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Student Learning Outcomes on Heat Material Using E-Learning-Based Collaborative Learning (KABEL)

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Abstract: This study aimed to determine whether student learning outcomes after using e-learning-based collaborative learning (KABEL) on heat material were better and whether there was a significant difference between student learning outcomes before and after the using KABEL application. This experimental study used a pre-experimental design and a one-group post-experimental design. Data was collected by giving a multiple-choice pre-test and post-test to 150 randomly selected class XI students. The results of data analysis showed that student learning outcomes increased by 47.34 when compared to the material before and after using e-learning-based collaborative learning. The learning outcomes of students' attitudes and skills after using e-learning-based collaborative learning (KABEL) are in the very good category, with an average score of 3.66 for the attitude aspect and 3.8 for the skills aspect.

Keywords: Collaborative Learning; E-Learning; Heat Material

Introduction

Physics learning is a learning process in which students learn a concept, consisting of principles and rules systematically arranged and presented in mathematical equations (Haryono et al., 2021). Collaborative, intriguing, and interactive learning is required to promote better, more effective learning and contribute to meaningful learning outcomes. Collaborative learning occurs when two or more people work together to learn. One of the objectives of collaborative learning is to create chances for students to actively participate in the learning process, often known as a student centre (Fitriasari et al., 2020).

There were several technological advances occurred in the 4.0 revolution in the industrial sector. A change that has taken place can be found in the field of education. This development can be seen from the changes in learning methods and obtaining information for learning. The current learning method allows students to carry out the learning process anywhere and anytime. This is supported by the use of the internet and the availability of online learning applications, commonly known as e-learning applications. Hidayati & Maslikhah (2022), suggests that e-learning is an internet application that can connect educators and students in an online learning space. The use of e-learning applications is able to make learners or students more flexible in accessing information and interacting between learners.

This can help learners improve their knowledge and skills. According to Wahyudi (2017), e-learning is an activity using internet technology to increase knowledge and skills that allow learners to control content, study time, learning rhythm, and media to achieve their own learning goals. By implementing e-learning-based collaborative learning, students can increase their knowledge to the maximum in a short time. In addition,

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students are no longer limited by space and time when obtaining information. Students can access KABEL from anywhere and at any time. In e-learning-based collaborative learning (KABEL), the teacher not only uploads learning materials that students can access online but also evaluates, establishes communication, and manages other learning-related aspects (Weni & Isnani, 2016).

According to a survey conducted at many high schools in East Java Regency, students were bored and uninterested in learning physics. Physics classes are difficult to understand and less engaging for students. Physics learning used by teachers is typically provided in the form of a series of formulas that students must memorize, and the models used by teachers are less varied and creative, which can increase students' enthusiasm to participate in the teaching and learning process in class (Haryono & Aini, 2021). Students are less motivated in the learning process due to low motivation, which influences student physics learning results, specifically under the Minimum Completeness Criteria (MCM) or less than 75.

The lack of student engagement in physics learning negatively affects their comprehension of concepts, resulting in poor achievement of learning competencies (Umbara, 2022). Heat material is a fundamental component in the field of physics education. Competency achievement indicators have been incorporated within student learning outcomes, which serve as standards for assessing proficiency in the heat material. Learning outcomes include a range of experiences acquired by students, including not only the acquiring of theoretical knowledge in a particular subject, but also the development of habits, perspectives, interests, social skills, various skills, aspirations, desires, and expectations. Learning outcomes refer to knowledge acquisition and the development of skills and attitudes. The implementation of collaborative learning through e-learning, known as KABEL as a learning application which is employed to address the current challenges.

Several prior research using e-learning-based instructional resources produced positive outcomes. (Julyanti, E., Rahma, I. F., Chanda, O. D., & Nisah, 2021) found that using Moodle e-learning-based instructional materials can improve learning outcomes by 42% on the subject of magnitude and unit. This suggests that developing e-learning-based instructional resources to improve scientific learning results for junior high school students is effective. Furthermore, (Purmadi & Surjono, 2016) found that creating web-based teaching materials may improve student learning by 31.87%. As a result, it is possible to conclude that web-based teaching resources can be useful in the learning process. This research is in line with previous research conducted by (Mulyadi et al., 2023) with the aim of knowing the implementation of learning using e-learning.

