



Implementation of the soundtrap platform as a learning medium in the basic digital audio workstation (DAW) course at the music education study program

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ABSTRACT

Conventional Digital Audio Workstation (DAW) learning is currently constrained by high hardware specifications, software licensing costs, and limited opportunities for students to engage in independent practice outside computer laboratory sessions. This study aims to analyze the implementation of the Soundtrap platform as a cloud-based learning medium and to examine students' experiences and responses during its use in the Basic Digital Audio Workstation course within the Music Education Study Program, Faculty of Languages and Arts, Universitas Negeri Padang. This study employed a descriptive qualitative approach. The participants were one course lecturer and 37 students from three classes selected through purposive sampling. Data were collected through classroom observations, analysis of students' digital music projects and course documents, a student survey, and semi-structured interviews with the lecturer and seven students, and were analyzed using the interactive model of Miles, Huberman, and Saldaña with source, technique, and time triangulation. The findings indicate that Soundtrap reduced hardware specification and software licensing constraints, as it can be accessed flexibly from various devices. All 37 students produced a digital music project covering recording, virtual instrument arrangement, editing, mixing, and exporting, and [XX]% of the surveyed students agreed that the platform was easy to use. Three themes emerged from the interviews: flexible access beyond laboratory hours, collaborative project development and feedback, and technical constraints related to internet stability and the free version. These findings suggest that cloud-based DAW platforms can complement, rather than replace, laboratory-based DAW instruction, particularly for students with varying levels of technological proficiency.



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Introduction

Digital transformation has brought fundamental changes across various aspects of life, including the education sector (Balkin & Sonnevend, 2016). Advances in information and communication technologies (ICT) have driven innovation in the teaching and learning process through the integration of various digital learning media that are intended to improve the quality of teaching and learning. However, the educational value of digital

media is not inherent in the technology itself; critical reviews show that claims of “technology-enhanced” learning are frequently asserted rather than demonstrated, and that outcomes depend on pedagogical design, institutional support, and students' access to infrastructure (Kirkwood & Price, 2014; Henderson et al., 2017). In higher education, digital learning media no longer serve merely as tools for delivering instructional content but also function as platforms that promote active, collaborative, and student-centered learning. Furthermore, the integration of digital technologies enables students to engage in learning more flexibly, both inside and outside the classroom, thereby fostering critical thinking, creativity, communication, and collaboration skills, which are considered essential competencies for 21st-century learning (Truong & Diep, 2023; Akour & Alenezi, 2022; Gazi, 2025).

Music education in higher education plays a strategic role in preparing graduates who not only possess strong musical competencies but also demonstrate pedagogical, artistic, and professional capabilities that align with advances in science and technology as well as the evolving demands of the workforce (Pratama et al., 2025). The learning process is designed to develop students' knowledge, skills, and attitudes through learning experiences that integrate theoretical and practical aspects in a balanced manner. Music education is no longer focused solely on the acquisition of musical techniques but also emphasizes the development of creativity, artistic production, collaboration, problem-solving, and digital literacy as essential competencies required in the era of the Fourth Industrial Revolution (Industry 4.0) and Society 5.0 (Gaunt et al., 2021).

Digital transformation has reshaped the landscape of music education by shifting instructional practices from teacher-centered approaches toward more flexible, interactive, and student-centered learning environments (Arhas et al., 2025). Advances in digital technology have enabled students to learn, create, and produce musical works using a wide range of software applications and web-based platforms that support practice-oriented learning, particularly in courses related to music technology. This development requires students not only to master musical concepts but also to acquire the competencies necessary to operate digital music production technologies as preparation for the evolving demands of the creative music industry. At the same time, studies of digitally mediated music learning have reported persistent tensions, including unequal access to devices and stable internet connections, audio latency that limits real-time music-making, increased workload for teachers, and the loss of embodied, face-to-face musical interaction (Daubney & Fautley, 2020; Camlin & Lisboa, 2021; Biasutti et al., 2022). These findings indicate that the integration of digital technology in music education is not uniformly beneficial and must be examined within specific instructional contexts.

