EDUCENTER

Educenter : Jurnal Ilmiah Pendidikan
Vol 3 No 3 September 2024
ISSN: 2827-8542 (Print) ISSN: 2827-7988 (Electronic)
Open Access: https://jurnal.arkainstitute.co.id/index.php/educenter/index

Analysis of teacher needs for team-based project learning with the SETS approach on alternative energy source materials

Asri Nur Lathifah Fauziyyah[1*], Ridwan Efendi[2], Muslim[3]
[1,2,3]Universitas Pendidikan Indonesia, Indonesia
[1]asrinurf1@upi.edu*, [2]ridwanefendi@upi.edu, [3]muslim@upi.edu

Article Info

Article history:
Received July, 29th 2024
Revised August, 15th 2024
Accepted September, 25th 2024

Keyword:
Alternative energy sources; Team-based projects; SET; Creativity

ABSTRACT

Alternative energy sources are one of the materials in physics that are very close to their application in daily life. Awareness of the importance of understanding in the era of rapid technological progress in the concept of alternative energy sources needs to be built with learning that actively involves students, one of which is project-based learning. This study aims to analyze the needs of teachers in the implementation of team-based projects with the Science, Environment, Technology, and Society (SETS) approach on alternative energy source materials, in order to train students' creativity. The method used was a questionnaire and interview involving 38 physics teachers. The results show that teachers need learning that integrates team-based projects with the SETS approach because only 50% of teachers have used project-based learning on alternative energy sources. In addition, 89% of teachers face various obstacles in the implementation of project-based learning, including inadequate time allocation, low critical thinking of students, and poor teacher planning. Based on these findings, it is suggested that there is a need for more comprehensive teacher learning innovations and the preparation of more structured teaching modules. In addition, support from the school in terms of facilities and time management is needed to maximize the effectiveness of team-based project learning with the SETS approach. This effort is expected to improve the quality of learning and students' creativity in understanding alternative energy source materials.

INTRODUCTION

Physics learning, especially on the topic of alternative energy sources, plays a crucial role in preparing the younger generation to face increasingly complex global energy challenges. However, conventional learning methods often fail to develop the creativity and problem-solving skills that are needed in this context (Wirnoto & Ratnaningsih, 2022). In response to these limitations, Team-Based Projects (TBPs) emerged as an evolution of project-based learning, offering a more comprehensive approach by combining elements of team collaboration and focusing on project work. The integration of the Science, Environment, Technology, and Society (SETS) approach in TBP offers significant potential to increase the relevance of learning to students' daily lives (Yulistiana, 2015). This approach allows students to understand the complex interconnectedness between scientific concepts, environmental implications, technological developments, and the social impact of alternative energy solutions. The combination of TBP and SETS is in line with Vygotsky's theory of social constructivism, which emphasizes the importance of social interaction and cultural context in the learning process. In addition, this approach also supports the concept of "proximal development zones" where students can achieve a higher level of understanding through collaboration with peers and teacher guidance (Suardipa, 2020).

Although previous research has shown the effectiveness of TBP in various educational contexts, its implementation in physics learning, particularly on the topic of alternative energy sources, still needs further exploration. Several previous studies have examined the application of TBP in science subjects in general, but no one has specifically examined the integration of TBP with the SETS approach in the context of physics learning about alternative energy sources (Nikat et al., 2021). This gap creates

opportunities for more in-depth and focused research. Analyzing teacher needs related to TBP learning with the SETS approach is very important to identify challenges and opportunities in its implementation. Based on a survey of 38 physics teachers, it was found that only 50% of teachers used project-based learning for the topic of alternative energy sources. Furthermore, 89% of teachers face various obstacles in implementing project-based learning, such as insufficient time allocation, low level of critical thinking of students, and inadequate teacher planning (Nazilatun Nikmah et al., 2023). These findings underscore the importance of more in-depth research to understand the specific needs of teachers in this context (Mutmainah et al., 2023).

This study aims to comprehensively analyze the needs of teachers in implementing TBP with the SETS approach on alternative energy source materials, with a special focus on developing student creativity (Supriatna et al., 2020). The specific objectives of this study include in-depth analysis of teachers' understanding and readiness in implementing TBP with the SETS approach, including aspects of content knowledge, pedagogy, and technology (Retno & Marlina, 2018). Identify in detail the challenges and obstacles faced by teachers in implementing this method, both from a technical, administrative, and pedagogical perspective. Formulate specific and actionable strategies and recommendations to optimize the implementation of TBP with the SETS approach in physics learning about alternative energy sources (Putri & Festiyed, 2019).