This study aims to determine the increase in learning outcomes by using e-learning-based collaborative learning on heat material. Another objective of this study is to determine whether there is a significant difference in learning outcomes before and after using e-learning-based collaborative learning (KABEL) on heat material in high school students.

Method

This type of research is experimental research with the form of Pre-Experimental Design and One Group Pretest-Posttest Design is shown on Figure 1. The O_2 and O_1 scores were used to compare student learning outcomes tests on the cognitive aspect. If the value of O_2 is greater than O_1, the learning is said to be effective.

O_1	X	O_2
Pre-test	Trearment	Post-test

Figure 1. One Group Pretest-Posttest Design

To determine the significance of differences in learning outcomes in cognitive aspects before and after using teaching materials by using the t-test if the data is normally distributed and the Wilcoxson signed ranks test if the data obtained is not normally distributed. The hypotheses tested are H_a (there are differences in learning outcomes before and after using e-learning-based collaborative learning (KABEL), if the P value <0.05) and H_o (there is no difference in learning outcomes before and after using e-learning based collaborative learning (KABEL), if the P value > 0.05). Analysis of student attitudes and skills learning outcomes using the following formula on Equation 1.

$$N = \frac{students' score}{maximal\ score} \times 4 \quad (1)$$

After the value is obtained, the next step is to determine the attitude and skill predicate with the K-13 assessment conversion table based on Permendikbud number 104 of 2014 which can be seen in the following table.

Table 1. Attitude and Skill Assessment Conversion Table

Value	Predicate	Attitude/Skills
3.83 < x ≤ 4	A	Very Good (SB)
3.50 < x ≤3.83	A-	
3.17 < x ≤ 3.50	B+	Good (B)
2.83 < x ≤ 3.17	B	
2.50 < x ≤ 2.83	B-	

2.17 < x ≤ 2.50	C+	Enough (C)
1.83 < x ≤ 2.17	C	
1.50 < x ≤ 1.83	C-	
1.17 < x ≤ 1.50	D+	Less (K)
1.00 < x ≤ 1.17	D	

The study included students from class XI of SMA X, SMA Y SMA Z during the academic year 2022/2023. Samples were collected using the intact group method, which involves selecting a sample from the population as a whole based on the class choice. A sample of students was randomly selected from various classes for participation in this study (An & Tillman, 2021; Pu et al., 2020). This study included a random sample of 150 students from class XI of three schools in East Java: SMA X, SMA Y SMA Z, for the academic year 2022/2023. The research instrument used in this study was an initial test (pre-test), a final test (post-test), and an observation sheet (Sukariasih et al., 2019).

Result and Discussion

The objective of utilizing e-learning-based collaborative learning in research is to help high school students in the East Java regency who have challenges in understanding the concept of heat. Using e-learning based collaborative learning (KABEL) is expected to improve student learning outcomes. The student learning outcomes in this case include three dimensions: cognitive, affective, and psychomotor (Sönmez, 2017). The cognitive aspects of students' knowledge in this learning outcome are assessed through pre-test and post-test evaluations on heat material (Serevina, 2018). These assessments are conducted during the research or implementation stages of using e-learning-based collaborative learning (Savic & Kashef, 2013). The pre-test is given to students before using e-learning-based collaborative learning, while the posttest is given to students after students have carried out the e-learning-based collaborative learning process. The tests were conducted using the online quiz feature provided by the website http://kabel.unisda.ac.id/. The two data collected from administering the two tests are used to assess the efficacy of e-learning-based collaborative learning (KABEL) in teaching heat material. Based on the pre-test results, it was determined that none of the students met the Minimum Completeness Criteria (MCC) at 75. Furthermore, the recapitulation showed that the mean score of the 150 students who participated in the pre-test was 36.53. The study showed that all 150 students, representing 100% of the participants, failed to meet the minimum passing grade (MPG) before implementing e-learning through collaborative learning on heat material. In addition, the Post-test results showed an average score of 83.87. Out of 150 students, 73.33% (110 students) obtained a grade equal to or higher than the minimum passing grade of 75. This shows an increase in learning outcomes as indicated by the percentage of completeness which reaches 73.33%, although some students still score below minimum passing grade. This increase in learning outcomes results from a collaborative learning process based on e-learning (Yeh & Fu, 2014)(Maria et al., 2020). The average pre-test and post-test values are compared in the figure 2.