The Basic Digital Audio Workstation (DAW) course is a core component of the Music Education curriculum, designed to equip students with essential competencies in music technology. The course focuses on developing students' skills in recording, editing, audio processing, mixing, mastering, and producing digital music through the use of Digital Audio Workstation software (Bell, 2015; Bauer, 2020). Mastery of these competencies is essential for preparing students to meet the evolving demands of the digital music industry, where technological proficiency has become an integral part of creative and professional practice.

The implementation of the Basic Digital Audio Workstation (DAW) course does not solely depend on the lecturer's mastery of the subject matter but is also influenced by the availability of learning media that support continuous practical activities. Ideally, DAW instruction should provide students with opportunities to explore, practice, and collaborate in creating digital music projects. However, the use of conventional DAW software still faces several limitations, including relatively high computer hardware requirements, software licensing constraints, and limited access for students to engage in practice activities outside the laboratory environment. Bell (2015) further argues that the promise of DAWs as democratizing tools has not been fully realized, because participation in “playing the studio” remains uneven, which raises questions of equity and access in DAW learning.

The integration of digital learning media into music education has become an important strategy for creating authentic, adaptive, and technology-enhanced learning experiences that are aligned with the evolving demands of the workforce. In particular, rapid advances in digital technology have transformed the ways in which students learn, create, and produce musical works. A wide range of software applications and web-based platforms are now utilized to support practice-based learning, especially in courses related to music technology. Consequently, students are expected not only to master fundamental musical concepts but also to develop the competencies required to operate digital music production technologies in preparation for careers in the creative music industry. One of the key courses that supports the development of these competencies is the Basic Digital Audio Workstation (DAW) course (Bauer, 2020). This course equips students with the skills required for recording, editing, audio processing, mixing, and producing digital music using Digital Audio Workstation (DAW) software. However, the implementation of DAW instruction continues to face several challenges, including students' limited access to computers that meet the required technical specifications, the high cost of software

licensing, and restricted opportunities for practical training in computer laboratories. These constraints may limit students' ability to develop their practical skills to their full potential.

Based on preliminary observations conducted in the Digital Audio Workstation (DAW) course within the Music Education Study Program, it was found that the learning process was still largely dependent on practice sessions conducted in computer laboratories using the available software. Consequently, students had limited opportunities to engage in independent practice outside scheduled class hours. In addition, students demonstrated varying levels of proficiency in operating DAW software, highlighting the need for instructors to provide flexible learning media that can accommodate diverse learning needs and support independent learning.

Initial observations on February 18, 2026 also showed that some students were accustomed to using various digital applications in their daily activities, but not many had utilized cloud-based platforms for learning music production. In fact, platforms like Soundtrap provide various features that support the recording, editing, mixing, use of virtual instruments, and collaboration in completing music projects. These conditions indicate that there is an opportunity to implement Soundtrap as a learning medium in Digital Audio Workstation (DAW) courses. One alternative learning medium that can be utilized is Soundtrap, a cloud-based Digital Audio Workstation platform that allows users to record, edit, use virtual instruments, mix, and collaborate on a single music project online. This platform can be accessed through various devices without requiring the installation of high-spec software, giving students the flexibility to learn anytime and anywhere. These characteristics make Soundtrap potentially support more active, collaborative, and student-centered learning (Hernandez, 2023). Empirical studies, however, portray Soundtrap less uniformly. Holdhus et al. (2023) found that technological and technical issues permeated classroom composing work with Soundtrap and shaped how teachers collaborated, whereas Black and Wilson (2025) reported that the platform enabled collaborative composing across continents but that uneven contributions, time-zone coordination, and the need for teacher scaffolding constrained participation.

