



Improving Students' Analytical Skills and Learning Interest Through the Tarl and CRT Approaches with The PBL Model on Chemical Buffer Material

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Abstract: Classroom action research was conducted to determine the increased analytical skills and students' interest in 2 cycles. Learning is carried out by applying the Problem-Based Learning (PBL) model with the Culturally Responsive Teaching (CRT) and Teaching at The Right Level (TaRL) approaches. Learning is carried out referring to the Kurikulum Merdeka. The research carried out was of the type of classroom action research. The research subjects were 26 students from the same class and school. The research was carried out in two cycles. The first cycle carried out learning using the PBL model with a CRT approach. The same learning was carried out in the second cycle using the TaRL approach. Data collection techniques are obtained from students' pre-tests and post-tests on students' analytical skills and learning interests. The research method is quantitative and descriptive qualitative, with an analysis technique using N-Gain and categorized based on the Likert scale. Research shows an increase in students' analytical skills to 0.46 or in the medium category. The classical increase in students' learning interest is as much as 95% in the high category.

Keywords: PBL model; CRT model; TaRL model; Analytical Skill; Learning interest; Chemical Buffer Material

Introduction

Education in Indonesia is a sector that always experiences development from time to time. Education in Indonesia is developing to increase the quality of learning in a better direction. Increasing the quality of education here is seen in the process and learning outcomes students achieve. This improvement aligns with the National Education System Law (UU Sisdiknas) article 1, number 20, where the interaction process between students, teachers, and the media in a learning environment is called learning (Sukerteyasa, 2021).

Education in Indonesia develops through adjustments to conditions and curricula within a certain period. Curriculum change is a series of processes

commonly occurring in Indonesia's education world (Melani & Gani, 2023). The curriculum is a form of the Indonesian government's efforts to perfect the previous education system through evaluation.

Currently, education in Indonesia applies a curriculum Merdeka, where the main focus of this curriculum is on several characteristics. The characteristics of the curriculum include a focus on essential material, more time duration so that the character development and competence of students can be maximized, learning outcomes adjusted to the developmental phase of students, and complete flexibility given to teachers and students (Oktavia et al., 2023). In the Merdeka curriculum, students' character development and potential are adapted to the identity of

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the Indonesian nation in the Pancasila Student Profile. Learning achievement is a learning competency that students must achieve. Learning achievement in the Merdeka curriculum is adjusted to the development phase of students. The high school level is classified into 2 phases: E and F.

The strategy for implementing learning in the Merdeka curriculum differs from the previous curriculum. Each material to be taught has its characteristics, which underlie the teacher's consideration in choosing a learning model. Teachers can apply many learning models during the learning process, including the Problem-Based Learning (PBL) learning model. The PBL learning model creates meaningful learning, helping students learn more easily (Mashami & Khaeruman, 2020; Rati et al., 2022). The buffer material taught to high school students is appropriate and can be taught using the PBL model (Widyaningrum et al., 2023). The PBL learning model can be applied to train students in analytical skills (Nugraheni et al., 2023). The problem-based learning model is based on actual problems experienced by students in their lives (Mashami & Khaeruman, 2020). For the implementation of learning using the PBL model, various approaches are carried out, one of which is Culturally Responsive Teaching (CRT) and Teaching at The Right Level (TaRL).

Culturally Responsive Teaching (CRT) aims to help empower students by using meaningful regional cultural connections to instill knowledge, social skills, and attitudes (Miskiyyah & Buchori, 2023). The CRT approach supports teachers' efforts to create learning without distinguishing between cultural backgrounds and equal rights between students. The CRT approach trains students' soft skills by linking regional culture with the subjects being taught so that students can understand the material while getting to know their cultural identity (Rahmawati et al., 2020; Robo et al., 2021). TaRL is a learning approach that orients students to learn based on their ability level (Marmoah et al., 2022; Ningrum et al., 2023).

An increase also follows efforts to improve Indonesian education quality and the professionalism of teachers. Professional teachers are not only tasked with educating, teaching, guiding, directing, assessing, and evaluating students, but teachers also have to carry out self and career development. It is in this self and career development that the teacher conducts Classroom Action Research. This research is based on finding problems in class and then finding solutions in learning activities (Nugraheni et al., 2023). One problem in learning is students' low literacy skills and low interest in learning about a material.

