

Investigating Concept Progression Of Prospective Primary School Teachers In Indonesia

Neni Hermita, Otang Kurniaman, Eddy Noviana, Adam Malik, Chaerul Rochman and Andi Suhandi

Abstract: The aim of this study is to investigate the learning progression that occurs in pre-service primary students during Visual Multimedia Supported Conceptual Change Text (VMMSCText) activity about battery function in the electrical circuit. VMMSCText is a conceptual change text supported by visual multimedia developed for the purpose of remediation of misconceptions through text mode. The method used in this research is mixed method (quantitative descriptive and qualitative). The study was conducted on 118 subjects of pre-service primary students in Pendidikan Guru Sekolah Dasar program at FKIP Universitas Riau Indonesia. Learning progression describes a change of conception from the initial state to the state of the process and then to the final state of the VMMSCText activity. Analysis of student worksheets and conception tests has been used to diagnose the state of conception in each of these circumstances. Learning progression consists of four types, namely 1) Type I, consistent with scientific conception; 2) Type II, progressing well; 3) Type III, not progression; and 4) Type IV, degradation. The results showed that during VMMSCText activities most of the subjects were in well-progressed types (81.25 %) and almost half of the subjects were still in non-progressed types (12.25 %). No subject is in the consistent with scientific conception type and type of degradation. The results of this study indicate that developed VMMSCText is good enough in facilitating the learning progression of students in order to change the conception of the condition of misconception and lack of knowledge to the condition of scientific conception

Index Terms: VMMSCText, learning progression, prospective primary school teachers, battery function in the circuit concept

1. INTRODUCTION

Essentially all concepts qualified in the pre-service primary school teacher are connected to the daily life as these students do not seem the physics periods as a tabula rasa (Beerenwinkel, 2006; Chi, & Roscoe, 2002). Prior they are going to college and subsequently the university times although they are going to university, students learn from their situation with different experiences. These different experiences increase diverse mental constructions about the concepts. But, on some cases, daily life can betray beginning minds. Chi and Roscoe (2002) defined the prior knowledge of the students approximately the concepts as naive knowledge and giving to them this knowledge is often wrong. This knowledge which is not created by a scientific crushed may cause misconceptions. Clemen and Tippet (1993) defined the extent misconception as the knowledge which activities with the scientific knowledge. In physics, there are many common misconceptions and some teachings on these misconceptions specified that it is unbreakable to regulate beginning minds (2010). Actually, when a group of students collects in a class and only one lecturer attempts to find their specific misconceptions, it can be motivated by conceptual change schemas of the students. On the advance effect, as stated Akgun (2009), the prospect that a lecturer can also have misconceptions must not be away. One of the changes ways for eliminating misconceptions is using computer supported instructional materials in classroom (Samsudin, et al.: 2016). Computer supported instructional materials provides students to learn with their speeds, enable knowledge, and contributes chances to repeat the development matters out of school. Developments controlled with computer supported instructional materials would be supported by pictures, videos, virtual experiment environments, animations, etc. (Cepni, et al.: 2006; Sinclair, et al.: 2004; She, et al.: 2008); Windschitl; 2001). Developing computers in classrooms have belong on students' effective education. Consequently, there is crucial for a substance which can restructure conceptual buildings of the students. This considerable essential be basically unfilled and basically presented and must be improvement from prior students' knowledge. Though using this material, learners must comprehend both old and new experiences on a

