

Students' Perceptions of Online Lectures in Mechanical Engineering Vocational Education

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Abstract

Online lectures have remained relevant beyond the emergency conditions of the COVID-19 pandemic; however, their effectiveness depends on students' access to technology, opportunities for interaction, comprehension of learning materials, and learning motivation. This phenomenological study explored students' perceptions of online lectures in the Mechanical Engineering Vocational Education Study Program at Sultan Ageng Tirtayasa University, focusing on adaptation to online learning, social interaction, comprehension of instructional materials, and learning motivation. The study involved 15 students who were purposively selected based on their previous experience with online lectures. Data were collected through semistructured interviews, observations, and document analysis and were analyzed through data reduction, data display, conclusion drawing and verification, and the identification and organization of phenomenological meaning units. The findings revealed that students appreciated the flexibility of online lectures in terms of time and location, accessibility, and convenience when attending in-person classes was difficult. Google Meet, Zoom, Google Classroom, and WhatsApp were the most frequently reported platforms used for online learning. However, students generally experienced greater difficulty understanding instructional materials because of limited opportunities for direct clarification and peer interaction. Unstable internet connections, inadequate technological devices, unfavorable learning environments, and reduced social interaction negatively affected students' concentration and learning motivation. Online interactions were perceived as more structured but less personally engaging than face-to-face interactions. Furthermore, practice-oriented courses presented particular challenges when hands-on training was replaced by theoretical instruction. These findings suggested that effective online learning in mechanical engineering vocational education required reliable technological infrastructure, interactive instructional strategies, accessible learning materials, lecturers' digital competencies, and sustained academic and social support.



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INTRODUCTION

(Cahyawati, 2020) Online and technology-mediated learning have become integral components of higher education rather than temporary responses to the COVID-19 pandemic. In the post-pandemic era, universities have increasingly integrated face-to-face, blended, and fully online learning activities, requiring students to engage with digital platforms, manage

independent learning, and maintain academic interactions across geographical distances (Widodo & Nursaptini, 2020). (Broadbent et al., 2023) found that several online learning practices introduced during the pandemic continued to be implemented in university courses after emergency remote teaching had ended. These findings suggested that the central concern in higher education had shifted from determining whether online learning should be adopted to identifying how it could be designed and implemented effectively to support meaningful learning experiences.

The significance of this issue is further reinforced by the continued expansion of internet access in Indonesia. According to the Indonesian Internet Service Providers Association (Asosiasi Penyelenggara Jasa Internet Indonesia, APJII), Indonesia had approximately 221,563,479 internet users in 2024, representing an internet penetration rate of 79.5%, compared with 78.19% in 2023 (APJII, 2024). This increasing connectivity has created opportunities for flexible learning, access to digital educational resources, and communication beyond conventional classroom settings. Nevertheless, widespread internet access does not necessarily guarantee effective learning experiences or improved educational outcomes. Students may continue to encounter unstable internet connections, inadequate technological devices, limited engagement, insufficient interaction, and difficulties comprehending instructional materials. These challenges become particularly significant when learning activities require practical demonstrations, hands-on experience, or immediate instructional feedback.

These challenges are especially relevant to vocational higher education, where learning outcomes encompass not only theoretical knowledge but also applied skills, technical proficiency, and practice-oriented competencies. Students enrolled in Mechanical Engineering Vocational Education programs are expected to integrate theoretical concepts with technical procedures, equipment operation, practical demonstrations, and problem-solving activities. Consequently, online instructional approaches that are effective for text-based or discussion-oriented courses may not provide equivalent learning experiences in subjects requiring extensive practical engagement. Students' perceptions are therefore essential for understanding whether the flexibility and accessibility of online lectures adequately compensate for limitations in direct interaction, hands-on learning opportunities, and practical skill development.

Recent studies have demonstrated that students' and educators' experiences with online learning remain varied in the post-pandemic period. (Giday & Perumal, 2024) found that perceived system quality, ease of use, and perceived usefulness were important factors influencing students' willingness to participate in online learning sessions. Similarly, (Broadbent et al., 2023) identified persistent changes in university teaching practices following the pandemic, while (Imran et al., 2023), through a systematic literature review of Scopus-indexed publications, highlighted blended learning as an important instructional approach in post-pandemic education. Within vocational education, (Sirk, 2024) reported that innovative online teaching practices were associated with greater teacher collaboration and learner-centered instructional support. Collectively, these findings suggested that the quality of online learning depended on instructional design, technological accessibility, opportunities for

interaction, and discipline-specific learning requirements rather than the availability of digital platforms alone.