Students' interest in learning is essential for ongoing education. In contrast, according to research, students interested in learning show fewer attitudes and tend to be playful and less happy in learning the material provided by the teacher (Putri et al., 2021). Besides that, students' critical thinking skills are also necessary for every level of education. Critical thinking helps students have a vital view of problems and overcome problems (Qohar & Made Sulandra, 2021). Several studies confirm that participants' critical thinking skills can be increased with various learning media, with support from related institutions, the community, and the environment outside of school (Hillary et al., 2023; Indahsari et al., 2023). Critical thinking ability is an essential ability to solve problems. Sub-critical thinking, namely: (1) Identify, formulate, and solve problems; (2) Ability to draw logical conclusions obtained from various sources such as oral, written, and graphic and accountable for the conclusions drawn; (3) Ability to interpret; develop and use ideas; and (4) The ability to distinguish between facts and opinions (Qohar & Made Sulandra, 2021).

Based on this background, the researcher prepared a solution by considering several similar studies. Research by Muzzaki 2023 and Sanova 2021 states that students' critical thinking skills can improve with PBL model learning with the help of students' scientific concept worksheets. Similar research was also carried out by Hamid, who reviewed literature about PBL learning models involving cultural cases and local (Muzakki et al., 2023; Sanova et al., 2021) wisdom in local areas that could improve student learning outcomes. Other research also explains that students' interest in learning can be increased through the PBL model (D. Handayani et al., 2022; Murtihapsari et al., 2022). The research was also carried out by applying the PBL model with the pre-test and post-test research methods. The results showed that students' interest in chemistry increased (Purba & Munzirwan, 2022; Rahmadhani & Suherman, 2022; Santi et al., 2021).

Based on the descriptions and research above, classroom action research was carried out to implement learning using the PBL model with CRT and TaRL concentrations. This learning is carried out to know the increase in students' analytical skills and learning interests.

Method

Classroom action research was conducted on Phase F students at SMAN 3 Jombang, East Java, Indonesia. There are 26 students taught in class XI IPA 6 for the 2022/2023 academic year. The research was carried out on Buffer material chemistry learning. In this class, action research is shown in Figure 1.

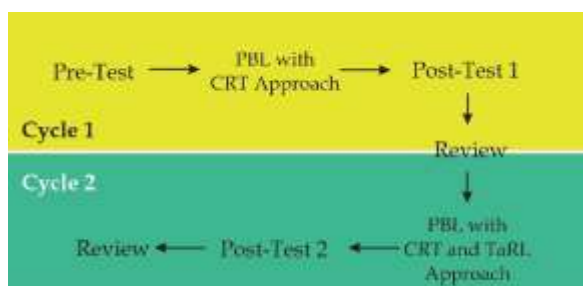


Figure 1. Research Cycle Adaptation (Yuris & Raniyah, 2022)

The detailed flow of classroom action research can be described as follows: The implementation of learning in cycle one begins with implementing the Pre-Test. The pre-test contains a cognitive assessment and an adapted student learning interest questionnaire (Azwar, 2012). Implementation of the Pre-test is before learning begins. Learning uses the Problem-Based Learning (PBL) model with a Culturally Responsive Teaching (CRT) approach. The learning media used is LKPD, adapted to the model and approach. A Post-Test is carried out at the end when the lesson is finished.

The next cycle is carried out after the analysis process; this cycle is carried out if it is felt that the results obtained by students are still not optimal in the first cycle. In this cycle, students are taught the same material again but added the Teaching at The Right Level approach. After learning is complete, a Post-Test is given to students.

The data obtained is in the form of the student’s cognitive analysis results and the responses of students’ learning interests to the learning they experience. The results of students’ cognitive assessment of the study of a problem in the problem were analyzed in a one-group pre-test post-test design using Normalized gain (N-Gain) (Nabella & Dwiningsih, 2022). Data processing techniques use the Average of N-Gain with the formula:

$$N-Gain = \frac{Post\ Test\ Score - Pre\ Test\ Score}{Maximum\ score - Post\ Test} \tag{1}$$

(Hake, 1999; Meltzer, 2002)

Then, the cognitive assessment results are categorized based on Table 1. The results of students’ responses to their learning interests were given a score based on the Likert scale. In answering the questionnaire, students were given four options: strongly agree, agree, disagree, and strongly disagree. Meanwhile, the questionnaire contained positive and negative statements (Putri et al., 2021). Analysis of increasing student interest in learning was carried out for each student, and then a classical average was calculated. The guidelines for scoring are based on Table 2. Furthermore, the data processing results of students’ interests can be categorized based on Table 3.

