RESEARCH ARTICLE

THE EFFECTIVINESS OF BIOLOGY TEXTBOOK-BASED MNEMONIC STRATEGIES-ASSISTED METHOD MIND MAPPING AGAINST LEARNING RETENTION OF STUDENTS TO THE STUDY OF BIOLOGY IN SENIOR HIGH SCHOOL

Helen Widia W.P and Dwi Wahyuni. Supeno.
University of Jember, Jember, Indonesia 68121.

Manuscript Info	*Abstract*
	Biology is one of the subjects at the secondary school that is studied by means of memorizing the material. As for the Biological material at the level of secondary school that demands a lot of memorizing the material one, namely the nervous system. The material is not only the nervous system require an appropriate learning strategy in the study, but also required also a Biology textbook that is able to help students in remembering the concepts found in the nervous system. By using this textbook, the students are expected to be given to the study of Biological material especially on the nervous system more easily and can be stored in their long-term memory. The purpose of this research is to know the effectiviness Biology textbook-based mnemonic strategies-assisted method of mind mapping against learning retention of students. This research is research development. The subject of research is the students of Class XI SMAN Pakusari Jember Indonesia 2017/2018 academic year. The technique of data collection was in the form of test. The technique of data analysis was using the formula recognition method. The results showed that the textbook Biology-based mnemonic strategies-assisted method of mind mapping effective against retention of student learning with student retention criteria very well.

Introduction:-
Biology is a natural science of living things or the scientific study of life. Biology concepts usually a principle theory (science products) which contained a number of values and attitudes (Rustaman, 2013). Biology is also one of the subjects at the middle school level are learned by rote material (Halim, et.al., 2012). As for the Biological material at the level of secondary school that demands a lot of memorizing the material one, namely the nervous system.

The nervous system is one of the many biological materials contain concepts that should be remembered by the students (Halim, et.al., 2012). As for concepts on the nervous system, among others, relate to the structure, functions, and processes as well as abnormalities can occur in diseases of the nervous system. The nervous system is also one of the materials considered difficult by students, because the content of the nervous system is necessary for considering the ability given the existing concepts (Hidayati, 2015). The material is not only the nervous system

---

Corresponding Author:- Helen Widia W.P.
Address:- University of Jember, Jember, Indonesia 68121.

require an appropriate learning strategy in the study, but also required also a Biology textbook that is able to help students in remembering the concepts found in the nervous system (Hidayati, 2015).

Textbook Biology right now there are still many who have not yet used the strategy to memorize or remember, so some students feel hard and boring Biology lessons (Halim, et.al., 2012). It's hard because a lot of memorizing the material load should be remembered and boring because in general, the lessons taught in monotonous recitation and memorization. It makes the subject matter cannot be remembered properly, so it will affect student learning retention. (Halim, et.al., 2012).

Based on the results of observation on SMAN Pakusari Jember Indosensia about a Biology textbook used for this, indicating that the used textbook only contains material by displaying many writing and lack of pictures supports, making students less interested and the difficulty in studying and considering the existing material. It is supported by the results of the now students regarding textbook used primarily on the nervous system material that showed that students expressed less satisfied with the textbook/Handbook of the nervous system that used the previous teacher. This shows that students feel less happy and feel nervous system material is less interesting, one of them is because they are less satisfied with the textbook/Handbook of the nervous system that used the previous teacher. Based on the results of the next question form previously used to books shows that previously used, the books are not yet using the techniques given and not showing coverage of ideas, ideas, concepts, and mind. Then students also state that felt the difficulty of the material on the nervous system, because a lot of demands on the material, and then memorize nervous system itself there are many terms that must be memorized by students. If it must be memorized one after the other parts of the nervous system, it will be difficult, so that students will have an impact on students learning retention.

Based on these teachers need to optimize student learning retention the study of biology. In addition, teachers also need to optimize memory and memory students to more easily understand the material the nervous system during the learning process. To optimize the mnemonic strategies, teachers need to use a textbook that is able to enhance the student's memory, as well as being able to increase the motivation of students so as to achieve the expected learning goals. As for the textbook Biology teachers can use i.e. textbook by using mnemonic learning strategies.

