PERCEPTION OF UNDERSTANDING ABILITY OF REDOX CONCEPT ON STUDENT E-LEARNING OUTCOMES

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Abstract

The application of e-learning greatly impacts the ability to understand concepts and student learning outcomes. The purpose of the study was to determine 1) the prerequisite test of research instruments 2) the perception of the ability to understand redox concepts in e-learning based on indicators of learning stimuli, responses, and evaluations. 3) the relationship of understanding redox concepts to student learning outcomes. The method used is descriptive quantitative, in-class X MIA at MAN Tangerang, 38 students were selected by purposive random sampling. Data collection was carried out through a questionnaire using a Likert scale. The results showed that the prerequisite test was declared valid, reliable, and normally distributed. Student perceptions generally agree based on learning stimulus indicators as much as 71.025%; response 71.075%; evaluation 62.475%. Students give full attention during learning, participate actively during discussions, and understand redox concepts. Understanding redox concepts on student learning outcomes has a significant relationship (strong and positive), seen from the value of sig. (2-tailed) of 0.000 less than 0.05, Pearson correlation of 0.967 greater than 0.329 (significance 5%). The results of this study serve as scientific information on e-learning for chemistry subject teachers in improving the learning process.

Keywords*: Perception, Concept Understanding Ability, Learning Outcomes*

INTRODUCTION

E-Learning is a learning process utilizing electronic information packages for the benefit of learning and education that can be accessed by students, anytime and anywhere based on ICT[1]. However, in reality, online learning still has many obstacles, students experience difficulties in terms of interaction, there is no guidance from the teacher so the subjects studied have problems that have a real impact on interest and learning achievement[2]. The online

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[1] Paulina Pannen et al., *Panduan Pelaksanaan Pendidikan Jarak Jauh 2016* (Jakarta: Direktorat Jenderal Pembelajaran dan Kemahasiswaan Kementerian Riset, Teknologi, dan Pendidikan Tinggi, 2016), http://kuliahdaring.dikti.go.id/s/berkas/view/1/panduan/pjj.

[2] Mubiar Agustin et al., "Tipikal Kendala Guru PAUD Dalam Mengajar Pada Masa Pandemi Covid 19 Dan Implikasinya," *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini* 5, no. 1 (2020): 334, https://doi.org/10.31004/obsesi.v5i1.598; Yusneli Syafari and Maria Montessori, "Analisis Pembelajaran Daring Terhadap

learning process can have an impact on students' interests and learning achievement[3]. The lack of interaction and interest in learning is due to the learning model provided by the teacher has not been able to provoke students to be active in the learning process which leads to not being motivated to be actively involved in the learning process. If these problems are left unchecked, it will hurt the quality of education.

Student perception is one factor that influences academic success. Perception is an essential psychological aspect for an individual in concluding information and interpreting a message by observing an object, event, or relationship through the five senses[4]. The indicators of an individual's perception are as follows: (1) the perceived object which gives rise to a stimulus; (2) response; and (3) evaluation[5]. As a result, it is critical to understand the perception of learning based on stimulus indicators, responses, and student evaluations. Students' learning outcomes are one of the final results that serve as a barometer for the success of their learning. Learning outcomes are changes in an individual's behavior that occur due to the learning process in the cognitive, affective, and psychomotor domains[6]. Learning outcomes that become the subject of learning assessment are new abilities acquired by students due to their participation in the teaching and learning process and learning experiences[7]. After completing the learning process, learning outcomes can be determined and measured using learning outcomes tests[8].

In learning redox reactions, students are not only required to know what a redox reaction equation is but students are required to describe balancing redox reactions, determining reduction, oxidation, reducing agent, an oxidizing agent as well as increasing and decreasing oxidation numbers as well as their application in everyday life. Oxidation-reduction (redox) is one of the chemical concepts that is still considered difficult by students. Many find it difficult to determine which reaction undergoes oxidation or reduction[9]. Concept difficulties and errors occur because students tend to memorize and do not understand concepts well, so they are easy to forget and have difficulty working on problems[10]. Therefore, it is important to know the

Motivasi Belajar Dan Prestasi Belajar Siswa Dimasa Pandemi Covid-19," *Jurnal Basicedu* 5, no. 3 (2021): 1294–1303, https://doi.org/10.31004/basicedu.v5i3.872.