Despite these developments, a research gap remains in understanding how students enrolled in practice-oriented vocational programs perceive and interpret their experiences with online lectures following the transition to digital learning. Much of the existing literature has relied on quantitative surveys, multidisciplinary student samples, data collected during the pandemic, or institutional perspectives on online learning. Comparatively limited attention has been given to the lived experiences of Mechanical Engineering Vocational Education students, particularly regarding their adaptation to online learning environments, perceptions of social interaction, understanding of instructional materials, and learning motivation. A phenomenological approach is therefore relevant because it enables an in-depth exploration of students' subjective experiences and the meanings they assign to online learning within their specific educational contexts.

The urgency of this research is closely related to institutional decisions concerning which components of online learning should be maintained, improved, or integrated with face-to-face instruction. Without a comprehensive understanding of students' experiences, higher education institutions may incorrectly equate technological accessibility with instructional effectiveness. In vocational education, inadequately designed online lectures may limit opportunities for clarification, practical training, peer collaboration, and sustained concentration. Conversely, appropriately structured online learning activities may enhance educational accessibility, reduce geographical and transportation barriers, and encourage independent learning. Understanding these advantages and limitations is essential for developing instructional approaches that preserve flexibility while maintaining the quality of vocational education and supporting the development of practical competencies.

The novelty of this study lies in its phenomenological examination of students' experiences with online lectures within the specific context of Mechanical Engineering Vocational Education at Sultan Ageng Tirtayasa University. Rather than focusing exclusively on satisfaction with digital platforms, the study explores how students interpret their adaptation to online learning, interactions with lecturers and peers, comprehension of instructional materials, technological challenges, and learning motivation. By integrating these experiential dimensions, the research seeks to provide a context-specific understanding of online learning in a vocational discipline characterized by substantial practical and technical learning requirements. This approach offers insights into the relationship between technological accessibility, instructional interaction, and students' perceived learning effectiveness.

Accordingly, this study aims to identify and describe students' experiences in adapting to online lectures, examine their perceptions of social interaction in online and face-to-face learning environments, investigate factors contributing to positive and negative perceptions of online learning effectiveness, and explore how online lectures influence students' learning motivation. These objectives emphasize students' lived experiences as the primary basis for understanding the strengths, limitations, and potential future applications of online learning within the Mechanical Engineering Vocational Education Study Program. Through this approach, the study seeks to identify the educational and contextual factors that shape students' engagement with technology-mediated instruction.

Theoretically, this study contributes to a deeper understanding of online learning as an educational experience influenced by the interaction of technological accessibility, instructional strategies, social presence, self-regulated learning, and vocational competency requirements. Empirically, it provides qualitative evidence concerning the experiences and perceptions of Mechanical Engineering Vocational Education students at Sultan Ageng Tirtayasa University. From a practical perspective, the findings are expected to assist lecturers and academic program administrators in identifying online instructional practices that require improvement, learning activities that benefit from greater face-to-face engagement, and technological or social support mechanisms that respond to students' needs. These contributions may support the development of more inclusive, interactive, and contextually appropriate learning environments.

The study focuses on students who have directly participated in online lectures within the Mechanical Engineering Vocational Education Study Program and are therefore able to describe their experiences of adaptation, academic interaction, instructional comprehension, learning motivation, and technological challenges. The anticipated benefits include improved planning and implementation of blended and online learning, more effective integration of interactive digital platforms, enhanced institutional support for internet connectivity and device accessibility, and stronger alignment between instructional delivery methods and the practical requirements of vocational courses. Furthermore, the findings are expected to provide a foundation for future comparative investigations involving different student cohorts, academic subjects, and vocational education disciplines.

METHOD

Type of Research and Researcher's Role

This study employed a qualitative phenomenological approach to explore students' lived experiences and perceptions of online lectures (Rizal, 2023). The research focused on students' adaptation to online learning, social interaction, comprehension of instructional materials, and learning motivation. Semistructured interviews served as the primary data collection method, supported by observations and interpretive analysis.

Informants, Sampling, and Data Sources

The informants were 15 students of Vocational Education in Mechanical Engineering (PVTM), Faculty of Teacher Training and Education, Sultan Ageng Tirtayasa University, from the 2019, 2020, 2021, and 2024 cohorts. Purposive sampling was used to select students who had experienced online lectures (Lenaini, 2022). Data were obtained through semi-structured interviews, observation of student–lecturer interaction during online sessions, documentation such as lecture notes, learning materials, and student feedback, and a supporting literature review.

