FOUR-TIER DIAGNOSTIC TEST AS A TOOL TO ASSESS STUDENTS MISCONCEPTION ABOUT EARTH AND SOLAR SYSTEM IN EAST BANDUNG REGION

RESEARCH PAPER

Submitted as Requirement to Obtain Degree of *Sarjana Pendidikan* in International Progran on Science Education

Arranged by:

Zalfa Julia Rosyani

NIM 2101584

SCIENCE EDUCATION STUDY PROGRAM

FACULTY OF MATHEMATICS AND SCIENCE EDUCATION

UNIVERSITAS PENDIDIKAN INDONESIA

2025

FOUR-TIER DIAGNOSTIC TEST AS A TOOL TO ASSESS STUDENTS MISCONCEPTION ABOUT EARTH AND SOLAR SYSTEM IN EAST BANDUNG REGION

Oleh

Zalfa Julia Rosyani

Sebuah skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Pendidikan pada Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

Universitas Pendidikan Indonesia

April 2025

APPROVAL SHEET

ZALFA JULIA ROSYANI

FOUR-TIER DIAGNOSTIC TEST AS A TOOL TO ASSESS MISCONCEPTIONS ABOUT EARTH AND SOLAR SYSTEM AMONG JUNIOR HIGH SCHOOL STUDENTS IN EAST BANDUNG REGION

Approved and confirmed by:

Supervisor I

Dr. Lilit Rusyati, S.Pd., M.Pd.

NIP. 198704202012122001

Supervisor II

Prof. Dr. Nuryani Rustaman, M.Pd.

NIPT. 920220119501231201

Received by,

Head of Science Education Study Program

Prof. Dr. Phil. Ari Widodo, M.Ed

NIP. 196705271992031001

DECLARATION

I am the undersigned:

Name	:	Zalfa Julia Rosyani
Student Id	:	2101584
Study Program	:	Science Education
Title	:	Four-Tier Diagnostic Test as A Tool to Assess Misconceptions About Earth and Solar System Among Junior High School Students in East Bandung Region

Hereby declare that this paper is my own work. I guarantee that the entire contents of this work, both in part and in whole, are not plagiarism of other people's work, except for the parts that have been clearly stated and mentioned their sources.

If in the future violations of academic ethics or elements of plagiarism are found, I am willing to accept sanctions in accordance with applicable regulations at the Universitas Pendidikan Indonesia.

Bandung, 25 April 2025

Declarant

Zalfa Julia Rosyani

2101584

ACKNOWLEDGEMENTS

The author offers the highest praise and deepest gratitude to Allah S.W.T., the Almighty God, for His endless grace and blessings that enabled the completion of this research. The author would also like to extend her heartfelt appreciation to the following individuals:

1. Dr. Lilit Rusyati, S.Pd., M.Pd. and Prof. Dr. Hj. Nuryani Rustaman, M.Pd., as supervisors, who have shown unwavering patience and dedication in providing innovative insights, valuable time, direction, guidance, and continuous encouragement throughout the entire process of this thesis writing.
2. Prof. Phil. Dr. H. Ari Widodo, M.Ed., as Head of the Science Education Study Program, and Dr. Eka Cahya Prima, S.Pd., M.T., as Secretary of the Science Education Study Program, for their encouraging support and dedicated service.
3. Mrs. Ai and Dr. Margi, who have supported this journey with their invaluable guidance, assistance, advice, and encouragement throughout the writing of this research paper.
4. All lecturers, teaching assistants, and administrative staff of the IPSE Study Program and UPI—especially Mrs. Diana, Mrs. Margi, Mrs. Lilit, Mrs. Eli, Mrs. Rika, Prof. Ari, Prof. Yayan, Mr. Eka, Mr. Ikmanda, Mr. Nanang, Mrs. Resik, Mr. Latief, and Mrs. Dhea—for their sincere support, assistance, dedication, and the valuable knowledge shared with the author throughout her academic journey in this program.
5. Thank you to the junior high school teachers and principals for granting permission, offering support, and allocating their time to enable the author to carry out research at the school. Sincere thanks are also given to all the participating students for their time, enthusiasm, and wholehearted contributions throughout the research process.