[3] Maria Kristina Ota, Ana Maria Gadi Djou, and Filzah Farid Numba, "Problematika Pembelajaran Daring Siswa Kelas Vii Smpn 1 Ende Selatan, Kabupaten Ende," *Mitra Mahajana: Jurnal Pengabdian Masyarakat* 2, no. 1 (2021): 74–81, https://doi.org/10.37478/mahajana.v2i1.769; Ria Yunitasari and Umi Hanifah, "Pengaruh Pembelajaran Daring Terhadap Minat Belajar Siswa Pada Masa COVID 19," *Edukatif : Jurnal Ilmu Pendidikan* 2, no. 3 (2020): 232–43, https://doi.org/10.31004/edukatif.v2i3.142.

[4] Fitri Jayanti and Nanda Tika Arista, "Persepsi Mahasiswa Terhadap Pelayanan Perpustakaan Universitas Trunojoyo Madura," *Competence : Journal of Management Studies* 12, no. 2 (2019): 205–23, https://doi.org/10.21107/kompetensi.v12i2.4958.

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[6] A Jihad and Abdul Haris, *Evaluasi Pembelajaran* (Yogyakarta: Multi Presindo, 2012).

[7] Widodo and Lusi Widayanti, "Peningkatan Aktivitas Belajar Dan Hasil Belajar Siswa Dengan Metode Problem Based Learning Pada Siswa Kelas VIIA MTs Negeri Donomulyo Kulon Progo Tahun Pelajaran 2012/2013" XVII, no. April (2013): 32–35.

[8] Danti Yuliarsi Saadjad, "Pengaruh Model Pembelajaran TGT Melalui Daring Terhadap Hasil Belajar Siswa MTs Negeri 1 Luwuk," *Linear : Jurnal Ilmu Pendidikan* 5, no. 1 (2021): 63–72, https://doi.org/10.53090/jlinear.v5i1.95.

[9] Auzan Qashdi, "Pengaruh Model Pembelajaran Think Pair Share Dengan Menggunakan Prezi Dekstop Terhadap Pemahaman Konsep Kimia Siswa," in *Prosiding Seminar Nasional Penelitian Dan Pengabdian 2021*, 2021, 36–41, http://prosiding.rcipublisher.org/index.php/prosiding/article/view/109.

[10] Trining Puji Astutik, Fariati, and Herunata, "Identifikasi Konsep Sukar Dan Kesalahan Konsep Reaksi Redoks" 5, no. 1 (2017): 22–28, ojs.umrah.ac.id/index.php/zarah.

students' ability to understand redox concepts. However, this material is very difficult for students to bring up and hone their understanding of their concepts.

Based on the results of initial observations that have been carried out in one of the MAN Tangerang schools on the learning process, it was found that teachers still use conventional methods, media, and printed books. This book still does not touch the microscopic aspects, producing a misconception. This results in an unbroken chain of conceptual errors and impacts on students' understanding of concepts. Besides, the impact of the pandemic has also changed the teaching and learning system in offline classes to become online. The use of technology-based media is expected to increase students' understanding of concepts because flexible online media can be used repeatedly according to the readiness and willingness of students. Repeated learning with high frequency can foster understanding of concepts.

