ significantly with metacognitive skills in guided discovery. Thus, it can be concluded that the effective learning steps to influence the students' metacognitive skills are the conceptual concept learning steps.

Cassata & French (2006) [8] explain that concept maps are metacognitive instruments that encourage students to think about what they know through the visual representation of relationships between concepts. Called as a metacognitive tool because through concept maps provides children the opportunity to monitor their own knowledge and control their thinking. In planning to create a map, students must first know the knowledge that has been obtained before, by asking "what do I know about...?" McAleese (1998, in Cassata & French,

2006) [8]. It means that by teaching students to create concept maps, students will always become aware with their knowledge at all times. This is because by creating concept maps, students become aware of the extent to which their cognitive structure and can alter the cognitive structure by relearning the related material and integrating it in the concept map.

In addition, another important aspect in conceptual learning strategy that helps students to improve their metacognitive skills is that students should make important decisions about concept planning that will be the focus of attention. In other words the student must decide where the concept will be placed on the map, and in what ways concepts can be linked to each other. By rearranging items on the concept map and hearing the classmates' experience of conceptual relationships, students are able to consider perspectives, and the ways that the ultimate goal can be achieved. The concept map provides powerful tools for checking reasoning and visual suggestions to correct or make corrections if errors are detected (Gallenstein, 2005) [18].

Conlusion

Learning strategies affect students' metacgonitive skills. Learning strategy Discovei + concept maps are more effective in improving students' metacognitive skills in Biology Science lessons in elementary school in Siau Island. Although the score of students 'metacgonitive skills on the Discoveri + learning strategy was a higher concept map, the results showed that the average metacognitive skills of the students on the Discoveri + learning strategy of concept map were not significantly different from the students' metacognitive skills in conceptual learning learning strategies.

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