scientific basis. Roth (1985) established the conceptual change texts (CCText) by implementing the phases of the conceptual change principle suggested by Posner et al. (1982), Chambers & Andre (1997), Dilber, et al. (2009) and Taşlıdere & Eryılmaz (2009). CCText resolutions at serving students to change their misconceptions with scientific concepts. Version to Roth (1985), phases of CCText concluded interrogations to the appropriate personalities with the persistence of discovery their standing misconceptions (dissatisfaction), dare to present misconceptions by using analogies (intelligibility), give the prescribed descriptions of the concepts (plausibility) and offer new conditions for smearing the new concept (fruitfulness). One mode used to remedy misconceptions is the mode of text by using conceptual change text. Some further researchers have reflected on the CCText since the learning of Roth (1985). Several studies e.g. Posner et al. (1982), Akpınar & Tan (2011), Aydin (2015), Durmuş & Bayraktar (2010), İpek & Çalık (2008), Ozkan & Selcuk (2015), Şahin et al (2010), Hermita, et al (2018), Suhandi et al (2017) was use the CCText in physics concepts. To improve CCText performance in remediation of misconceptions related to abstract and microscopic phenomena, Sahin et al (2010) have developed computer supported conceptual change text (CSCCText). For this purpose, the researcher has developed visual multimedia supported conceptual change (VMMSCText). CCText is supported by the variety of visual or multimedia visual media given the term Visual Multimedia supported conceptual change Text (VMMSCText). One of the aspects that can be used to mark the occurrence of conceptual change is learning progression. Learning progression describes a sequential series of how one's knowledge changes in a better direction over time, e.g Hess (2012), Plummer (2015), Flummer (2015), Torija & Aleixandre (2017), Hermita, et al. (2017), Hermita (2017) so learning progression can be used to describes a change of conception from the initial state to the state of the process and then to the final state of the VMMSCText activity. Conceptual change describes the change of conception from the initial state to the final state, while learning progression describes the process of change that occurs between the initial state and the final state. In the literature

there are four types of learning progression, that is, 1) Consistent with the scientific conception (Type I); 2) Well Progression (Type II); 3) No Progression (Type III); and Degradation (Type IV). Electric circuit topic, according to Malik et al. (2017) is an essential topic because of it is usually practical to daily existence. In adding, the electrical circuit is an experiential science that is appropriate to be considered concluded exploration activities. This study aims to get a picture of learning progression that occurs in pre-service primary school students during VMMSCCText activity about battery function in direct current electric circuit

2 METHODS

The method used in this study is mixed method (descriptive quantitative and qualitative) because the purpose of this study was to describe the state of learning progression that occurs in primary school teacher candidates during VMMSCCText activity about the battery function in direct current electric circuit. The subjects of the study were 118 pre-service elementary school in Pendidikan Guru Sekolah Dasar programs at Universitas Riau, Indonesia. Instruments used to diagnose the state of student conception during the VMMSCCText activity were student worksheets and conception tests. The student worksheet was the sheet that the student used to write the responses to the questions contained in each section of VMMSCCText. While conception test was used to diagnose student conception after following VMMSCCText activity. The conception test was made by four tier test format (FTT). To perform data analysis about the type of learning progression used reference as in Table 1.

TABLE 1
LEARNING PROGRESSION'S TYPE

No	Learning progression's Type	Designs of conception change				
		Pre-Conceptions*	Change to	Process	Change to	Post-Conceptions
1	Consistent with the scientific conception (Type I)	SC	→	SC	→	SC
2	Well Progression (Type II)	M	→	SC	→	SC
		M	→	M	→	SC
		M	→	NC	→	SC
		NC	→	SC	→	SC
		NC	→	M	→	SC
3	No Progression (Type III)	NC	→	NC	→	NC
		M	→	M	→	M
4	Degradation (Type IV)	SC	→	M	→	M
		SC	→	NC	→	M
		SC	→	NC	→	NC
		SC	→	SC	→	M
		SC	→	SC	→	NC

*Notes: NK, M, SC stand for No Conception, Misconceptions and Scientific Conceptions.

3 RESULTS

Table 2 shown the quantity of students in each state of conception prior to the VMMSCCText activity and whose misconceptions were remediated after the VMMSCCText activity relates to the concept of battery function in electrical

circuit.