6. With deep love, the author extends heartfelt gratitude to the most beloved parents, the author's first love in life, Papap Doday R Radhiana and Mamah Heni Sri Hendriyati. Thank you for all the love you have given, for always offering the best support through your patience, care, attention, and constant prayers throughout each day. May Papap and Mamah always be blessed with good health and happiness in life.
7. To my dearest Bunda, Ririn Ratna Purnama, who brought the author into this world—thank you for all the sacrifices and unconditional love you have given. Thank you for choosing to give birth and allowing the author to exist in this world. May Bunda always be in good health and continue to accompany the author on the journey ahead.
8. Heartfelt thanks to the beloved older siblings, Aa Ricky, Yudi, and Aji. Thank you for loving the author wholeheartedly and caring for the author since childhood, as well as for all the prayers and unwavering support over the years. Gratitude is also extended to the dearest younger siblings, Abang Rafi, Kaka Yuri, Dede Yasmin, and Eril, may we always stay together and continue to share this journey side by side.
9. To the cherished woman in the author's life, Vinasti Martha Mustika, thank you for being a sister, a friend, and a guiding figure. Thank you for the constant support, the encouragement, and the love you share each and every day. Your willingness to listen to the author's thoughts and feelings has meant so much.
10. To someone special whom the author deeply loves, Nazmi Dhiya Ulhaq—thank you for all the kindness you have shown throughout this time. Thank you for bringing such a meaningful change in the author's life, for your encouragement, care, and love. Your constant presence and the safe space you provide have been a source of strength and comfort through life's ups and downs. May you succeed in life, become the person you've always dreamed of, and receive all the goodness this world has to offer. And may we continue to walk through life together, hand in hand, through both joy and sorrow.

11. Thank you to the Ajojing girls — Hilda Oktapiani, Annaya Keisa Fasya, Ragil Dwikesuma, and Sifa Pringgi Alzazeera. Thank you for being such wonderful friends throughout this college journey and for all the joyful moments we've shared together. Wishing you all success and endless happiness in everything you pursue.
12. Thank you to the Assessment Girls — Arifah, Sabila, Nisrina, Ragil, and Keisya — for being there through every phase of this thesis journey, from beginning to end. Your support, encouragement, and help have meant so much to the author, and for that, heartfelt gratitude is extended to each of you.
13. Thank you to all members of IPSE 2021 for being part of this four-year college journey. Your presence has made this experience meaningful and memorable.
14. Last but not least, to myself — thank you for holding on and staying committed until the very end. You’re amazing! Thank you for being strong and resilient, even through the tears and exhaustion. Keep going with courage and hope, because I know you have what it takes to get through anything life throws your way.

FOUR-TIER DIAGNOSTIC TEST AS A TOOL TO ASSESS STUDENTS MISCONCEPTION ABOUT EARTH AND SOLAR SYSTEM IN EAST BANDUNG REGION

Zalfa Julia Rosyani
International Program on Science Education
Universitas Pendidikan Indonesia
zalfajuliar@upi.edu

ABSTRACT

Conceptual misunderstanding or misconception is one of the common obstacles that often arise in the learning process, potentially hindering the achievement of expected learning outcomes. This study focuses on exploring and analyzing the conceptual problems experienced by students when learning the topic of Earth and the Solar System. To support this objective, a multiple-choice questionnaire was used as an instrument, designed based on a four-tier diagnostic test format and thoroughly validated. Of the 14 test items subjected to validation, 12 were declared valid and covered various key concepts within the topic. Using the Convenience Sampling method, a total of 547 eighth-grade junior high school students in the East Bandung area who had already studied this topic were selected as the research sample. The results showed that 33% of students had a low level of understanding of Earth and Solar System concepts, which also affected their self-confidence. In addition, around 25% of students experienced misconceptions, making it the second most prevalent category in conceptual understanding. Meanwhile, only 21% of students demonstrated scientific understanding. The categories of false positive and false negative responses were found in the range of 10–12% each. These findings highlight the importance of using appropriate diagnostic instruments to identify misconceptions and the need for instructional strategies that can more effectively improve students' conceptual understanding.

