

## Development of Project-Based Learning Teaching Materials of the Dissertation Supporting Course to Improve Students' Abilities in Compiling Research Proposal in Order to Realize SDGs - 4 (Quality Education)

Suyatno Sutoyo\*, Achmad Lutfi, Erman, I Gusti Made Sanjaya, Sophia Allamin  
Doctoral Program of Science Education, State University of Surabaya, Surabaya, Indonesia  
\*Corresponding author email: [suyatno@unesa.ac.id](mailto:suyatno@unesa.ac.id)

### ABSTRACT

Based on the national qualification framework, doctoral students must have the ability to carry out research to produce creative, original, and tested work through inter-, multi-, and transdisciplinary approaches. This research is aimed to develop the project-based learning teaching materials of Dissertation Supporting Course to improve students' abilities in compiling research proposal. This research is developmental research using a modified Research and Development (R & D) model. This research is limited to the preliminary study stage, which includes literature study, field survey, initial product preparation followed by validation of product by experts (expert judgment) and product revision. The teaching materials developed consist of the lesson plan, student activity sheets, and assessment of project product. The research data were analyzed descriptively quantitatively. The research results showed that the teaching materials developed, namely the lesson plan, student activity sheets, and assessment of project product had high validity, with an average Aiken value of 0.92, 0,90 and 0.89, respectively. Thus, these teaching materials can be implemented in learning Dissertation Supporting courses to improve students' abilities in compiling research proposal in order to realize SDGs-4 (Quality Education).

**Keywords:** Teaching materials, project based learning, dissertation supporting course, research proposal, SDGs 4

### 1. INTRODUCTION

The 21<sup>st</sup> century is a century that began with economic globalization which hit all countries in the world, taking place so rapidly, simultaneously and pervasively (Astra, 2018; Shpeizer, 2018). Globalization and free trade, such as AFTA, AFLA, and APEC, have encouraged the formation of free trade and tight competition in goods and services. The strength, resilience and national competitiveness of a nation or country are no longer determined by the wealth of its natural resources, but are more determined by the ability, creativity and skills of its human resources (Anazifa & Djukri, 2017; Muhammad, 2018).

The very rapid development of science and technology has greatly influenced the pattern of society's demands on the education system, especially in Higher Education Institutions. The existence of this system is increasingly being challenged to be able to adapt to developments and changes in society's needs, both on a national and global scale. Efforts to improve the quality, quantity and relevance of education continue to be carried out although until now the results have

not been fully realized. In order to improve the quality of education, various innovations have been carried out both in the aspects of learning methods, learning models or approaches, and curriculum (Anazifa & Djukri, 2017; Jamil et al., 2018; Muhammad, 2018).

Based on Indonesian Government Regulation no. 37 of 2022, State University of Surabaya was designated by the government as a Legal Entity State University (LESU) starting from 20 October 2022. As a LESU, State University of Surabaya is obliged to develop an internationalization program. This program also supports the achievement of the 8<sup>th</sup> main performance indicator for higher education which has been determined by the Directorate General of Education and Culture of the Ministry of Education and Culture, namely the International Standard Study Program.

The Doctoral Program of Science Education (DPSE) is one of 7 doctoral programs at State University of Surabaya, which was founded on 15 September 2010. This study program has been accredited by LAMDIK with a superior level based on Decree No. 702/SK/LAMDIK/Ak/D/VI/2025. Since its founding in 2010, the DPSE has received a good response from the community. Most of the alumni of the DPSE work as lecturers, both in state and private universities, and others as lecturers at Education and Training Centers, as well as teachers in schools. Many alumni have gained trust from the institutions where they work, for example as rector, vice rector, dean, vice dean, heads of study programs, heads of institutions/schools, heads of quality assurance institutions, and so on (Sutoyo et al., 2019).

In order to support Unesa's internationalization program, DPSE had applied for ASIIN international accreditation and on 22 March 2024, DPSE received international fully accreditation from ASIIN (2024-2029). International accreditation is very important because it can have a positive impact on the academic community because if a university already has international accreditation, then the university will definitely get a plus score from BAN-PT. The benefits of international accreditation are gaining higher education recognition, foreign lecturers can teach at universities, the quality of higher education can be further improved, and recognized by the Ministry of Education and Culture (Kemendikbud, 2020). The DPSE is also preparing to accept foreign students. Thus, all courses in the DPSE must be prepared in English.