Currently, e-learning-based learning research is a trending topic, including; Sappaile (2019) only discusses the relationship between understanding the concept of comparison with the learning outcomes of stoichiometric chemistry[11]; Herlina & Loisa (2020) discusses the perception of the ability to understand mathematical concepts in e-learning learning on learning achievement[12]; Permatasari & Muda (2021) only discusses the application of flipped classrooms as a learning solution during a pandemic[13]; Hatimah & Khery (2021) discusses understanding concepts and scientific literacy in the application of android-based chemistry learning media[14]. However, research on the perception of the ability to understand redox concepts in e-learning on student learning outcomes is still very limited. Therefore, this research is very necessary. With this research, it can be seen that the instrument prerequisite test will be carried out, the perception of the ability to understand redox concepts based on indicators of learning stimulus, response, and evaluation, besides that it can be seen the relationship and influence between the ability to understand redox concepts on student learning outcomes. The purposes of this study: 1) Test the instrument prerequisites, 2) Analyze the perception of the ability to understand redox concepts based on indicators of learning stimulus, response, and evaluation, 3) find out the relationship and influence between the ability to understand redox concepts on student learning outcomes in the application of e-learning platforms. madrasa. This research is expected to be useful in creating interesting, critical, innovative learning and great potential in building 21st-century skills so that it can print a generation of nations that are by the demands of the 21st-century.

RESEARCH METHODS

This study uses a quantitative descriptive method because it analyzes numerical data into a data description[15]. The subject of class X MIA MAN in Tangerang. The sampling technique was purposive random sampling. Purposive random sampling is a sampling

[11] Nursiah Sappaile, "Hubungan Pemahaman Konsep Perbandingan Dengan Hasil Belajar Kimia Materi Stoikiometri" 2, no. 2 (2019): 58–71.
[12] Herlina and Loisa, "Persepsi Kemampuan Pemahaman Konsep Matematika Pada Pembelajaran E-Learning Terhadap Prestasi Belajar."
[13] Besse Intan Permatasari and Maria Theresia Ferdinanda Agustiani Muda, "Penerapan Flipped Classroom Sebagai Solusi Pembelajaran Di Masa Pandemi Covid-19 Di SMP Negeri 22 Balikpapan," *Kompetensi Universitas Balikpapan* 14, no. 2 (2021): 113–16.
[14] Husnul Hatimah and Yusran Khery, "Pemahaman Konsep Dan Literasi Sains Dalam Penerapan Media Pembelajaran Kimia Berbasis Android," *Jurnal Ilmiah IKIP Mataram* 8, no. 1 (2021), https://e-journal.undikma.ac.id/index.php/jiim/article/view/4078.
[15] Sandu Siyoto and Ali Sodik, *Dasar Metodologi Penelitian* (Yogyakarta: Literasi Media Publishing, 2015).

technique by takes into account the considerations made by the researcher[16]. The researcher aims to use purposive random sampling so that the sample is by the research objectives. A sample of 38 students consisted of 13 boys and 25 girls and had participated in online redox learning, took a redox concepts test, and filled out a questionnaire.

Data Collection Instruments and Techniques

Collecting student perception data using an instrument in the form of a questionnaire determines the ability to understand students' redox concepts. The test instrument consists of 12 items questions arranged based on the modification of Walgito's theory (2010) which includes 3 indicators, namely learning stimuli, learning responses, and evaluation of learning outcomes[17]. The questionnaire instrument was given in a google form distributed through a WhatsApp group. The instrument was arranged using a Likert scale from 1 to 5[18]. According to Sugiyono (2011), the Likert scale is a scale used to measure attitudes, opinions, and perceptions of individuals or groups about a phenomenon[19].

Stages of redox learning using the Madrasa e-learning platform

First, determine variable X (ability to understand concepts) and variable Y (learning outcomes). Second, students participate in redox learning using the Madrasa e-learning platform. Furthermore, students are given a written test consisting of 20 multiple choice questions after the learning process is complete. The chemical test instrument with the redox concept consists of a level (C3) to calculate and determine, a level (C4) to analyze, and a level (C5) to conclude. This test is carried out to get the value of student learning outcomes. Then the distribution of questionnaires to determine the ability to understand the redox concept of these students.