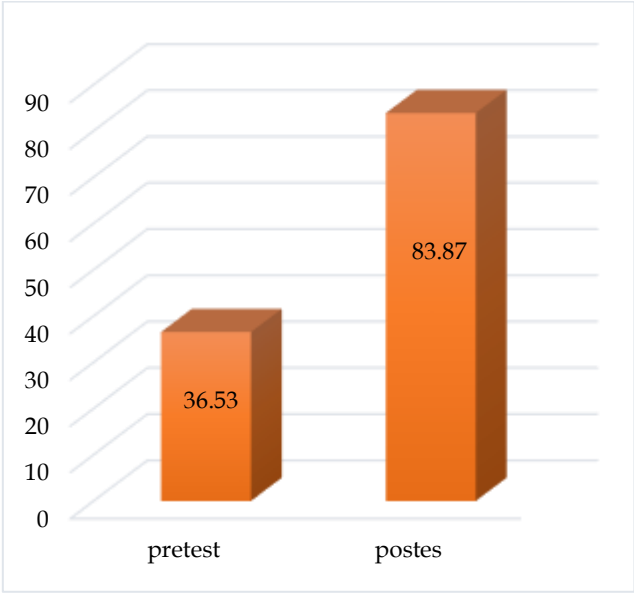

Figure 2. Average Score of Students' Pre-test and Post-test

According to the figure 2, there is an increase in the average value of learning outcomes, showing an improvement in student learning outcomes after using e-learning-based collaborative learning on heat material. According to the figure above, the average score of the pre-test, or before using teaching materials, is 36.53, and the average score of the post-test, or after using e-learning-based collaborative learning is 83.87. This improvement in learning outcomes is closely linked to student's interest in the website http://kabel.unisda.ac.id/, which offers images, videos, and audio to help students learn. Because students gain experience and make the learning process enjoyable, the use of audio-visual media has been shown to substantially impact student learning outcomes (Adnan et al., 2019). Furthermore, this increases students' desire to participate in the offered e-learning-based collaborative learning (KABEL). And may stimulate new desires and interests, motivate and promote learning activities, and even psychologically impact students (Manurung, 2022). Through e-learning based collaborative learning, student learning indicators on heat material can be achieved. This can be seen by the

percentage of student completion, with 73.33% of students completing the Minimum Completeness Criteria in physics disciplines, particularly heat material. To determine how much students' learning outcomes improved after participating in collaborative learning based on e-learning, researchers compared pre-test and post-test scores, which were then analysed using the t-test. The table below shows the results of a two-sample paired t-test using the SPSS version 24 application.

Table 2. Paired Correlation Sample Results on the t test

	N	Correlation	sig
Pretest&Posttest	150	0.537	0.002

Based on Table 2, the results of the t-test of two paired samples using the SPSS version 24 application, it is known that the correlation between pretest and posttest values is quite strong and significant. This is because the correlation value displayed from the results of data analysis is 0.537.

Table 3. Paired Sample Test Results on t Test

				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std Error Mean	Lower	Upper	t	df	Sig (2-tailed)
Pretest-Posttest	-47.33	12.57	2.294	-52.025	-42.64	-20.63	29	0.000

Based on the Table 3, it is also known that there is a significant difference between learning outcomes before and after using e-learning-based collaborative learning (KABEL) on the heat material carried out. It is known from the value of Sig. (2-tailed) which is smaller than 0.05, namely 0.000. Then, when compared to t_{count} and t_{table}, it is known that $t_{count} > t_{table}$ so that it can be said that H_o is rejected and H_a is accepted. Based on these results, there are differences in the use of e-learning-based collaborative learning (KABEL) on heat learning before and after using e-learning-based collaborative learning. In addition to cognitive aspects, other aspects measured by researchers are psychomotor aspects. Psychomotor aspects or student skills are used to measure students' abilities in using electronic devices and their application, related to the e-learning that is being carried out. Aspects of skills assessed in this study are hardware, software, and internet.

