

Improving Student Understanding and Edupreneurship Based on Analytical Chemistry Student Activity Sheets (SAS) Closed Case Study

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ABSTRACT

Keywords:

closed case studies,
edupreneurship,
student activity sheets
(SAS).

Policies regarding key performance indicators of State Universities continue to be encouraged to implement problem-based and collaborative learning. Therefore, innovation in learning is needed with learning methods that empower the role of students (student-centered learning), one of which is case-based (closed case study). In line with the Vision and Mission of the Faculty of Mathematics and Natural Sciences, The State University of Surabaya for the 2021-2025 period, one indicator is the implementation of research-based education characterized by edupreneurship. The purpose of this research is to improve the understanding and edupreneurship of undergraduate chemistry education students. Treatment to achieve this goal is case study-based learning (closed case study) assisted by student activity sheets (SAS) on analytical chemistry. The research sample was 20 undergraduate Chemistry Education students from the 2023 batch of the Faculty of Mathematics and Natural Sciences, Unesa. The research followed a quasi-experimental one-group pretest-posttest design. The variables in this study were evaluated using an assessment instrument for student understanding of analytical chemistry, questionnaire responses to closed case study learning, and the edupreneurship attitude variables used are (1) self efficacy, (2) tenacity, (3) courage in making decisions, (4) creativity, and (5) independence.. Data on changes in conceptual understanding were then explained descriptively as an introduction and reinforced using inferential analysis using the Wilcoxon Signed Ranks Test because the population was known to be non-normally distributed ($0.006 < 0.05$). The results showed a significant change in students' understanding of analytical chemistry (basic chemical separation concepts) before and after learning (Asymp. Sig. (2-tailed) value $0.00 < 0.05$). This achievement is in line with the results of the respondent questionnaire, which showed that more than 80% stated that learning based on closed case studies and edupreneurship can increase understanding and edupreneurship attitude on the variable self-efficacy, courage in making decisions and independence.

INTRODUCTION

The Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) issued Ministerial Decree No. 210/M/2023 concerning key performance indicators, which essentially contain the Key Performance Indicators for Higher Education and Higher Education Services at the Ministry of Education, Culture, Research, and Technology. The goal is to create adaptive higher education institutions based on more concrete outcomes. In line with this, Permendikristek No. 39 of 2025 aims to improve the quality of higher education implementation that has an impact and is aligned with developments in international quality assurance. Through this policy, Kemendikristek strives to ensure that higher education institutions have high adaptability to changing times, have a more direct impact on society, and are able to

achieve international higher education standards. Guarantees of convenience and sharper targets are also provided to lecturers as the main resources in higher education. Lecturers continue to be encouraged to be able to implement problem-based, collaborative learning and not only rely on the learning process in the classroom. This is in accordance with the formulation of key performance indicators 7 regarding the implementation of collaborative and participatory classes, one of which uses the case method. Article 14, paragraph 3 of Minister of Education and Culture Regulation Number 3 of 2020 explains that the learning methods that can be selected for implementing learning in courses include: group discussions, simulations, case studies, collaborative learning, cooperative learning, project-based learning, problem-based learning, or other learning methods that can effectively facilitate the achievement of learning outcomes (Minister of Education and Culture Regulation Number 3 of 2020). Based on the graduates of this policy, the learning methods used by lecturers must be more creative, innovative, and able to encourage students to think at a higher level.

In line with key performance indicators 7, Unesa also adheres to key performance indicators 1, which states that every University must be able to map alumni profiles through tracer studies as feedback aimed at improving and developing the quality and system of education (Minister of Education and Culture, Research and Technology Decree Number 210/M/2023). The Vision and Mission of the Faculty of Mathematics and Natural Sciences, Unesa for 2021-2025 is to provide research-based education characterized by edupreneurship. Edupreneurship is also crucial to support the 20-credit off-campus Merdeka Belajar Kampus Merdeka (MBKM) program. Edupreneurship students must possess the initial skills required to provide an authentic, chemistry-integrated, and comprehensive learning experience. This is the hope of achieving the Bachelor of Chemistry Education study program's Das Sollen (Das Sollen). Davies (1987) stated, "We have tended to forget that the real essence of education is learner-learning, not teacher-teaching. Somehow, we have tended to create a mystical position for the teacher in the educational process, and have neglected the individual student's desire and capacity to create, discover, and learn for themselves."