TABLE 2
QUANTITY OF STUDENTS ON ANY STATE OF CONCEPTION PRIOR TO VMMSCCTEXT ACTIVITY AND WHOSE MISCONCEPTIONS ARE REMEDIATED AFTER VMMSCCTEXT ACTIVITY

No	Concept	Quantity of students on any state of conception prior to VMMSCCText (%)			Quantity of students whose misconceptions are remediated after VMMSCCText activity (%)
		SC	M	NC	
1	Battery function in the electrical circuit	6.25	52.08	41.67	100,00

In the table above it appears that in the initial circumstances of VMMSCCText activity, only a small percentage of students have had a scientific conception, most of them experiencing misconceptions and almost half were in a state of lack of knowledge. After participated in VMMSCCText activities all pre-service primary school student (100.00%) experiencing misconceptions on the concept of battery function in electrical circuits can be remediated. This suggests that the use of VMMSCCText in remedial teaching of basic science concepts could facilitate the conceptual change of all students experiencing misconceptions.

Figure 1 shown a bar chart of the percentage of primary school teacher candidates in each type of learning progression that occurs during VMMSCCText activities. Of the subjects studied, 6.25% were in type consistent with scientific conception, 81.25% were in well-progression type, 12.50% were in not-progression and 0% were in degradation-type. If it calculated from the number of students who initially misconception and lack of knowledge, then obtained that 86.90% of students are on the type of well-progression. This shown that the use of VMMSCCText had a high effectiveness in facilitating learning progression in the type of well-progression.

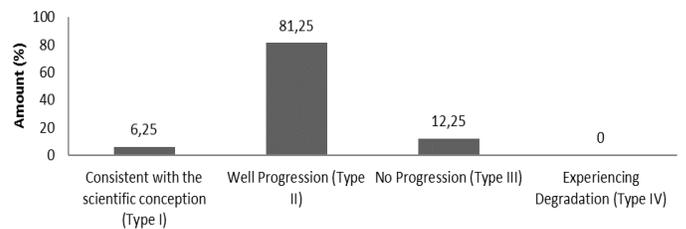


Figure 1. Bar chart diagram percentage of the number of students prospective elementary teachers in each type of learning progression that occurred on the concept of battery function in electrical circuits.

4 DISCUSSION

Learning progression was quite positive because there was no one student whose conception changed to a worse or degraded. All the students who previously had a scientific conception nothing had turned into a misconception or lack of

knowledge, but remained steadfastly in a state of scientific conception. A good learning progression that occurs in pre-service primary school student during VMMSCText, demonstrated the success of cognitive conflict strategies provided in Part II of VMMSCText in creating conflict situations in students' minds that led to a decrease in their level of belief in the false conceptions that they have been embracing. This situation also demonstrates the success of scientific explanation provided by the Phase III section of VMMSCText supported by the visual multimedia that enables the new conception introduced to become more clear and plausible. The last good learning progression was also supported by part IV VMMSCText which presents the strengthening and enrichment of conception that could assist the students in establishing the scientific conception they had. This supported by Rochman et al (2017) about strategy of organizing the material plays a very important role in designing learning. This is covered by research conducted by Hermita et. al (2016), Hermita et al (2017a, 2017b, 2017c, 2017d), Hermita et al (2018), Suhandi et al (2017) the VMMSCText can facilitated students' learning progression and CCText supported virtual simulation very successfully to remediate misconceptions.

5 CONCLUSION

It can be concluded that developed VMMSCText about battery function in electrical circuits has good potential for using remedial teaching activities oriented to misconceptions remediation. However, it was necessary to make improvements in some parts of VMMSCText so that its potential to remedy misconceptions is even better.

ACKNOWLEDGMENT

The authors thank LPPM, Universitas Riau, for supporting this study under the grand of PNPB LPPM UNRI 2018.