Other research shows that the use of Soundtrap has increased significantly in online music learning, making it one of the cloud-based Digital Audio Workstation platforms widely used by educational institutions. Soundtrap is considered capable of supporting collaborative learning, distance learning, and both synchronous and asynchronous music creation activities (Lind & MacPherson, 2017). Taken together, prior scholarship has established three strands of evidence: (1) the broad competencies required of music graduates in a digitalized profession, including creativity, collaboration, and digital literacy (Gaunt et al., 2021; Pratama et al., 2025); (2) the general effectiveness and challenges of digital technologies in music education (Rexhepi et al., 2024; Camlin & Lisboa, 2021); and (3) the use of Soundtrap mainly in school-level composing projects or international collaborations (Holdhus et al., 2023; Black & Wilson, 2025). Gaunt et al. (2021) offer a conceptual foundation for professional higher music education rather than an empirical account of DAW instruction, while Pratama et al. (2025) develop a needs-based learning model for piano accompaniment rather than for music technology courses. What remains unknown is how a browser-based DAW functions as a learning medium within a formal, credit-bearing introductory DAW course in music teacher education, where students differ in device ownership and technological proficiency, and how the affordances of the platform relate to the attainment of specified course learning outcomes. Therefore, this study attempts to fill this gap by analyzing the Soundtrap implementation process, student learning experiences, user responses, as well as supporting factors and obstacles that arise during the learning process. The novelty of this study lies in the examination of the implementation of a web-based DAW platform in the context of introductory DAW learning in the Music Education Study Program, Faculty of Languages and Arts, Universitas Negeri Padang, interpreted through established frameworks of technology-mediated learning, namely technological pedagogical content knowledge (TPACK) (Mishra & Koehler, 2006; Bauer, 2013), the Community of Inquiry (Garrison et al., 2000), and personal learning environments for self-regulated learning (Dabbagh & Kitsantas, 2012).

Considering the importance of continuity between classroom theory and independent practice, the inclusive integration of digital technology is an essential supporting aspect in modern music education. Utilization of the Soundtrap platform is expected to enrich students' learning experience by providing access to more practical and adaptive music production. Therefore, in an effort to optimize students' practical skills in the digital era, providing flexible and easily accessible learning media is a very important strategic step. The presence of cloud-based technology offers an innovative solution to expand independent learning space outside of lecture hours, so that students can explore the material without being limited by space and time. Therefore, this study aims to analyze the implementation of the Soundtrap platform as a learning medium in the Basic Digital Audio Workstation (DAW) course in the Music Education Study Program, FBS UNP, and to examine students' experiences and responses in utilizing this technology. Specifically, this study addresses three research questions: (1) How was Soundtrap implemented in the stages of the Basic DAW course? (2) To what extent did students attain the fundamental DAW competencies of the course (audio recording, MIDI and virtual instrument use,

audio editing, mixing, and project exporting) when using Soundtrap? (3) How did the students and the lecturer perceive the affordances and constraints of the platform?

Method

This study employed a qualitative descriptive design to investigate the implementation of the Soundtrap platform as a learning medium in the Basic Digital Audio Workstation (DAW) course. The study was conducted at the Music Education Study Program, Faculty of Languages and Arts, Universitas Negeri Padang. A qualitative descriptive design was chosen rather than a classroom ethnography because the study aimed to provide a rich, low-inference account of how the platform was used and experienced within one course during one semester, rather than to interpret the broader culture of a learning community through prolonged immersion. The research procedure is summarized in Table 1.

The participants consisted of one course instructor and 37 undergraduate students enrolled in three Basic Digital Audio Workstation (DAW) classes during the 2025/2026 academic year. The participants were selected using purposive sampling because they were directly involved in the implementation of Soundtrap throughout the learning process. The students were distributed across three classes, consisting of 14 students in Class A, 14 students in Class B, and 9 students in Class C. The inclusion criteria were: (1) being officially enrolled in the Basic DAW course in the 2025/2026 academic year, (2) participating in the Soundtrap-based learning sessions, and (3) having an active Soundtrap account in the course group. Because all enrolled students met these criteria, the student sample corresponds to the entire course population (Palinkas et al., 2015), which reduces selection bias within the course but limits transferability beyond it. From these participants, seven students were selected as key informants for semi-structured interviews to represent the three classes and varying levels of prior DAW experience.

Data were collected through classroom observations, a student survey, semi-structured interviews, and document analysis. These techniques were employed to obtain comprehensive information regarding the implementation of Soundtrap, students' learning experiences, responses to the platform, and challenges encountered during the learning process.