Das Sein (facts) that still occur in the field include: first, the phenomenon of student passivity in lectures, due to the lecturer's use of lectures, group presentations, and teacher-centered discussions, particularly in analytical chemistry courses. Second, assessment still relies on cognitive assessment through assignments, midterm exams, and final exams. Third, based on the 2024 Chemistry Education undergraduate tracer study report, 74% of alumni work in government and non-government institutions, with an average income still below the provincial minimum wage (UMP). 21% continue their studies to postgraduate level or professional teacher education programs, and only 5% become entrepreneurs. The low number of alumni who become entrepreneurs provides significant input for chemistry education study programs, which should be followed up by preparing students with entrepreneurship programs (edupreneurship). Asna et al. (2023) emphasized that unemployment in Indonesia remains relatively high. This is because the high number of college graduates is not commensurate with the number of job opportunities available. Furthermore, the lack of an entrepreneurial mindset and the

absence of early career planning are also factors in the high unemployment rate. Therefore, efforts are needed, one of which is from educational institutions through edupreneurship programs. Based on the statement above, it can be concluded that there is an imbalance between *Das Sollen* (hope) and *Das Sein* (reality), so the researcher made innovations in analytical chemistry learning, from the original teacher-centered learning to a method that empowers students (student-centered learning) based on problem solving. According to Oh (2015), the atmosphere of learning has a significant effect on the quality of edupreneurship practice. A conducive learning atmosphere can enhance individual understanding and edupreneurship attitude. The variables of edupreneurship attitude variables used are (1) self efficacy, (2) tenacity, (3) courage in making decisions, (4) creativity, and (5) independence (Dioneo-Adetayo, 2006).

RESEARCH METHOD

To address this research problem, a pre-experimental approach with a single case study design was used, as shown in Figure 1. Student activity sheets (SAS) on Analytical Chemistry material were used by users to train edupreneurship. The users consisted of 20 undergraduate chemistry education students from the class of 2023. Respondents used student activity sheets that included learning experiences developed as closed-case study learning practices. In this closed-case study learning practice, students also used student activity sheets as a reference source to develop their understanding of educational practices. Data collection techniques used tests, questionnaire responses to closed case study learning, and the edupreneurship attitude variables used are (1) self efficacy, (2) tenacity, (3) courage in making decisions, (4) creativity, and (5) independence. The tests were used to determine students' initial and final understanding scores on analytical chemistry questions. The questionnaire was used to gather data on interest in learning using case studies. The research design is visualized in Figure 1.

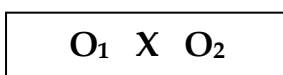


Figure 1. One-group pretest-posttest design

X : Learning with Closed Case Study-based student activity sheets (SAS) on Analytical Chemistry material to train Edupreneurship

O₁ and O₂ : Student comprehension scores of the closed case study learning before and after reading and understanding.

The research procedures were: (1) measuring students' initial understanding (O₁); (2) student learning with student activity sheets (SAS) based on Closed Case Study to train edupreneurship by observing edupreneurship attitude variables;; (3) measuring students' final understanding (O₂); (4) having students complete a questionnaire responding to the learning; and (5) data organization, data analysis, and drawing conclusions.

Statistical tests to determine the significance of the mean differences between students' understanding scores on Analytical Chemistry in Training Edupreneurship were planned using the inferential statistical technique of a one-tailed t-test. If the data are normally distributed, a t-test cannot be performed, so a non-parametric Wilcoxon Signed Rank Test (STM) was used as an alternative (Non-Parametric Statistics) (Sugiyono, 2023).

RESULTS AND DISCUSSION

The initial stage of the research, prior to the closed case study method, began with assessing students' understanding through an initial comprehension test of the analytical chemistry sub-basics of chemical separation. Respondents then used the student activity sheets (SAS), which included learning experiences developed as a closed case study learning practice. In this closed case study learning practice, students also used the student activity sheets (SAS) on analytical chemistry material as a reference source to develop their understanding of edupreneurship. Closed case studies are a method that focuses students on learning. They can hone their knowledge in solving problems or phenomena and their skills in expressing opinions and finding appropriate solutions for learning (Sidebang, 2021).

After the learning, a final test was administered to determine students' final understanding. The following are the comprehension scores of 20 undergraduate Chemistry Education students regarding the student activity sheets (SAS) on analytical chemistry material in Training Edupreneurship.

Table 1. Student Understanding Scores for Closed Case Study Learning in Training Edupreneurship.

Student Serial No.	Student Comprehension Score	
	Before	After
1	40	100
2	20	80
3	40	100
4	80	100
5	60	100
6	60	100
7	20	100
8	40	80
9	40	100
10	40	100

Student Serial No.	Student Comprehension Score	
	Before	After
11	60	80
12	80	100
13	80	100
14	40	100
15	60	80
16	80	100
17	40	100
18	20	80
19	20	100
20	40	80

The significance of the mean difference between students' understanding scores of Analytical Chemistry based on a closed case study in the Edupreneurship Training program was planned using the inferential statistical technique of a one-tailed t-test. The t-test could not be performed because the population was not normally distributed. The results of the population normality test are shown in Figure 2.

