Aplication ofInteractive Concept Mapping *Phylum Chordata* To Increase Student Learning Outcomes

Zainul Arifin[1], Dr. Muhibbuddin, M.S[2], Prof. Dr, M. Ali S., M.Si[3]

[1]*Student of Masters in Biology Education at Syiah Kuala University*
[2]*Lecturer at Masters in Biology Education at Syiah Kuala University, Banda Aceh*
[3]*Lecturer at Masters in Biology Education at Syiah Kuala University, Banda Aceh*

Abstract: *Phylum Chordata is one of the subject matter that is difficult to understand but fundamental to be understood by students in class X. The purpose of this study is to see the effect of applying interactive concept mapping to improving student learning outcomes in chordate material at Nagan Raya High School. One way to improve their learning outcomes is by using interactive concept maps. The population of this study was all students of class X SMAN 1 Seunagan, SMAN 2 Kuala and SMAN 3 Kuala Nagan Raya Regency in the academic year 2018/2019. The sample is 75 students of class X MIPA as an experimental class and 75 students of class X MIPA as a control class. Data was collected through a multiple choice question test on the phylum chordata. Based on data analysis, it was found that the N-gain score of the experimental class was 73.35 and the control class was 53.55. Hypothesis testing is that the t-calculated value is 9.12 and the t-table value is 1.65 with a significant value (á) 0.05. The results showed that there were significant differences in student learning outcomes in chordate material through the application of interactive concept maps and conventional learning methods. This shows that the application of interactive concept mapping can improve student learning outcomes at Nagan Raya High School in Phylum Chordata*

Keywords*: Interactive Concept MappingPhylum Chordata, Learning Outcomes*

I. Foreword

Learning is the core activity in the world of education, everything that has been arranged and planned is implemented through learning. All components of learning that include teachers and students process therein to jointly achieve learning objectives (Trihono, 2015).

In essence the learning process is a process of interaction or reciprocal relationship between teacher and students in a learning. The teacher has a very important role in the learning process to improve student learning outcomes. Therefore, the teacher must be able to think about and choose various methods, models or learning media and use these methods in accordance with the learning objectives to be achieved.

The problems that occur in the learning of chordate material biology are caused by the application of learning which is only oriented to the target of completing a number of materials and is memorizing concepts. Learning chordate material is linked or connected with sub-phyla. Therefore this research uses the application of interactive concept map learning in the hope that it can help the process of forming understanding so that it will improve the learning outcomes obtained by students. While the understanding intended in this study is the understanding of class X students of SMAN 1 Seunagan, SMAN 2 Kuala and SMAN 3 Kuala on biology chordata material. So this study aims to determine the effect of the application of interactive concept maps on improving student learning outcomes.

According to the results of the study (Kizilgol et al., 2016) states that the main problem experienced by students is a learning process that takes place in a class that is watching and boring which is only limited to books and conventional methods, listening and recording explanations from the teacher and some of the students answer the teacher's questions . This shows that the lack of application of learning that involves student activity and creates a pleasant learning atmosphere for students. This situation also affects the low learning outcomes obtained by students, so by using the concept map method can help students carry out meaningful learning processes and can determine the relationship between concepts, students can improve problem solving skills and understanding of material provided by the teacher.

Based on the results of interviews with Biology teachers in 3 Nagan Raya Regency High Schools, it was stated that the majority of class X students still had difficulty in learning and understanding biology lessons, especially on chordate material. This resulted in low student learning outcomes. The material about chordates is one of the materials that is classified as difficult and contains a lot of scientific language and classification of each animal, then in this material students often have difficulty in understanding the concepts in the chordate

---

material. Difficulties in students' ability to absorb and understand the material explained by the teacher are caused by the way the teacher presents the material based on conventional methods (lectures) only. This is certainly very boring for students so that the learning outcomes obtained by students are low in biology, especially in chordate material. For this reason, one method that can overcome this problem is the interactive concept map method.

