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EXPLORING THE NETS-S IN TECHNOLOGY-ENHANCED PROJECT-BASED LEARNING FOR VOCATIONAL ENGLISH LEARNERS

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Abstract

This study investigated whether the NETS-S in Technology-Enhanced Project-Based Learning (TE-PBL) effectively incorporated among vocational English learners to develop essential skills for the 21st century. A questionnaire was administered to 110 English on-Job Related students who created digital air travel-themed posters. The study reveals that implementing TE-PBL effectively equips vocational English learners with essential skills for success in the 21st-century workplace, including idea creation, communication, collaboration, and critical thinking, including digital literacy, fluency, and citizenship. However, areas for improvement include enhancing higher-order thinking skills, developing intercultural competence, and strengthening troubleshooting abilities.

Keywords*: English learners; NETS-S, technology, project-based learning, digital product*

INTRODUCTION

The 21st century workforce demands a workforce equipped with a diverse skillset beyond traditional academic knowledge. The modern workplace demands a blend of English language proficiency and communication skills (Temple et al., 2021), critical thinking (Cheang & Yamashita, 2020), creativity (Rachmawati et al., 2021), collaboration (Pouragha et al., 2020), and digital literacy (Al-Khalidi, 2024). These competencies are interrelated and collectively contribute to an individual's ability to succeed in a competitive job market. As organizations continue to evolve, the emphasis on these skills will likely intensify, necessitating ongoing education and training to equip individuals for future challenges.

The air travel industry, a vital sector of the global economy, exemplifies the need for these skills. Professionals in this industry require not only technical expertise but also strong communication skills, adaptability, and the ability to navigate complex and dynamic situations. This demands a shift in vocational training approaches towards a more holistic model that integrates 21st-century skills development alongside technical training. This includes the adjustment of methods for the teaching and learning of vocational English in the context of the air travel industry, intending to prepare learners for the evolving demands of this sector.

Project-Based Learning (PBL), especially when enhanced by technology (henceforth referred to as TE-PBL), has been shown to provide significant benefits to a large number of English language learners. The integration of technology and digital media into project-based learning (PBL) emerges as the optimal strategy to address the challenges encountered in the contemporary English classroom (Ginusti, 2023). Studies have shown that TE-PBL fosters active engagement, promotes learner interest, and creates interactive and enriching learning experiences (Kildė, 2023; Ramalingam et al., 2022; Ramzan, 2023). Moreover, PBL significantly improves a large number of students' English language acquisition, especially their communicative abilities (Anugraha & Padmadewi, 2023; Pinphet, 2022; Sirisrimangkorn, 2021). Through deeply engaging students in substantially meaningful as well as authentic activities, TE-PBL considerably increases motivation along with enhancing overall English language expertise.

A meaningful number of conventional teaching approaches frequently fail to provide sufficient real-world application. PBL stands out as a highly promising alternative, actively engaging students in complex, real-world projects that cultivate critical thinking, collaboration, and problem-solving (Larmer, et.al., 2015). Technology integration further enhances PBL by providing access to a wide range of resources, powerful collaborative platforms, and exceptionally wealthy opportunities for original expression. In addition, the implementation of technology through PBL offers several advantages, including a high level of student autonomy, a student's control of technology, naturally differentiated learning experiences, and the development of students’ technical skills (Hamilton, 2018).

Recent research highlights the exceptional importance of technology-enhanced PBL (TE-PBL) in vocational education, integrating 21st-century skills such as critical thinking, communication, collaboration, and creativity (Jalinus et al., 2023; Septiana et al., 2023), thereby preparing students for a rapidly evolving job market. Production-based learning models have been shown to enhance technical competencies and foster interpersonal skills that are highly valued in the workplace (Yudiono et al., 2019; Widayana, 2023). Furthermore, a study by Syarofatin (2022) emphasises that integrating technology into PBL, such as the creation of digital posters and video presentations, effectively enhances students' digital literacy. The present research focuses on the creation of digital projects (as presented in Figure 1) through the multiutilisation of digital tools as a means of learning and gathering information for production.