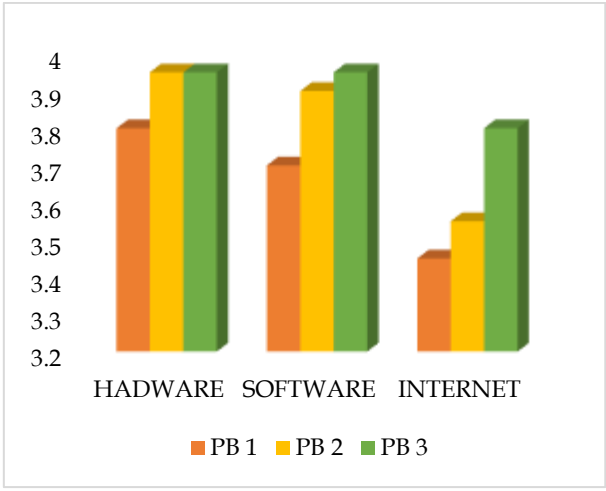

Figure 3. Results of Student Skills Assessment

Based on the graph on Figure 3, it is known that the average score of students' skills during learning process 1 (PB 1), learning process 2 (PB 2), and learning process 3 (PB 3) ranges from 3.66 to 3.94. This shows that the skills of students reach the very good category. The next aspect that is measured in student learning outcomes is the affective aspect, or attitude aspect. The affective aspect in this study was used to measure students' attitudes during the learning process. Three are 3 aspects of attitudes are assessed, namely responsibility, cooperation, and student independence in the learning process. The results of observations of students' attitude assessment can be seen briefly in the Figure 4.

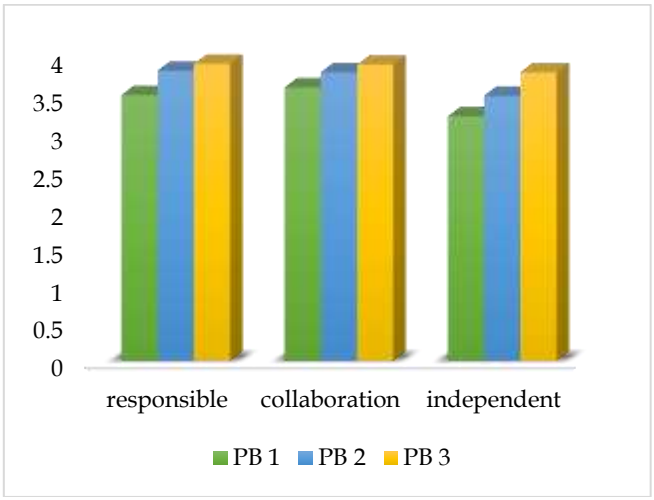

Figure 4. Results of Student Attitude Assessment

Based on the picture above, it is known that the average value of student attitudes in learning process 1 (PB 1), learning process 2 (PB 2), and learning process 3 (PB 3) ranges from 3.44 to 3.87, which indicates that student attitudes reach the very good category. Through KABEL, students have a greater sense of responsibility in completing assignments because the assessment

results can be captured automatically and seen directly by students. The quiz feature in KABEL makes it easier for students to do assignments and motivates students to do assignments. In addition, student collaboration has also increased because in this teaching material, students are directed to carry out discussions, either in groups or in pairs. In addition, learning outcomes on the affective aspect also show an increase in student independence through the use of e-learning (Panigrahi et al., 2021)(Sorgenfrei & Smolnik, 2016).