Learning strategies are the ways mnemonic to memorize or commonly known with the method "Jembatan Keledai". Memonic strategy are tools help memory to remember information becomes easier (Pal, 2014). Basically, the mnemonic strategies related to the techniques or strategies to help with memory helped form the association that scientifically there are no. The techniques or strategies commonly used mnemonic strategies including the method of loci, a mnemonic acronym, acrostic, images, keywords, methods of verbal mnemonic, etc. (Bakken, 2011; Pal, 2014; Maghy, 2015). Based on the research results, the strategy of mnemonic can be very effective and can make students motivated and more interesting class (Georger, 1997). Mnemonic strategies was also able to increase the retention of students. It is as expressed Bakken & Simpson (2011) stating that the mnemonic technique has been proven to help individuals remember information by making it easier to remember and more concrete. In addition, based on the research results, the strategy also proved to be mnemonic was able to increase student learning outcomes (Mahadiani, et al., 2012).

Mnemonic strategies commonly used to remember information that nature per item or per section. Mnemonic strategies to optimize the content of the nervous system which is structurally necessary, considering the methods that can be used to recall material to structural nature or organized. As for one example of a method given the method can use the learning mind mapping. According to Buzan (2011:4), mind efficiency of mapping is a way of developing the activity of thinking in all directions, capturing various thoughts in different angles. This method of learning mind mapping is a way to put information into the brain and took it back to the outside of the brain. Mind mapping shapes like a map of a street in a city that has a lot of branches. Through a map of learners can plan a route that the fastest and precise and knowing where it will go and where it is located (Herdian, 2009:1). DePorter, et al. (2005:175-176) say that mind maps (mind mapping) are a method of noting the creative that we keep a lot of information. Mind mapping is one of the learning methods that have been proven to be able to optimize the results of the study.

Research Method:-

This type of research is research and development. This research includes research development because developed a textbook. Textbook developed i.e. textbook based mnemonic strategy assisted method mind mapping for high school students of Class XI in sub subject of the nervous system. Research on the development of textbook Biology uses prototype development model McKenney (2001) which consists of (1) the needs and context analysis; (2) design, development and formative evaluation; and (3) of semiautomatic summative evaluation. The research design used was one group pretest – posttest design by using one of the selected sample group intentionally, then given preferential treatment in the form of pre-test (preliminary test) O followed by administering treatment (treatment in the process of learning to use the textbook Biology-based mnemonic strategies using mind mapping method at each stage of its implementation) X, and at the end of the learning sample is given the post-test 1 (final test) O2. Then 2 weeks after the post-test 1 test done retention that is given the post-test 2 (retest). This design is used to find the effectiveness of biology textbook-based mnemonic strategies-assisted method of mind mapping.. The subject of this development is research grade XI SMAN Pakusari Jember Indonesia 2017/2018 academic year. Data analysis techniques are used to find out the effectiveness of biology textbook-based mnemonic strategies-assisted method of mind mapping against learning retention retention that is using the formula recognition method (Sawrey and Telford, 1988). Basically the textbook Biology-based mnemonic strategies-assisted method of mind mapping is said to be effective, if the minimum criteria of learning retention criteria of "good".

Findings and Discussion:-

This research is the development of research that aims to obtain an effective textbook product against the retention of students. This textbook is designed using mnemonic strategies with the tricks in remembering/memorize material, especially on the nervous system. On textbook developed this, use some kind of mnemonic strategies, such as using type loci, the kind of songs/chants, a type of acronym, acrostic, type the type of grouping, the kind of chunking, the types of pictures, and the type of the keyword. Types of mnemonic loci on this textbook was used to make it easier to remember the material components of the nervous system that is by imagining/analogies with material objects/places that are familiar to us. Types of mnemonic songs on this textbook applied by singing the song lyrics cell parts with the tune of "Asal Kau Bahagia". The next type of mnemonic groupings, i.e. by grouping/summarize the mechanism of impulse so that transfers are more concise and easier to remember. Types of the mnemonic acronym, acrostic, chunking, and images in this book are used to make it easier for students to remember the material classification of the nervous system. The next type of mnemonic keyword is used in this book to make it easier for students to remember the material on the nervous system disorders, namely, by writing 4 important keywords on each of the nervous system abnormalities. In addition to a textbook is also designed with mind mapping sheets that can stimulate the memory and creativity the students so that students are more motivated to learn and understand the material. Mind mapping sheets are displayed on some of the material found in the nervous system that helps students remember the material is structural. In addition, the textbook is also displayed on the task to make mind mapping in accordance with creation or material that has been remembered by the students. With the collaboration of several types of mnemonic methods and methods of mind mapping is expected to make this textbook is more interesting and more ease in remembering the material students, who will have an impact on the results of his studies.