The dissertation supporting course is a one of course at Doctoral Program of Science Education, FMNS, State University of Surabaya, that is aimed at equipping doctoral students of science education with the ability to prepare a dissertation research proposal. Based on the national qualification framework, doctoral students must have the ability to carry out research to produce creative, original, and tested work through inter-, multi-, and transdisciplinary approaches. Therefore, this research is very important to carry out in an effort to produce teaching materials for one of the subjects in the DPSE, namely the Dissertation Supporting course to support the effectiveness and quality of learning of the course.

The Dissertation Supporting course is a priority because it is a course given in the first semester and provides a very important basis for students to immediately prepare their dissertation research proposal. The teaching materials that will be developed include lesson plan, student activity sheets, assessment of project product. In this research, the teaching materials were developed using the Project-based learning (PjBL) model. PjBL is a learning model that uses projects as the core of learning. Students explore, assess, interpret and synthesize information to produce various forms of learning outcomes. Through PjBL students are trained to think critically, think creatively, solve problems, communicate and collaborate according to 21<sup>st</sup> century skills

(Abidin et al., 2020; Anita, 2017; Fitri et al., 2018). The PjBL model is student-centered and provides meaningful learning experiences, training and improving the ability to solve challenging concrete problems in daily life. Provide experience working on tasks that are complex, challenging and require teamwork (Almulla, 2020; Purnomo et al., 2019). Student involvement in solving real problems in daily life makes learning more enjoyable and improves student learning outcomes (Sandrianti et al., 2024).

The problem that will be resolved through this research is what is the validity of the teaching materials for the Dissertation Supporting course which were developed based on the results of expert judgment.

## 2. LITERATURE REVIEW

### Project-Based Learning

Project-Based Learning (PjBL) model is a learning model that uses projects as the core of instruction. The PjBL model consists of 6 syntaxes, namely (1) start with essential questions, (2) design projects, (3) create schedules, (4) monitor the students and progress of the project, (5) assess outcomes, (6) evaluation of experience (Prayitno, et al., 2024). In project-based learning, students explore, assess, interpret, synthesize, and collect information to produce various forms of learning outcomes. They are actively involved in planning, implementing, and evaluating their own projects. PjBL emphasizes learning through practical experience and the application of knowledge in real-world situations. This learning model is particularly suitable because it encourages students to learn actively and independently. Consequently, students not only gain a deep understanding of concepts but also develop critical thinking, collaboration, and problem-solving skills (Sufyadi, et al., 2021; Kurt & Akoglu, 2023). The PjBL model is developed based on students' level of cognitive development, and is centered on student learning activities, enabling learners to engage in tasks that align with their skills, comfort, and learning interests. With project-based learning, students can explore their knowledge through direct involvement in the learning process and gain meaningful learning experiences based on the products they create (Susanti, 2013; Anggara et al., 2017; Rihatno et al., 2023). According to Halimah and Marwati (2022), project-based learning offers several benefits, including: (1) Increased motivation (2) Increased problem-solving ability (3) Improved library research skills (4) Increased collaboration (5) Increased resource-management skills.

### Project Based Learning in Science Learning

According to Kilinc et al. (2022), science learning aims to educate students to become aware of problems in everyday life, view these problems from a scientific perspective, make observations, think analytically, critically, and creatively to solve real-life problems. However, students' motivation and understanding of science education declined in the early 1990s (Krajcik & Shin, 2014). The implementation of a project-based learning model, which involves students in solving real-world problems through projects carried out using scientific methods can serve as a solution to increase students' interest in learning science (Krajcik & Shin, 2014). Through project-based learning, students' motivation, problem-solving skills, collaboration, and understanding of science can be improved (Prayitno et al., 2024).

## Teaching Materials

Teaching materials are a set of tools, media, and materials that are systematically designed to guide teachers and students in implementing the learning process so that instructional objectives can be achieved effectively and efficiently (Abad & Hattie, 2025). In the learning process, required teaching materials include lesson plans, student textbooks, student activity sheets, and assessment instruments (Fahrurrozi & Mohzana, 2020). The development of teaching materials is based on the results of a needs analysis. To ensure that teaching materials are suitable for achieving effective and efficient learning objectives, their validity, practicality, and effectiveness must be tested (Plomp & Nieveen, 2013). Several models for developing teaching materials has been proposed, including the research and development (R&D) model, the 4-D model (Define, Design, Develop, Disseminate), and the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) (Sukmadinata, 2011; Sutoyo et al., 2019; Martatiana et al., 2023).