Normality Test (Shapiro-Wilk)				
			W	p
Before	-	After	0.851	0.006

Note. A low p-value suggests a violation of the assumption of normality

Figure 2. Results of Normality Testing as a Requirement in Parametric Statistics

Based on Figure 2, the results of the Shapiro-Wilk normality test using JAMOV software obtained a significance value of $0.006 < 0.05$, meaning H_0 was accepted. In other words, the population was not normally distributed. Instead of the t-test (parametric test), the non-parametric Wilcoxon test was used (Sugiyono, 2023). The description and results of the statistical test using Wilcoxon are presented in Figure 3.

Paired Samples T-Test			Statistic	df	p	Mean difference	SE difference
Before	After	Student's t	-9.98	19.0	< .001	-46.0	4.61
		Wilcoxon W	0.00		< .001	-50.0	4.61

Note. $H_0: \mu_{\text{Measure 1}} - \mu_{\text{Measure 2}} = 0$

Figure 3. Results of the Wilcoxon Signed Ranks Test (JAMOV Software)

Based on the results of the Wilcoxon Signed Ranks Test (Figure 3), the Asymp. Sig. (2-tailed) value was $0.00 < 0.05$, indicating that H_a was accepted. In other words, the understanding of undergraduate Chemistry Education students significantly increased in analytical chemistry through training in edupreneurship after learning using case studies (closed case studies) assisted by the student activity sheets (SAS) on analytical chemistry material. The conclusion is that the student activity sheets (SAS) on analytical chemistry material meets the quality criteria for improving student understanding of case study-based learning and embedding edupreneurship into analytical chemistry material, particularly the fundamentals of chemical separation, as evidenced by the increase in students' final understanding scores. Through case study learning, students read the presented case, then analyze it and solve the problem (Zulfikar, 2018). This method is contextual because it provides real-life case studies on how to formulate chemical separations, reviewed from relevant supporting data, as a means of practicing edupreneurship. Case studies or problem-solving are narrative learning tools that immerse students in real-life situations, where students and instructors work on the problem. Students are required to understand the context and formulate a course of action. In a closed case study, students complete the case according to the instructor's instructions. These instructions are presented in the form of study questions, a list of questions presented at the end of the case. Through these questions, students apply what they know to analyze data and propose solutions rather than simply memorizing facts, names, labels, and formulas.

The increased student understanding is also supported by high motivation and interest in learning, as evidenced by the results of the questionnaire. The assessment results of the questionnaire responses provided by the closed-case study-based student activity sheets (SAS) on analytical chemistry material in training edupreneurship by student users received positive responses, as presented in Figure 4.

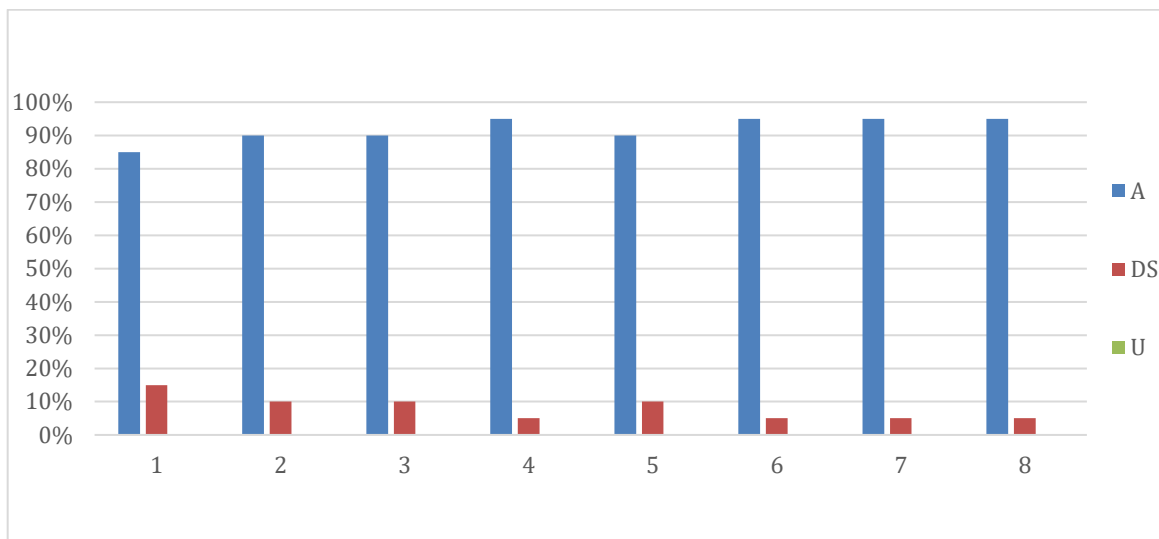


Figure 4. Percentage of Users Who Agree (A), Disagree (DS), and Undecided (U) with Statements Representing Indicators of Suitability of the Closed-Case Study student activity sheets (SAS) for Training Edupreneurship