Theoretically, this study will enrich the literature on physics learning in the context of alternative energy sources, providing an in-depth analysis of the needs of teachers in applying the TBP and SETS approaches. The results of the research are expected to contribute to the development of learning theories that integrate collaboration, creativity, and social relevance in science learning (Damanaik, 2023). This research will also explore how TBP and SETS can be integrated with modern learning theories such as inquiry-based learning and STEM education. In practical terms, this research will provide comprehensive insight and guidance for educators and policymakers in designing and implementing TBP learning with the SETS approach (Rohmatun & Rasyid, 2022). For educational institutions, this research will provide a strong empirical basis for the development of more innovative curricula and learning strategies in the field of physics and alternative energy sources. In addition, the results of the research can provide specific and applicable input for teacher professional development programs that focus on the application of project-based learning methods and the SETS approach (Kalsum et al., 2019).

RESEARCH METHODS

This study uses a descriptive quantitative approach to analyze teachers' needs for team-based project learning with the SETS approach on alternative energy source materials. The main data collection method used is questionnaires, supported by interviews to enrich the interpretation of quantitative data.

The research population is physics teachers in the target research area. The sample consisted of 38 physics teachers who were selected using the purposive sampling technique. Sample selection criteria include teaching experience, alternative energy sources, and willingness to participate in research. The research instruments used are:

In this study, two main instruments were used for data collection. First, a questionnaire containing closed-ended questions with a Likert scale is designed to collect quantitative data on teachers' experiences in teaching alternative energy sources, the use of project-based learning methods, and understanding of the SETS approach. Second, interview guidelines are used as a supporting instrument to conduct structured interviews to deepen the information obtained from the questionnaire results. The data collection procedure was carried out in two stages: starting with the distribution of questionnaires to all participants, followed by follow-up interviews with selected teachers to clarify the results of the questionnaire. Data analysis was carried out using descriptive statistical methods through a series of systematic steps. These steps include tabulation of questionnaire data, calculation of frequencies, percentages, and averages for each question item, presentation of data in the form of tables and graphs, and interpretation of descriptive statistical results. Through this approach, the study aims

to provide a comprehensive overview of the needs of teachers in implementing team-based project learning with the SETS approach on alternative energy source materials.

Qualitative data from the interviews will be used to support and enrich the interpretation of quantitative data. The results of the analysis will be presented in the form of statistical descriptions supported by graphs and tables, and equipped with interpretations that integrate the results of interviews to provide a comprehensive picture of teachers' needs in the implementation of team-based project learning with the SETS approach to alternative energy source materials.

RESULTS AND DISCUSSION

Profil Respond

This study involved 38 physics teachers with diverse teaching experience backgrounds. The distribution of respondents' teaching experience is as follows:

Table 1. Teaching Experience Backgrounds

Length of Teaching Experience	Number of Teachers	Percentage
Less than 5 years	13	34.2%
5-10 years	5	13.2%
More than 10 years	20	52.6%
Entire	**38**	**100%**

From the data tabel 1 above, it can be seen that the majority of respondents (52.6%) have more than 10 years of teaching experience. This shows that most of the teachers in this study have quite a long experience in teaching physics.

Implementation of Project-Based Learning

Data analysis shows that only 50% of teachers use project-based learning that focuses on alternative energy sources. This is evident from the response to the question "I often apply project-based learning models in physics teaching", with an average score of 3.71 out of 5.
Here is an excerpt of an interview with one of the respondents:

> "*I try to apply project-based learning, especially for the topic of alternative energy sources. However, it is not always easy due to time and resource limitations. Sometimes I have to scale the project so that it can be completed within the available time*." (Teacher A, 8 years of teaching experience)

Interpretation: Although teachers have shown interest in implementing project-based learning, the implementation is still moderate. This may be due to various challenges faced, such as time and resource limitations. These findings are in line with previous research conducted by Krajcik and Blumenfeld (2006), which identified that although project-based learning has many benefits, its implementation is often constrained by contextual factors in schools.