Table 1. Student Perception Questionnaire

Indicator of Concept Understanding Ability		Statements
The perceived object which gives rise to a stimulus (learning stimulus)	1.	Interactive learning media on redox material makes me excited to learn
	2.	I am focused on listening to the material taught by the teacher.
	3.	I was motivated to analyze the answers to the examples of redox questions given.
	4.	I am motivated to repeat the redox material that has been taught by watching videos and power points in Madrasah E-Learning.
Stimulus generates awareness and attention (response)	5.	I actively respond to discussions when discussing examples of redox material problems.
	6.	I actively ask questions when there are material or examples of questions that have not been understood.
	7.	I can convey or explain my answer to the teacher and friends.
	8.	The results of discussions with teachers and friends when learning online made me understand more.
Individual assessment of the stimulus object (evaluation)	9.	I feel confident when answering redox daily test questions because I already understand the material well.

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[16] Sutrisnno Hadi, *Metodologi Research* (Yogyakarta: Andi Offset, 2004).
[17] Herlina and Loisa, "Persepsi Kemampuan Pemahaman Konsep Matematika Pada Pembelajaran E-Learning Terhadap Prestasi Belajar."
[18] Viktor Handrianus Pranatawijaya et al., "Pengembangan Aplikasi Kuesioner Survey Berbasis Web Menggunakan Skala Likert Dan Guttman," *Jurnal Sains Dan Informatika* 5, no. 2 (2019): 128–37, https://doi.org/10.34128/jsi.v5i2.185.
[19] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, Dan R&D* (Bandung: Alfabeta, 2011).

10.	I can analyze my shortcomings/errors in answering redox daily test questions.
11.	I can rework other questions of the same type.
12.	Online learning makes me even more active in learning.

Data analysis technique

Data on student perceptions of the ability to understand redox concepts obtained were analyzed and then the results were tested for prerequisites, namely validity, reliability, and normality tests using SPSS (Statistical Program for Social Science). Next, the percentage is calculated using the following formula[20]:

$$P = \frac{f}{N} \times 100\%$$

explanation:
P = Percentage Numbers; f = Obtained raw score; N = The best score in the questionnaire

DISCUSSION

Instrument Prerequisite Test Results

The results of the instrument prerequisite test include the validity, reliability, and normality tests of table 2.

Table 2. Validity Test

No	1	2	3	4	5	6	7	8	9	10	11	12
Corrected Item-Total Correlation	.743	.666	.790	.573	.661	.471	.653	.709	.650	.721	.721	.457

Based on table 2, the validity of the 12 items in the form of positive statements shows that the calculated r-value for all questions is more significant than 0.329 (r arithmetic > 0.329), and the r table value for n 36 at 5% significance is 0.329. This shows that the question instrument is declared valid. Items are displayed valid if the r count is greater than the r table[21]

Table 3. Reliability and Normality Test

	Cronbach's Alpha	N of Items	
Reliability Test	.913	12	
		Kolmogorov-Smirnov	
		N	Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
Normality Test	Unstandardized Residual	38	.907	.384

Based on table 3, the reliability value of 12 items worth 0.913 is reliable, meaning that if this instrument is used at different times, the same person, or at the same time, the results are

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[20] Agus Purwanto et al., "Studi Eksploratif Dampak Pandemi COVID-19 Terhadap Proses Pembelajaran Online Di Sekolah Dasar," *EduPsyCouns: Journal of Education, Psychology and Counseling* 2, no. 1 (2020): 1–12, https://ummaspul.e-journal.id/Edupsycouns/article/view/397.

[21] Ahmad Rustam, Eva Dwi Kumala Sari, and Luki Yunita, *Statistika Dan Pengukuran Pendidikan: Analisis Menggunakan SPSS, Iteman, Dan Lisrel* (Tangerang Selatan: PT. Ilham Sejahtera Persada, 2018).

consistently reliable. The questionnaire is reliable if the Cronbach's Alpha value is > 0.60 [22]. The results of the normality test used the Kolmogorov-Smirnov test. The hypotheses to test the normality of the data are H_0 (data not normally distributed) and H_1 (data normally distributed). The test criteria used are if the probability value (sig.) is greater than 0.05, then H_1 is accepted (normally distributed data), H_0 is rejected [23]. Based on the results of the Kolmogorov-Smirnov normality test in table 2, the Asymp value is known. Sig. (2-tailed) of 0.384 has a value greater than 0.05, it is concluded that the data from the prerequisite test of the research instrument, namely the validity of 12 questions, is declared valid, reliable, and normally distributed or student learning outcomes are normally distributed.