REFERENCES

- [1] Akgün, A. (2009). The Relation between Science Student Teachers' Misconceptions about Solution, Dissolution, Diffusion and Their Attitudes toward Science with Their Achievement. *Education and Science*, 34 (154) (2009), 26-36.
- [2] Akpınar & Tan. (2011). Developing, Implementing, And Testing A Conceptual Change Text About Relativity. *Western Anatolia Journal of Educational Sciences (WAJES)*, Dokuz Eylul University Institute, Izmir, Turkey ISSN 1308-8971.
- [3] Aydin. (2015). Pre-service Science Teachers' Views on Conceptual Change Strategies and Practices Carried out. *International Journal of Psychology and Educational Studies*. 2 (2) 21-34
- [4] Beerwinkel, A. (2006) Fostering Conceptual Change in Chemistry Classes Using Expository Texts. Unpublished Ph.D. Thesis, Bergischen Universität, Wuppertal.
- [5] Cepni S, Tas E, Kose S. (2006). The effects of computer-assisted materials on students' cognitive levels, misconceptions and attitudes towards science. *Comp Educ* 2006 (46) (2006)192-205,
- [6] Chambers, S. K., & Andre, T. (1997). Gender, Prior Knowledge, Interest, and Experience in Electricity and Conceptual Change Text Manipulations in Learning about Direct Current. *Journal of Research in Science Teaching*, 34 (2) 107-123
- [7] Chi, M. H., & Roscoe, R. D. (2002). Reconsidering Conceptual Change: Issues in Theory and Practice. In M. Limon, & L. Mason (Ed.), *The Processes and Challenges of Conceptual Change*. (pp. 3-27). Dordrecht: Kluwer Academic Publisher.
- [8] Clement, J. (1993) Using Bridging Analogies and Anchoring Intuitions to Deal with Students' Preconceptions in Physics. *Journal of Research in Science Teaching*, 30 (10) (1993), 1241-1257
- [9] Dilber, R., Karaman, I., & Duzgun, B. (2009). High school students' understanding of projectile motion concepts. *Educational Research and Evaluation*, 15 (3) 203-222
- [10] Durmuş, J., & Bayraktar, Ş. (2010). Effects of Conceptual Change Texts and Laboratory Experiments on Fourth Grade Students' Understanding of Matter and Change Concepts. *Journal of Science Education and Technology*, 19 498-504,
- [11] Fulmer, G.W. (2015). Validating Proposed Learning Progressions On Force And Motion Using The Force Concept Inventory: Findings From Singapore Secondary Schools. *Int J of Sci and Math Educ*, 131235. doi:10.1007/s10763-014-9553-x,
- [12] Hermita N, Suhandi A, Syaodih E, Samsudin A, Isjoni, Rosa F, Sapriadil S, Setyaningsih R & Johan H . (2017a). Constructing and Implementing a Four Tier Test about Static Electricity to Diagnose Pre-Service Elementary School Teachers' Misconception. *Journal of Physics: Conference Series*, 895.012167.
- [13] Hermita N, Suhandi A, Syaodih E, Samsudin A, Mahbubah K, Kurniaman O, Noviana E. (2018). Constructing VMMSCText for Re-conceptualizing Students' Conception. *Journal of Applied Environmental and Biological Sciences. J. Appl. Environ. Biol. Sci.*, 8(3)1-1.
- [14] Hermita N, Suhandi A, Syaodih E, Samsudin A. (2017b). Profil Learning Progression Mahasiswa Calon Guru SD Terkait Konsep Benda Netral Setelah Aktivitas VMMSCText. *Jurnal Pedagogika*, Vol 7 no 2.
- [15] Hermita, N., Suhandi A. & Syaodih, E. (2016). Identifikasi Miskonsepsi konsep listrik statis pada mahasiswa calon guru sekolah dasar. *Prosiding Seminar Nasional Pendidikan Dasar UPI Bandung*.
- [16] Hermita, N., Suhandi, A., Syaodih, E., Samsudin, A. (2017c). Level Conceptual Change Mahasiswa Calon Guru SD Terkait Konsep Benda Netral Sebagai Efek Implementasi VMMSCText. *Jurnal Wahana Pendidikan Fisika*, Vol.2 No. 2: 71-76.
- [17] Hermita, N., Suhandi, A., Syaodih, E., Samsudin, A., Isjoni, I. & Rosa F. (2017d). Assessing Pre-service Elementary School Teachers' Alternative Conceptions through a Four-Tier Diagnostic Test on Magnetism Concepts. *Advanced Science Letter*, 23 (11).
- [18] Hess, K. (2012). Learning progressions in K-8 classrooms: How progress maps can influence classroom practice and perceptions and help teachers make more informed instructional decisions in support of struggling learners (Synthesis Report 87). Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes.
- [19] Hess, K. (2010). Learning Progressions Frameworks Designed for Use with the Common Core State Standards in Mathematics K-12. National Alternate Assessment Center at the University of Kentucky and the