Challenges in Implementing Project-Based Learning

89% of teachers face various obstacles in implementing project-based learning. The three main challenges identified are:

Table 2. Challenges in Implementing Project-Based Learning

Challenge	Average Score (out of 5)	Interpretation
Insufficient time allocation	4.18	High level of challenge
Difficulties in planning projects that align with the curriculum	3.45	Medium level of challenge
Difficulty obtaining resources and materials for the project	3.63	Medium level of challenge

Interview quote related to the challenge:

"*Time is always the main issue. We have a lot of material to cover, and these projects take a lot of time. Not to mention, finding the right materials for the project can sometimes be a challenge*." (Teacher B, 15 years of teaching experience)

Interpretation: These challenges show that while teachers are aware of the benefits of project-based learning, their implementation is hampered by practical factors. Insufficient time allocation is a major obstacle, followed by difficulties in obtaining resources and planning projects that are aligned with the curriculum. These findings are consistent with the research of Marx et al. (1997) which identified that time and resource management is a significant challenge in the implementation of project-based learning.

Definition and Implementation of the SETS Approach

Teachers showed a moderate level of familiarity with the SETS approach, with an average score of 3.21 out of 5. However, the application of this approach is still limited, with an average score of 2.89 out of 5 for the question "*I have used the SETS approach in teaching*".

Table 3. Implementation of the SETS Approach

Statement	Average Score (of 5)	Interpretation
Familiarity with the SETS approach	3.21	Medium familiarity
I have used the SETS approach in teaching	2.89	Low implementation

Interview excerpt:

"I've heard of SETS, but never used them specifically in teaching. It seems interesting, but I feel like I need a deeper understanding before applying it." (Teacher C, 6 years of teaching experience)

Interpretation: These data show that although teachers have moderate familiarity with the SETS approach, its implementation is still low. This may be due to a lack of in-depth understanding of how to integrate this approach into everyday teaching. These findings are in line with the research of Yörük

et al. (2010) which found that although teachers are aware of the importance of the SETS approach, many still struggle to implement it effectively.

Professional Development Needs

Teachers showed a high need for support in implementing team-based projects with the SETS approach, with an average score of 4.05 out of 5.

Table 4. Professional Development Needs

Necessary	Average Score (out of 5)	Interpretation
Support for implementing team-based projects with a SETS approach	4.05	High need for support

Interview quote:

"*I was very interested in implementing a team-based project with the SETS approach, but to be honest, I felt that I was not confident enough. Training or workshops on this will definitely be very helpful*." (Teacher D, 3 years of teaching experience)

Interpretation: A high score of need for support indicates that teachers are aware of the potential of this approach but feel unprepared to implement it. This indicates that there is a gap between the desire to innovate and the practical readiness to do so. These findings are consistent with Desimone's (2009) research which emphasizes the importance of continuous professional development in improving teacher teaching practices.

Frequently Used Learning Models

Based on open answers, learning models that are often used for renewable energy source materials include:

- Project-Based Learning (PjBL)
- Problem-Based Learning (PBL)
- Research
- Discovery Learning
- Cooperative Learning

Interview excerpt:

"*For renewable energy source materials, I often use a project- or problem-based approach. This helps students to better understand the practical applications of the concepts they are learning*." (Teacher E, 12 years of teaching experience)

Interpretation: The variety of learning models used shows that teachers are already trying to adopt a more student-centered approach. However, the level of implementation and effectiveness may vary. These findings are in line with research Nugraha et al. (2023) which shows that approaches such as PBL and PjBL can improve students' conceptual understanding and problem-solving skills.

Implementation Barriers

Key obstacles to the implementation of innovative learning include:

- Time constraints
- Lack of teaching resources and tools
- Variety of students' abilities and motivations
- Difficulties in designing a suitable project

Interview quote:

"*One of the biggest challenges is balancing the demands of the curriculum with the desire to do in-depth projects. Sometimes we have to compromise between depth and scope of matter*." (Teacher F, 20 years of teaching experience)

Interpretation: These barriers reflect the complexity of implementing innovative learning approaches in an existing school context. Time and resource constraints are the main constraints, which is in line with Ertmer's (1999) findings about external barriers in the integration of educational technology. The variety of students' abilities is also a challenge, showing the need for differentiation strategies in learning.