The results of the perception of the ability to understand redox concepts

The results of the perception of the ability to understand redox concepts are in table 4.

Table 4. Perception of Concept Understanding Ability

Stimulus	Percentage			Response	Percentage			Evaluation	Percentage		
	< 3	3	> 3		< 3	3	> 3		< 3	3	> 3
1	5.3	21.1	73.7	1	7.9	23.7	68.4	1	2.6	31.6	65.8
2	7.9	23.7	68.4	2	-	36.8	63.2	2	2.6	23.7	73.7
3	10.5	15.8	73.6	3	5.3	23.7	71.1	3	2.6	18.4	78.9
4	5.3	26.3	68.4	4	5.3	13.2	81.6	4	10.5	57.9	31.5
Average is greater than 3			71.025	Average is greater than 3			71.075	Average is greater than 3			62.475

*Information: greater than 3 (>3); neutral (3); smaller than 3 (< 3)

Based on table 4, the average stimuli indicator answered with a score greater than 3 (71.025%). This shows that in general students are enthusiastic about taking redox material chemistry lessons using the Madrasa e-learning platform, feel not bored, focus on listening to the material, and are motivated to analyze the answers to the sample questions given, and repeat the material on their own accord. Previous research stated that fun learning can increase students' interest and motivation in carrying out learning activities [24]. The better the quality of online learning, the higher the interest in learning [25]. If interest in learning is high, students can maximize their potential [26]. Besides that, curiosity grows from within, encouraging students to reach an understanding [27]. However, some students are indicated otherwise and are not motivated to participate in online learning. This is indicated by the response of students answering less than 3 (7.25%). The importance of creativity from an educational point of view lies in its power to

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[22] Imam Ghozali, *Aplikasi Analisis Multivariate Dengan Program IBM SPSS19* (Semarang: Badan Penerbit Universitas Diponegoro, 2011).

[23] Ahmad Rustam, Eva Dwi Kumala Sari, and Luki Yunita, *Statistika Dan Pengukuran Pendidikan* (Bogor: PT Ilham Sejahtera Persada, 2018).

[24] Siti Suryaningsih, Muliharto, and Fakhira Ainun Nisa, "Integrasi Science, Technology, Engineering, Art, Mathematics (STEAM) Project: Inovasi Pembelajaran Kimia Terhadap Minat Dan Motivasi Siswa," in *Prosiding Seminar Nasional FITK UIN Jakarta 2021*, 2021, 222–36; Siti Suryaningsih et al., "Learning Innovations: Students' Interest and Motivation on STEAM -PjBL," *International Journal of STEM Education for Sustainability* 2, no. 1 (2022): 66–77.

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[26] Zahra Alhumairah Basa and Hudaidah, "Perkembangan Pembelajaran Daring Terhadap Minat Belajar Matematika Siswa SMP Pada Masa Pandemi Covid-19," *Edukatif : Jurnal Ilmu Pendidikan* 3, no. 3 (2021): 943–50, https://doi.org/https://doi.org/10.31004/edukatif.v3i3.461.

[27] Bakhtawer Nasrullah, Ghulam Fatima, and Dur e Nayab, "Strategies Used by Public Primary School Teachers for Enhancing Students' Curiosity in Science," *Journal of Accounting and Finance in Emerging Economies* 7, no. 1 (2021): 93–101, https://doi.org/10.26710/jafee.v7i1.1568.

find solutions creatively[28]. Critical thinking skills can also be applied in literacy both in social and digital environments, namely the ability of students to think critically about the information received.