E-learning was chosen because this media is the right medium to direct students to be able to learn independently, with or without a teacher in the process (Hashim & Tasir, 2020). This is in accordance with the statement of (Devi, 2020) which states that e-learning has a focus on increasing personal abilities and realizing independent learning. There is an increase in student learning outcomes due to collaborative learning based on e-learning which combines several student learning styles, namely visual, auditory, and also kinesthetic. E-learning modules based on multiple representations are integrated with Geo Gebra that developed is very feasible to use with the average validation assessment in the amount of 82.95%(Sari et al., 2021), while the practicality form students responses classified within the criteria of very practical with average percentage is 87.80 % (Setiawan et al., 2023)(Rochmatin & Muchlis, 2023).

In this learning, students can observe several contextual images, watch videos, listen to explanations through videos, and interact with fellow students in the discussion forums provided by the feature of e-learning-based collaborative learning (Sasmita, 2020). By applying some of these learning styles, students can easily absorb the information presented. Students understand their own learning styles such as how to understand lessons well, so they can properly accept the subject matter presented by the teacher (Ningsih & Jayanti, 2022). In addition to learning styles, another factor that improves student learning outcomes through e-learning-based collaborative learning is student interest in technological advances to increase student enthusiasm and enthusiasm in learning this heat material (Liu & Mu, 2022)(Pradana, 2023)(Wijaya et al., 2021). Students' interest in learning includes a feeling of being interested and happy to learn, active participation, a tendency to pay attention and great concentration, and a sense of comfort when studying (Riswanto, 2022).

Conclusion

Based on the research that has been done using e-learning-based collaborative learning on heat material, it can be concluded that: The student learning outcome before using e-learning-based collaborative learning (KABEL) on heat material was 36.53 and after was 83.87 in the good category. This shows that e-learning-based collaborative learning is able to improve student learning outcomes on heat material. There are differences in student learning outcomes in the material and after using e-learning-based collaborative learning from the t-test results. The learning outcomes of students' attitudes and skills aspects after using e-learning-based collaborative learning are included in the very good category with an average score of 3.66 and 3.8 respectively. The use of e-learning-based collaborative learning is able to increase student cooperation, independence, and responsibility.

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References

Adnan, N. L., Karomiah, W., Abdullah, W., Raihana, N., & Sallem, M. (2019). International Journal of Recent Technology and Engineering (IJRTE). *International Journal of Recent Technology and Engineering*, *2*. Retrieved from www.ijrte.org

An, S. A., & Tillman, D. A. (2021). Music activities as a meaningful context for teaching elementary students mathematics: a quasi-experiment time series design with random assigned control group. *European Journal of Science and Mathematics Education*, *3*(1), 45–60. https://doi.org/10.30935/scimath/9420

Devi, N. U. K. (2020). Adaptasi Pranata Keluarga Pada Proses Pembelajaran E-Learning Dalam Menghadapi Dampak Pandemi Covid-19. *Publicio: Jurnal Ilmiah Politik, Kebijakan Dan Sosial*, *2*(2), 1–6. https://doi.org/10.51747/publicio.v2i2.599

Fitriasari, N. S., Apriansyah, M. R., & Antika, R. N. (2020). Pembelajaran Kolaboratif Berbasis Online. *Inspiration: Jurnal Teknologi Informasi Dan Komunikasi*, *10*(1), 77–86. https://doi.org/10.35585/inspir.v10i1.2564

Haryono, H. E., & Aini, K. N. (2021). Diagnosis misconceptions of junior high school in Lamongan

on the heat concept using the three-tier test. *Journal of Physics: Conference Series*, *1806*(1). https://doi.org/10.1088/1742-6596/1806/1/012002

Haryono, H. E., Samsudin, A., Aini, K. N., & Siahaan, P. (2021). Teams' games tournaments with cognitive conflict instruction (CCI) model to unveil students' misconceptions. *Cypriot Journal of Educational Sciences*, *16*(4), 1343–1356. https://doi.org/10.18844/cjes.v16i4.5983

Hashim, M. H.M, & Tasir, Z. (2020). An e-learning environment embedded with sign language videos: research into its usability and the academic performance and learning patterns of deaf students. *Educational Technology Research and Development*, *68*(6), 2873–2911. https://doi.org/10.1007/s11423-020-09802-4