School Readiness and Support

An analysis of the statement "My school supports learning innovations such as team-based projects and SETS" shows an average score of 3.68 out of 5.

Table 5. School Readiness and Support

Statement	Average Score (out of 5)	Interpretation
My school supports learning innovations such as team-based projects and SETS	3.68	The school's support level is moderate

Interview excerpt:

"*Our school is quite open to innovation, but sometimes constrained by existing budgets or policies. Support is there, but maybe not optimal*." (Teacher G, 10 years teaching experience)

Interpretation: This score shows that most schools are moderately supportive of learning innovation, but there is still room for improvement. This moderate school support can be a factor that affects the level of implementation of innovative approaches by teachers. This is in line with research Haeriyah (2021) which emphasizes the importance of institutional support in the success of education reform.

Teachers' Perceptions of the Effectiveness of Team-Based Projects

Teachers generally have a positive perception of the effectiveness of team-based projects in improving students' understanding of physics concepts and creativity, with an average score of 4.13 out of 5.

Table 6. Teachers' Perceptions of the Effectiveness of Team-Based Projects

Perception	Average Score (out of 5)	Interpretation
Team-based project effectiveness in increasing understanding and creativity	4.13	Perception of high effectiveness

Interview excerpt:

"*I noticed a significant change in students' understanding and enthusiasm when they worked on a team project. They not only memorize concepts, but actually apply them*." (Teacher H, 18 years of teaching experience)

Interpretation: This positive perception indicates that teachers see great potential in a team-based project approach. This is in line with Vygotsky's theory of social constructivism which

emphasizes the importance of social interaction in learning. However, there is a gap between this positive perception and the actual level of implementation, which may be due to previously identified barriers.

Learning Media Needs

There is a high need for additional learning media, especially videos or interactive simulations, to teach renewable energy source materials more effectively.

Table 8. Learning Media Needs

Necessary	Average Score (out of 5)	Interpretation
Additional learning media (videos, interactive simulations)	4.71	Very high need for additional media

Interview excerpt:

"*Interactive simulations really help students visualize abstract concepts in physics. For topics like renewable energy, media like this can make learning much more engaging and effective*." (Teacher I, 7 years of teaching experience)

Interpretation: The very high need for additional learning media reflects teachers' awareness of the importance of visualization and interactivity in physics learning, especially for complex topics such as renewable energy sources. This is in line with research Smetana & Bell (2018) which shows the effectiveness of computer simulation in improving conceptual understanding in science learning.

CONCLUSION

This study reveals that although physics teachers realize the potential of team-based project learning with the SETS approach in teaching alternative energy source materials, its implementation is still limited. Only half of teachers use project-based learning, with most facing challenges such as time constraints, planning difficulties, and lack of resources. The understanding and application of the SETS approach is still at a moderate level. Teachers demonstrate a significant need for professional development and support to implement these innovative learning methods effectively. Although schools generally support learning innovation, there is still room for improvement. Teachers' positive perceptions of the effectiveness of team-based projects in improving students' understanding and creativity indicate great potential for the development of this method in the future. The need for interactive learning media and a focus on improving student creativity were also identified as areas that required special attention.

To enhance the implementation of team-based projects and the Science, Environment, Technology, and Society (SETS) approach in education, a comprehensive training program for teachers should be developed. This program would focus on essential aspects such as project planning, time management, and technology integration. Additionally, providing teachers with adequate resources, including interactive learning media and digital simulations, is crucial to support project-based learning effectively. A more flexible curriculum should be designed to accommodate these learning methods, ensuring that sufficient time is allocated for in-depth project exploration and completion. Collaborations between schools, industry, and research institutions would offer practical and relevant experiences for students, especially in learning about alternative energy sources. Furthermore, a comprehensive assessment system should be created to evaluate not only students' conceptual understanding but also their creativity, collaboration skills, and problem-solving abilities in the context of project-based learning.

