ADDRESSING CONCEPT MASTERY AND CURIOSITY ABOUT THE PHYSICS OF LIGHT IN MIDDLE SCHOOL STUDENTS THROUGH DISCOVERY LEARNING WITH "LEGENDS OF LEARNING" EDUCATIONAL GAMES

RESEARCH PAPER

Submitted as Requirement to Obtain Degree of *Sarjana Pendidikan* in International Program on Science Education (IPSE) Study Program

Arranged by:

Annisa Fadhila Nur Fikriah

1703388

INTERNATIONAL PROGRAM ON SCIENCE EDUCATION

FACULTY OF MATHEMATICS AND SCIENCE EDUCATION

UNIVERSITAS PENDIDIKAN INDONESIA

2021

ADDRESSING CONCEPT MASTERY AND CURIOSITY ABOUT THE PHYSICS OF LIGHT IN MIDDLE SCHOOL STUDENTS THROUGH DISCOVERY LEARNING WITH "LEGENDS OF LEARNING" EDUCATIONAL GAMES

Skripsi ini diajukan untuk memenuhi salah satu syarat
memperoleh gelar Sarjana Pendidikan
pada Program Studi International Program on Science Education (IPSE)
Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

Annisa Fadhila Nur Fikriah
Universitas Pendidikan Indonesia
August 2021

APPROVAL SHEET

ADDRESSING CONCEPT MASTERY AND CURIOSITY ABOUT THE PHYSICS OF LIGHT IN MIDDLE SCHOOL STUDENTS THROUGH DISCOVERY LEARNING WITH "LEGENDS OF LEARNING" EDUCATIONAL GAMES

By:

Annisa Fadhila Nur Fikriah

1703388

Approved:

Supervisor I

Dr. Mary Margaret Thomas, M.Sc., Ph.D

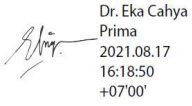
Supervisor 2

Dr. Nanang Winarno, S.Si, S.Pd, M.Pd

NIP. 198403212014041001

Perceived by,

Head of International Program on Science Education Study Program



Dr. Eka Cahya Prima, S.Pd., M. T.

NIP 19900626220240410001

DECLARATION

I do hereby declare that every aspect written in this research paper entitled "Improving Concept Mastery and Curiosity about Properties of Light in Middle School Students through Discovery Learning with "Legends of Learning" Educational Games" is my original idea, effort, and work without copying or plagiarizing from other papers. All theories, experts' opinions, and other statements contained in this paper have been quoted or referenced based on scientific code from UPI and accordance with scientific ethics that apply on scholarly academic rules. This declaration was created with honest and mindful consideration, based on scientific ethics. If there's a violation nor irresponsibly quoted statements, I am willing to accept the academic sanctions that correspond to the applicable academic law in this university.

Bandung, August 2021

Declarant,

Annisa Fadhila Nur Firkiah

1703388

ACKNOWLEDGEMENTS

The author praises gratitude to Allah SWT for this Mercy so that the author can finish this research paper. On this occasion, the author would like to express sincere gratitude and appreciation to the following:

1. My beloved family members, my gorgeous Mama Puji, my amazing Ayah Chris, my lovely brother Fiki and sister Tita, I love them all so much to the moon and back. They always have been supporting me in my whole life, not only while I was finishing this thesis, but also in my every life steps. I am beyond grateful for having them as my main support system. I wish nothing but best fate for my family members.
2. My second family members, Mah aa, Pak aa, A Ipal, The Fajrin, A Sandi, Om Tomy, Ocha, Azka and Daneen. I will be forever grateful having them as my second family that I can always counted on. I hope they will always be showered by blessings and happiness.
3. Dr. Eka Cahya Prima, S.Pd., M.T. as the Head of International Program on Science Education Study Program with all the support that he provided to help me in every way he could. He always amazed me with his knowledges and capability to manage everything, I hope he has all the best in life.
4. Dr. Mary Margaret Thomas, M.Sc., Ph.D. as my first supervisor who always do her best to guide me with her sophisticated notes, valuable solutions, and all of her efforts to help me finishing this thesis, she is so amazing, I can't even describe it with words. May God always bless her with pure happiness, health and wealth as she deserved.
5. Dr. Nanang Winarno, S.Si., S.Pd., M.Pd. as my second supervisor for all the encouragement, full guidance, and motivation all the time. He has the biggest heart and pure patience while guiding me in the process, I hope Allah give him all the blessing and joy in life.

