# STUDENTS' SCIENCE INQUIRY SKILLS AND CONCEPT MASTERY BY THE IMPLEMENTATION OF WEB-BASED INQUIRY LEARNING ON COORDINATION AND RESPONSE TOPIC

RESEARCH PAPER

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

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INTERNATIONAL PROGRAM ON SCIENCE EDUCATION

FACULTY OF MATHEMATICS AND SCIENCE EDUCATION

UNIVERSITAS PENDIDIKAN INDONESIA

2021

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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

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Agustus 2021

APPROVAL SHEET

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## DECLARATION

I hereby declare that the thesis entitled "Students' Science Inquiry Skills And Concept Mastery by The Implementation of Web-Based Inquiry Learning on Coordination and Response Topic" and all its contents have been done by my work. I do not plagiarize or quote citations from other research in ways that are not following the ethics of science applicable in scientific societies. For this statement, I am prepared to bear the risk of sanction if a later violation of scientific ethics is discovered or there is a claim from another part for the authenticity of my work.

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## ACKNOWLEDGEMENT

The author praises gratitude to Allah SWT for His mercy and blessing, the author can complete this research paper. This paper will not be completed without the help and support of all individuals involved. Furthermore, the author would like to convey the profound gratitude and appreciation on this occasion:

1) Dr. Diana Rochintaniawati, M.Ed. as my supervisor who always gives sincere advice, knowledge, time to improve the quality of my research. She also always guide and encourage me during this research. May Allah SWT grants her health and happiness.
2) Tuszie Widhiyanti, M.Pd., Ph.D as my supervisor, with his humility and broad knowledge, assisted my research with extending ideas by devoted her mind, knowledge, and time to provide guidance and motivation by detailing my work to improve the research.
3) Dr. Eka Cahya Prima, S.Pd., M.Pd as the Head of International Program on Science Education study who always motivate and give support along the years of study.
4) Eliyawati, M.Pd as an academic supervisor who always gives us a chance to share the moment, give advice, motivate all the time during college life.
5) Sarah Syarifah, S.Pd from Al-Irsyad Satya Islamic School who always help, guide, and support me during my PPL and for accomplishing my research in her lesson time.
6) Al-Irsyad Satya Islamic School staffs and crews, thank you for accepting me as an intern teacher there and giving me a memorable experience.
7) Students of Al-Irsyad Satya Islamic School especially grade 8, thank you for all the warm welcome, it is such an honor to teach and create a memory with you
8) My beloved family, Bapak-Ibu, and my sister, Nazwa as the incomparable support system. This gratitude for them who always had my back and become first-hand witnesses from my entire life. May Allah SWT grant them eternal pleasure.

9) All IPSE lecturers, Laborant, and Administrator (Mrs. Lilit, Mr.Ikmanda, Mrs. Rika, Mrs. Margie, Mr. Nanang, Mr. Latief, Mrs. Resik, and Mrs. Dhea) thank you for all the support, knowledge, and support me to accomplish my study since 2017.
10) My one call away friends, Mia Wulansani who always give me help, support and as a place to share every single moment especially during college life. Blessed to have you.
11) To Kamila Putri and Diana Ayu who always accompany me during this research since the beginning.
12) All IPSE 2017 mates Yusril, Salma KH, Sofi, Annisa, Rossy, Arsanti, Tashya, Dikey, Shafa, Dira, Bintang, Abah, Naya, Raisha, Nurs, Imel, Tiara, Erika, and Novi who shares the most valuable memories in college life. Thank you for having me as your friend.
13) To everyone who has given to the 22 years of my life that cannot I mention one by one. I am so thankful for everything that they taught me. May our paths cross again in the future.

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## ABSTRACT

The development of technology plays an important role in the educational field. Pandemic situations due to Covid-19 tend to move the learning system into online learning and to avoid the students from passiveness, their contribution is needed during this learning. Web-Based Inquiry Learning (WBIL) is an online platform that provides the activity for students to do the investigation actively through internet-based. The purpose of this research is to investigate the students' science inquiry skills and concept mastery. There are 29 students in grade $8^{th}$ who are chosen by convenience sampling from one private school in Bandung that use a Cambridge curriculum. The method used is pre-experimental with posttest design only to investigate the science inquiry skills and pre-posttest design to investigate the concept mastery. The inquiry skills measured in this research is consists of five phases. The results showed that implementing the WBIL gain a high category (90%) in formulating questions and constructing data into the table, while the lowest category is in discussing the result which gains a sufficient category (81%). In average, the implementation of WBIL for inquiry skills gain 86.4% (high category). Further analysis checked in concept mastery using paired sample t-test. The result shows the data is normally distributed, homogenous ($0.156 > 0.5$) and $H_0$ is rejected ($0.000 < 0.05$), it shows there is a difference in students' concept mastery after being given treatment and each of the levels cognitive has been analyzed with N-gain score is 0.52 which is interpreted as a medium.