Prior to test effectiveness, this textbook has previously been through the stages of validation. Validation in this research was conducted by 6 validators, i.e. 3 validator experts originating from Science Education Master's degree Jember University lecturer and 3 validator users/biology teacher. Test the effectiveness is implemented to student grade XI of State SMAN Pakusari Jember Indonesia in the 2016/2017 academic year by using one group pretest – posttest design. Then given preferential treatment in the form of pre-test (preliminary test) O followed by administering treatment (treatment in the process of learning to use the textbook Biology-based mnemonic strategies using mind mapping method at each stage of its implementation) X, and at the end of the learning sample is given the post-test 1 (final test) O2. Then 2 weeks after the post-test 1 test done retention that is given the post-test 2 (retest). Test the effectiveness of the implementation is done in 2 cycles in accordance with the plan of learning that has been designed and has been validated by the validator. Where in the cycle 1 the material being taught regarding nerve cells (neurons), all kinds of nerve cells, the principle of motion, the impulses of ordinary transfers, and reflex motion. While on cycle 2 studies the material about the classification and abnormalities in the nervous system. Study on cycle 1 and cycle 2, conducted using the textbook Biology-based mnemonic strategies using mind mapping method at each stage of implementation. When learning is in progress, then the observer will conduct an assessment regarding the course of learning and will be used as a reflection for the next learning cycle. By doing this the

effectiveness test, it will be known how the effectiviness of biology textbook-based mnemonic strategies-assisted method of mind mapping against learning retention of students. Data retention of students at SMAN Pakusari After the use of the textbook biology-based mnemonic strategies-assisted method of mind mapping can be seen in table 1.

Table 1:-The average retention of students at SMAN Pakusari Jember Indonesia After the use of textbook Biology-based mnemonic strategies-assisted method of mind mapping

No.	Aspects	The average value of Post-Test 1	The average value of Post-Test 2	$\% \text{ Retensi} = \frac{Posttest\ 2}{Posttest\ 1} \times 100\%$	Category Score Retention
1	**Cognitive**	83,86	80,86	96,48	very good

The effectiveness of the Biology textbook-based strategy mnemonic-assisted methods of mind mapping is also supported by data retention of students based on the results of the retest is done 2 weeks after the posttest. Retention is the ability given the knowledge after an interval (Djubaedah, 2013; Utami, et al., 2015). Based on the analysis of the data and table 2 shows the average value of the post-test 1 students at SMAN Pakusari i.e. of 83.86, the average value of post-test 2 of 80.86, the average score of 96.48 retentions by category. From the results, it can be concluded that retention, the textbook of biology-based mnemonic strategies using mind mapping method is effective for use in stimulating memory students/retention. With the mnemonic strategies and methods of mind mapping is shown in the book will make students more interested and more easily given in the study of the material to be studied. As also expressed by Komalasari (2010:15) States that one of the construct knowledge someone needed the ability given and revealed that her experience based on the back. Mnemonic strategies are also a way to improve one's memory through the process of mind in interpret one's words, ideas or ideas, and a description so that information is more easily stored in long-term memory (Mahadiani, et al, 2012). It is as expressed Bakken & Simpson (2011) stating that the mnemonic technique it self has been proven to help individuals remember information by making it easier to remember and more concrete. In addition, it is amplified due to the collaboration with mind mapping method in the textbook so that makes the material contained in the book are more easily remembered by the students. This statement is in accordance with expressed by DePorter, et al. (2005:175-176) say that mind mapping is a method of noting the creative that we keep a lot of information. In addition Bunzan (2007:19-20) states that the methods of mind mapping is a form of record keeping that allows creative students remember and are able to create meaningful learning.