Concept maps are a learning strategy that can analyze topics, link relevant concepts, reflect students' understanding when constructing concept maps and concept maps can provide a thorough understanding of the concepts being studied and concept maps have the potential to investigate how students develop their conceptual knowledge (Katsuhiko oda, 2016).

then the interactive concept map is a medium used by the teacher to students to be able to understand the concept of material with multimedia that is equipped with a controller that can be operated by the user so that the user can choose what is desired for the next process, an interactive concept map can be made with the help of power Points that are drawn in which there are pictures, vedio and explanations (Safitri et al., 2017) For this reason, one of the methods considered to be the most effective in the learning process for chordate material is learning using interactive concept map methods. Through the interactive concept map method, the teacher tries to display the main idea of the material that is to be explained, then it is connected with interconnected sub-materials in the form of rectangular box graphics, then there are explanations, pictures and vedio in hyperlingform to clarify the material that is wanted explained that students are quick in understanding the concept of the material. Concept maps are one of the teaching techniques that might affect the ability to control oneself and strategies that can be used in learning with any material and concept maps as a method that provides innovations that make students to remember a lot of information and graphics in the form of images or symbols that colorful so that it can affect the brain's ability to think critically (Naderifar, 2018).

The steps taken in the concept map method are (1) the concept map is made in the form of graphs to organize and represent knowledge, (2) the teacher determines the main ideas in general, (3) is connected with sub-materials in the form of boxes or circles drawn between concepts that show the relationship between these concepts, (4) words in the line are connected so that it can describe the relationships that are so bound between these concepts (Law et al., 2016). Then the concept map method is carried out with three approaches namely the rational approach, the cluster approach and the frequency approach in the analysis (Conceição et al., 2017).

In this method students are given the opportunity to develop their imagination in the form of making individual concept maps that have been understood according to material previously studied, visualization of the relationship between concepts in the form of two-dimensional graphical representations and concepts represented by rectangles or round circles and the interrelationships between two or more concepts will be connected with arrows, the part of which is called the proposition and the connecting of these words that line up parallel is called a hierarchy and interconnected ones are called cross relations and the last line of the concept map is called with a number of examples (Ismono et al., 2018). Based on the foregoing, a study was conducted on the application of interactive concept maps to chordate material to improve student learning outcomes.

II. Methodologi

The method used in this study is an experimental method with a quantitative approach and the research design used is a pretest-posttest control group design (Arikunto, 2006).

The population in this study were all students of class X SMAN 1 Seunagan, SMAN 2 Kuala and SMAN 3 Kuala in the 2018/2019 academic year. The sample in this study was conducted with the Purposive Sampling technique based on the average score of the pretest approaching the next then determined as the experimental class and the control class. The sample in this study consisted of 2 classes, namely the experimental class with 75 students and the control class with 75 students.

The instrument in this study was a preliminary test and a final test of 40 items in the form of multiple choice, lesson plans (RPP), student worksheets (LKPD), and the media used in the study were interactive concept maps of chordate material. The learning achievement test is used to determine the learning outcomes of the chordate material in the two classes that are the research samples.

The pretest and posttest score data are tabulated, calculated the average value and the gain value by finding the difference between the posttest score and the pretest score, then the results obtained are normalized by using a formula from Meltzer (2002).

III. Discussion

Data from the results of research that has been done, can be seen in Figure 1. Based on the results of initial and final ability measurements can be seen that the pretest score in the experimental class 28.37 while in the control class 28.43. Postest scores in the experimental class 76.20 while in the control class 46.60 then N-gain scores in the experimental class 73.30 while in the control class 53.55.
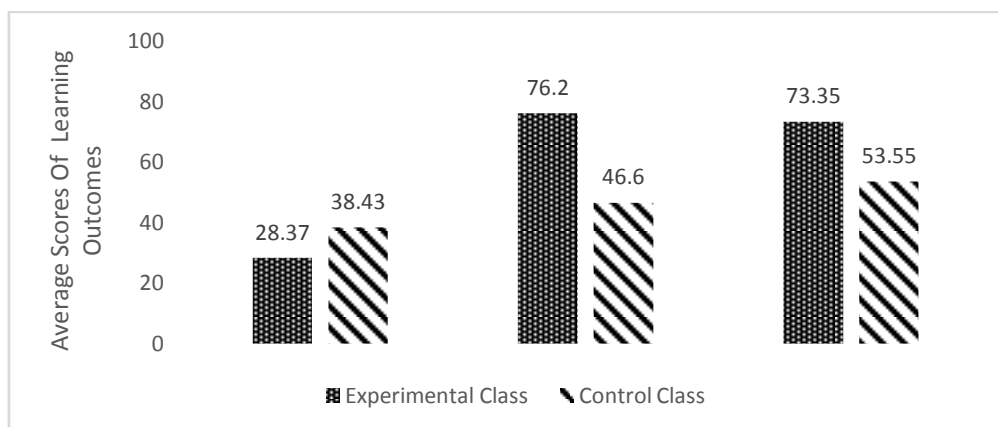
Figure 1. Average pretest, posttest and N-gain scores

Based on Figure 1. It can be explained that the assessment of learning outcomes is done through two stages, namely the Pretest and Postest stages. From the results of the above analysis it can be seen that the pretest value of the two classes is not much different because the researcher takes the average value close to the same so that it has the same value at the initial value before treatment in that class.