6. Dr. Diana Rochintaniawati, M.Ed as the most wholesome lecturer who always amazes me with her way on explaining things, encouraging the students and give off such a positive energy to the class. She always supports me with her motivational words and assure me to finish the thesis on time. I hope she always surrounded by happiness and time to take enough rest.
7. Mrs. Eliyawati, M.Pd. as the expert judgment and my amazing academic supervisor, who always motivates me to finish this thesis as soon as possible and living the best life as she is. She is an amazing lecturer with great personality and fascinating knowledges. I hope she has more time to take enough rest since she always has something to do every day.
8. Mr. Ikmanda Nugraha, M. Pd. as the most adorable lecturer in this study program, he always amazed me with his valuable solutions and the way he solves complex problems, I hope nothing but happiness in his life.
9. Mrs. Rika Rafikah Agustin, S.Pd., M.Pd., the prettiest lecturer with great attitude and wholesome personality. I adore the way she breaks down complicated things to be seems simple and easy to solve. I wish she has enough rest and take care of her health.
10. Mrs. Lilit Rusyati, S.Pd., M.Pd., the most diligent lecturer with soft and kind personality which I adore the most. She has always been my role model to manage things neatly and make plans for everything. I wish she could have more time to reward her amazing self.
11. Mrs. Resik Ajeng Maria, M.Pd. as the nicest laboratory assistant in this study program, I love the way she helps us with clear instructions. I will never forget that she used to give me foods whenever I'm starving at the college, she deserves to be treated as a queen.
12. Mrs. Dhea Aprilia Andhini, as the most diligent and kind staff. Especially when it comes to administrative things, she always shows clear steps and make sure the students get what they need in every time.
13. Mr. Latief Budiana as the most charming staff in this study program, he is beyond nice as a human being, and an amazing delicate staff. I wish him nothing but good fates and joy in life.

14. The Headmaster of SMP Al Irsyad Satya Islamic School for all the help, and facilitates me for taking the data for this thesis requirements.
15. All the science teachers in SMP Al Irsyad Satya Islamic School especially for Mr Rudi and Mrs Indah. I am so thankful for the sharing, guidance, and motivation during teaching practicum and taking the data for this thesis.
16. Putri Aulia Salsabila, my adorable significant other who always encourage me with love, support, and pure affections. She always drawn me with precious cares, I will forever be grateful for that. She is indeed my favorite form of loving.
17. Arsanti Satriani Salim, I don't even know how could I finish any of these college life without emotional, physical and mental support from her, she is the perfect best friend that anyone could have. I am beyond grateful having the chance to receive all of her loves.
18. Naufal Rabah Wahidin and Nur Shinta Ratna Wulan the only two persons who always worrying about my mental health and constantly checking up on me. I will miss the moment they always asked to have a zoom meeting together. They deserve nothing but a whole universe.
19. To the precious 10 years of friendship I have with Falatansa Saxena Ramadhani, Yudesty Liean, Anggun Setiawati Ardi and Aini Sarifah. They are the most wholesome besties anyone would wish to have. I hope we can still be friends till Jannah, May Allah always bless our every steps and filled our lifes with happiness and joy only. We deserve the whole universe.
20. All of my beloved close friends who always charge me with positive energy and serotonin boost; (Salma Khoirotunnisa, Dhika Andraresti Lazuardi, Nur Shinta Ratna Wulan, Nadira Renata Putri, Kamila Putri Nursyahbani, Shafa Rihadatul Aisy, Diana Ayu Latifah, Tashya Alfiah Yasin, Dewi Achdamia Agustin, Alya Sukmawati, Dewi Intan Ananda Putri, Yoga Yudira Wibawa Sunda, Navilla Septieny Gunawan, Dianisa Sapta, Fathurrahman, M. Fadil Ar Rasyid, Amran Majid, Geri Aria Firmansah, Kristina Valencia Dew, Edrenita Shahrilla Betranty, Novi Sopiah, Salsabila Melati Armadani, Annisaa Rahma, Nikita Nabila, Yunita Rahmawati Hazanah, Muhammad Ramadhan, Citra

Fadilah Nurhijriah, Farah Fauziah Apriliza, Annisa Melani, Tia Marliani Syafira, Zaenab Karbela Isna, Tisa Shafira Nurfauzia, Dyandra Prakasita, Cindy Stefanie Irawan, Eka Rahayu, Ravina Stella)