Observations were conducted during classroom learning activities to examine how Soundtrap was implemented in the Basic Digital Audio Workstation (DAW) course, covering [number] sessions between [month] and [month] 2026, each lasting approximately [duration] minutes. A structured observation sheet was used to record four aspects: (1) the stages of instruction, (2) students' use of Soundtrap features, (3) student–student and student–lecturer interaction, and (4) technical problems encountered. Interviews were conducted with the course instructor and the seven selected students to explore their perceptions, experiences, and responses to the platform. The semi-structured interview guide was organized around four topics: prior DAW experience, ease of use and accessibility, collaboration and feedback, and obstacles. Each interview lasted approximately [duration] minutes and was audio-recorded and transcribed verbatim. The survey consisted of [number] closed items on a five-point Likert scale addressing ease of use, accessibility, usefulness for practice, and collaboration, adapted from the perceived ease of use and perceived usefulness constructs of the Technology Acceptance Model (Davis, 1989), and was administered to the students at the end of the course. Documentation was collected throughout the study to support and validate the findings obtained from observations and interviews. The documents analyzed (Bowen, 2009) comprised the Semester Learning Plan (RPS), instructional modules, students' Soundtrap project files and activity records, and screenshots of learning activities. Students' projects were examined against the five fundamental competencies stated in the course learning outcomes: audio recording, MIDI and virtual instrument use, audio editing, mixing, and project exporting.

The data were analyzed using the interactive model proposed by Miles, Huberman, and Saldaña, which consists of three stages: data condensation, data display, and conclusion drawing and verification. During the data condensation stage, the researcher selected, focused, and organized the data according to the research objectives. Interview transcripts and observation notes were coded using a hybrid inductive–deductive procedure: initial codes were generated inductively from the data and then grouped into themes aligned with the research questions (Braun & Clarke, 2006). Coding was conducted independently by two researchers, discrepancies were discussed until consensus was reached, and the codebook was refined iteratively. Data collection was considered sufficient when additional interviews and observations no longer yielded new codes relevant to the research questions (Guest et al., 2006). The data display stage involved presenting the findings in narrative descriptions supported by tables, figures, and interview excerpts. Finally, conclusions were drawn and continuously verified throughout the research process to ensure the credibility and consistency of the findings.

To ensure trustworthiness, data validity was established through source triangulation, technique triangulation, and time triangulation. Source triangulation was conducted by comparing information obtained

from the lecturer and students. Technique triangulation involved comparing data collected through observations, interviews, and documentation. Time triangulation was achieved by collecting data across several learning sessions to obtain a consistent understanding of the implementation of Soundtrap in the Basic Digital Audio Workstation (DAW) course. In addition, trustworthiness was addressed through the criteria of credibility, transferability, dependability, and confirmability (Nowell et al., 2017). Credibility was strengthened through triangulation and member checking, in which interview summaries were returned to participants for confirmation (Birt et al., 2016); transferability was supported by a thick description of the course context and participants; and dependability and confirmability were supported by an audit trail of raw data, coding decisions, and analytic memos.

Table 1. Research Design and Procedure

Stage	Activities	Output
Preliminary study	Preliminary observation of DAW learning (February 18, 2026) and identification of learning problems	Research problem and questions
Implementation and data collection	Classroom observations ([number] sessions), student survey, semi-structured interviews (one lecturer and seven students), and document collection	Field notes, survey data, transcripts, and documents
Data condensation	Coding of transcripts and field notes; grouping of codes into themes	Codebook and themes
Data display	Narrative descriptions, tables, figures, and interview excerpts	Organized findings
Conclusion drawing and verification	Source, technique, and time triangulation; member checking; audit trail	Verified conclusions

Results and Discussions

The implementation of the Soundtrap platform as a learning medium in the Basic Digital Audio Workstation (DAW) course was carried out at the Music Education Study Program, Faculty of Languages and Arts, Universitas Negeri Padang. The learning process integrated cloud-based digital technology into practical music production activities. At the initial stage, the lecturer introduced the concept of Digital Audio Workstation (DAW), explained the main functions and features of Soundtrap, and demonstrated the procedures for creating projects, recording audio, using virtual instruments, editing tracks, mixing, and saving project files. Students then practiced these activities independently using their own devices, resulting in an active and student-centered learning environment.



Figure 1. Learning activities in the Basic Digital Audio Workstation (DAW) course using the Soundtrap platform

Observation data indicated that students were able to follow each stage of the learning process successfully. Students actively explored the available features, engaged in discussions with the lecturer and peers, and

completed practical assignments according to the provided instructions. The cloud-based nature of Soundtrap enabled students to continue working on their projects outside scheduled class hours without depending on laboratory facilities.