Research Instrument and Data Collection

The main instrument was a semi-structured interview guide designed to obtain comparable information while allowing participants to explain their experiences in depth (Ardiansyah et al., 2022). Open-ended questions addressed perceived effectiveness, barriers, interaction, motivation, and expectations for online learning. Interviews were conducted face-to-face or through telecommunication media and documented. The reported procedure included

preparing interview questions, interviewing the 15 PVTM students, attaching documentation to each interview, recording the questions asked, and analyzing the interview data.

Data Analysis and Validity

Analysis followed (Miles & Huberman, 1984) through data reduction, data display, and conclusion drawing/verification. During reduction, the manuscript states that data were summarized, coded, and organized into themes using Stevick–Colaizzi–Keen steps: describing experiences, identifying statements relevant to the research issue, identifying meaning units, and grouping those units into themes. Data were then displayed through thematic narratives and other organizing forms, and interpretations were checked through triangulation, consistency, and logic. Credibility, transferability, dependability, and confirmability were used as quality criteria.

RESULTS AND DISCUSSIONS

Results

The available interview material was organized around recurring experiential domains: understanding and use of online lectures, technological access, comprehension of learning materials, social interaction, learning motivation, and expectations for improvement. Table 1 condenses these domains and their principal patterns. The themes are consistent with the four research questions because they show how students adapt to online delivery, how they interpret interaction, which conditions shape effectiveness, and how those conditions affect motivation.

Table 1. Definition of Online Lectures and Verification of Results (condensed)

Aspect	Main finding from the interviews
Definition of online lectures	Distance learning that uses digital platforms and the internet.
Platforms used	Google Meet, Zoom, Google Classroom, WhatsApp, Skype, Edmodo, and YouTube.
Clarity of material	Most respondents found material easier to understand face-to-face because of direct interaction with lecturers and friends.
Challenges and obstacles	Unstable internet connection, inadequate devices, and an uncondusive environment.
Interaction and discussion	Less active in online lectures than face-to-face.
Need for online lectures	Necessary in certain situations, such as emergencies (e.g., a pandemic) or when lecturers or students cannot attend physically.
Overall response	Varied, but many acknowledge the flexibility and convenience offered.
Understanding material (online vs face-to-face)	Most respondents found online material harder to understand because of limited in-person interaction and potential technical glitches.
Learning motivation	Online lectures tend to lower motivation because of limited social interaction and difficulty maintaining focus.
Improvements needed	Technological infrastructure, learning interactivity, material accessibility, and community support: stable internet, fuller use of interactive platform features, course-specific applications, advanced technologies such as AI and holograms, comprehensive reading materials, and online learning communities.

Source: Interview data summarized by the authors.

Across the analyzed material, students described online lectures as simultaneously useful and limiting. Flexibility, ease of access, and the possibility of attending from a distance were the main positive meanings. The main negative meanings concerned unstable connections,

inadequate devices or environments, reduced direct interaction, and difficulty understanding materials that would normally benefit from explanation or practice. These patterns should be interpreted as themes derived from the analyzed interview material rather than as statistical generalizations.

The analyzed responses therefore indicate an ambivalent experience: students recognize the practical value of online lectures but generally regard face-to-face interaction as more supportive for immediate clarification, practical learning, and social engagement. The manuscript reports that the nine 2024 transcripts contained no analysis; consequently, claims about the full group of 15 participants cannot be finalized until those transcripts are systematically analyzed or their exclusion is explicitly justified.

Discussion

Students' descriptions of online lectures are consistent with the idea of online learning as non-face-to-face instruction mediated by digital platforms (Liyas, 2022). Their familiarity with Google Meet, Zoom, Google Classroom, and WhatsApp indicates that platform use itself is not the central issue. Instead, the meaningful distinction lies in how technological access interacts with the learning task. Flexibility in time and place was repeatedly valued, especially when physical attendance was difficult, but this benefit did not automatically translate into easier learning. This supports the broader argument in the manuscript that online-learning effectiveness depends on student readiness, self-efficacy, learning independence, and the quality of implementation rather than on the presence of technology alone (Rustika, 2012; Rizki et al., 2021; Pangestuti et al., 2022). For vocational students, this distinction is especially important because a platform can efficiently transmit information while still being less suitable for learning experiences that depend on demonstration, practice, and immediate feedback.