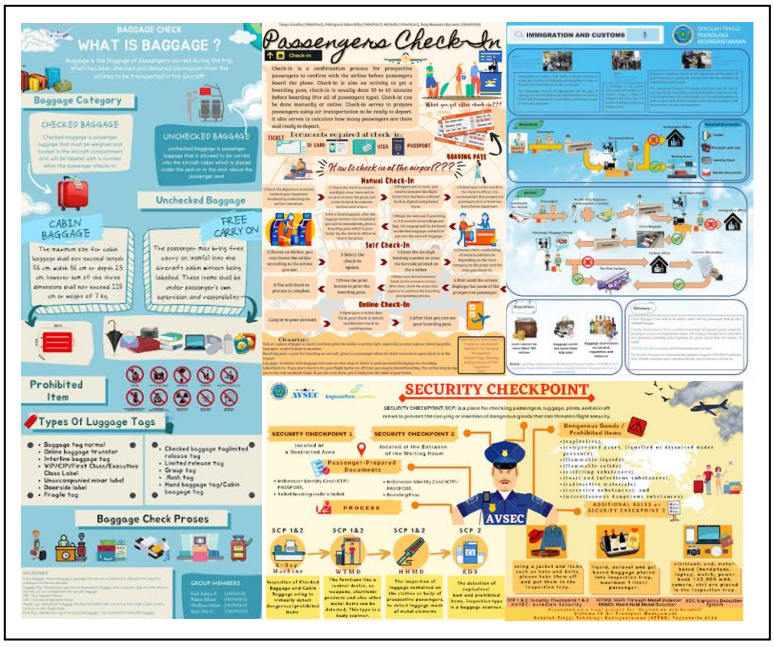

Figure 1. Students' digital poster products

Typically, PBL that incorporates technology often complies with several ISTE Standards as it emphasizes the importance of technology in enhancing learning experiences (Bross & Kraus, 2007; Hamilton, 2018; Shelly, 2010). The National Educational Technology Standards for Students (NETS-S) provides a framework for effective technology integration, emphasizing critical competencies for the 21st century. These standards encompass creativity and innovation, communication and

collaboration, research and information fluency, critical thinking, problem-solving, digital citizenship, and technology operations and concepts.

However, a gap exists in research on the specific application and effectiveness of these standards within TE-PBL for vocational English learners. While research explores the benefits of PBL and technology integration in general, few studies investigate their intersection within vocational English language learning, and even fewer examine the ISTE Standards' role as a guiding framework.

This study was conducted to evaluate the technology integration in Project-Based Learning for vocational English learners guided by National Educational Technology Standards for Students (NETS-S) to assist the development of 21st-century skills in this digital age. **Accordingly, this study aims to answer the question: is the NETS-S in the TE-PBL effectively incorporated in the context of vocational English learners?**

This research contributes to vocational English language education by providing empirical evidence on the effectiveness of a structured TE-PBL approach. The findings will offer valuable insights for educators, curriculum developers, and vocational training programs to better prepare students for the 21st-century workplace. By focusing on the air travel industry, this study also provides practical examples and recommendations for integrating industry-relevant content into language learning experiences.

RESEARCH METHOD

This is a quantitative method that provides data and generalizes findings from a sample of a study from varied perspectives by distributing a series of questions to a sample of research participants (Ghanad, 2023). The participants of this research are 110 students in an English on-Job Related class who were selected through simple random sampling by Slovin's formula (Siregar, 2017). Questionnaires were used to collect data to gain insights into the student's learning experiences and perceptions after the integration of technology in PBL. The data collection instruments adopted the National Educational Technology Standards for Students (NEST-S). The questionnaire comprised 20 items with Likert-scale responses ranging from 1 (Strongly Disagree) to 4 (Strongly Agree). The questionnaire's reliability was tested using Cronbach's Alpha, which yielded a value of 0.882, indicating that the questionnaire is very reliable

(Sugiyono, 2019). The statistical tools employed for quantitative descriptive analysis included frequency tables, mean, and standard deviation (Thomas & Zubkov, 2023).