Documentation analysis revealed that learning activities were systematically recorded through digital projects stored in students' accounts. Supporting documents, including the Semester Learning Plan (RPS), instructional modules, project outputs, and screenshots of Soundtrap activities, demonstrated that students were capable of creating projects, recording audio, utilizing virtual instruments, editing tracks, mixing audio, and producing digital music compositions in accordance with the course learning outcomes.

Interview findings with the course instructor revealed that Soundtrap facilitated practical learning by allowing students to access course materials and project files online. Consequently, practical activities were not restricted to laboratory sessions but could be continued independently outside class. The instructor also emphasized that Soundtrap's collaborative features supported project monitoring and feedback provision throughout the learning process.

Student interviews indicated overwhelmingly positive responses toward the use of Soundtrap. Students reported that the platform was easy to learn, featured a user-friendly interface, and could be accessed through various internet-connected devices. They also expressed that the platform encouraged creativity, independent practice, and collaborative project development. However, some students identified unstable internet connectivity and limitations of the free version as challenges during implementation.



Figure 2. Student Projects on the Soundtrap Platform

Survey data from the 37 students and interview data from the seven key informants indicated that the use of Soundtrap facilitated practical learning activities in the Basic Digital Audio Workstation (DAW) course. Students reported that the platform enabled them to access learning materials and music projects online, allowing practical activities to extend beyond computer laboratory sessions and continue independently outside scheduled class hours. In addition, the course instructor stated that Soundtrap's collaborative features facilitated the monitoring of student progress and the provision of continuous feedback throughout project development. Specifically, [XX]% of the students agreed or strongly agreed that Soundtrap was easy to use, [XX]% that it enabled them to practice outside laboratory hours, and [XX]% that its collaboration features supported group work.

Most students expressed positive perceptions of Soundtrap as a learning medium. They reported that the platform was easy to learn, featured an intuitive user interface, and could be accessed through various internet-connected devices. Furthermore, students felt that Soundtrap provided greater opportunities for practice, creativity development, and collaborative music production. Nevertheless, several students identified unstable internet connectivity as a challenge when accessing and synchronizing online projects. Some participants also noted that limitations in the free version restricted access to several advanced production features. For example, one student stated, “[insert verbatim interview excerpt]” (S[number], interview, [date]).

Thematic analysis of the interview data yielded three main themes. The first theme, flexible access beyond the laboratory, comprised the codes device independence, no software installation, and practice at home. The second theme, collaborative production and feedback, comprised the codes project sharing, peer review, and lecturer monitoring. The third theme, technical and access constraints, comprised the codes unstable internet

connectivity, delays in project synchronization, and limitations of the free version. These themes structure the discussion that follows.

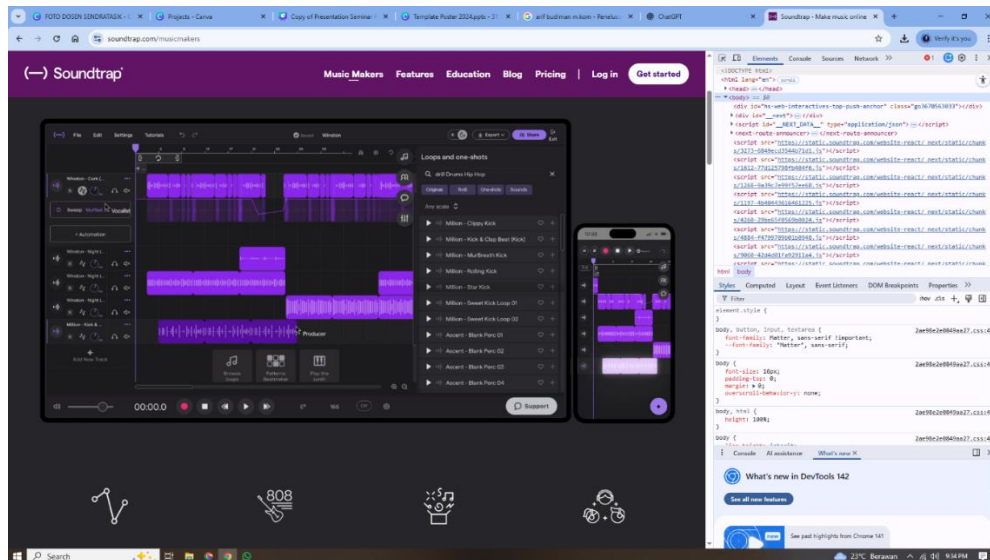


Figure 3. Screenshot of Students' Digital Music Projects on the Soundtrap Platform