## 3. METHODS

This type of research is development research using a modified Research and Development (R & D) development model (Sukmadinata, 2011). There are 3 stages in R & D research, namely the preliminary study stage, model development and model testing stage. This research is limited to the preliminary study stage, which includes literature study, field survey, initial product preparation followed by product validation by experts (expert judgment) and product revision of teaching materials that have been developed. The teaching materials developed include lesson plan (LP), student activity sheets (SAS), assessment of project product (APP) (Kusmanto & Siregar, 2019; Prastowo, 2021).

Research activities are carried out in the following stages: (1). The research team prepares a research schedule starting from the preparation stage to the research results reporting stage. (2).The research team developed teaching materials in the form of lesson plan, student activity sheets, assessment of project product.. All teaching materials are prepared in two languages, namely Indonesian and English. (3). The Research team carried out validation of the teaching materials that had been developed, followed by FGD activities to discuss the validation results. (4). The research team revised the input for improvements submitted by the validator. (5). The research team prepares the final manuscript of the teaching materials for the Dissertation Supporting course and proposes copyright. In addition, the research team prepared articles to be published in international conference.

The data collection technique used in this research is a validation technique (expert judgment). This technique is used to determine the validity of the teaching materials that have been developed for the Dissertation Supporting course. The data analysis technique used in this research is an analysis of the validity of teaching materials for the Study of Research Results course. All data was obtained using a validation sheet which had been assessed by 3 experts (validators). The validation score given by the validator is categorized using a Likert scale. The validation data were analyzed using quantitative descriptive analysis by calculating the Aiken value using the following equation:

$$V = \frac{\sum s}{n(c-1)}$$

Description:

V = Item validity (Aiken value)

s = Score of validator is reduced by the lowest score (r – lo)

r = Score of validator

c = The highest score of validity (in this case 4)

lo = The lowest score of validity (in this case 1)

n = the number of validator

The Aiken values obtained are interpreted for validity according to the criteria presented in Table 1.

**Tabel 1.** Interpretation of Aiken value

Aiken value (V)	Criteria
> 0.8	High
$0.4 \leq V < 0.8$	Medium
< 0.4	Low

(Nurjanah, et al., 2021; Sutoyo, et al, 2025)

The quality of the teaching materials that have been developed is determined based on the validation scores resulting from the validator's assessment. Validation data were analyzed using quantitative descriptive analysis. The assessment agreement between validators is calculated based on the similarity of the values given by three validators using the formula:

$$\text{Percentage of Agreement} = \left(1 - \left[\frac{A-B}{A+B}\right]\right) \times 100\%$$

Description:

A= Highest score of validator

B= Lowest score of validator

An instrument is said to obtain assessment agreement if the percentage of agreement obtained is  $\geq 75\%$  (Kusuma et al., 2022; Lestari et al., 2021).

#### 4. FINDINGS

The teaching materials in the form of a Lesson plan, Student activity sheets, and assessment of project product had been validated by three validators who are experts in the field of science education. Validated aspects include content validity, construct validity and language validity. The validation results of the teaching materials are presented in Table 2-4.

**Tabel 2.** The validation results of lesson plan of dissertaion supporting course

Teaching materials	Type of validity	Aiken value	Category	PA (%)	Category
Lesson plan	Content	0.90	High	93.65	Reliable
	Construct	0.95	High	96.19	Reliable
	Average score	0.93	High	94.92	Reliable

**Tabel 3.** The validation results of student activity sheets of dissertation supporting course

No	Teaching materials	Type of validity	Aiken value	Category	PA (%)	Category
1	Student's activity sheet-1	Content	0.92	High	95.91	Reliable
		Construct	0.91	High	93.65	Reliable
		Average score	0.92	High	94.78	Reliable
2	Student's activity sheet-2	Content	0.91	High	96.82	Reliable
		Construct	0.91	High	95.24	Reliable
		Average score	0.91	High	96.03	Reliable
3	Student's activity sheet-3	Content	0.86	High	94.55	Reliable
		Construct	0.85	High	92.24	Reliable
		Average score	0.86	High	94.90	Reliable
Total of average score			0.90	High	95.24	Reliable