Keyword: Misconceptions, Earth and Solar System, Four-Tier Diagnostic Test

TES DIAGNOSTIK EMPAT TINGKAT SEBAGAI ALAT UNTUK MENGUKUR MISKONSEPSI TENTANG BUMI DAN TATA SURYA DI KALANGAN SISWA SMP DI BANDUNG TIMUR

Zalfa Julia Rosyani
International Program on Science Education
Universitas Pendidikan Indonesia
zalfajuliar@upi.edu

ABSTRAK

Kesalahan pemahaman konsep atau miskonsepsi merupakan salah satu hambatan yang kerap muncul dalam proses pembelajaran, sehingga berpotensi mengganggu tercapainya hasil belajar yang diharapkan. Penelitian ini difokuskan untuk menggali dan menganalisis permasalahan konseptual yang dialami siswa saat mempelajari topik bumi dan tata surya. Untuk mendukung tujuan tersebut, digunakan instrumen berupa angket pilihan ganda yang dirancang berdasarkan format tes diagnostik empat tingkat dan telah melewati tahap validasi secara menyeluruh. Dari 14 butir soal yang diuji validitasnya, 12 dinyatakan valid dan mencakup berbagai konsep kunci dalam topik tersebut. Dengan menggunakan metode *Convenience Sampling*, sebanyak 547 siswa kelas 8 SMP di wilayah Bandung Timur yang telah mempelajari topik ini dijadikan sebagai sampel penelitian. Hasil penelitian menunjukkan bahwa sebanyak 33% siswa memiliki pemahaman yang rendah terhadap konsep-konsep Bumi dan Tata Surya, yang juga berdampak pada rendahnya kepercayaan diri mereka. Selain itu, sekitar 25% siswa mengalami miskonsepsi, menjadikannya kategori kedua terbanyak dalam pemahaman konsep. Sementara itu, siswa yang menunjukkan pemahaman ilmiah hanya mencapai 21%. Adapun kategori hasil positif palsu dan negatif palsu masing-masing ditemukan pada kisaran 10–12%. Temuan ini menggarisbawahi pentingnya penggunaan instrumen diagnostik yang tepat dalam mengidentifikasi miskonsepsi serta perlunya strategi pembelajaran yang mampu memperbaiki pemahaman konseptual siswa secara lebih efektif.

Kata Kunci: Miskonsepsi, Bumi dan Tata Surya, Tes Diagnostik Empat Tingkat

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

REFERENCES

Adadan, E., & Savasci, F. (2012). An analysis of 16–17-year-old students' understanding of solution chemistry concepts using a two-tier diagnostic instrument. *International Journal of Science Education*, *34*(4), 513–544.

Adawiyah, F. (2021). Variasi Metode Mengajar Guru Dalam Mengatasi Kejenuhan Siswa Di Sekolah Menengah Pertama. *Jurnal Paris Langkis*, *2*(1), 68–82.

Agustina, S. Y., & Aziz, R. A. (2024). Perancangan Media pembelajaran Interaktif Pengenalan Sistem Tata Surya Untuk Siswa Sekolah Dasar. *Repeater: Publikasi Teknik Informatika Dan Jaringan*, *2*(3), 198–205.

Argaruri, Y., Sulianto, J., Listyarini, I., & Rini, D. N. K. S. P. (2023). Penggunaan Media Pembelajaran Konkret Dalam Meningkatkan Minat Belajar Matematika Peserta Didik SDN Kalicari 01 Semarang. *INNOVATIVE: Journal Of Social Science Research*, *3*(2), 189–201.