21. All of the IPSE 2017 students (Mia Wulansani, Miftah Ummi Hanifa, Xavierina Dewi Endangsari Adiningsih, Sulistinayah Suwaka Putri, Sofi Alfiani, Raisha Nur Kanina, Syahida Ainaya, Mohamad Yusril Aldiana Mahendra, Putri Sekar Melati, Erika Oktaviani, Tiara Syifanida, Rossy Andini Herindra Putri, and Novi Nursafitri) who always help, listen and give valuable advice during my difficult times and cheer me up with their unique ways.
22. LOONA, Dreamcatcher, Niki Zefanya, Bibi, Olivia Rodrigo and Keshi for producing good musics and accompany me through the night while I was finishing this thesis.
23. All of the other party or indirect help that I received, May Allah bless their lives with pure joy and good fates.
24. Last but not least, I want to thank me, for believing in me, for doing all this hard work, for having no days off, for never quitting, for always being a giver, and trying give more than I receive, for trying to do more right than wrong, I want to thank me for just being me at all times. Thank you for being you, Caca.

ADDRESSING CONCEPT MASTERY AND CURIOSITY ABOUT THE PHYSICS OF LIGHT IN MIDDLE SCHOOL STUDENTS THROUGH DISCOVERY LEARNING WITH "LEGENDS OF LEARNING" EDUCATIONAL GAMES

Annisa Fadhila Nur Fikriah

International Program on Science Education

fadhila_nnisa@upi.edu

ABSTRACT

There are dozens of teaching methods using many kinds of learning approaches and media. Nowadays, it is appropriate to use the advantages of technology. However, students tend to be less excited when the technology used is constant projector plays like PowerPoint or videos. Not only that, but also a correct learning approach could help students achieve the objectives from a curriculum smoother. Therefore, the game is often applied in a learning activity to engage students' exploration and build excitement. This study used Discovery Learning, in which students did their own exploration, supported by Legends of Learning (LoL), one of the biggest web-educational games providers based on standard curriculum, and were used to investigate whether students improved their concept mastery and curiosity about the physics of light. The research approach was pre-experimental with a one group pre-test and post-test design. The participants were 50 8th-grade student naïve to LoL games, discovery learning and the specific science topics on light. The results of this study showed a medium improvement with N-Gain result 0.34 for student concept mastery enhancement. The implementation also showed the highest improvement of Light Properties subtopic and C2 Cognitive Domain. The lowest improvement is the Speed of Light Subtopic and C3 Cognitive Domain. However, student curiosity enhancement has not showed positive impact since the N-Gain was -0.24 and categorized as low enhancement. Nevertheless, this research could be a basis for more extensive research in the future.

Keyword: Discovery Learning, Legends of Learning, Concept Mastery, Curiosity, Web Educational Games, Light

PENERAPAN PENGUASAAN KONSEP DAN RASA INGIN TAHU TENTANG CAHAYA PADA SISWA MENENGAH PERTAMA MELALUI PEMBELAJARAN DISCOVERY LEARNING DENGAN PERMAINAN EDUKATIF DARI "LEGENDS OF LEARNING"

Annisa Fadhila Nur Fikriah

International Program on Science Education

fadhila_nnisa@upi.edu

ABSTRAK

Terdapat puluhan metode pengajaran dengan berbagai macam pendekatan dan media pembelajaran. Saat ini, sudah sepantasnya untuk memanfaatkan keunggulan teknologi. Namun siswa cenderung kurang bersemangat jika teknologi yang digunakan adalah pemutaran proyektor seperti video maupun PowerPoint. Tidak hanya itu, pendekatan pembelajaran yang benar juga dapat membantu siswa mencapai tujuan dari kurikulum dengan lebih lancar. Oleh karena itu, game sering diterapkan dalam kegiatan pembelajaran untuk melibatkin eksplorasi dan ketertarikan siswa. Penelitian ini menggunakan Discovery Learning, dimana siswa melakukan eksplorasi sendiri, didukung oleh Legends of Learning (LoL), salah satu web-educational game terbesar berdasarkan kurikulum standar, untuk menyelidiki apakah penguasaan konsep dan rasa ingin tahu siswa tentang cahaya dapat ditingkatkan. Metode penelitian ini adalah pre-eksperimental dengan satu kelompok pre-test dan post-test desain. Pesertanya adalah 50 siswa kelas 8 yang naif terhadap game dari LoL, Discovery Learning, maupun topik Cahaya. Hasil penelitian ini menunjukkan peningkatan sedang dengan hasil N-Gain 0.34 terhadap tingkat penguasaan konsep siswa. Implementasi juga menunjukkan peningkatan paling tinggi pada subtopik sifat-sifat cahaya dan C2 ranah kognitif. Peningkatan terendah terdapat di subtopic kecepatan cahaya dan C3 ranah kognitif. Namun hasil peningkatan rasa ingin tahu siswa belum menunjukkan dampak yang positif karena N-Gain sebesar -0.24 tergolong ke peningkatan yang rendah. Namun demikian, penelitian ini dapat bermanfaat bagi penelitian lain yang lebih luas di masa depan.