Table 1. The category of N-Gain Score

Score N-Gain	Category
$g > 0.7$	High
$0.3 \leq g \leq 0.7$	Medium
$g < 0.3$	Low

(Hake, 1999; Meltzer, 2002)

Table 2. The score of Student Responses

Student Responses	Positive	Negative
Constantly	4	1
Frequently	3	2
Rarely	2	3
Never	1	4

(Sugiyono, 2012)

Table 3. Student Interest Categorization

Score	Category
0-40	Low
41-60	Medium
61-100	High

(Azwar, 2012)

Result and Discussion

Implementing classroom action research produced two kinds of data: the students’ cognitive level through assessing analytical skills and students’ interest in learning. The research started from cycle one, namely the stage of giving a pre-test cognitive assessment of analytical skills and an interest in learning questionnaire. After this stage is completed, the teacher starts learning. Learning uses Problem-Based Learning (PBL) as a learning model with a Culturally Responsive Teaching (CRT) as a learning approach. In the learning process, students are given student worksheets (LKPD) with the theme of the distribution of Jombang coffee beer. Students must solve the problem of how coffee beer can be preserved during the distribution process. During the learning process, students are trained in critical thinking skills, especially in analysis.

At the end of the lesson, teacher give a cognitive assessment again to determine how far the participants can analyze a phenomenon, table, or graph to the student. The results obtained can be seen in Figure 2.

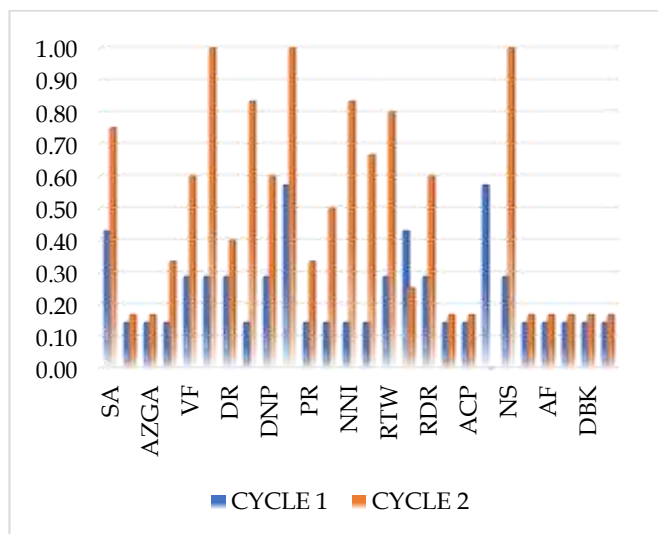


Figure 2. The result of cognitive assessment

After the analysis phase, data from cognitive assessment results on students' analytical skills were obtained, with an N-Gain value of 0.24. These results can be expressed in the low N-Gain category so that it can be said that the learning carried out in cycle one is categorized as low in increasing the ability of students to analyze skills. Because of the results obtained, it continues to the second learning cycle.

In the second cycle, learning was carried out using the PBL model with the CRT approach. However, differentiating power was given in the first and second cycles as a Teaching at the Right Level (TaRL) approach. In the learning in the second cycle, the teacher regrouped students, but in this cycle, students were grouped homogeneously according to their level of analytical skills. Groups with good analytical skills were given exercises to hone their analytical skills again, while groups with poor analytical skills were given exceptional guidance in groups. In this cycle, the teacher teaches analytical skills according to the student's level of understanding in each group, so it is hoped that classical analytical skills can increase. After learning, students are given a cognitive assessment in the form of a post-test to determine how much their analytical skills have improved.

After the results are obtained, the teacher analyzes the data as in the first cycle. The results show that the N-Gain value in the second cycle is 0.46. Based on the data, there is an increase in the medium category in cycle two, with an increase from the original 0.24 to 0.46, with the low to moderate category.