Aydeniz, M., Bilican, K., & Kirbulut, Z. D. (2017). Exploring Pre-Service Elementary Science Teachers' Conceptual Understanding of Particulate Nature of Matter through Three-Tier Diagnostic Test. *International Journal of Education in Mathematics, Science and Technology*, *5*(3), 221–234.

Aziz, A., & Shaleh, M. (2019). Variasi metode pembelajaran dan peningkatan motivasi belajar siswa. *Edupedia: Jurnal Studi Pendidikan Dan Pedagogi Islam*, *4*(1), 87–94.

Azizah, S. N., Akhsan, H., Muslim, M., & Ariska, M. (2022). Analysis of college students misconceptions in astronomy using four-tier test. *Journal of Physics: Conference Series*, *2165*(1), 012004.

Badiro, D., Syuhendri, S., & Fathurohman, A. (2019). Pengembangan media pembelajaran aplikasi android berbasis teori perubahan konseptual materi tata surya dan fase bulan mata kuliah ipba. *Jurnal Inovasi Dan Pembelajaran Fisika*, *6*(1), 103–112.

Bayrak, B. K. (2013). Using Two-Tier Test to Identify Primary Students' Conceptual Understanding and Alternative Conceptions in Acid Base. *Online Submission*, *3*(2), 19–26.

Budhi, G. S., Adipranata, R., Sugiarto, M., Anwar, B., & Setiahadi, B. (2011). Pengelompokan Sunspot Pada Citra Digital Mahatari Menggunakan Metode Clustering Dbscan. *Seminar Nasional Aplikasi Teknologi Informasi (SNATI)*.

Capili, B. (2021). Cross-sectional studies. *AJN The American Journal of Nursing*, *121*(10), 59–62.

Council, N. R., Behavioral, D. of, Sciences, S., Education, B. on S., & Education, C. on U. S. (1997). *Science teaching reconsidered: A handbook*. National Academies Press.

Creswell, J. W. (2015). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. pearson.

Desfandi, M., Abdi, A. W., Gadeng, A. N., & Sofia, I. (2020). Identification of misconceptions in geography using the three-tier diagnostic test. *IOP Conference Series: Earth and Environmental Science*, *561*(1), 012040.

Faizah, K. (2016). Miskonsepsi dalam pembelajaran IPA. *Jurnal Darussalam: Jurnal Pendidikan, Komunikasi Dan Pemikiran Hukum Islam*, *8*(1), 115–128.

Fakhriyah, F., & Masfuah, S. (2021). The development of a four tier-based diagnostic test diagnostic assessment on science concept course. *Journal of Physics: Conference Series*, *1842*(1), 012069.

Fauziah, A. N. M., Agustin, B. P. T., Imamy, H. S., & Fachrina, I. (2024). MEMAHAMI PROSES FASE BULAN SETENGAH (FIRST QUARTER) DAN PENGARUH INTENSITASNYA PADA MALAM HARI. *BIOCHEPHY: Journal of Science Education*, *4*(1), 44–50.

Firdaus, T., & Sinensis, A. R. (2017). Perdebatan Paradigma Teori Revolusi: Matahari Atau Bumi Sebagai Pusat Tata Surya? *Titian Ilmu: Jurnal Ilmiah Multi Sciences*, *9*(1), 23–32.

Genç, H. N., & Aksoy, A. C. A. (2024). Measurement Tool for The Determination of Misconceptions About Change of State. *Research on Education and Psychology*, *8*(1), 146–164.

Guerra-Reyes, F., Guerra-Dávila, E., Naranjo-Toro, M., Basantes-Andrade, A., & Guevara-Betancourt, S. (2024). Misconceptions in the learning of natural sciences: A systematic review. *Education Sciences*, *14*(5), 497.

Gurel, D. K., Eryılmaz, A., & McDermott, L. C. (2015). *A review and comparison of diagnostic instruments to identify students' misconceptions in science*.

Hadiyanti, L. N., & Widodo, A. (2015). Pengembangan bahan ajar materi sistem kekebalan tubuh manusia berbasis pengetahuan awal siswa SMA. *Jurnal Pembelajaran Biologi*, *2*(2), 12.