**Tabel 4.** The validation results of assessment of project product of of dissertation supporting course

No.	Teaching materials	Type of validity	Aiken value	Category	PA (%)	Category
1	Assessment of project-1	Content	0.95	High	95.24	Reliable
		Construct	0.96	High	96.82	Reliable
		Language	0.84	High	90.47	Reliable
		Average score	0.92	High	94.18	Reliable
2	Assessment of project-2	Content	0.89	High	95.24	Reliable
		Construct	1.00	High	100.00	Reliable
		Language	0.78	High	95.24	Reliable
		Average score	0.89	High	96.83	Reliable
3	Assessment of project-3	Content	0.84	High	90.47	Reliable
		Construct	1.00	High	100.00	Reliable
		Language	0.73	High	95.24	Reliable
		Average score	0.86	High	95.24	Reliable
Total of average score			0.89	High	95.42	Reliable

## 5. DISCUSSION

In this reseach it had been developed three kinds of teaching materials of dissertaion supporting course, namely lesson plan, student activity sheets, and assessment of project product. All three teaching materials had been validated by three validators who are experts in the field of science education. Based on the validation results from three expert validators in the field of science education on three kind of teaching materials, namely lesson plan, student activity sheets, and assessment of project product can be satetd that all teaching materials obtained an average of

Aiken value of 0.93, 0.90, and 0.89, respectively, with high validity categories ( $> 0.80$ ) (Nurjanah, et al., 2022; Rahman et al., 2024; Susanah, 2019; Wulandari et al., 2013).

The average percentage of agreement between the three validators in validating three teaching materials were 94.92%, 95.24%, and 95.42%, respectively. Thus, the all teaching materials are categorized as reliable because the percentage of agreement is  $\geq 75\%$  (Lestari et al., 2021; Kusuma et al., 2022; Fikriyati, et al., 2022). All validators stated that all teaching materials developed could be used with minor revisions, including improvements to the writing system and several sentences of the assessment rubric that needed to be clarified so that they were in line with the learning indicators. Thus, all teaching materials developed can be used in learning process of the Dissertation Supporting course to improve students' abilities in compiling research proposal in order to realize SDGs -4 (quality education).

## 5. CONCLUSION

Based on results of data analysis can be concluded teaching materials developed, namely the lesson plan, student activity sheets, and assessment instruments of project product were categorized as high validity, with an average Aiken value of 0.93, 0.90, and 0.89, respectively. Thus, these teaching materials can be implemented in learning process of Dissertation Supporting courses to improve students' abilities in compiling research proposal in order to realize SDGs -4 (quality education).

## AUTHOR CONTRIBUTIONS

All authors contributed to the conception, design, analysis, and writing of this manuscript and approved the final version.

## FUNDING

We thank Faculty of Mathematics and Natural Sciences, State University of Surabaya for financial support through the faculty policy research grant (Grant number: 532/UN38/HK/2025)

## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interests.

## REFERENCES

- Abad, L.G. & Hattie, J. (2025). The Impact of Teaching Materials on Instructional Design and Teacher Development, *Frontier in Education*, 10:1577721, <https://doi.org/10.3389/educ.2025.1577721>
- Abidin, Z., Utomo, A. C., Pratiwi, V., & Farokhah, L. (2020). Project-Based Learning - Literacy in Improving Students' Mathematical Reasoning Abilities in Elementary Schools. *JMIE (Journal of Madrasah Ibtidaiyah Education)*, 4(1), 39–52, <https://doi.org/10.32934/jmie.v4i1.170>
- Almulla, M. A. (2020). The Effectiveness of the Project-Based Learning (PBL) Approach as a Way to Engage Students in Learning. *SAGE Open*, 10(3), 1–15. <https://doi.org/10.1177/2158244020938702>
- Anazifa, R. D., & Djukri. (2017). Project- Based Learning and Problem- Based Learning: Are They Effective to Improve Student's Thinking Skills? *Jurnal Pendidikan IPA Indonesia*, 6(2), 346–355.