An examination of the platform's technical characteristics revealed several advantages that distinguish Soundtrap from conventional Digital Audio Workstation (DAW) software commonly used in music production instruction. Unlike traditional DAW applications that generally require software installation, high-performance computer specifications, and local project storage, Soundtrap operates through a cloud-based environment that can be accessed directly via a web browser. This feature enables students to create, edit, save, and access projects from different devices without the need for manual file transfers. Furthermore, Soundtrap provides automatic cloud synchronization, allowing project data to remain accessible and up to date throughout the learning process.

Table 2. Operational Features of Soundtrap Utilized in the Basic Digital Audio Workstation (DAW) Course

Feature	Learning Function	Student Activity
Project Creation	Creating new music projects	Developing individual and group assignments
Audio Recording	Recording vocal and instrumental tracks	Recording musical performances
Virtual Instruments	Producing music using digital instruments	Creating melodies, harmonies, and accompaniment
Audio Editing	Trimming, cutting, and arranging tracks	Improving recording quality
Mixing Tools	Adjusting volume, panning, and effects	Balancing and refining musical compositions
Cloud Storage	Automatic online project storage	Accessing projects from different devices
Collaboration Feature	Real-time collaborative project development	Group project work and peer feedback

Another notable advantage of Soundtrap is its integrated collaboration functionality. The platform allows multiple users to work on the same project simultaneously, facilitating communication, project sharing, and collaborative editing among students. Such functionality is not commonly available in conventional DAW software without additional cloud services or third-party applications. As a result, Soundtrap supports a more interactive and collaborative learning environment that aligns with project-based learning approaches frequently applied in music education, as highlighted by Kladder (2022). In other words, the platform supports the achievement of the project-based learning outcomes implemented in the Music Education Study Program, Faculty of Languages and Arts, Universitas Negeri Padang, by enabling students to collaboratively design, produce, refine, and present authentic music projects.

In addition, Soundtrap provides a wide range of built-in resources, including virtual instruments, audio loops, recording tools, sound effects, and cloud-based project management features. These resources reduce the technical barriers commonly encountered by novice users, allowing students to focus more on developing music production skills and creative expression. Furthermore, the cloud-based recording and project management system enables users to store, organize, and access audio recordings efficiently while supporting collaborative workflows throughout the production process. As noted by Black and Wilson (2025), cloud-based project storage

facilitates collaborative work on shared audio projects across locations and devices, making them particularly suitable for educational settings that emphasize collaborative and project-oriented learning.

The findings obtained from observations, interviews, surveys, and document analysis consistently demonstrated similar patterns regarding the implementation of Soundtrap in the Basic Digital Audio Workstation (DAW) course. Observation data showed active student participation throughout practical sessions, while interview and survey data confirmed that students perceived the platform as accessible, flexible, and supportive of independent learning. These findings were further supported by documentation records, including project files, screenshots, and learning artifacts stored within students' Soundtrap accounts. The consistency of evidence obtained from multiple sources indicates a strong convergence of findings and strengthens the credibility of the study.

Analysis of student project outputs also indicated that participants were able to achieve the expected learning outcomes of the course. The majority of students successfully completed essential DAW activities, including audio recording, virtual instrument arrangement, track editing, mixing, and project exporting. Documentation records showed that all students produced digital music projects that reflected the competencies targeted in the course learning outcomes. The resulting projects demonstrated students' ability to apply both technical and creative skills acquired during the learning process. This evidence suggests that Soundtrap functioned not only as a technological tool but also as an effective learning medium for facilitating practical music production activities.