Hidayati, S. U., & Maslikhah, M. (2022). Pengembangan E-learning Berbasis Moodle pada Pembelajaran Tematik Bagi Siswa Kelas IV MI Mangunsari Salatiga. *Quality*, *10*(2), 307. https://doi.org/10.21043/quality.v10i2.15665

Julyanti, E., Rahma, I. F., Chanda, O. D., & Nisah, H. (2021). *Pengaruh Motivasi Terhadap Hasil Belajar Siswa Sekolah Menengah Pertama Jurnal Pembelajaran Dan Matematika Sigma (Jpms), 7*(1), 2460–2593. Retrieved from https://jurnal.ulb.ac.id/index.php/sigma/article/view/1942

Liu, M., & Mu, X. (2022). Analysis of Computer Network Technology on New Media Problem-Based Learning (PBL) Teaching Method. *Wireless Communications and Mobile Computing*, *2022*, 3235078. https://doi.org/10.1155/2022/3235078

Manurung, D. (2022). the Effect of Spiritual Development on Students' Attitudes in Applicing Religious Value in Junior High School Karawang Nation'S Heritage 2015/2016 Academic Year. *European Journal of Psychological Research*, *9*(1), 2022. Retrieved from https://www.idpublications.org/wp-content/uploads/2022/04/Full-Paper-THE-EFFECT-OF-SPIRITUAL-DEVELOPMENT-ON-STUDENTS-ATTITUDES-IN-APPLICING-RELIGIOUS-VALUE-IN-JUNIOR-HIGH-SCHOOL.pdf

Maria, E., Albeta, S. W., Rery, R. U., Abdullah, & Osman, K. (2020). The efforts of learning outcomes and motivation improvement through collaborative learning based on e-learning with course review horay on basic chemistry subject. *Journal of Physics: Conference Series*, *1567*(4), 2–8. https://doi.org/10.1088/1742-6596/1567/4/042007

Umbara, D. M. A. (2022). Pengembangan E-Modul Berbasis Stem Untuk Meningkatkan Hasil Belajar Siswa Pada Materi Limbah Hasil Hewani. *Jurnal Pendidikan*, *13*(1), 32–50. Retrieved from https://jp.ejournal.unri.ac.id/index.php/JP/index

Mulyadi, M., Ridwan, R., Lisabe, C.M., Lasino, L., & Afif Alfiyanto. (2023). Perceptions of Students Using E-Learning Application in Learning Science. *Jurnal Penelitian Pendidikan IPA*, *9*(6), 4315–4319. https://doi.org/10.29303/jppipa.v9i6.3849

Ningsih, E. L. C., & Jayanti, U. N. A. D. (2022). Discovery Blended Learning in Biology: Its Effectiveness on Self-Efficacy and Student Learning Outcomes in the New Normal Era. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *12*(2), 147–160. https://doi.org/10.30998/formatif.v12i2.13748

Panigrahi, R., Srivastava, P. R., & Panigrahi, P. K. (2021). Effectiveness of e-learning: the mediating role of student engagement on perceived learning effectiveness. *Information Technology & People*, *34*(7), 1840–1862. https://doi.org/10.1108/ITP-07-2019-0380

Pradana, H. D. (2023). The Impact of Digital Media on Student Learning at University. *Jurnal Ilmu Pendidikan (JIP) STKIP Kusuma Negara, 15*(1), 1-8. https://doi.org/10.37640/jip.v15i1.1717

Pu, S., Yan, Y., & Zhang, L. (2020). Peers, Study Effort, and Academic Performance in College Education: Evidence from Randomly Assigned Roommates in a Flipped Classroom. *Research in Higher Education*, *61*(2), 248–269. https://doi.org/10.1007/s11162-019-09571-x

Purmadi, A., & Surjono, H. D. (2016). Pengembangan Bahan Ajar Berbasis Web Berdasarkan Gaya Belajar Siswa Untuk Mata Pelajaran Fisika. *Jurnal Inovasi Teknologi Pendidikan*, *3*(2), 151. https://doi.org/10.21831/jitp.v3i2.8285