The average student responses indicator answered with a score greater than 3 (71.075%). This shows that in general students are actively participating in learning, actively participating in discussions, actively asking when there is a material that has not been understood, and can re-explain the material that has been delivered, and feel more understanding of the material after the discussion. Previous research stated that even though they are e-learning, they still convey their ideas and opinions to create an active and two-way learning atmosphere. Collaboration is a communication relationship between two or more individuals in a social environment, such as in a group learning environment. Communication between students or students with teachers is very important because communication is defined as the ability to convey information to others both orally and in writing[29]. However, some students indicated otherwise and were not active during learning. This is indicated by the response of students answering less than 3 (4.625%). Cultivating student curiosity is an important factor in improving students' persistence, creativity, and success[30]. Curiosity is a personality trait that encourages students to ask exploratory questions and develop creative solutions to problems[31]. The ability to think analytically is also essential in the educational process[32]. Analytical thinking is defined as integrating a concept with relevant data, which necessitates higher-order thinking abilities[33]. Analytical thinking related to students' scientific attitude to solve problems in the twenty-first century can improve analytical thinking[34]. Technology-enhanced pedagogy, if properly integrated into learning can improve student learning performance[35].

The average evaluation indicator answered with a score greater than 3 (62.475%). This shows that generally, students feel confident in answering questions, can understand the

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[28] Yasamin Abedini, "Students ' Creativity in Virtual vs. Classroom Courses on the Basis of Their Personality Traits : A Prediction Study," *The Electronic Journal of E-Learning* 18, no. 6 (2020): 525–36, https://doi.org/10.34190/JEL.18.6.005; Yavuz Akbaş and Safiye Çakmak, "The Effect of Place-Based Education Integrated Project Studies on Students' Problem-Solving and Social Skills," *Asian Journal of Education and Training* 5, no. 1 (2019): 183–92, https://doi.org/10.20448/journal.522.2019.51.183.192.

[29] R Rismayanti, M Octafianti, and S Sartika, "Analisis Kemampuan Komunikasi Matematis Dan Minat Belajar Siswa Smp Berdasarkan Gender," *Journal On Education* 01, no. 03 (2019): 429–37.

[30] Gina Baleria, "Counteracting Othering in the Community College Setting: Increasing Belonging and Curiosity to Improve Student Success," *Community College Journal of Research and Practice* 45, no. 4 (2021): 273–89, https://doi.org/10.1080/10668926.2019.1689207; Andrew J Hale, Daniel N. Ricotta, and Jason Freed, "Fostering Medical Students ' Curiosity through Early Clinical Experiences," *Journal Academic Medicine* 96, no. 3 (2021): 2021; Ketut Alit Adi Untara, Gustina Gustina, and Ielda Paramita, "The Development of Oil-Fueled Gas Steam Stove as a Learning Media to Enhance Students' Curiosity," *Jurnal Ilmiah Pendidikan Fisika* 5, no. 1 (2021): 10, https://doi.org/10.20527/jipf.v5i1.2589.

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[33] Anastasiya M. Spaska et al., "Developing Analytical Thinking in Tertiary Students Using Debates," *European Journal of Educational Research* 10, no. 2 (2021): 879–89, https://doi.org/10.12973/eu-jer.10.2.879.

[34] R. Andriani and Y. L.I. Supiah, "Effect of Problem Based Learning Models on Students' Analytical Thinking Abilities and Scientific Attitudes in Chemistry," *Journal of Physics: Conference Series* 1806, no. 1 (2021), https://doi.org/10.1088/1742-6596/1806/1/012190; Yandriani, R. U. Rery, and Maria Erna, "Developing and Validating the Assessment Instruments to Measure Students' Analytical Thinking Ability and Chemical Literacy on Colligative Properties," *Journal of Physics: Conference Series* 1788, no. 1 (2021), https://doi.org/10.1088/1742-6596/1788/1/012027.