In obtaining data on students' level of interest in learning given at the beginning of learning, Students' interest in learning is shown in the form of a questionnaire with several questions with four answer options. Questionnaires were distributed and received responses from all students in the class, namely as many

as 26 students. The results of increasing students' interest in learning can be seen in Figure 3. Classically, students' interest in learning chemistry in the buffer material is 65% in the moderate category. However, the interest questionnaire was returned to students after completing the lesson. After learning, there is an increase in the interest of students in a classically high category by as much as 92%.

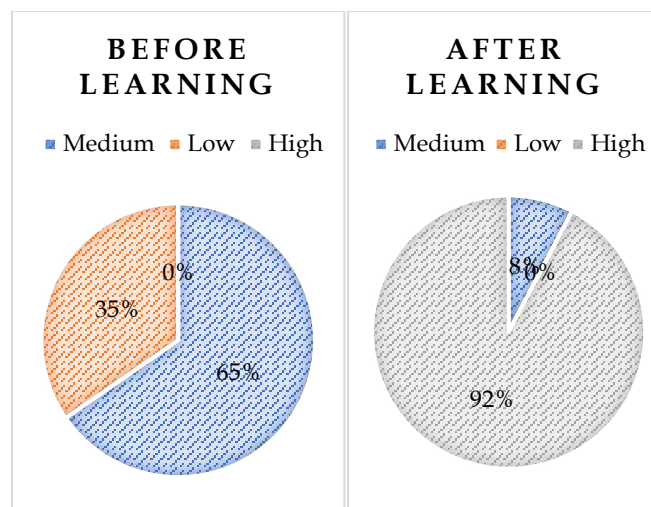


Figure 3. Questionnaire Results of Students' Learning Interest

The research results showed that students' interest in learning increased after two cycles of learning in buffer material. Supported by the PBL learning model and TaRL and CRT approaches, it can also improve students' skills in analyzing authentic problems surrounding supporting material. The results achieved are in line with similar research that has been carried out based on various sources (A. Handayani & Koeswanti, 2021; Qohar & Made Sulandra, 2021; Sanova et al., 2021).

Conclusion

Classroom action research was conducted to determine the increased analytical skills and students' interest in 2 cycles. Learning is done by applying the PBL model with the CRT and TaRL approaches. This classroom action research showed increased analytical skills by 0.24 to 0.46, ranging from low to moderate. The response of students' interest in classical learning increased from the medium category to the high category by 92%.

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Author Contributions

The contributions of the authors are equal. Dei Gratia Kanthi Nabella did conceptualization, investigation, data analysis, and draft writing. Rinaningsih did validation and writing-review draft; Lina Dwi Setyawati did supervision and reflection.

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Conflicts of Interest

In preparing and publishing this scientific article, the authors had no conflicts of interest.