The data in Figure 4 shows that the eight questionnaire statements representing indicators of suitability of the student activity sheets (SAS) on analytical chemistry material in increasing interest and motivation in learning were agreed upon by a majority of users (>80%). Therefore, it can be concluded that the closed-case study-based student activity sheets (SAS) on analytical chemistry material for training edupreneurship has met quality criteria. During the implementation phase of case study-based learning (closed case studies), fostering multidirectional communication in analyzing the presented cases is also a key factor. This is evident because students actively participate in analyzing and expressing their opinions based on their knowledge of the solutions used to solve the presented problems. Lecturers need to create a fresh classroom atmosphere to ensure effective delivery of material, such as through the application of the case method (Purba et al., 2020).

Respondents used the student activity sheets (SAS) on analytical chemistry material, which encompasses learning experiences developed as a closed case study learning practice. In this closed case study learning practice, students also used the student activity sheets (SAS) on analytical chemistry material as a reference source to develop their understanding of educational practices. The data collection technique used a closed case study learning response questionnaire, and observation sheets by observers on the edupreneurship attitude variables during the learning process, while the indicators of the observed attitude variables include (1) self-efficacy/self-confidence in completing tasks, (2) perseverance in learning, (3) courage in making decisions, (4) creativity in creating new ideas/solutions in solving problems, and (5) independence in trying to find answers to tasks and always re-checking the understanding. The results of the analysis of the edupreneurship attitude variables that were successfully collected from students during the learning process are presented in Table 2.

Table 2. Student Edupreneurship Attitude Variable

Number Variable	Edupreneurship Attitude Variable	Mode of 20 respondents	Category
1	Self Efficacy	5	Very good
2	Tenacity	4	Good
3	Courage in making decisions	5	Very good
4	Creativity	4	Good
5	Independence	5	Very good

The results obtained indicate that the variables of edupreneurship attitudes in student respondents of the study showed a very good mode, seen from attitudes towards self-efficacy/self-confidence in completing assignments, courage in making decisions, and independence in trying to find answers to assignments and constantly re-checking their understanding through peer discussions or discussions with lecturers. These good observation results indicate a positive, active, creative learning climate is created, and increases student learning outcomes and edupreneurship attitudes. The concept of edupreneurship also combines entrepreneurial principles with educational values to create a generation of creative, innovative, and responsible entrepreneurs. The concept of edupreneurship emphasizes the importance of developing entrepreneurial skills from an early age, both in technical aspects and in character development (Arma & Iswatiningsih, 2025). This not only equips individuals with the ability to create business opportunities alone, but also teaches the importance of the role of ethics, sustainability, and positive contributions to bring benefits to society.

CONCLUSION

Students' understanding and edupreneurship of analytical chemistry material improved after learning using student activity sheets (SAS) on analytical chemistry material based on closed case study, marked by a decrease in the number of students who answered the comprehension questions incorrectly. The questions tested measured students' understanding of the basic concepts of chemical separation in terms of their implementation in edupreneurship. The results of the inferential analysis using the Wilcoxon Signed Ranks Test assisted by JAMOWI software concluded that not a single student's final score decreased or remained the same. All students (20 respondents) experienced an increase in their comprehension scores. Students' understanding increased significantly after learning (Asymp. Sig. (2-tailed) value $0.000 < 0.05$). Positive responses were also given by students after learning, as indicated by the high percentage of respondents who answered agree and strongly agree with the learning using student activity sheets (SAS) on analytical chemistry material based on closed case study by practicing edupreneurship. It is also strengthened by the edupreneurship attitude variable which is in the very good mode category (scale 5) including self-efficacy, courage in making decisions and independence.