Hartanto, T. J., & Marcelina, S. (2019). Studi Tentang Konsepsi (Maha) Siswa Dalam Memahami Fenomena Pergantian Siang Dan Malam. *Vidya Karya*, *34*(2), 79–91.

Hasanah, N., Suryana, Y., & Nugraha, A. (2018). Pengaruh metode eksperimen terhadap pemahaman siswa tentang gaya dapat mengubah

gerak suatu benda. *PEDADIDAKTIKA: Jurnal Ilmiah Pendidikan Guru Sekolah Dasar*, *5*(1), 127–139.

Hasanuddin, M. I. (2020). Pengetahuan Awal (prior knowledge): konsep dan implikasi dalam pembelajaran. *Edisi*, *2*(2), 217–232.

Hayati, N., Riskilawati, I., Alfajri, M. I., Paisal, A., & Ridho, A. R. (2024). GERAK DAN ROTASI BUMI: REALITAS ILMIAH DALAM AL-QURAN: Menelusuri Bukti Ilmiah dalam Kitab Suci A-Quran. *Jurnal Intelek Dan Cendikiawan Nusantara*, *1*(3), 4661–4673.

Hazlita, H., Zulkardi, Z., & Darmawijoyo, D. (2015). Pengembangan Soal Penalaran Model TIMSS Konteks Sumatera Selatan di Kelas IX SMP. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *5*(2), 170–179.

Husna, N., Putra, M. J. A., & Alim, J. A. (2022). Pengembangan Materi Pembelajaran Komik Digital Komik Celestial Objek Untuk Memfasilitasi Minat Baca Siswa Kelas VI Sd. *Primary: Jurnal Pendidikan Guru Sekolah Dasar*, *11*(5), 1618–1630.

Inabuy, V., Sutia, C., Maryana, O. F. T., Hardanie, B. D., & Lestari, S. H. (2021). Ilmu Pengetahuan Alam untuk SMP Kelas VII. *Pusat Kurikulum Dan Perbukuan Badan Penelitian Dan Pengembangan Dan Perbukuan Kementerian Pendidikan, Kebudayaan, Riset, Dan Teknologi*.

Inaltekin, T., & Akbaba, U. (2024). Investigation of Middle School Students' Model of Astronomy Events and Information Sources of Incorrect Model. *International Journal of Contemporary Educational Research*, *11*(4), 508–524.

Istiyono, E. (2022). Diagnostic tests as an important pillar in today's physics learning: four-tier diagnostic test a comprehensive diagnostic test solution. *Journal of Physics: Conference Series*, *2392*(1), 012001.

Istiyono, E., Dwandaru, W. S. B., Fenditasari, K., Ayub, M. R. S. S. N., & Saepuzaman, D. (2023). The Development of a Four-Tier Diagnostic Test Based on Modern Test Theory in Physics Education. *European Journal of Educational Research*, *12*(1).

Jannah, R., Taufiq, M., & Rahma, R. (2022). Pengaruh penerapan pendekatan STEAM pada materi fluida statis terhadap pemahaman konsep siswa kelas XI SMA Negeri 1 Jangka. *JEMAS: Jurnal Edukasi Matematika Dan Sains*, *3*(2), 73–77.

Jumadi, J., Sukarelawan, M. I., & Kuswanto, H. (2023). An investigation of item bias in the four-tier diagnostic test using Rasch model. *Int J Eval & Res Educ ISSN*, *2252*(8822), 8822.

Kaltakci-Gurel, D., Eryilmaz, A., & McDermott, L. C. (2017). Development and application of a four-tier test to assess pre-service physics teachers'

misconceptions about geometrical optics. *ReseaRch in Science & Technological EducaTion*, *35*(2), 238–260.

Kanli, U. (2015). Using a Two-Tier Test to Analyse Students' and Teachers' Alternative Concepts in Astronomy. *Science Education International*, *26*(2), 148–165.