Riswanto, A. (2022). The Effect of Online Learning on Student Learning Interest and Motivation *EDUEKSOS: Jurnal Pendidikan Sosial dan Ekonomi 2022, 11*(2), 258–270. Retrieved from https://www.syekhnurjati.ac.id/jurnal/index.php/edueksos/article/view/12132/4877

Rochmatin, F., & Muchlis. (2023). Development of Student Worksheet Oriented on PBL and Science Literacy to Improve Students' Critical Thinking Skills on Buffer Solution Material. *PENDIPA Journal of Science Education*, *7*(2), 208–216. https://ejournal.unib.ac.id/index.php/pendipa208

Sari, R. H., Halim, A., & Yusrizal, Y. (2021). Development of E-learning Module based on Multiple Representation Integrated with

GeoGebra. *Jurnal Penelitian Pendidikan IPA*, *7*(4), 758–762. https://doi.org/10.29303/jppipa.v7i4.856

Sasmita, R. S. (2020). Pemanfaatan internet sebagai sumber belajar. *Jurnal Pendidikan dan Konseling (JPDK),* *2*(1), 99-103. Retrieved from https://journal.universitaspahlawan.ac.id/index.php/jpdk/article/view/603

Savic, M., & Kashef, M. (2013). Learning outcomes in affective domain within contemporary architectural curricula. *International Journal of Technology and Design Education*, *23*(4), 987–1004. https://doi.org/10.1007/s10798-013-9238-8

Serevina, V. (2018). Development of e-module based on Problem Based Learning (PBL) on Heat and Temperature to improve student's science process skill. *TOJET: The Turkish Online Journal of Educational Technology*, *17*(3), 26–36. Retrieved from https://eric.ed.gov/?id=EJ1184205

Setiawan, D., Supriyadi, S., & Ellianawati, E. (2023). Using STEM Development Worksheets at Free Fall Montion Concept to Toward the Generic Science Skills. *Jurnal Penelitian Pendidikan IPA*, *9*(5), 2497–2504. https://doi.org/10.29303/jppipa.v9i5.2442

Sönmez, V. (2017). Association of Cognitive, Affective, Psychomotor and Intuitive Domains in Education, Sönmez Model. *Universal Journal of Educational Research*, *5*(3), 347–356. https://doi.org/10.13189/ujer.2017.050307

Sorgenfrei, C., & Smolnik, S. (2016). The Effectiveness of E-Learning Systems: A Review of the Empirical Literature on Learner Control. *Decision Sciences Journal of Innovative Education*, *14*(2), 154–184. https://doi.org/10.1111/dsji.12095

Sukariasih, L., Ato, A. S., Fayanto, S., Nursalam, L. O., & Sahara, L. (2019). Application of SSCS model (Search, Solve, Create and Share) for improving learning outcomes: The subject of optic geometric. *Journal of Physics: Conference Series*, *1321*(3), 0–6. https://doi.org/10.1088/1742-6596/1321/3/032075

Wahyudi, I. (2017). Pengembangan Program Pembelajaran Fisika SMA Berbasis E-Learning dengan Schoology. *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, *6*(2), 187–199. https://doi.org/10.24042/jipfalbiruni.v6i2.1850

Weni, D. M., & Isnani, G. (2016). Meningkatkan Hasil Belajar Siswa dengan Pengembangan Media Pembelajaran E-Learning Berbasis Blog. *Jurnal Pendidikan Bisnis Dan Manajemen*, *2*(2), 114–123. Retrieved from http://journal2.um.ac.id/index.php/jpbm/article/view/1697

Wijaya, R. E., Mustaji, M., & Sugiharto, H. (2021). Development of Mobile Learning in Learning Media to Improve Digital Literacy and Student Learning Outcomes in Physics Subjects: Systematic Literature Review. *Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences,* *4*(2), 3087-3098. https://api.semanticscholar.org/CorpusID:236249431

Yeh, S. P., & Fu, H. W. (2014). Effects of cooperative E-Learning on learning outcomes. *Eurasia Journal of Mathematics, Science and Technology Education*, *10*(6), 531–536. https://doi.org/10.12973/eurasia.2014.1212a