FINDINGS AND DISCUSSION

The findings of this study provide valuable insights into the effectiveness of NETS-S in enhancing learning outcomes within a Technology-Enhanced Project-Based Learning (TE-PBL) environment for vocational English learners. Overall, the results indicate that the TE-PBL activities successfully integrated technology and fostered the development of several NETS-S skills, which include creativity and innovation, communication and collaboration, research and information fluency, critical thinking, problem-solving, and decision-making, digital citizenship, and technology operations and concepts, as presented in Table 1.

Table 1. Students' Responses towards NETS-S in TE-PBL

No	Items	SDA	DA	A (%)	SA	M	Std.D
	I. Creativity & Innovation						
1	I generated ideas with the help of technology & media.	0,91	4,55	42,73	51,82	3,45	,630
2	I expressed or informed thoughts & ideas creatively using different tools or digital media.	0,91	6,36	61,82	30,91	3,23	,601
3	I created authentic works as a means of personal or group projects using a variety of digital tools.	2,73	12,73	50,00	34,55	3,16	,748
	II. Communication & Collaboration						
4	I interacted, collaborated, & reported my work to others employing a variety of digital environments and media.	3,64	5,45	44,55	46,36	3,34	,745
5	I communicate information & ideas effectively to others using a variety of media & formats.	1,82	10,00	50,91	37,27	3,24	,703
6	I developed cultural understanding & global awareness by engaging with students from different social & cultural backgrounds.	0,00	13,64	60,91	25,45	3,12	,617
7	I contributed to project teams to complete & produce work.	1,82	8,18	38,18	51,82	3,40	,719
	III. Research & Information Fluency						
8	I collected & ethically used information from a variety of digital sources & media.	0,91	5,45	45,45	48,18	3,41	,640
9	I evaluate and select information sources & digital tools based on the appropriateness of specific tasks.	1,82	5,45	59,09	33,64	3,25	,638
10	I process the information & report results.	1,82	4,55	51,82	41,82	3,34	,654
	IV. Critical Thinking, Problem Solving, & Decision Making						
11	I identify & define significant questions for investigation or to conduct research with the help of technology.	0,91	10,00	57,27	31,82	3,20	,647
12	I plan & manage activities to develop or complete tasks or a project using digital tools or technology.	2,73	6,36	56,36	34,55	3,23	,686
13	I collected & analyzed information from digital resources to draw conclusions.	0,91	6,36	63,64	29,09	3,21	,592

	V. Digital Citizenship						
14	I practiced safe, legal, & responsible use of information & technology.	1,82	3,64	60,00	34,55	3,27	,619
15	I exhibited ethical & respectful behavior using data & information obtained from various sources.	0,91	5,45	56,36	37,27	3,30	,614
16	I engaged online with others by performing a positive attitude to create a good community.	0,91	5,45	50,91	42,73	3,35	,629
	VI. Technology Operations & Concepts						
17	I understood & used media & technology systems that I choose.	0,00	10,91	58,18	30,91	3,20	,618
18	I selected & utilized applications effectively and productively.	0,00	10,00	44,55	45,45	3,35	,658
19	I troubleshooted systems & applications.	0,91	18,18	59,09	21,82	3,02	,663
20	I learned to use new technologies.	1,82	9,09	58,18	30,91	3,18	,666

The results of the questionnaire, administered to 110 students, reveal the descriptive analysis results of 20 questions (Q1-Q20). The average score for each question ranged from 3.02 to 3.45, indicating a tendency among students to provide answers that fall in the middle of the scale, rather than being too extreme in the positive or negative direction. The relatively small standard deviation (between 0.592 to 0.748) indicates that respondents' answers to each question tend to be fairly consistent, although there is a slight variation. It can be inferred that students in general have a fairly positive perception of the use of Technology in Project-Based Learning (TE-PBL) in the project of creating a digital poster themed on the process of air travel in English classes.

Creativity and Innovation

As shown in the table, the majority of students employed diverse technologies and digital media to assist them in generating ideas (94.55%) and to articulate and express their thoughts creatively (92,73%). Integrated technology in PBL effectively improves students' 21st-century skills, including creativity and innovation (Lubis, et.al, 2018; Zaniyyah et.al., 2022). The availability of online resources, digital tools, and collaborative platforms can broaden students' perspectives and expose them to diverse ideas, stimulating their own creative processes. However, a moderate proportion of students (84.55%) perceive themselves as creating authentic works using various digital technologies, suggesting that while students recognize the potential of technology for creative projects, actual implementation and creation of authentic works may require further encouragement and guidance.