[35] Guolin Lai, Zhiwei Zhu, and Douglas Williams, "Enhance Students' Learning in Business Statistics Class Using Video Tutorials," *Journal of Teaching and Learning with Technology* 6, no. 1 (2017): 31–44, https://doi.org/10.14434/jotlt.v6.n1.21161.

material better, can analyze and solve problems in answering questions, and can rework questions of the same type. Previous research stated that the learning process can be said to be successful when the learning process is fun so that students can be active, creative, and able to solve the problems given. Problem-solving skills are the most complex level of student cognitive activity because they require creativity in solving these problems. The importance of creativity from an educational point of view lies in its power to find solutions[36]. However, some students indicated otherwise which did not make them more active in learning. This is indicated by the response of students answering less than 3 (4.575%). Teachers can design more project-based learning so that students are trained in their creativity to find answers or solutions to a problem[37]. Evaluation activities can help students develop an honest attitude because later students will convey their experiences openly during the learning process[38]. In general, it can be concluded that the perception of the ability to understand redox concepts using the Madrasa e-learning platform based on indicators of student learning stimuli was answered on average with a score greater than 3 (71.025%); response indicator (71.075%); learning outcomes evaluation indicators (62.475%). This shows that students generally pay full attention during learning, participate actively during discussions, and understand redox concepts.

Ability to understand redox concepts on student learning outcomes

Ability to understand redox concepts on student learning outcomes table 5.

Table 5. Students Learning Outcomes

N	Valid	39
	Missing	0
Mean		76.18
Std. Deviation		12.704
Minimum		45
Maximum		95

Based on table 5, it is known that the standard deviation value is smaller than the average value (mean). This shows that the distribution of student learning outcomes data groups is included in the fairly good category. The relationship between the ability to understand redox concepts in online learning and student learning outcomes table 6.

Table 6. Correlation Coefficient of Concept Understanding Ability to Learning Outcomes and T-Test

	Measurement	Learning results
Concept Understanding Ability	Pearson Correlation	.967**
	Sig. (2-tailed)	.000
	N	38

[36] Abedini, "Students ' Creativity in Virtual vs. Classroom Courses on the Basis of Their Personality Traits : A Prediction Study"; Akbaş and Çakmak, "The Effect of Place-Based Education Integrated Project Studies on Students' Problem-Solving and Social Skills."

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[38] Mentari Reza Apriliana et al., "Pengembangan Soft Skills Peserta Didik Melalui Integrasi Pendekatan Science, Technology, Engineering, Arts, and Mathematics (STEAM) Dalam Pembelajaran Asam Basa," *JRPK: Jurnal Riset Pendidikan Kimia* 8, no. 2 (2018): 42–51, https://doi.org/10.21009/jrpk.082.05.

	Test T	
Design	T	Sig.
Perception of Concept Understanding Ability	22.729	.000

Pearson Correlation test results show that there is a very significant correlation (strong and positive) between the ability to understand concepts (variable X) and learning outcomes (variable Y), seen from the sig value. (2-tailed) of 0.000 < 0.05, Pearson correlation of 0.967 > 0.329 (t_{table}) at 5% significance. Based on the data analysis, it indicates that the correlation between the ability to understand redox concepts and student learning outcomes has a very significant relationship. The results of the t-test have a sig value of 0.000 < 0.05, so the perception of the ability to understand concepts in e-learning has a significant effect on the value of learning outcomes.

The perception of the ability to understand redox concepts in learning using the Madrasa e-learning platform has a very significant influence on student learning outcomes with a sig value of 0.000 <0.05 with a correlation coefficient value of 0.967 which means it is strong and positive and the determination is 96.7% which means that 96.7% of the perception variables of understanding the redox concept have a contribution in explaining learning outcomes. Students who have good conceptual understanding skills will get good learning outcomes as well. These results are following the results of research by Rahmatia, Monawati, & Darnius (2017), that there is an influence of e-learning media on mathematics learning outcomes[39]. In line with that, electronic learning has a positive and significant effect on the quality of learning[40]. The digital project-based learning model can improve ICT literacy, interest, and student motivation. Students become more active, creative, and motivated to produce something useful[41]. Implementation of ICT literacy as an element of classroom learning is the key to producing graduates who can compete in the future[42]. In addition, mastering ICT literacy helps students and teachers in presenting information in an interesting, effective, and efficient manner, so that information can be more easily understood[43]. So, in general, it is concluded that the ability to

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[39] Maya Rahmatia, Monawati, and Said Darnius, "Pengaruh Media E-Learning Terhadap Hasil Belajar Matematika Siswa Kelas IV SDN 20 Banda Aceh," *Jurnal Ilmiah Pendidikan Guru Sekolah Dasar FKIP Unsyiah* 2, no. 1 (2017): 212–27, https://media.neliti.com/media/publications/188229-ID-pengaruh-media-e-learning-terhadap-hasil.pdf.