Then the posttest scores in the experimental class get higher learning outcomes value of 76.20 compared to the value of learning outcomes in the control class which is relatively low which is 46.60. This means that learning using interactive concept maps on chordata material provides higher learning outcomes in class X students. The average N-gain value of student learning outcomes based on 2 stages assessed in the chordata material is presented in table 1.

Table 1. Difference in Average N-gain Value of Student Learning Outcomes

Class	Average Score	Normality *	Homogeneity **	Hypothesis test
				T test ***
Experimental Class	73,35	$X^2_{hit} < X^2_{tab}$ $(0,47 < 11,07)$ (Normal)	$F_{hit} < F_{tab}$ $(2,16) < (3,91)$	$t_{hit} > t_{tab}$ $(9,12) > (1,65)$ (Real different) Significant
Control Class	53,55	$X^2_{hit} < X^2_{tab}$ $(1,07 < 11,07)$ (Normal)		

The application of interactive concept maps is one of the excellent ways to improve student learning outcomes in biology, especially on chordate material at SMAN 1 Seunagan, SMAN 2 Kuala and SMAN 3 Kuala. This can be seen in Table 1, the average scores obtained experimental class students = 73.35 and 53.55 control class

Homogeneity of data obtained in the experimental class and the control class are normally distributed and homogeneous, so the data can be tested using t-test statistics. The results of hypothesis testing with the t test statistic obtained tcount>ttab namely 9.12> 1.65 with a significant level of 0.05. Therefore it can be said that the data is significantly different between the experimental class and the control class and it can be concluded that the media learning interactive concept map on the chordata material provides higher learning outcomes in the experimental class X class students of SMAN 1 Seunagan, SMAN 2 Kuala and SMAN 3 Kuala.

The difference in learning outcomes can be due to the concept map learning media can improve students' social skills can be seen from the experimental class that uses a superior concept map strategy because students are more active, enthusiastic and creative in making concept maps when the learning process takes place compared to the control class with conventional learning methods. The advantages of concept map media include helping students to explain the key concepts or propositions that must be learned and linking new knowledge with prior knowledge (Musyrifah& Ismail, 2014); (Setyowati et al., 2020). Through concept maps, students try to show their skills in making concept maps using their own words that are easy to understand and can connect between ideas in the concept and create concept maps in graphical form that have been linked between the main concepts with supporting sub concepts which are interconnected, so that with this concept map they can easily understand the new concepts they get (Romero et al., 2017). Because the concept map serves as a schematic tool to represent a series of concepts that are described in a framework of propositions. The map reveals meaningful relationships between concepts and emphasizes key ideas (Roini, 2012). Besides concept maps can be combined with visual media, student-centered, active teaching methods can encourage student-teacher interaction, students are accustomed to building relationships between concepts rather than

remembering concepts separately, providing clarity of concepts, and can be used for many different topics (Kilic&Cakmak, 2013).

According to (Rismawati& Anita Sri RejekiHutagaol, 2018) stated that the ability to understand the concept is closely related to the activities of thinking, through thinking activities slowly which initially did not understand became clearly understood and understood so as to reduce misunderstanding on the material being studied by students . In the learning process graphic tools can help students to develop and arrange ideas about the subject being studied (Benny A &Delfy, 2015). In addition, concept maps can be combined with interactive media that are able to combine text, material, graphics / images, sound, video and animation so that the use of these media will facilitate students in understanding subject matter (Prayitno&Hidayati, 2017).

the main activity in learning by applying interactive concept maps in this research consists of several stages, namely when making interactive concept maps initial activities discussing together with groups and partners to determine the main ideas / ideas, the two students determine the main concept map ideas in accordance with the material described by the teacher, the three students develop the main idea into secondary concepts that support the main idea and place the main ideas the main ideas in the middle or on the top of the map, the four students connect the main idea with the secondary idea with a line and provide an appropriate conjunction and group secondary ideas under the main idea that shows the relationship of these ideas with the main idea (Dian yuliani, 2017).