Keyword: Discovery Learning, Legends of Learning, Penguasaan Konsep, Rasa Ingin Tahu Siswa, Web-Educational Games, Cahaya

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

REFERENCES

Alfieri, L., Brooks, P. J., Aldrich, N. J., & Tenenbaum, H. R. (2011). Does Discovery-Based Instruction Enhance Learning? *Journal of Educational Psychology*. https://doi.org/10.1037/a0021017

Anderson, L. W., Krathwohl Peter W Airasian, D. R., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J., & Wittrock, M. C. (2001). *Taxonomy for Assessing a Revision of Bloom's Taxonomy of Educational Objectives*.

Ardani, R. A., & Setyaningrum, W. (2018). Game-Based Edutainment Media using Guided Discovery Approach: What teachers say? *Journal of Physics: Conference Series*, *1097*(1), 7–10. https://doi.org/10.1088/1742-6596/1097/1/012101

As, F., Yunanto, S. H., & Nugroho, E. W. (2013). *Educational Game as Way to Help Child ' s Curiosity*. *December*, 12–13.

Balım, A. G. (2009). The Effects of Discovery Learning on Students ' Success and Inquiry Learning Skills. *Eurasian Journal of Educational Research*.

Bonawitz, E. B., & Lombrozo, T. (2012). Occam's rattle: Children's use of simplicity and probability to constrain inference. *Developmental Psychology*. https://doi.org/10.1037/a0026471

Castronova, J. (2002). Discovery learning for the 21st century: What is it and how does it compare to traditional learning in effectiveness in the 21st century. *Action Research Exchange*, *1*(1), 1–12.

Creswell, J. W. (2012). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research 4th Edition* (4th ed.). Pearson Education.

Dalgarno, B., Kennedy, G., & Bennett, S. (2014). The impact of students' exploration strategies on discovery learning using computer-based simulations. *Educational Media International*. https://doi.org/10.1080/09523987.2014.977009

De Jong, T., & Van Joolingen, W. R. (1998). Scientific discovery learning with

computer simulations of conceptual domains. *Review of Educational Research*, *68*(2), 179–201. https://doi.org/10.3102/00346543068002179

Dr. Moh. Syarif, D. (2017). High School Biology Professional Development Module: Integrated Strengthening Character Education. *Quality Improvement for Teacher and Educational Personel (QITEP) in Science*, 11–12. https://doi.org/10.1017/CBO9781107415324.004

Duncan, T. (Cambridge). (2014). *Cambridge IGCSE Physics : Third Edition* (Third, Vol. 3, Issue June).

Feriyanti, D. (2018). Discovery Learning As a Method To Teach Descriptive Text in Building Students' Character: a Case of Seventh Grade Students of Smp N 3 Ulujami. *ETERNAL (English Teaching Journal)*, *5*(2). https://doi.org/10.26877/eternal.v5i2.2148

Frankel, J. R., Wallen, N. E. & Hyun, H. H. (2011). How to Design and Evaluate Research in Education (8th Edition). In *Boston: McGraw-Hill.*

Frey, B. B. (2018). Normal Distribution. *The SAGE Encyclopedia of Educational Research, Measurement, and Evaluation*, *August*. https://doi.org/10.4135/9781506326139.n476

Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, *66*(1), 64–74. https://doi.org/10.1119/1.18809

Helmi, N Y Rustaman, F S Tapilouw, T. H. (2019). Students' Concept Mastery: Reasoning Ability and Concept Mastery of Evolution. *Indonesian Journal of Social Research*, *1*(1), 23–29.

Jirout, J. J., Vitiello, V. E., & Zumbrunn, S. K. (2018). Curiosity in Schools. *The New Science of Curiosity*, *July 2018*, 243–266.

Kurniasih, I., & Sani, B. (2014). Implementasi Kurikulum 2013 Konsep dan Penerapan. *Kementrian Pendidikan Dan Kebudayaan*, 1–162.