<https://doi.org/10.15294/jpii.v6i2.11100>

- Anita, I. W. (2017). Implementasi Pembelajaran Berbasis Proyek Untuk Menumbuhkan Kemampuan Berpikir Kreatif Matematis Mahasiswa. *Jurnal Penelitian Dan Pembelajaran Matematika*, 10(1), 125–131. <https://doi.org/10.30870/jppm.v10i1.1287>
- Anggara, S. A., Islam, U., Maulana, N., & Ibrahim, M. (2017). Penerapan Model Project Based Learning. *Arabi: Journal of Arabic Studies*. 2(2), 186–196, <https://doi.org/10.24865/ajas.v2i2.57>.
- Astra, I. M. (2018). Character building in physics learning for Indonesia children. *Journal of Physics: Conference Series*, 1040(1). <https://doi.org/10.1088/1742-6596/1040/1/012043>.
- Fahrurrozi, M. & Mohzana (2020). *Pengembangan Perangkat Pembelajaran*. Mataram: Universitas Hamzanwadi Press.
- Fikriyatii, A., Agustini, R., Sutoyo, S. (2022). Critical Thinking Cycle Model to Promote Critical Thinking Skills of Pre-Service Science Teacher. *Cryptot Journal of Educational Sciences*, 17(1), 120–133, <https://doi.org/10.18844/cjes.v17i1.6690>
- Fitri, H., Dasna, I. W., Suharjo, S. (2018). Pengaruh Model Project Based Learning (PjBL) Terhadap Kemampuan Berpikir Tingkat Tinggi Ditinjau dari Motivasi Berprestasi Siswa Kelas IV Sekolah Dasar. *Briliant: Jurnal Riset Dan Konseptual*, 3(2), 201–212. <https://doi.org/10.28926/briliant.v3i2.187>.
- Halimah, L. & Marwati, I. (2022). *Project Based Learning Untuk Pembelajaran abad 21*. Bandung: PT Refika Aditama
- Jamil, D., Muslim, M., & Suprianto, B. (2018). Entrepreneurial science thinking approach in project-based learning. *International Conference on Mathematics and Science Education of Universitas Pendidikan Indonesia*, 514–518.
- Kepmendikbud. (2020). *Kepmendikbud No. 83/P/2020 tentang Lembaga akreditasi internasional*.
- Kilinc, B., Yasar, M. D. & Batdi, V. (2022). Evaluating the project based learning in science education through mixed-meta method. *Journal of Inonu University Faculty of Education*, 23(3), 1663-1681. <https://doi.org/10.17679/inuefd.1170144>
- Krajcik, J., & Shin, N. (2014). Project-based learning. In K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences*, Cambridge University Press, <https://doi.org/10.1017/CBO9781139519526.018>
- Kurt, G. & Akoglu, K. (2023). Project-based learning in science education: A comprehensive literature review, *Interdisciplinary Journal of Environmental and Science Education*, 19(3), e2311, <https://doi.org/10.29333/ijese/13677>.
- Kusmanto, J., & Siregar, S. A. (2019). Pengembangan Rencana Pembelajaran Semester (RPS) Mata Kuliah Bahasa Inggris Berbasis Task-Based Language Teaching (TBLT). *Jurnal Pendidikan Bahasa Dan Sastra*, 13(1), 1–17. [https://doi.org/10.17509/bs\\_jpbasp.v19i1.20754](https://doi.org/10.17509/bs_jpbasp.v19i1.20754)
- Kusuma, A. E., Wasis, Susantini, E., & Rusmansyah. (2022). The Effect of Rode Learning Model on Enhancing Students Communication Skills. *Studies in Learning and Teaching*, 3(3), 132–140. <https://doi.org/10.46627/silet.v3i3.170>.
- Lestari, T., Supardi, Z. A. I., & Jatmiko, B. (2021). Virtual classroom critical thinking as an alternative teaching model to improve students' critical thinking skills in pandemic Coronavirus disease era. *European Journal of Educational Research*, 10(4), 2003–2015. <https://doi.org/10.12973/EU-JER.10.4.2003>.
- Martatiyana, D.R., Usman, H., Lestari, H.D.(2023). Application of The Addie Model in Esigning Digital Teaching Materials. *Journal of Education & Teaching Primary School Teachers*. 6 (1) 105-109, <https://doi.org/10.55215/jppguseda.v6i1.7525>.
- Muhammad, Y. (2018). *Era industri 4.0. Tantangan dan peluang perkembangan pendidikan kejuruan*

Indonesia. Universitas Negeri Makassar.