The things described above are not visible for learning by conventional methods. In conventional learning, when the learning process takes place the teacher gives an oral explanation using the direct learning approach about the material to be taught. The process of initial learning activities starts from explaining the teaching materials accompanied by examples, students take notes on teaching materials, give questions, the teacher answers questions from students, and the final activity provides exercises as feedback. By using these conventional methods, it can cause low learning outcomes obtained by students, students are not compelled to search but students only accept what is given, students look passive, students feel bored and bored during the learning process, the teacher only completes the material but does not see the effect of the method that the teacher gives to students is less precise and efficient. Furthermore according to research (Erasmus, 2013); (Vural& Zellner, 2010) in their research states that learning using conventional models causes passive learners so as not to be able to improve learning outcomes while using video-based concept maps can improve understanding in the learning process thereby increasing student cognitive which makes students eager to follow the process learning well.

According to (Santos et al., 2017) there are several benefits that can be obtained by using the concept map method, namely: (1) allows to build a schema representation of the knowledge learned or obtained and can easily be understood by students, (2) facilitate students in determine the main idea, (3) can connect sub-material one with other sub-material on a regular basis so students easily understand it, (4) material can be made in the form of an attractive graph scheme so students become interested in learning the material, (5) can improve student learning outcomes, the structure of the concept map is flexible and easy to understand.

The benefits of interactive concept maps that can be obtained from the results of this study are as follows: (1) students can find out the main ideas of the material being studied, (2) can help students in overcoming difficulties, (3) the learning process is shorter and clearly no longer the occurrence of rote learning, (4) can summarize the material points in an orderly form, (5) concept maps as a medium of learning in discussing complex topics, (6) students can be more creative in making concept maps, (7) shorter explanations and meaningful so that students are easier in understanding the material being taught (Kinchin et al., 2019)

In its application, this method needs to be supported by several important things, which provide benefits to achieve learning objectives, namely the use of interactive concept map methods such as those contained in an explanation accompanied by pictures and vedio about the material to be explained which makes students able to improve the understanding of the concepts of the material explained. The advantages of using concept maps are: (1) using concept maps in learning are determined in an easy way in the representation of the learning process, evaluating students 'knowledge and skills, (2) concept maps used to organize the knowledge in students' minds and to prepare assimilation new to organize the planning and design of activities, 92% of students can participate in the construction of concept maps disebuut as feedback because they have mastered new concepts more easily so that students are integrated in existing knowledge systems and conduct comprehensive learning, (3) presenting in the form of networks that are interconnected with each other so students can understand easily (Lăcrămioara, 2015).

Furthermore, the application of interactive concept maps is supported by several benefits to achieve the desired learning goals, namely the concept map is an effective way for students to train from higher thinking skills and achieve high cognitive levels. Concept maps are not only a means of learning but can also be an ideal evaluation tool for education to measure the growth and value of student learning. Students as concept map makers start ideas using words and can help them identify ideas and concepts that are not quite right, educators (teachers) can see which parts of the material students do not understand so that teachers can provide accurate,

objective ways to evaluate share the material concepts that are not fully understood by students. Concept maps provide several goals for students: (1) help students exchange ideas and generate new ideas, (2) encourage students to find new concepts and propositions that link these concepts, (3) enable students to be clearer in communicating ideas, thoughts and information (Ismono et al., 2018)

From some research states learning concept maps using interactive multimedia in the learning process is one way to create interesting and innovative learning and can show the relationship between the main ideas in the explanation by visually appealing as well as a collection of graphs showing the relationship between concepts and ideas, the use of concept maps that are colored differently in each proposition, hierarchy and examples can improve long-term memory with creative ideas in making concept maps, students feel happy in making concept maps so that the concept participants are produced good as well as the use of effective learning models depending on the model or method used in accordance with the material to be explained to students (Atmawarni, 2011); (Maurisa& Abdullah, 2016); (Musyrifah& Ismail, 2014); (Putri et al., 2016); (Romero et al., 2017); (Chiou et al., 2012); (Ige, 2019).

According to research (Joel &Kamji, 2016); (Soika&Reiska, 2014) states that concept maps can be used extensively in the learning process at school, in this study it shows to prevent memorization learning, allows students to summarize previous learning concepts, can help in making presentations and concept maps strategies are very effective in improving the ability to solve problems in learning in students. Significant differences occur between the ability to memorize, allowing problem solving depends on the teacher in the class separated between men and women depending on the instructional strategies taught to them.