Kiray, S. A., & Simsek, S. (2021). Determination and evaluation of the science teacher candidates' misconceptions about density by using four-tier diagnostic test. *International Journal of Science and Mathematics Education*, *19*, 935–955.

Korur, F. (2015). Exploring seventh-grade students' and pre-service science teachers' misconceptions in astronomical concepts. *Eurasia Journal of Mathematics, Science and Technology Education*, *11*(5), 1041–1060.

Kurniawan, D., & Wustqa, D. U. (2014). Pengaruh perhatian orangtua, motivasi belajar, dan lingkungan sosial terhadap prestasi belajar matematika siswa SMP. *Jurnal Riset Pendidikan Matematika*, *1*(2), 176–187.

Lee, Y.-W., & Sawaki, Y. (2009). Cognitive diagnosis approaches to language assessment: An overview. *Language Assessment Quarterly*, *6*(3), 172–189.

Lelliott, A., & Rollnick, M. (2010). Big ideas: A review of astronomy education research 1974–2008. *International Journal of Science Education*, *32*(13), 1771–1799.

Leoniza, M. B. T., Styawati, R., Umami, S. R., Thohir, M. A., & Utama, C. (2025). Identifikasi Miskonsepsi Materi Sistem Tata Surya Menggunakan Three-Tier Diagnostic Test dengan Certainty Response Index. *PENDIPA Journal of Science Education*, *9*(1), 1–9.

Lestiawati, I. M. (2019). Mengenal dan memahami konsep pembelajaran sains dan matematika untuk anak usia dini. *Pratama Widya: Jurnal Pendidikan Anak Usia Dini*, *4*(2), 122–131.

Lubis, T. (2013). Pengembangan Multimedia Pembelajaran Berbentuk Komik dengan Alur Cerita Berangkai untuk Identifikasi Lack of Knowledge Siswa dalam Memahami Mata Pelajaran TIK SMP. Bandung: UPI. Dari Perpustakaan. upi. edu. *Bandung: Universitas Pendidikan Indonesia*.

Magdalena, I., Fauziah, S., Sari, P. W., & Berliana, N. (2020). Analisis Faktor Siswa Tidak Memperhatikan Penjelasan Guru. *Nusantara*, *2*(2), 283–295.

Maulana, Y., Sopandi, W., Rosmiati, I., & Agustina, N. S. (2023). Analysis of prior knowledge elementary school students using three-tier diagnostic

test to identify blood circular system misconceptions. *Edu Sains: Jurnal Pendidikan Sains Dan Matematika*, *11*(1), 69.

Muhabib, Z., Anggoro, S., Nisa, L. C., & Amani, I. D. Z. (2024). Using a Two-tier Diagnostic Test to Analyze Students' Misconceptions and Misunderstandings of Solar System. *Forum for University Scholars in Interdisciplinary Opportunities and Networking*, *1*(1), 499–507.

Musdalifah, R. (2019). *Pemrosesan dan Penyimpanan Informasi pada Otak Anak dalam Belajar: Short Term and Long Term Memory*.

Muzzaki, I., Nur, L. O., & Edwar, E. (2022). Perancangan Dan Realisasi Purwarupa Sistem Komunikasi Satelit Nano Dengan Menggunakan Modul RF4463PRO–433. *EProceedings of Engineering*, *9*(6).

Negoro, R. A., & Karina, V. (2019). Development of a four-tier diagnostic test for misconception of oscillation and waves. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, *5*(2), 69–76.

Pambudi, B., Efendi, R. B., Novianti, L. A., Novitasari, D., & Ngazizah, N. (2019). Pengembangan alat peraga IPA dari barang bekas untuk meningkatkan motivasi belajar dan pemahaman siswa sekolah dasar. *Indonesian Journal of Primary Education*, *2*(2), 28.

Pertiwi, U. D., Atanti, R. D., & Ismawati, R. (2018). Pentingnya literasi sains pada pembelajaran IPA SMP abad 21. *Indonesian Journal of Natural Science Education (IJNSE)*, *1*(1), 24–29.