Communication & Collaboration

The findings revealed that a significant majority of students (90.91%) interacted, collaborated, and reported their work to others using a variety of digital environments and media. A majority of students (88.18%) were able to successfully communicate information and ideas by employing a range of media and forms and (90,00%) participated in team-based projects. These findings support research demonstrating the positive impact of technology-rich environments on collaborative learning and communication skills (Herstätter et al., 2021; Kim & Choi, 2019). The use of digital tools likely facilitated communication and information sharing (Kim & Choi, 2019), as well as feedback within the project teams. Furthermore, the TE-PBL activities provided opportunities for students to develop their communication skills in diverse digital contexts, supporting the notion that TE-PBL can enhance students' communication skills by providing authentic and engaging communication opportunities. However, students showed a moderate level of agreement (86.36%) in developing cultural understanding and global awareness. This suggests that while TE-PBL provided opportunities for interaction, further integration of global perspectives and cultural exchange activities within the projects could enhance students' intercultural competence. Kapogiannis and Sherratt (2018) posit that integrated collaborative technologies in PBL can lead to a more cohesive collaborative culture within project teams.

Research & Information Fluency

The study provides an overview of the student's research and information literacy skills that were effectively fostered. That is an individual’s overall ability to identify information, including the capacity to locate and access information, investigate and filter information, and publish and use information appropriately (Lanning, 2017). It was revealed that (93.64%) of students gathered and ethically used information from various digital sources. In terms of evaluating and selecting information sources, 92.73% of students evaluate both the content and the source of the information in terms of task suitability. A moderate level of students (93,64%) proceed with the information and finally report their results using technology. By involving students in real-world tasks that call for information retrieval and processing, PBL improves digital literacy abilities, especially in vocational high school students (Haryani, 2023). This supports the notion that integrating technology into PBL fosters critical abilities and complies

with Hasanah et al. (2020), who highlight the positive impact of digital learning on students' literacy. Syarofatin (2022) also emphasizes that integrating technology into PBL, such as creating digital posters and video presentations, effectively enhances students' digital literacy. Digital literacy, which Cordell (2013) defines as a more recent concept than information literacy, encompasses various library users and provides fundamental skills for managing digital environments, enabling students to succeed in information literacy and other study areas.

Critical Thinking, Problem Solving, & Decision Making

It can also be seen that students demonstrate students apply critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. The study found that students utilised technology to prepare for research, identifying and categorising questions (89.09%). However, it suggests the need for developing higher-order thinking skills like inquiry-based learning and independent project planning. Furthermore, digital technology was widely used in planning and managing activities for project development (90.91%), indicating the opportunities for planning and management skills. The study also revealed that 92.73% of students demonstrated their ability to apply critical thinking skills in a practical setting by gathering necessary information from digital resources to complete project tasks and then analysed it to draw conclusions. Poonpon's (2022) study illustrates how integrating self-generated online projects in English Language Teaching (ELT) during the pandemic has led to improved critical thinking and problem-solving skills among students. Sungkono’s findings (2023) emphasize that the effectiveness of PBL in improving critical thinking is linked to the facilitation of project completion, which requires students to engage in higher-order thinking processes. Wulandari et al. (2020) highlight the importance of integrating observation, analysis, and judgment reasoning for effective decision-making. It is also supported by Nofiarida (2023) that this not only cultivates critical thinking but also equips students with the skills necessary to tackle real-world challenges. Moustaghfir (2024) argues that fostering critical thinking in the digital era is essential for empowering students to navigate the complexities of information abundance and ethical considerations associated with digital tools. Furthermore, Poonpon (2022) also states

that the contribution of critical thinking, problem-solving skills, and content knowledge simultaneously is crucial for responsible digital citizenship.