References

- Azwar, S. (2012). *Reliabilitas dan Validitas*. Pustaka Pelajar.
- Hake, R. (1999). *Analyzing change/gain scores*. Dept of Physics, Indiana University.
- Handayani, A., & Koeswanti, H. D. (2021). Meta-Analysis Model Pembelajaran Problem Based Learning (PBL) Untuk Meningkatkan Kemampuan Berpikir Kreatif. *Jurnal Basicedu*, 5(3), 1349-1355. <https://doi.org/10.31004/basicedu.v5i3.924>
- Handayani, D., Anwar, Y. A. S., Junaidi, E., & Hadisaputra, S. (2022). Pengembangan Modul Pembelajaran Kimia Materi Asam Basa Berbasis Problem Based Learning (PBL) untuk Meningkatkan Motivasi Belajar Siswa. *Chemistry Education Practice*, 5(1), 107-114. <https://doi.org/10.29303/cep.v5i1.2765>
- Hillary, G., Djulia, E., & Hasibuan, R. H. (2023). Analysis Critical Thinking Ability and Environmental Care Attitude of Junior High School Students on Global Warming Material. *Jurnal Penelitian Pendidikan IPA*, 9(5), 2383-2390. <https://doi.org/10.29303/jppipa.v9i5.2603>
- Indahsari, H. K., Suyanta, S., Yusri, H., Khaerunnisa, N., & Astuti, S. R. D. (2023). Analysis of the Use of Android-Based Edusan Learning Media on Students' ICT Literacy Skills. *Jurnal Penelitian Pendidikan IPA*, 9(5), 2312-2318. <https://doi.org/10.29303/jppipa.v9i5.2808>
- Marmoah, S., Istiyati, S., Mahfud, H., Supianto, & Sukarno. (2022). Persepsi Guru terhadap Implementasi Program Sekolah Penggerak di Sekolah Dasar. *DWIJA CENDEKIA: Jurnal Riset Pedagogik*, 6(2), 361-371. Retrieved from <https://jurnal.uns.ac.id/jdc/article/view/65122>
- Mashami, R. A., & Khaeruman, K. (2020). Pengembangan Multimedia Interaktif Kimia Berbasis PBL (Problem Based Learning) untuk Meningkatkan Keterampilan Generik Sains Siswa. *Hydrogen: Jurnal Kependidikan Kimia*, 8(2), 85-96. Retrieved from <https://e-journal.undikma.ac.id/index.php/hydrogen/article/view/3138>
- Melani, A., & Gani, E. (2023). Penerapan Implementasi Kurikulum Merdeka dalam Pembelajaran Bahasa Indonesia di SMP Negeri 16 Padang. *Educaniora: Journal of Education and Humanities*, 1(2), 23-32. <https://doi.org/10.59687/educaniora.v1i2.28>
- Meltzer, D. E. (2002). *Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif dan R&D)*. Alfabeta.
- Miskiyyah, Z., & Buchori, A. (2023). Pengembangan E-Modul dengan Pendekatan Culturally Responsive Teaching pada Materi Sistem Persamaan Linear Dua Variabel. *Enggang: Jurnal Pendidikan, Bahasa, Sastra, Seni, Dan Budaya*, 3(2). Retrieved from <https://e-journal.upr.ac.id/index.php/enggang/article/view/9039>
- Murtilhapsari, M., Achmad, F., Larasati, C. N., & Yogaswara, R. (2022). Penggunaan Model Pembelajaran Problem Based Learning Terhadap Minat Hasil Belajar Kimia. *Jambura Journal of Educational Chemistry*, 4(2), 64-69. <https://doi.org/10.34312/jjec.v4i2.14050>
- Muzakki, A. R., Prafitasari, A. N., & Wulandari, F. Peningkatan Keterampilan Berpikir Kritis Siswa Kelas XI MIPA Menggunakan PBL Berbantuan LKPD Saintifik Konsep. *DWIJA CENDEKIA: Jurnal Riset Pedagogik*, 7(2), 629-640. Retrieved from <https://jurnal.uns.ac.id/jdc/article/view/75270>
- Nabella, D. G. K., & Dwiningsih, K. (2022). Development of Android-Based Mobile Learning (M-Learning) on Voltaic Cell Sub Materials to Increase Learning Effectiveness in Pandemic Covid-19 Era. *Jurnal Penelitian Pendidikan IPA*, 8(1), 183-187. <https://doi.org/10.29303/jppipa.v8i1.1243>
- Ningrum, M. C., Juwono, B., & Suchayo, I. (2023). Implementasi Pendekatan TaRL untuk Meningkatkan Motivasi Belajar Peserta Didik pada Pembelajaran Fisika. *PENDIPA Journal of Science Education*, 7, 94-99. <https://doi.org/10.33369/pendipa.7.2.94-99>
- Nugraheni, L., Mutianingsih, N., Astutik, E. P., & Rahayu, S. (2023). Pelatihan Penyusunan Penelitian Tindakan Kelas (PTK) Berbasis PBL dan PjBL Bagi Guru SMA Se-Kabupaten Mojokerto. *Pancasona*, 2(1). <https://doi.org/10.36456/pancasona.v2i1.6676>
- Oktavia, A. B. R., Wiryanto, & Wulandari, N. (2023). Peningkatan Hasil Belajar Peserta Didik Melalui Model Problem Based Learning Pada Mata Pelajaran Matematika Kelas IV SDN Pacarkeling V/186 Surabaya. *Journal Of Social Science Research*,