Pilendia, D. (2022). Stellarium sebagai media pembelajaran fenomena astronomi: kajian LITERATUR. *Jurnal Ilmiah Wahana Pendidikan*, *8*(1), 525–532.

Putica, K. B. (2023). Development and validation of a four-tier test for the assessment of secondary school students' conceptual understanding of amino acids, proteins, and enzymes. *Research in Science Education*, *53*(3), 651–668.

Rahi, S. (2017). Research design and methods: A systematic review of research paradigms, sampling issues and instruments development. *International Journal of Economics & Management Sciences*, *6*(2), 1–5.

Ramadhani, A. (2023). *Dampak Kehadiran Guru di Kelas terhadap Kedisiplinan Siswa dalam Proses Pembelajaran di UPT SDN Laiyolo No. 52 Kepulauan Selayar. Harmoni: Jurnal Ilmu Komunikasi Dan Sosial, 1 (2), 162–175*.

Safitri, L. S. I., Hamdu, G., & Saputra, E. R. (2024). Analisis miskonsepsi siswa kelas V pada materi sifat dan perubahan wujud benda di SDN 1 Nagarawangi. *COLLASE (Creative of Learning Students Elementary Education)*, *7*(4), 603–608.

Saputri, I. D., & Rusyati, L. (2024). Analysis of Junior High School Students' Misconceptions About the Human Excretion Using a Four-Tier Diagnostic Test. *Jurnal IPA & Pembelajaran IPA*, *8*(2), 123–130.

Soeharto, S., & Csapó, B. (2021). Evaluating item difficulty patterns for assessing student misconceptions in science across physics, chemistry, and biology concepts. *Heliyon*, *7*(11).

Stavinschi, M., García, B., & Sosa, A. (2018). Tata Surya. *Jurnal Prodi Astronomi Bandung*, *73*.

Sullivan, G. M., & Artino Jr, A. R. (2013). Analyzing and interpreting data from Likert-type scales. *Journal of Graduate Medical Education*, *5*(4), 541–542.

Suprapto, N. (2020). Do we experience misconceptions?: An ontological review of misconceptions in science. *Studies in Philosophy of Science and Education*, *1*(2), 50–55.

Supriatna, U., Samsudin, A., & Efendi, R. (2019). Teaching solar system topic through Predict-Observe-Explain-Apply (POEA) strategy: A path to students' conceptual change. *Tadris: Jurnal Keguruan Dan Ilmu Tarbiyah*, *4*(1), 1–15.

Taslidere, E. (2016). Development and use of a three-tier diagnostic test to assess high school students' misconceptions about the photoelectric effect. *Research in Science & Technological Education*, *34*(2), 164–186.

Tsui, C., & Treagust, D. (2010). Evaluating secondary students' scientific reasoning in genetics using a two-tier diagnostic instrument. *International Journal of Science Education*, *32*(8), 1073–1098.

Wahyuni, W., Husna, N., Mustanir, M., & Sulastri, S. (2020). Sains dan Al â€"Quran: Proses Terjadinya Gerhana Matahari. *Al-Tadabbur: Jurnal Ilmu Al-Qur'an Dan Tafsir*, *5*(02), 349–364.

Wang, X., & Cheng, Z. (2020). Cross-sectional studies: strengths, weaknesses, and recommendations. *Chest*, *158*(1), S65–S71.

Wibowo, A. M. (2012). Peningkatan pemahaman konsep sains di madrasah ibtidaiyah melalui perbaikan bahan ajar. *Madrasah: Jurnal Pendidikan Dan Pembelajaran Dasar*, *4*(2).

Yuberti, Y., Suryani, Y., & Kurniawati, I. (2020). Four-tier diagnostic test with certainty of response index to identify misconception in physics. *Indonesian Journal of Science and Mathematics Education*, *3*(2), 245–253.

Yuliati, Y. (2017). Miskonsepsi siswa pada pembelajaran IPA serta remediasinya. *Bio Educatio*, *2*(2), 279470.