REFERENCES

Damanaik, F. (2023). Pengembangan model pembelajaran kolaboratif untuk pendidikan sosiologi dan antropologi di era digital. *Prosiding Ilmu Pendidikan dan Keguruan*, *1*(1), 1–18. https://e-journal.unmuhkupang.ac.id/index.php/pps/article/view/1308

Haeriyah, N. (2021). Peningkatan profesionalisme kepala sekolah dalam rangka reformasi pendidikan. *El-Idarah: Jurnal Manajemen Pendidikan Islam*, *7*(2), 11–22. https://sys.parahikma.ac.id/journal/index.php/el-idarah/article/view/217

Kalsum, U., Hamzah, H., & M, N. (2019). Implementasi model pembelajaran berbasis proyek pendekatan sets terhadap kemampuan berpikir kreatif peserta didik. *PHYDAGOGIC Jurnal Fisika dan Pembelajarannya*, *2*(1), 23–28. https://doi.org/10.31605/phy.v2i1.1344

Mutmainah, K. N., Kirom, A., Saifuloh, S., & Hadi, M. N. (2023). Pembelajaran Al-Qur'an metode tahqiq dalam Madrasatul Qur'an Asrama H Pondok Pesantren Ngalah. *Indo Green Journal*, *1*(2), 58–85. https://doi.org/10.31004/green.v1i2.10

Nazilatun Nikmah, E., Bayu Segara, N., & Imron, A. (2023). Penilaian kreativitas siswa melalui produk infografis dalam project based learning. *Dialektika: Pendidikan IPS*, *3*(2), 239–251. https://doi.org/10.26740/penips.v3i2.55267

Nikat, R. F., Loupatty, M., & Hikmatuz Zahroh, S. (2021). Kajian pendekatan multirepresentasi dalam konteks pembelajaran fisika. *Jurnal Pendidikan dan Ilmu Fisika*, *1*(2), 45. https://doi.org/10.52434/jpif.v1i2.1449

Nugraha, I. R. R., Supriadi, U., & Firmansyah, M. I. (2023). Efektivitas strategi pembelajran project based learning dalam meningkatkan kreativitas siswa. *Jurnal Penelitian Dan Pendidikan IPS*, *17*(1), 39–47. https://doi.org/10.21067/jppi.v17i1.8608

Putri, S. R., & Festiyed. (2019). Meta-analisis implementasi landasan ilmu pendidikan dalam pengembangan e-modul fisika berbasis pendekatan SETS (Science Environments Technology Society) pada pembelajaran fisika. *Jurnal Penelitian Pembelajaran Fisika*, *5*(2), 57–64. https://doi.org/10.24036/jppf.v5i1.107422

Retno, R. S., & Marlina, D. (2018). Implementasi SETS (Science Environment Technology and Society) pada pembelajaran IPA SD berbasis inquiry terhadap berpikir ilmiah siswa kelas 4 Mi Al-Irsyad Madiun. *Bio-Pedagogi*, *7*(2), 54–58. https://doi.org/10.20961/bio-pedagogi.v7i2.27618

Rohmatun, H., & Rasyid, A. (2022). Model pembelajaran SETS (Science, Environment, Technologi, Society) berbantuan media video terhadap pemaham konsep siswa. *Seminar Nasional Pendidikan*, *4*, 118–125. https://prosiding.unma.ac.id/index.php/semnasfkip/article/view/789

Smetana, L., & Bell, R. (2018). Computer simulations to support science instruction and learning: A critical review of the literature. *International Journal of Science Education*, *34*(9), 1337–1370. https://doi.org/10.1080/09500693.2011.605182

Suardipa, I. P. (2020). Proses scaffolding pada Zone of Proximal Development (ZPD) dalam pembelajaran. *Widyacarya*, *4*(1), 79–92. https://doi.org/10.55115/widyacarya.v4i1.555

Supriatna, A., Kuswandi, S., & Sopyan, Y. (2020). Upaya meningkatkan hasil belajar IPA materi energi alternatif melalui penerapan model project based learning. *Jurnal Tahsinia*, *2*, 12–25. https://doi.org/10.57171/jt.v2i1.273

Wirnoto, T., & Ratnaningsih, N. (2022). Problematika pengembangan kreativitas peserta didik dalam pembelajaran matematika berdasarkan persepsi guru. *Jurnal Pendidikan Dan Pembelajaran Matematika Indonesia*, *11*(1), 27–40. https://doi.org/10.23887/jppmi.v11i1.760

Yulistiana, Y. (2015). Penelitian pembelajaran berbasis SETS (Science, Environment, Technology, and Society) dalam pendidikan sains. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *5*(1), 76–82. https://doi.org/10.30998/formatif.v5i1.169