- Nurjanah, S., Istiyono, E., Widiastuti, W., Iqbal, M., Kamal, S. (2022). The Application of Aiken's V method for evaluating the content validity of instruments that measure the implementation of formative assessments. *Journal of Research and Educational Research Evaluation*. 12 (2)125-133, <https://doi.org/10.15294/jere.v12i2.76451>
- Plomp, T. and Nieveen, N. (2013). . *Educational Design Research. Part A: An introduction*. Netherlands Institute for Curriculum Development (SLO), Enschede, Netherland.
- Prastowo, A. (2021). *Panduan kreatif membuat bahan ajar inovatif: menciptakan metode pembelajaran yang menarik dan menyenangkan* (Yogyakarta (Ed.)). Diva Press.
- Prayitno, M.A., Haryani, S., Wardani, S., & Wijayati, N. (2024). Chemoentrepreneurshipbased Learning Influence on Social and Vocational Skills. *LUMAT : International Journal on Math, Science and Technology Education*. 12 (1), 1-17, <https://doi.org/10.31129/LUMAT.12.2.2067>.
- Purnomo, A., Suryadi, A., & Ramadhany, A. (2019). *Influence Using the Project-Based Learning Model in History Learning on Learning Outcomes Student Class XI IPS MAN Temanggung*. 4(2), 39–48.
- Rahman, N., Sutoyo, S., & Lutfi, A. (2024). Validity of PBEST Learning Model: An Innovative Learning to Improve Creative Thinking Skill and Entrepreneurial Science Thinking. *Journal of Curriculum and Teaching*, 13(1), 195–205. <https://doi.org/10.5430/jct.v13n1p195>
- Rahman, N., Sutoyo, S., & Lutfi, A. (2024). Validity of PBEST Learning Model: An Innovative Learning to Improve Creative Thinking Skill and Entrepreneurial Science Thinking. *Journal of Curriculum and Teaching*, 13(1), 195–205. <https://doi.org/10.5430/jct.v13n1p195>.
- Rihatno, T., Nuraini, S., Marini, A., Safitri, D., Sujarwo, Ibrahim, N. (2023).. Pelatihan Pembelajaran Berbasis Proyek Bagi Kelompok Guru Sekolah Dasar. *Jurnal Gembira (Pengabdian Kepada Masyarakat)*, 1(4), 894-901.
- Sandrianti, Nasriadi, A., & Zaliqa, F. B. (2024). Implementation Of Problem-Based Learning Model to Improve Students' Learning Outcomes On The Material of Geographical Conditions of Indonesia. *IJIE Journal*, 1, 10–22. <https://ejournal.bbg.ac.id/ijie%0AP-Shpeizer>.
- Shpeizer, R. (2018). Teaching critical thinking as a vehicle for personal and social transformation. *Research in Education*, 100(1), 32–49. <https://doi.org/10.1177/0034523718762176>.
- Sufyadi, S., Harjatanaya, T.Y., Adiprima, P., Satria, M.R., Andiarti, A., Herutami, I. (2021). *Panduan Pengembangan Proyek Penguatan Profil Pelajar Pancasila Jenjang pendidikan Dasar dan Menengah*. Jakarta: Pusat Asesmen dan Pembelajaran Kemendikbudristek.
- Sukmadinata, N. S. (2011). *Metode penelitian pendidikan*. Bandung: Remaja Rosdakarya.
- Susanti. (2013). Pengaruh Pembelajaran Berbasis Proyek Terhadap Kemampuan Berpikir Kreatif dan Sikap Ilmiah Siswa Pada Materi Nutrisi. *Jurnal Pengajaran MIPA*, 18 (1), 36-42.
- Susanah, S. (2019). Pengembangan Lembar Kegiatan Mahasiswa Matematika Dasar. *Buana Matematika: Jurnal Ilmiah Matematika Dan Pendidikan Matematika*, 9(1), 7–12. <https://doi.org/10.36456/buanamatematika.v9i1.1977>
- Sutoyo, S., Sanjaya, I. G. M., & Supardi, Z. (2019). *Laporan Tracer Studi Prodi S3 Pendidikan Sains*. Universitas Negeri Surabaya.
- Sutoyo, S., Susantini, E., Setiawan, B., Allamin, S., Aris, S.R.S.(2025). Exploration of Information Literacy, Technological Pedagogical And Content Knowledge (TPACK) and Technological Integration Self-Efficacy (TISE) Abilities of Preservice Chemistry Teachers, *Edelweiss Applied Science and Technology*, 9 (12) 806-816, <https://learning-gate.com/index.php/2576-8484/article/view/11482>.

- Sutoyo, S., Azizah, U., Allamin, S. (2019). Effectiveness of the Guided Inquiry Model Integrated with STEM to Improve the Student Critical Thinking Skills in Chemistry Learning. *International Journal of Innovative Science and Research Technology*, 4 (12) 349-353.
- Wulandari, D. T., Suyatna, A., & Rosidin, U. (2013). Pengembangan Lembar Penilaian Berbasis Keterampilan Berpikir Kritis. *Jurnal Pembelajaran Fisika*, 1(7), 43–54.  
<https://doi.org/10.1787/f945a7f8-he>