- 3(2), 6412-6423. Retrieved from <http://j-innovative.org/index.php/Innovative/article/view/1069>
- Putri, Y. P. (2021). Analisis Minat Belajar Siswa Kelas X SMA At-Taubah pada Materi SLPTV dengan Metode Pembelajaran Daring. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 5(3), 2934-2940. <https://doi.org/10.31004/cendekia.v5i3.987>
- Purba, E., & Munzirwan, R. (2022). Penerapan model pembelajaran problem based learning terhadap hasil belajar dan minat siswa pada materi laju reaksi di SMA Katolik Medan XI IPA 4. *Educenter: Jurnal Ilmiah Pendidikan*, 1(6), 701-706. Retrieved from <https://jurnal.arkainstitute.co.id/index.php/educenter/article/view/189>
- Qohar, A., & Made Sulandra, I. (2021). Analisis Kemampuan Berpikir Kritis Siswa SMA Kelas X Dalam Memecahkan Masalah SPLTV. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 5(2), 909-922. Retrieved from <https://www.j-cup.org/index.php/cendekia/article/view/574>
- Rahmadhani, W., & Suherman, S. (2022). Penerapan Model Problem Based Learning (PBL) pada Materi Larutan Elektrolit dan Nonelektrolit untuk Meningkatkan Minat Belajar. *Media Eksakta*, 18(2), 133-137. <https://doi.org/10.22487/me.v18i2.2365>
- Rahmawati, Y., Ridwan, A., Faustine, S., & Mawarni, P. C. (2020). Pengembangan Soft Skills Siswa Melalui Penerapan Culturally Responsive Transformative Teaching (CRTT) dalam Pembelajaran Kimia. *Jurnal Penelitian Pendidikan IPA*, 6(1). <https://doi.org/10.29303/jppipa.v6i1.317>
- Rati, F., Rohiat, S., & Elvinawati. (2022). Pengembangan Multimedia Pembelajaran Interaktif Berbasis Problem Based Learning (PBL) Menggunakan Aplikasi Articulate Storyline Pada Materi Ikatan Kimia. *Jurnal Pendidikan Dan Ilmu Kimia*, 6(1), 70-79. Retrieved from <https://ejournal.unib.ac.id/alotropjurnal/article/view/21799>
- Robo, R., Taher, T., & Lukman, A. (2021). Penerapan Pendekatan Culturally Responsive Teaching Terintegrasi Etnokimia untuk Mengembangkan Keterampilan Abad 21 Siswa. *Jurnal Ilmiah Wahana Pendidikan*, 7(8), 225-231. Retrieved from <https://jurnal.peneliti.net/index.php/JIWP/article/view/1148>
- Sanova, A., Afrida, Bakar, A., & Yuniarccih, H. (2021). The Use of Etnoscience Approach Through Problem Based Learning on Chemical Literacy of Buffer Solutions Topics. *Jurnal Zarah*, 9(2), 105-110.
- Santi, D. V., Handayani, D., & Noviyanti, N. (2021). Penerapan Model Problem Based Learning Berbantuan Multimedia untuk Meningkatkan Hasil Belajar dan Aktivitas Belajar Kimia Siswa. *Faktor: Jurnal Ilmiah Kependidikan*, 8(3), 282. <https://doi.org/10.30998/fjik.v8i3.9242>
- Sugiyono. (2012). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Alfabeta.
- Sukertayasa, I. P. (2021). Upaya Meningkatkan Hasil Belajar PPKn Peserta Didik Melalui Penerapan Model PBL Pada Materi Peran Indonesia Dalam Perdamaian Dunia Di Kelas XI IPS 4 SMA Negeri 2 Denpasar. *Jurnal Pendidikan Kewarganegaraan Undiksha*, 9(1), 81-88. Retrieved from <https://ejournal.undiksha.ac.id/index.php/JJPP/article/view/31430>
- Widyaningrum, W., Nurhayati, S., Mursiti, S., Eko, D., Susatyo, B., Kimia, J., Matematika, F., Ilmu, D., & Alam, P. (2023). Chemistry in Education Pengaruh Penerapan Blended Problem Based Learning terhadap Kemampuan Berpikir Kritis pada Materi Larutan Penyangga. *Chemined*, 12(1). Retrieved from <https://journal.unnes.ac.id/sju/index.php/chemined/article/view/65145>
- Yuris, E., & Raniyah, Q. (2022). Strategi Meningkatkan Motivasi Belajar melalui Kegiatan Outbound pada Anak Usia Dini di Yayasan H. Abdurrahim Harahap Kecamatan MedanAmplas. *Journal on Teacher Education*, 4(2), 1238-1249. Retrieved from <https://journal.universitaspahlawan.ac.id/index.php/jote/article/view/7153>