**Keyword**: Web-based inquiry, online learning, science inquiry skills, concept mastery, coordination and response, science education

# KETERAMPILAN SCIENCE INQUIRY SISWA DAN PENGUASAAN KONSEP DENGAN PENERAPAN PEMBELAJARAN INQUIRY BERBASIS WEB PADA TOPIK KOORDINASI DAN RESPON

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## ABSTRAK

Perkembangan teknologi memiliki peranan penting dalam bidang pendidikan. Situasi pandemi akibat Covid-19 mengubah sistem pembelajaran menjadi daring, sebagai upaya untuk menghindari siswa dari kepasifan, peran serta siswa perlu dilibatkan. Web-Based Inquiry Learning (WBIL) adalah sebuah platform online yang menyediakan aktivitas bagi siswa untuk melakukan penyelidikan secara aktif dengan berbasis internet. Tujuan dari penelitian ini adalah untuk mengetahui kemampuan inkuiri sains dan penguasaan konsep siswa. Terdapat 29 siswa kelas 8 yang dipilih denga convenience sampling dari salah satu sekolah swasta di Bandung yang menggunakan kurikulum Cambridge. Metode yang digunakan adalah pre-experimental dengan posttest design untuk mengetahui kemampuan inkuiri sains dan pre-posttest design untuk mengetahui penguasaan konsep. Keterampilan inkuiri yang diukur dalam penelitian ini terdiri dari lima tahap. Hasil penelitian menunjukkan bahwa penerapan WBIL memperoleh kategori tinggi (90%) dalam merumuskan pertanyaan dan mengkonstruksi data ke dalam tabel, sedangkan kategori terendah adalah pada hasil dan pembahasan dengan memperoleh kategori cukup (81%). Secara rata-rata, penerapan WBIL untuk keterampilan inkuiri memperoleh 86,4% (kategori tinggi). Analisis lebih lanjut diperiksa dalam penguasaan konsep menggunakan uji t sampel berpasangan. Hasil penelitian menunjukkan data berdistribusi normal, homogen (0,156 > 0,5) dan $H_0$ ditolak (0,000 < 0,05) hal ini menunjukkan adanya perbedaan penguasaan konsep siswa setelah diberikan perlakuan dan analisis pada masing-masing tingkat kognitif menunjukan bahwa nilai N-gain sebesar 0,52 yang dimaknai sebagai sedang.

**Kata kunci:** Web berbasis inkuiri, pembelajaran online, kemampuan sains inkuiri, pemahaman konsep, koordinasi dan respon, pendidikan IPA

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Afriani, T., Agustin, R. R., & Eliyawati, E. (2019). The Effect of Guided Inquiry Laboratory Activity with Video Embedded on Students' Understanding and Motivation in Learning Light and Optics. *Journal of Science Learning*, *2*(3), 79–84. https://doi.org/10.17509/jsl.v2i3.15144

Al-Irsyad Satya Islamic Report Book Regulation. (2021). *Al-Irsyad Satya Islamic Report Book Regulation*.

Alper, C. (2018). *Embracing Inquiry-Based Instruction*. Edutopia. https://www.edutopia.org/article/embracing-inquiry-based-instruction

Anderson, & Krathwohl. (2001). *Bloom ' s Digital Taxonomy*. 1–43.

Andrini, V. S. (2016). The Effectiveness of Inquiry Learning Method to Enhance Students ' Learning Outcome : A Theoritical and Empirical Review. *Journal of Education and Practice*, *7*(3), 38–42.

Antika, R. R. (2014). Process of Student Centered Learning Based. *BioKultur*, *III*(1), 251–263.