Based on the results and a discussion of Biology textbook-based mnemonic strategies-assisted method of mind mapping concluded that textbook that has developed has been effective against the retention of student learning, and can be used in the real learning.

Discussion:-
This research is research development. The purpose of this research is to know the efectiveness of Biology textbook-based mnemonic strategies-assisted method of mind mapping against learning retention of students. To achieve that goal, conducted trials using the textbook Biology-based mnemonic strategies-assisted method of mind mapping in learning as learning resources.

Learning to use the textbook Biology-based mnemonic strategies-assisted method of mind mapping will facilitate students in considering an information because the textbook was designed using mnemonic strategies with the tricks in remembering/ memorize the material. In addition to a textbook is also designed with mind mapping sheets that can stimulate the memory and creativity the students so that students are more motivated to learn and understand the material.

Based on the results of the study, the researchers suggested that for advanced researchers, we recommend that you research this development is done on a broader scale so that the textbook developed more proven their effectiveness.

Conclusion:-
Based on the results and discussion may be inferred that the textbook Biology-based mnemonic strategies using mind mapping methods effective against the retention of learned students with student retention criteria very well.

Bibliography:-

1. Bakken, J. P., & Simpson, C. G. 2011. Mnemonic strategies: success for the young-adult learner. The Journal of Human Resource and Adult Learning. 7 (2).
2. Buzan, Tony. 2007. The book is smart Mind Map for the child. Jakarta: PT Gramedia.
3. Georger, A. J. 1997. Memorys and Remembering: Everyday Memory in Context. New York: Longman Human Learning and Memory, 6 (5), 558-567.
4. DePorter, Bobbi, Mark Reardon, and Sarah Singer Nourie. 2005. Quantum Teaching. Bandung: Mizan Pustaka.
5. Djubaedah, E., 2013. ICT-based learning with a Model to improve the concept of Mastery STAD and retention of knowledge on the material system of food digestion. Thesis. Bandung. The Indonesia University Of Education.
6. Hake, R. R. 1998. Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics tests data for introductory physics courses. American Journal of Physics. 66 (1): 64-74.
7. Halim, Muhammad Abdul, Sri Widya Wijayanti, and Rin Agustin. 2012. The effectiveness of Mnemonic Techniques to improve long-term memory in Learning biology in Grade VIII SMP Al-Islam 1. Vol 1, No 2.
8. Herdian. 2009. learning Mind mapping Model. Working paper.
9. Hidayati, N. 2015. Student activity sheet Material development of the nervous system, Sensory, and hormones. Journal. The Unfortunate Biology Education Courses: IKIP Budi Utomo. Vol. 17, no. 2.
10. Komalasari, Kokom. 2010. Contextual Learning concepts and applications. Bandung: PT Refika Aditama.
11. Maghy. 2015. The effectiveness of mnemonic on students in mathematics at high school level. International Journal of Modern Engineering Research (IJMER). ISS. 4. Vol. 5:2249-6645.
12. Mahadiani, Widya, Wiyasa, and Rini Kristiantari. 2012. The influence of Contextual Approach Towards Learning Outcomes-based Mnemonic IPS Grade IV ELEMENTARY Cluster III Sukawati. Journal. Singaraja Route: University Education Ganesh.
13. McKenney, S. 2001. Computer-Based Support for Science Education Materials Developers in Africa: Exploring Potential. Enschede: PrintPartners Ipskamp.
14. Pal, Sita Ram. 2014. Teaching language through Mnemonics Programme in pre-school Children with Hearing Impairment. American International Journal of Research in Humanities, Arts, and Social Sciences. pp. 196-199.
15. Rastaman, N. 2013. Biology Teaching And Learning Strategies. Bandung: Department Of Biology Education FPMIPA UPI.
16. Sawrey, J. M., and Telford, C.W. 1988. Educational Psychology 4th Edition. Boston: Allyn and Bacon.
17. Utami W. T. 2015. The difference in the ability to solve problems and retention using a model of PBL and speaking engagements vary in Indonesia biodiversity material grade X MIA 2 SMA Negeri Surakarta years lessons 2014/2015. Journal of BIO-PEDAGOGY 4 (1): 53-58.