Lee, H. S., & Anderson, J. R. (2013). Student learning: What has instruction got to dowith it? *Annual Review of Psychology*, *64*, 445–469.

https://doi.org/10.1146/annurev-psych-113011-143833

Lin, C. H., Liu, E. Z. F., Chen, Y. L., Liou, P. Y., Chang, M., Wu, C. H., & Yuan, S. M. (2013). Game-based remedial instruction in mastery learning for upper-primary school students. *Educational Technology and Society*, *16*(2), 271–281.

Litman, J. A., & Silvia, P. J. (2006). The latent structure of trait curiosity: Evidence for interest and deprivation curiosity dimensions. *Journal of Personality Assessment*, *86*(3), 318–328. https://doi.org/10.1207/s15327752jpa8603_07

Liu, E. Z. F., & Chen, P.-K. (2013). The Effect of Game-Based Learning on Students' Learning Performance in Science Learning – A Case of "Conveyance Go." *Procedia - Social and Behavioral Sciences*, *103*, 1044–1051. https://doi.org/10.1016/j.sbspro.2013.10.430

Markey, A., Chin, A., Vanepps, E. M., & Loewenstein, G. (2014). Identifying a reliable boredom induction. *Perceptual and Motor Skills*. https://doi.org/10.2466/27.PMS.119c18z6

Martaida, T., Bukit, N., & Ginting, E. M. (2017). The Effect of Discovery Learning Model on Student's Critical Thinking and Cognitive Ability in Junior High School. *IOSR Journal of Research & Method in Education (IOSR-JRME) e-ISSN: 2320–7388,p-ISSN: 2320–737X Volume 7, Issue 6 Ver. I (Nov. – Dec. 2017), PP 01-08 Www.Iosrjournals.Org*, *7*(6), 1–8. https://doi.org/10.9790/7388-0706010108

Mukherjee, A. (2015). Effective Use of Discovery Learning to Improve Understanding of Factors That Affect Quality. *Journal of Education for Business*, *90*(8), 413–419. https://doi.org/10.1080/08832323.2015.1081866

Mulenga, I. M. (2018). Conceptualization and Definition of a Curriculum. *Journal of Lexicography and Terminology*, *2*(2), 1–23.

Murugesan, V. (2019). Modern teaching techniques in education. *Journal of Applied Science and Computations*, *VI*(I), 2594.

OECD. (2018). What 15-year-old students in Indonesia know and can do. *Programme for International Student Assessment (PISA) Result from PISA*

2018, 1–10.

Ornek, F., Robinson, W., & Haugan, M. (2007). What Makes Physics Difficult. *Science Education International*, *18*(3), 165–172.

Pratama, L. D., & Setyaningrum, W. (2018). Game-Based Learning: The effects on student cognitive and affective aspects. *Journal of Physics: Conference Series*, *1097*(1). https://doi.org/10.1088/1742-6596/1097/1/012123

Raftopoulos, A., & Constantinou, C. P. (2005). *The Properties and the Nature of Light : The Study of Newton ' s Work and the The Properties and the Nature of Light : The Study of Newton ' s Work and the Teaching of Optics*. *January 2014*. https://doi.org/10.1007/s11191-004-5609-6

Smyrell, G. (2003). Teaching methods. *International Water Power and Dam Construction*. https://doi.org/10.5005/jp/books/12876_20

Ulfa, K., Anggraeni, S., & Supriatno, B. (2017). How to Improve the Mastery of Students' Concept on Photosynthesis Topic? *Journal of Physics: Conference Series*, *895*(1). https://doi.org/10.1088/1742-6596/895/1/012137

Vate-U-Lan, P. (2015). Transforming classrooms through game-based learning: A feasibility study in a developing country. *International Journal of Game-Based Learning*, *5*(1), 46–57. https://doi.org/10.4018/ijgbl.2015010104

Weible, J. L., & Zimmerman, H. T. (2016). Science curiosity in learning environments: developing an attitudinal scale for research in schools, homes, museums, and the community. *International Journal of Science Education*, *38*(8), 1235–1255. https://doi.org/10.1080/09500693.2016.1186853

Zahara, A., Feranie, S., & Winarno, N. (2020). *Influence of Discovery Learning Supported by Solar System Scope Application on Students' Curiosity: The Case of Teaching Solar System*. *August*. https://doi.org/10.4108/eai.12-10-2019.2296415

Zirawaga, V., Olusanya, A., & Maduki, T. (2017). Gaming in education: Using games a support tool to teach History. *Journal of Education and Practice*, *8*(15), 55–64. https://files.eric.ed.gov/fulltext/EJ1143830.pdf