Asmoro, S. P., Suciati, & Prayitno, B. A. (2020). Empowering Scientific Thinking Skills of Students with Different Scientific Activity Types through Guided Inquiry. *International Journal of Instruction*, *14*(1), 947–962. https://doi.org/10.29333/IJI.2021.14156A

Bañez, R. M., & Yedra, J. L. V. (2019). Information and Communication Technology Approaches and Multimedia Authoring Skills of Public Elementary School Teachers. *Journal of Educational Science and Technology (EST)*, *5*(2), 176. https://doi.org/10.26858/est.v5i2.9687

Baumfalk, B., Bhattacharya, D., Vo, T., Forbes, C., Zangori, L., & Schwarz, C. (2019). Impact of model-based science curriculum and instruction on elementary students' explanations for the hydrosphere. *Journal of Research in Science Teaching*, *56*(5), 570–597. https://doi.org/10.1002/tea.21514

Bonett, D. G., & Wright, T. A. (2015). Cronbach's alpha reliability: Interval estimation, hypothesis testing, and sample size planning. *Journal of Organizational Behavior*, *36*(1), 3–15. https://doi.org/10.1002/job.1960

Cambrdige Assessment International Education. (2021). *Syllabus Cambridge IGCSE ™ Biology 0610* (Issue March 2020). Cambridge Pathway.

Cayvaz, A., Akcay, H., & Kapici, H. O. (2020). Comparison of Simulation-Based and Textbook-Based Instructions on Middle School Students' Achievement, Inquiry Skills and Attitudes. *International Journal of Education in Mathematics, Science and Technology*, *8*(1), 34. https://doi.org/10.46328/ijemst.v8i1.758

Çetin, A. (2015). *Design And Evaluation Of Web Based Science Learning Environments*. *August*, 98–105.

Cohen, L., Manion, L., & Morrison, K. (2008). Research Method in Education. In

*JETP Letters* (Vol. 86, Issue 10). https://doi.org/10.1134/S0021364007220055

Connor, G. O., & Rosicka, C. (2020). *Science inquiry skills* (2nd ed.). Australian Council for Educational Researc (ACER).

Creswell, J. W. (2012). *Educational Research: Planning, Conducting, and Evaluating quantitative and qualitative research* (C. Robb (ed.); 4th editio). Pearson education.

Darmaji, D., Kurniawan, D. A., & Suryani, A. (2019). Effectiveness of Basic Physics II Practicum Guidelines Based On Science Process Skills. *JIPF (Jurnal Ilmu Pendidikan Fisika)*, *4*(1), 1. https://doi.org/10.26737/jipf.v4i1.693

Erol, K., & Danyal, T. (2020). Analysis of distance education activities conducted during COVID-19 pandemic. *Educational Research and Reviews*, *15*(9), 536–543. https://doi.org/10.5897/err2020.4033

Fatmawati, B., & Rustaman, N. Y. (2020). The study of inquiry ability in the photosynthesis concept. *Jurnal Pendidikan IPA Indonesia*, *9*(4), 583–589. https://doi.org/10.15294/jpii.v9i4.23989

Fraenkel, J. R. (2012). *How to Design and Evaluate Research in Education*.

Haidar, D. A., Yuliati, L., & Handayanto, S. K. (2020). The effect of inquiry learning with scaffolding on misconception of light material among fourth-grade students. *Jurnal Pendidikan IPA Indonesia*, *9*(4), 540–553. https://doi.org/10.15294/jpii.v9i4.22973

Hairida, H. (2016). The effectiveness using inquiry based natural science module with authentic assessment to improve the critical thinking and inquiry skills of junior high school students. *Jurnal Pendidikan IPA Indonesia*, *5*(2), 209–215. https://doi.org/10.15294/jpii.v5i2.7681

Handayanti, Y., Sopandi, W., & Kadarohman, A. (2016). Profil Kemampuan Berinkuiri Siswa Sma Pada Topik Pengaruh Perubahan Suhu Terhadap Sistem Kesetimbangan Kimia. *JTK (Jurnal Tadris Kimiya)*, *1*(2), 38–46. https://doi.org/10.15575/jta.v1i2.1249

Hastuti, I. D., Surahmat, Sutarto, & Dafik. (2020). The effect of guided inquiry learning in improving metacognitive skill of elementary school students. *International Journal of Instruction*, *13*(4), 315–330. https://doi.org/10.29333/iji.2020.13420a

Ibrohim, I., Sutopo, S., Muntholib, M., Prihatnawati, Y., & Mufidah, I. (2020). Implementation of inquiry-based learning (IBL) to improve students' understanding of nature of science (NOS). *AIP Conference Proceedings*, *2215*(April). https://doi.org/10.1063/5.0000632

Iii, F. J. L., & Bittner, G. L. (2019). *Moving Toward Developing Inquiry Skills*. *4562*. https://doi.org/10.1080/08924562.2018.1560135

Ješková, Z., Balogová, B., & Kireš, M. (2018). Assessing inquiry skills of upper

secondary school students. *IOP Conf. Series: Journal of Physics*, *1076*, 2. https://doi.org/doi :10.1088/1742-6596/1076/1/012022