[40] R Andriyani, K Shimizu, and A Widiyatmoko, "The Effectiveness of Project-Based Learning on Students ' Science Process Skills : A Literature Review," in *Journal of Physics: Conference Series* (IOP Publishing, 2019), 1–6, https://doi.org/10.1088/1742-6596/1321/3/032121; Muhammad Nasir, Rini Fakhrunnisa, and Luvia Ranggi Nastiti, "The Implementation of Project-Based Learning and Guided Inquiry to Improve Science Process Skills and Student Cognitive Learning Outcomes," *International Journal of Environment & Science Education* 14, no. 5 (2019): 229–38; S Suwarno, Wahidin, and Sofyan Hasanudin, "JPBI (Jurnal Pendidikan Biologi Indonesia) Project-Based Learning Model Assisted by Worksheet : It ' s Effect on Students ' Creativity and Learning Outcomes," *Jurnal Pendidikan Biologi Indonesia (JPBI)* 6, no. 1 (2020): 113–22, https://doi.org/https:// doi.org/10.22219/jpbi.v6i1.10619; Siti Suryaningsih and Fakhira Ainun Nisa, "Kontribusi STEAM Project Based Learning Dalam Mengukur Keterampilan Proses Sains Dan Berpikir Kreatif Siswa," *Jurnal Pendidikan Indonesia* 2, no. 6 (2021): 1097–1111.

[41] Andriyani, Shimizu, and Widiyatmoko, "The Effectiveness of Project-Based Learning on Students ' Science Process Skills : A Literature Review"; Nasir, Fakhrunnisa, and Nastiti, "The Implementation of Project-Based Learning and Guided Inquiry to Improve Science Process Skills and Student Cognitive Learning Outcomes"; Suwarno, Wahidin, and Hasanudin, "JPBI (Jurnal Pendidikan Biologi Indonesia) Project-Based Learning Model Assisted by Worksheet : It ' s Effect on Students ' Creativity and Learning Outcomes."

[42] David Caldevilla-Domínguez, Alba María Martínez-Sala, and Almudena Barrientos-Báez, "Tourism and ICT. Bibliometric Study on Digital Literacy in Higher Education," *Education Sciences* 11, no. 4 (2021), https://doi.org/10.3390/educsci11040172.

[43] Abdulmajid Alsaadoun, "The Effect of Employing Electronic Static Infographic Technology on Developing University Students' Comprehension of Instructional Design Concepts and ICT Literacy," *International Journal of Education and Literacy Studies* 9, no. 1 (2021): 54, https://doi.org/10.7575/aiac.ijels.v.9n.1p.54.

understand redox concepts on student learning outcomes has a significant relationship and influence (strong and positive), seen from the sig value. (2-tailed) is 0.000 < 0.05, Pearson correlation is 0.967 > 0.329 (significance 5%).

CONCLUSION

The research instrument prerequisite test results, namely the validity of 12 questions, were declared valid, reliable, and normally distributed. Perceptions of the ability to understand redox concepts in e-learning based on indicators of student learning stimuli answered on average with a score greater than 3 as much as 71.025%; response indicator 71.075%; learning outcomes evaluation indicators 62.475%. This shows that students generally give full attention during learning, participate actively during discussions, and understand redox concepts. The ability to understand redox concepts on student learning outcomes has a significant relationship and influence (strong and positive), seen from the value of sig. (2-tailed) is 0.000 < 0.05, Pearson correlation is 0.967 > 0.329 (significance 5%). This research is limited to learning redox material chemistry. It is hoped that further research can be carried out on learning chemistry in other materials that are integrated with the STEAM digital project to develop students' critical thinking skills.

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