According to (Kinchin et al., 2019) and (Kovacic&Virtci, 2018) explain that the learning process by using concept maps can facilitate students in understanding the material explained because the main idea of the material to be explained is directly related to propositions, hierarchies, the number of relationships between sub material with one another accompanied by examples so that students can more easily understand the concepts explained so that it can foster innovative learning experiences for students and can improve the learning outcomes obtained.

According to (Tajeddin& Tabatabaei, 2016) the results of the study show that with concept maps in the form of text can increase students' reading interest as an active reading process, concept maps stimulate thinking about ideas in the text that are interconnected with other ideas and using Concept maps in the context of learning can help students become more independent, concept maps can also be used as teaching tools to present and display the main points of the material that they want to explain.

According to research that has been done (Ige, 2019) explains that the conventional method is very suitable for teaching ICT subjects in social studies while the concept map method is very suitable for teaching about ecology which has many divisions in its sub-material so students are quick in understanding the material presented the teacher of this study can be concluded that the learning method that is suitable with the material being taught is very influential on the understanding and learning outcomes obtained by the students themselves.

IV. Conclusion

Based on the results of research on the application of interactive concept maps on chordata material to improve student learning outcomes in SMA Negeri Nagan Raya Regency, it can be concluded that; there is an influence of the application of interactive concept maps on chordata material to improve student learning outcomes on phylum chordata.

References

[1]. Atmawarni. (2011). Use Of Interactive Multimedia Use Of Interactive Multimedia Using Creates Innovative Learning In School. Journal Of Social Sciences, Faculty Of Social Sciences *Uma*, *4*(1), 20–27.

[2]. Benny A, P., & Delfy, R. (2015). Mplementation Of Concept Mapping Strategy (Mapping) In Tutorial Programs On Scientific Article Writing Techniques For Teachers. Implementation Of Concept Map Strategies, *16*(2), 76–88.

[3]. Chiou, C., Lee, L., & Liu, Y. (2012). Effect of Novak Colorful Concept Map with Digital Teaching Materials on Student Academic Achievement. *Journal Procedia Social and Behavioral Sciences*, *64*(1), 192–201. https://doi.org/10.1016/j.sbspro.2012.11.023.

[4]. Conceição, S. C. O., Samuel, A., & Biniecki, S. M. Y. (2017). Using concept mapping as a tool for conducting research : An analysis of three approaches research : An analysis of three approaches. *Cogent Social Sciences*, *3*(1), 1–18. https://doi.org/10.1080/23311886.2017.1404753.

[5]. Dian Yuliani. (2017). Application Of The Concept Map Strategy To Improve Activity And Results Of Learning Ips Students In Class V Sd. Journal Of Primary School Teacher Education *3*(6), 192–198.

[6]. Erasmus, C. J. (2013). Concept Mapping as a Strategy to Enhance Learning and Engage Students in the Classroom. *Journal of Famyli and Consumer Sciences Education*, *31*(1), 27–35.

[7]. Ige, O. (2019). Using Action Learning, Concept-Mapping, and Value Clarification to Improve Students' Attainment in ICT Concepts in Social Studies: The Case of Rural Learning Ecologies Olugbenga IGE 1. *Journal of Social Stude=ies Education Research*, *10*(1), 301–322.

[8]. Ismono, Poedjiastoeti, S., & Suyoto, S. (2018). The Development of Learning Model of Map. *Atlantis Press Advences in Engineering Research*, *171*, 185–191.

[9]. Joel, E., & Kamji, T. (2016). The Efficacy of Concept Mapping Instructional Strategy in Remedying Students ' Problem-Solving Difficulties in Stoichiometry. *African Research Review an International Multi Disciplinary Journal*, *10*(41), 144–157.

[10]. Katsuhiko oda. (2016). Concept Maps as a Tool to Analyse College Students ' Knowledge of Geospatial Concepts. *Rige Review of*

Internasional Geographical Education Online, 6(2), 176–198.

[11]. Kilic, M., & Cakmak, M. (2013). Concept Maps As A Tool For Meaningful Learning And Teaching In Chemistry Education. *International Journal On New Trends In Education And Their Implications*, 4(4), 152–164.

[12]. Kinchin, I. M., Möllits, A., & Reiska, P. (2019). Uncovering Types Of Knowledge In Concept Maps. *Education Science*, 9(131), 1–14.