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REFERENCES

- Arma, O., P., & Iswatiningsih, D. (2025). Analisis Pembelajaran Berbasis Konsep Edupreneurship. *Sibatik Journal Volume 4 N0.5 DOI: <https://doi.org/10.54443/Sibatik.V4i5.2746>*
- Asna, N., Nana, A., & Binti, N., A. (2023). Urgensi Edupreneurship sebagai Upaya dalam Mempersiapkan Indonesian Golden Era. *Jurnal Pendidikan Tambusai. <https://doi.org/10.31004/jptam.v7i1.5886>*.
- Dioneo-Adetayo, E.A. (2006). "Factors influencing attitude of youth towards entrepreneur", *International Journal of Adolescence and Youth*, Vol. 13 No. 1-2, pp. 127-145.
- Davies, I. K. (1987). *Pengelolaan Belajar*. Jakarta: Rajawali Press.
- Diktisaintek, D. (2025). Peraturan Menteri Pendidikan Tinggi, Sains, Dan Teknologi Republik Indonesia Nomor 39 Tahun 2025 Tentang Penjaminan Mutu Pendidikan Tinggi. *Sustainability (Switzerland)*, 11(1), 1-14.
- Dioneo-Adetayo, E.A. (2006). "Factors influencing attitude of youth towards entrepreneur". *International Journal of Adolescence and Youth*, Vol. 13 No. 1-2, pp. 127-145.
- Kepmendikbud, Nomor 3/M/2021. (2021). Tentang Indikator Kinerja Utama Perguruan Tinggi dan Lembaga Layanan Pendidikan Tinggi di Kemendikbud. Jakarta.
- Kepmendikbudristek, Nomor 210/M/2023. (2023). Tentang Indikator Kinerja Utama Pendidikan Tinggi dan Lembaga Layanan Pendidikan Tinggi di Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi. Jakarta.
- Mwasalwiba, E.S. (2010). "Entrepreneurship education: a review of its objectives, teaching methods, and impact indicators". *Journal education and training*, Vol. 52 Issue 1, pp. 20-47.
- Oh, S. (2015). "How learning atmosphere is connected to quality practices:—a case study of a korean service firm", *Journal Procedia-Social and Behavioral Sciences*, Vol. 177, pp. 83-87.

- Purba, J. M., Sinaga, R., & Tanjung, D. S. (n.d). (2020). Pengaruh Model Pembelajaran Tipe Kooperatif Tipe Scramble Terhadap Hasil Belajar Siswa Pada Tema Daerah Tempat Tinggalku Kelas IV, 10(4), 216–224.
- Pradana, S.D.S., Parno, P., Handayanto, S.K. (2017). Pengembangan Tes Kemampuan Berpikir Kritis pada materi optik Geometri untuk Mahasiswa Fisika. *Jurnal Penelitian dan Evaluasi Pendidikan*, 21(1): 51-64. doi:10.21831/pep.v21i1.13139.
- Rosidah, S. T., Pramulia, P. (2021). Team Based Project dan Case Method sebagai Strategi Pengembangan Keterampilan Mengembangkan Pembelajaran Mahasiswa. *Jurnal Kajian Pendidikan dan Pengajaran*, Vol 7(2); 245-251. doi: 10.30653/003.202172.196.
- Satwika, Y. W., Laksmiwati, H., Khoirunnisa, R, N. (2018). Penerapan Model Problem Based Learning untuk Meningkatkan Kemampuan Berpikir Kritis Mahasiswa. *Jurnal Pendidikan (Teori dan Praktik)*, 3(1); 7-12. doi:10.26740/jp.v3n1.
- Sidebang, R. (2021). Pengaruh Disiplin Belajar Siswa Terhadap Prestasi Belajar Pada Siswa Kelas iii Sd Negeri 040528 Sukadame T.P. 2020/2021. *ESJ (Elementary School Journal)*, 11(1), 15–22.
- Stanikzai, M., I. (2023). Critical Thinking, Collaboration Creativity and Communication Skills among School Student. *European Journal of Theoretical and Applied Sciences*. 1(5):441-453. doi: 10.59324/ejtas.2023.1(5).34.
- Sugiyono. (2023). Metode Penelitian Studi Kasus (Pendekatan Kuantitatif, Kualitatif, & Kombinasi). Bandung: ALFABETA.
- Yonisa, R. K., Novi, I., Yoyok, S., and Osman, J. (2019). Comparative Study of Student Entrepreneurship of UNESA Indonesia and UPSI Malaysia. *International Journal of Supply Chain Management*. Vol. 8, No. 4, August.
- Zulfikar, F. (2018). Model Pembelajaran Studi Kasus Untuk Meningkatkan Pengetahuan Siswa Dan Respon Siswa. Prosiding Seminar Nasional PPKn 2018 “Seminar Nasional Penguatan Nilai-Nilai Kebangsaan Melalui Pendidikan Kewarganegaraan Persekolahan dan Kemasyarakatan”.