Digital Citizenship

The integration of ethical frameworks into project-based learning is vital for helping students develop the skills necessary to engage with technology responsibly and critically. The research findings showed that students demonstrated an understanding of ethical behavior in the digital environment (94,55%) and strong ethical and respectful conduct towards data and information (93.64%). During online engagement, 93.64% of students agreed that they had contributed positively to the creation of a sense of community through their actions and behaviours. Creating a positive and inclusive online environment is needed to foster a sense of community and ethical online interactions (Yue & Beta, 2022). Hidayah, et. al. (2023) highlight that information literacy significantly influences students' critical and responsible citizenship, particularly when exposed to digital information sources. This fosters curiosity about the world, understanding, and respect for shared cultures, beliefs, and views, contributing to humanity's shared qualities. In addition, through digital literacy students can create appropriate information, avoid hate speech, and communicate effectively on digital devices (Baharuddin, et.al, 2024). This is crucial in today's interconnected world where digital citizenship plays a vital role.

Technology Operations & Concepts

Based on the research findings, students demonstrated a good level of digital fluency in selecting and utilizing appropriate applications for their learning needs. Based on the findings most have a comprehensive understanding of and proficiency in media and technological systems (89.09%) and were aware of how to select and use applications successfully and productively (90,00%). This is in line with the research of Mirra, et al. (2022), which states that technology integration in project-based learning not only improves digital fluency but also fosters students' ability to work independently. This shows that students were able to acquire a high degree of digital fluency since the TE-PBL activities successfully included technology in the learning process. Students were able to employ a variety of digital tools for learning and project development. Hawa et al., (2021) posit that, in addition to enhancing students' technical proficiency, project-based learning facilitates comprehension of the fundamental ideas

of technology and its diverse applications. However, further emphasis on cultivating troubleshooting skills can enhance students' ability to independently resolve technical issues and maintain their digital learning environment, as evidenced by the fact that only 80,91% could troubleshoot any issues while a few (19,09%) needed support. By incorporating a variety of technologies, 89.09% of students learned to use them suggesting that the TE-PBL activities encouraged a growth mindset in technology use, fostering students' willingness to explore and learn new technologies.

CONCLUSION

The findings of this study demonstrate that TE-PBL, when implemented effectively, can significantly enhance 21st-century skills among vocational English learners. The integration of technology into project-based activities fostered a positive learning environment that nurtured creativity, communication, collaboration, research and information fluency, critical thinking, digital citizenship and technological skills – all of which are essential skills for success in the digital age.

The integration of technology into project-based activities has been identified as a promising approach for equipping vocational English learners with the necessary 21st-century skills. The findings of this study demonstrate that such integration fosters a dynamic learning environment that nurtures the development of these critical competencies. Students have demonstrated a high level of proficiency in utilising technology for various tasks, including generating ideas, expressing themselves creatively, collaborating with peers, and conducting research. The integration of digital tools within project teams fostered effective communication, the sharing of information, and the provision of feedback, thereby engendering a collaborative learning environment. Students employed digital tools to collaborate, share information, and provide feedback within project teams, thereby cultivating strong communication skills – a prerequisite for success in the air travel industry. Moreover, students cultivated robust research and information literacy skills, effectively gathering, evaluating, and utilising information from various digital sources. The integration of technology in the identification of research questions, the planning and management of projects, and the analysis of information to draw conclusions, demonstrated critical thinking skills necessary for navigating complex situations in the workplace. The effective integration

of technology in the TE-PBL activities enabled students to develop a high level of digital fluency in selecting, utilising, and troubleshooting various digital tools, a crucial skill in today's digital world.

Whilst the present study highlights the effectiveness of TE-PBL in integrating NETS-S and fostering 21st-century skills, there is always room for improvement. Future research could explore ways to further enhance the development of higher-order thinking skills and intercultural competence within the TE-PBL framework. Furthermore, the provision of additional opportunities for students to develop their troubleshooting skills would enhance their ability to independently resolve technical issues and navigate the digital learning environment with greater confidence. By carefully considering areas for improvement, such as higher-order thinking skills and digital citizenship, educators can further optimise the TE-PBL approach to maximise student learning outcomes and prepare them for success, especially for the evolving demands of the air travel industry and the broader 21st-century workplace.

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