- National Center for the Improvement of Educational Assessment, Dover, N.H.
- [20] İpek, H., & Çalık, M. (2008). Combining Different Conceptual Change Methods within Four-Step Constructivist Teaching Model: A Sample Teaching of Series and Parallel Circuits. *International Journal of Environmental and Science Education*, 3 (3) 143-153.
- [21] Malik A, Setiawan A, Suhandi A, Permanasari A, Dirgantara Z, Yuniarti, H, Sapriadil S, Hermita N. Enhancing Communication Skills of Pre-service Physics Teacher through HOT Lab Related to Electric Circuit. *Journal of Physics: Conference Series* 953 (2017) 012017.
- [22] Ozkan & Selcuk. (2015). Effect of Technology Enhanced Conceptual Change Texts on Students' Understanding of Buoyant Force. *Universal Journal of Educational Research* 3 (12) 981-988. <http://www.hrpub.org> . DOI: 10.13189/ujer.2015.031205
- [23] Plummer, J, D. (2015). Embodying the Earth's place in the solar system: Students investigating seasonal constellations. *Science and Children*, 53 (4) 52-61
- [24] Posner, G.J., Strike, K.A., Hewson, P.W., dan Gertzowg, W.A. (1982). Accomodation of a scientific conception: Toward a theory change. *Science Education*, Vol 66, 211-227.
- [25] Rochman C, Nasrudin D, Muslim & Hermita N. (2017). Characteristics of the ability of Physics concept in enrichment teaching materials of Natural and Mineral resources (NMRs) Literacy. *Jurnal Pendidikan IPA Indonesia* Vol 6 (2).
- [26] Roth, K. J. (1985). Conceptual Change Learning and Students' Processing of Science Text. Annual Meeting of the American Education Research Association. Chicago.
- [27] Şahin, Ç., İpek, H., & Çepni, S. (2010). Computer Supported Conceptual Change Text: Fluid Pressure. *Procedia Social and Behavioral Sciences*, 2 922-927
- [28] Samsudin, Suhandi, Rusdiana, Kaniawati and Coştu. (2016). Investigating the effectiveness of an active learning based-interactive conceptual instruction (ALBICI) on electric field concept. *Asia-Pacific Forum on Science Learning and Teaching*, Volume 17, Issue 1, Article 1 (Jun., 2016)
- [29] She H, Lee CQ. (2008). SCCR Digital learning sytem for scientific conceptul(a change and scientific reasoning. *Comp Educ* 2008 (51) 724-742,
- [30] Sinclair Kesley J, Renshaw CE & Taylor HA. (2004). Improving computer assisted instruction in teaching higher order skills. *Comp Educ* 2004 (42) (2004) 169–180
- [31] Suhandi A, Hermita N, Samsudin A, Maftuh B & Coştu B. (2017). The effectiveness of visual multimedia supported conceptual change text on overcoming students' misconception about Boiling concept. *Turkish Online Journal of Educational and Technology (TOJET)*, Special issue Oktober 2017 For INTE 2017.
- [32] Taşlıdere, E., & Eryılmaz, A. (2009). Alternative to Traditional Physics Instruction: Effectiveness of Conceptual Physics Approach. *Eurasian Journal of Educational Research* (35) 109-128
- [33] Tippett, C. D. (2010). Refutation Text in Science Education: A Review of Two Decades of Research. *International Journal of Science and Mathematics Education*, 8(2010), 951-970,
- [34] Torija, B & Aleixandre, MP. (2017). Developing an Initial Learning Progression for the use of Evidence in Decision-Making Context. *Int J Sci and Math Educ*,
- [35] Windschitl M. (2001). Using simulations in the middle school: Does assertiveness of dyad partners influence conceptual change? *Int J Sci Educ* 2001 (23) 17-32.