Kazeni, M., Baloyi, E., & Gaigher, E. (2018). Effectiveness of individual and group investigations in developing integrated science inquiry skills. *South African Journal of Education*, *38*(3), 1–12. https://doi.org/10.15700/saje.v38n3a1549

Khoiri, N., Huda, C., Rusilowati, A., Wiyanto, Sulhadi, & Wicaksono, A. G. C. (2020). The Impact of Guided Inquiry Learning with Digital Swing Model on students' Generic Science Skill. *Jurnal Pendidikan IPA Indonesia*, *9*(4), 554–560. https://doi.org/10.15294/jpii.v9i4.26644

Kim, H. (2011). Inquiry-Based Science and Technology Enrichment Program: Green Earth Enhanced with Inquiry and Technology. *Journal of Science Education and Technology*, *20*(6), 803–814. https://doi.org/10.1007/s10956-011-9334-z

Krathwohl, D. R. (2002). *A Revision of Bloom ' s Taxonomy : An Overview*. *41*(4).

Lederman, J., Lederman, N., Bartels, S., Jimenez, J., & Akubo, M. (2019). *International Collaborative Investigation of Beginning Seventh Grade Students' Understandings of Scientific Inquiry*.

Lubis, M. A., Harahap, M. B., & Manurung, S. R. (2017). Effects of Scientific Inquiry Learning Model and Logical Thinking Ability of Senior High School Students Science Process Skills. *Jurnal Pendidikan Fisika*, *Vol 6*, *No*, 70–75.

Mackean, D. ., & Hayward, D. (2014). Cambrodge IGCSE: BIology. *Cambridge IGCSE: Biology Third Edition*, 24–33.

Mahdiannur, M. A., Romadhoni, W., Sciences, N., Negeri, U., Sciences, N., & Kaltara, U. (2020). *EVALUATION OF SENIOR HIGH SCHOOL STUDENTS ' SCIENTIFIC INQUIRY SKILLS : A PERSPECTIVE FROM PROPOSING ACTION AND*. *5*(2), 80–86.

Manoj, T. I., & Devanathan, S. (2010). Effects Of Web Based Inquiry Science Environment On Cognitive Outcomes In Biological Science In Correlation To Emotional Intelligence. *I-Manager's Journal on School Educational Technology*, *6*(2), 30–35. https://doi.org/10.26634/jsch.6.2.1312

Mardiana, H. (2018). Lecturer's Attitude towards Advance Technology and Its Impact to the Learning Process: Case study in Tangerang City Campuses. *Journal of Educational Science and Technology (EST)*, *4*(1), 12. https://doi.org/10.26858/est.v4i1.4974

Minium, E. W., King, B. M., & Bear, G. (1993). *Statistical Reasoning in Psychology and Education* (third). John Wiley & Son, Inc.

Mohd Razali, N., & Bee Wah, Y. (2011). Power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests. *Journal of Statistical Modeling and Analytics*, *2*(1), 13–14.

Ormancı, Ü., & Çepni, S. (2019). *Developing Web-Assisted Science Material Based on Guided Inquiry Approach : Bones*. *9*(2), 96–108.

Ormancı, Ü., & Çepni, S. (2020). Investigating the effects of web-based science material for guided inquiry approach on information and communication skills of students. *Participatory Educational Research*, *7*(1), 201–219. https://doi.org/10.17275/per.20.12.7.1

Pratami, A. R. (2020). *The Profile of Students' Concept Mastery and Students' Perception Using Semantic Network Analysis in Learning Global Warming*.

Putri, A. U., Rusyati, L., & Rochintaniawati, D. (2018). The Impact of Problem-Solving Model on Students' Concept Mastery and Motivation in Learning Heat Based on Gender. *Journal of Science Learning*, *1*(2), 71. https://doi.org/10.17509/jsl.v1i2.9793

Raes, A., Schellens, T., & De Wever, B. (2014). Web-based Collaborative Inquiry to Bridge Gaps in Secondary Science Education. *Journal of the Learning Sciences*, *23*(3), 316–347. https://doi.org/10.1080/10508406.2013.836656

Raja, R., & Nagasubramani, P. C. (2018). Impact of modern technology in education. *Journal of Applied and Advanced Research*, *3*(S1), 33. https://doi.org/10.21839/jaar.2018.v3is1.165

Sarioglan, A. B., & Gedik, I. (2020). Investigated effects of guided inquiry-based learning approach on students' conceptual change and durability. *Cypriot Journal of Educational Sciences*, *15*(4), 674–685. https://doi.org/10.18844/cjes.v15i4.5050

Series, C. (2018). *Questioning skill of science teacher from the students perscpective in senior high school Questioning skill of science teacher from the students perscpective in senior high school*.