Adaptation emerged as both a technical and self-regulatory process. Unstable internet connections, inadequate devices, and unconducive home environments disrupted concentration and participation, echoing concerns about infrastructure and implementation reported in earlier online-learning research (Argaheni, 2020; Dewi, 2024). At the same time, students described becoming more independent in seeking information, managing time, and completing tasks. This dual experience helps explain why online lectures can be perceived as convenient yet demanding. The positive side of flexibility may strengthen autonomy, but the same flexibility transfers more responsibility for attention, time management, and clarification to the learner. In a vocational context, the burden becomes greater when students must understand practical content through theory-oriented explanations. The distinctive issue is therefore not simply whether online lectures are effective, but which components of vocational learning can be supported online and which require richer physical, demonstrative, or interactive conditions.

Social interaction was another central theme. Students experienced online communication as more structured and efficient but less spontaneous and emotionally meaningful than face-to-face interaction. Reduced contact with lecturers and peers made some students less confident in asking questions and weakened the sense of classroom presence. This pattern is consistent with studies in the manuscript showing that online learning can facilitate participation and independent access to resources while also producing disengagement, stress, or reduced motivation when learners encounter obstacles (Sukma, 2021; Hasanah, 2020; Isnaini, 2020;

Safarati & Rahma, 2021). Motivation in this study was therefore contextual rather than uniformly low or high. Students who valued time flexibility, home access, and lower transportation demands could remain motivated, whereas those who depended on direct explanation, peer interaction, or a structured learning environment reported greater difficulty maintaining focus. The findings suggest that motivation should be interpreted as an outcome of the interaction between personal self-regulation and external learning conditions, not as an isolated student trait.

The proposed improvements follow directly from these themes. Students emphasized stable internet access, more interactive use of platform features, course-specific applications, comprehensive learning materials, online communities, and stronger support from lecturers. These suggestions reinforce the need to design online learning around pedagogical requirements rather than around technology alone. For Mechanical Engineering Vocational Education, online delivery may be most useful when it supports preparation, explanation, communication, and access to resources, while practical learning still requires methods that preserve demonstration, feedback, and applied engagement. The manuscript also records proposals for combining online and offline learning, which reflects students' attempt to retain digital flexibility without losing the strengths of direct interaction. Institutionally, this means that infrastructure, lecturer technological competence, learning design, and social support must be improved together. The findings remain context-specific to one study program and cannot be generalized to all university students. In addition, the unresolved status of the nine 2024 transcripts limits the completeness of the current phenomenological synthesis; final interpretation should follow only after the analytic sample is confirmed and all included transcripts are treated consistently.

CONCLUSION

The findings of this study revealed that students' perceptions of online lectures in Mechanical Engineering Vocational Education were mixed and influenced by technological accessibility, instructional requirements, social interaction, and self-regulated learning. Although online lectures offered flexibility and improved access to educational resources, students generally experienced greater difficulties obtaining immediate clarification, understanding practice-oriented course materials, maintaining concentration, and establishing meaningful social interactions. The primary contribution of this study was to demonstrate that the effectiveness of online learning in vocational education could not be evaluated solely on the basis of convenience or digital platform availability. Instead, it required consideration of how effectively instructional approaches supported practical skill development, timely feedback, academic interaction, and learning motivation.

The findings highlighted the importance of improving internet connectivity and device accessibility, strengthening lecturers' digital competencies and interactive teaching practices, providing accessible instructional materials, and designing online learning activities that complemented rather than replaced hands-on vocational training. Nevertheless, the study was limited to a single academic program, and an unresolved inconsistency concerning nine interview transcripts collected in 2024 required clarification. These methodological limitations should be addressed before drawing broader conclusions about students' experiences with online vocational education. Future research should include participants from multiple vocational disciplines and institutions, compare online, blended, and face-to-face instructional

approaches, and examine longer-term academic performance, practical competency development, learning motivation, and social engagement across diverse educational settings.

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AUTHOR CONTRIBUTION

All authors contribute to the preparation of research concepts, methodology development, data collection and analysis, manuscript preparation, and manuscript revision. All authors have read and approved the final version of the manuscript.

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The authors state that generative artificial intelligence (AI) was used in the preparation of this manuscript. The authors acknowledge the use of generative AI to help improve language clarity and improve the grammatical structure of manuscripts. The use is carried out in compliance with applicable ethical guidelines regarding the use and disclosure of generative AI in scientific research. Each author has made substantial intellectual contributions to this work. The entire content of the manuscript has been carefully reviewed to ensure its accuracy, and the author is solely responsible for the integrity and final content of the manuscript

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