[13]. Kizilgol, O., Kilic, B. I., & Abdioglu, H. (2016). The Effects Of Using The Concept Mapping And The Traditional Method On The Academic Achievement Of Students In Learning The Fundamental Topics Of Cost Accounting. *Journal Of Business Economics And Finance*, 5(2), 171–190.

[14]. Kovacic, R., & Virtci, P. (2018). Developing Energy Concept Maps – An Innovative Educational Tool for Energy Planning. *Journal of Sustainable Develompment of Energy, Water and Environment Systems*, 6(4), 742–754.

[15]. Lăcrămioara, O. C. (2015). New Perspectives About Teacher Training : Conceptual Maps Used For Interactive Learning. *Procedia Social And Behavioral Sciences*, 180(1), 899–906. Https://Doi.Org/10.1016/J.Sbspro.2015.02.239

[16]. Law, D. D., Meyer, S., &Fall, L. (2016). Using Family Science Concept Maps To Gain Higher Order Student Learning Outcomes Utah State University. *Family Science Concept Maps*, 21(2), 117–133.

[17]. Maurisa, annisa maulida, & Abdullah, H. (2016).Relationship Ability To Make Concept Maps With Student Learning Results In Class Xi In The Materials Of Human Excression Systems. Pelita Pendidikan Journal,4(2), 15–19.

[18]. Musyrifah, & Ismail. (2014).the effect of the application of the IT-based concept map to the learning outcomes of biology cognitive students of class XI IPA Pamboang High School in cell Subject matter.*Journal Bionature*, 15(1), 6–15.

[19]. Naderifar, A. (2018). The comparative effect of concept mapping and vocabulary notebook keeping on Iranian EFL learners ' self-regulation in vocabulary learning. *Cogent Education*, 5(1), 1–16. https://doi.org/10.1080/2331186X.2018.1491782

[20]. Prayitno, T. A., & Hidayati, N. (2017). Development Of Interactive Multimedia Using Edmodo Android-Based Microbiological Materials. Bioilmi Journal,3(2), 86–93.

[21]. Putri, H. K., Indrawati, & Mahardika, K. (2016). Learned Inquiry Learning Model With Concept Map Technique In Physical Learning In High School. Journal Of Physics Learning,4(4), 321–326.

[22]. Rismawati, M., &Anita Sri Rejeki Hutagaol. (2018).Analysis Of The Understanding Of The Understanding Of The Concept Of Mathematics Students Of Pgsd Stkip Persada Khatulistiwa Sintang. Journal Of Basic Education In Perkasa,4(1), 91–105.

[23]. Roini, C. (2012). Increased understanding of high school students' genetic concepts through learning concept maps at different categories of schools. Bionature Journal, 13(1), 25–30.

[24]. Romero, C., Cazorla, M., & Buzón, O. (2017). Meaningful Learning Using Concept Maps As A Learning Strategy. *Journal of Technology and Science Education*, 7(3), 313–332.

[25]. Safitri, A. P., Shadi, & Haryono. (2017). Comparative Study Of The Use Of Concept Map And Interactive Multimedia Media (Macromedia Flash) Through The Problem Solving Learning Model Of High School Students Of Education, 1. Molicon Conseption Of High School, Negotiation Students 1. Chemistry Of Mathematics6(1), 1–9.

[26]. Santos, V., Souza, É. F. De, Felizardo, katia R., & nandamudi L. Vijaykumar. (2017). Analyzing the Use of Concept Maps in Computer Science : A Systematic Mapping Study. *Journal Informatics in Education*, 16(2), 257–288. https://doi.org/10.15388/infedu.2017.13

[27]. Setyowati, D., Raharjo, & Joko, T. (2020). The Effectiveness of Concept Mapping on Social Skills of Students in Social Learning of Elementary School. *Journal of Primary Education*, 9(1), 16–24.

[28]. Soika, K., & Reiska, P. (2014). Using concept mapping for assess. *Journal of Batic Science Education*, 13(5), 662–673.

[29]. Tajeddin, Z., & Tabatabaei, S. (2016). Concept Mapping as a Reading Strategy : Does It Scaffold Comprehension and Recall. *Journal the Reading Matrix an International Online*, 16(1), 194–208.

[30]. Vural, Ö. F., & Zellner, R. (2010). Using Concept Mapping in Video-Based Learning Video Temelli Öğrenmede Kavram Haritalarının Kullanımı. *Journal Using Concept Mapping in Video Based Learning*, 9(3), 747–757.