Setyaningsih, R., Abdullah, A., Prihantoro, E., & Hustinawaty, H. (2019). Model Penguatan Literasi Digital Melalui Pemanfaatan E-Learning. *Jurnal ASPIKOM*, *3*(6), 1200. https://doi.org/10.24329/aspikom.v3i6.333

Shanmugam, K., & Balakrishnan, B. (2019). Motivation in information communication and technology-based science learning in tamil schools. *Jurnal Pendidikan IPA Indonesia*, *8*(1), 141–152. https://doi.org/10.15294/jpii.v8i1.16564

Shidiq, A., Rochintaniawati, D., & (Page 01-13 ), Y. S. (2017). The Use of Self Construction Animation Learning Software to Improve the Students Concept Mastery on Structure and Functions of Plants. In *Pancaran Pendidikan* (Vol. 6, Issue 3). https://doi.org/10.25037/pancaran.v6i3.31

Siregar, E., Rajagukguk, J., & Sinulingga, K. (2019). Improvement of Science Process Skills Using Scientific Inquiry Models With Algodoo Media and Quotient Adversity in High School Students. *Journal of Transformative Education and Educational Leadership*, *1*(2), 2684–7086. https://jteel.unimed.ac.id

Suwarni, D. I., Kurniasih, S., & Rostikawati, R. T. (2018). Penerapan model pembelajaran think-talk-write (TTW) dan demonstrasi reciprocal untuk meningkatkan hasil belajar ekosistem Siswa SMP PGRI Suryakencana

Cileungsi Kabupaten Bogor Universitas Pakuan , Jln Pakuan Po Box 452 Bogor. *Jurnal Pendidikan Ilmiah*, *3*(3), 90–95.

Taber, K. S. (2017). Encyclopedia of science education. In *Teacher Development* (Vol. 21, Issue 2). https://doi.org/10.1080/13664530.2016.1199398

Temiz, B. K. (2020). *Assessing Skills of Identifying Variables and Formulating Hypotheses Using Scenario-Based Multiple-Choice Questions*. *7*(1), 1–17.

Ulus, B., & Oner, D. (2020). *Fostering Middle School Students ' Knowledge Integration Using the Web-Based Inquiry Science Environment ( WISE )*. 242–256.

UNESCO. (2020). *Education: From discruption to recovery*. Unesco.Com. https://en.unesco.org/covid19/educationresponse

Van Uum, M. S. J., Verhoeff, R. P., & Peeters, M. (2016). Inquiry-based science education: towards a pedagogical framework for primary school teachers. *International Journal of Science Education*, *38*(3), 450–469. https://doi.org/10.1080/09500693.2016.1147660

Wang, M., Cheng, B., Chen, J., Mercer, N., & Paul, A. (2017). The use of web-based collaborative concept mapping to support group learning and interaction in an online environment. *The Internet and Higher Education*. https://doi.org/10.1016/j.iheduc.2017.04.003

Williams, G., & Fosbery, R. (2015). *Essential Biology.pdf* (L. Ryan (ed.); 2nd Editio). Cambridge Internation Curriculum.

Yang, X., Zhang, M., Kong, L., Wang, Q., & Hong, J.-C. (2020). *The Effects of Scientific Self-efficacy and Cognitive Anxiety on Science Engagement with "Question-Observation-Doing-Explanation" Model during Schools Disruption in COVID-19 Pandemic*. 1–28. https://doi.org/10.21203/rs.3.rs-40814/v1

Yasin, A. I., Rochintaniawati, D., & Prima, E. C. (2021a). The development of web based inquiry as online science inquiry environment. *Journal of Physics: Conference Series*, *1806*(1). https://doi.org/10.1088/1742-6596/1806/1/012141

Yasin, A. I., Rochintaniawati, D., & Prima, E. C. (2021b). The development of web based inquiry as online science inquiry environment. *International Conference on Mathematics and Science Education (ICMScE)*. https://doi.org/10.1088/1742-6596/1806/1/012141

Zhou, G., & Xu, J. (2017). Microteaching Lesson Study: An Approach to Prepare Teacher Candidates to Teach Science through Inquiry. *International Journal of Education in Mathematics, Science and Technology*, *5*(3), 235–235. https://doi.org/10.18404/ijemst.296039