Furthermore, the cloud-based characteristics of Soundtrap contributed significantly to the continuity of learning beyond classroom sessions. Documentation records revealed that students frequently accessed, modified, and revised their projects outside scheduled laboratory hours, indicating a higher level of learning autonomy. This finding was consistent with student statements during interviews, in which participants reported spending additional time practicing and refining their projects independently. The convergence of observational, interview, and documentation data demonstrates that Soundtrap successfully expanded learning opportunities and encouraged self-directed learning behaviors among students.

Another notable finding concerns the collaborative dimension of the platform. Observational data showed frequent interaction among students during project development, while interview data revealed that students highly valued the ability to share, edit, and review projects collaboratively. The lecturer further reported that the platform simplified the monitoring of student progress and enabled more immediate and continuous feedback throughout the learning process. These findings collectively indicate that Soundtrap effectively supported collaborative learning practices and strengthened communication among participants during music production activities.

Although several challenges were identified, particularly concerning internet stability and limitations associated with the free version of the platform, these issues did not substantially hinder the achievement of learning objectives. Evidence gathered through observations, interviews, surveys, and documentation consistently demonstrated that the educational benefits of accessibility, flexibility, collaboration, and extended learning opportunities outweighed the technical constraints encountered during implementation. The consistency of findings obtained through multiple data collection techniques and sources supports the trustworthiness of the results and suggests that, within this course context, Soundtrap functioned as a suitable learning medium for supporting instruction in the Basic Digital Audio Workstation (DAW) course.

The discussion in this study is grounded in two interrelated conceptual perspectives. The first perspective focuses on the fundamental competencies of Digital Audio Workstation (DAW) learning, which include audio recording, the use of MIDI and virtual instruments, audio editing, mixing, and project exporting. These competencies constitute the main learning outcomes of the Basic Digital Audio Workstation course and serve as indicators of students' technical ability in digital music production.

The second perspective relates to the concept of learning media in music education. Learning media are understood not merely as technological devices but also as pedagogical resources that facilitate interaction, engagement, creativity, collaboration, and the achievement of learning objectives (Bauer, 2020; Webster, 2016). From this perspective, Soundtrap is understood not only as a cloud-based Digital Audio Workstation platform but also as a learning medium that supports meaningful learning experiences and facilitates the attainment of learning outcomes (Holdhus et al., 2023).

Based on these two perspectives, the findings of this study are interpreted through two main indicators: (1) students' attainment of the fundamental Digital Audio Workstation competencies and (2) the characteristics of Soundtrap as a learning medium that supports interaction, creativity, collaboration, and meaningful learning experiences. To explain why these outcomes occurred, the interpretation further draws on the TPACK

framework (Mishra & Koehler, 2006), the Community of Inquiry framework (Garrison et al., 2000), and the notion of personal learning environments for self-regulated learning (Dabbagh & Kitsantas, 2012). The integration of these perspectives provides a conceptual framework for understanding the role of Soundtrap in supporting digital music learning in higher education.

The findings of this study indicate that the implementation of Soundtrap as a learning medium contributed positively to the learning process in the Basic Digital Audio Workstation (DAW) course at the Music Education Study Program, Faculty of Languages and Arts, Universitas Negeri Padang. The results obtained from observations, interviews, surveys, and documentation analysis revealed that students were able to achieve the fundamental competencies expected in introductory DAW instruction. These competencies included audio recording, MIDI and virtual instrument utilization, audio editing, mixing, and project exporting. The successful completion of these activities demonstrates that students were able to apply theoretical concepts through practical digital music production tasks and achieve the intended learning outcomes of the course.

Documentation data in the form of student project outputs showed that students successfully completed the stages of the music production workflow using Soundtrap. Students were able to create digital music projects, record audio materials, arrange musical compositions using virtual instruments, edit and refine recordings, perform mixing processes, and export completed projects. These findings suggest that the platform supported the acquisition of both technical and creative competencies required in Digital Audio Workstation learning. In music technology education, the mastery of such competencies is considered an important indicator of learning success because students are expected not only to understand theoretical concepts but also to demonstrate practical production skills through authentic musical products.

From the perspective of music education, learning media are defined as tools, resources, or technological systems that facilitate learning experiences and support the development of musical knowledge, skills, attitudes, and creativity (Bauer, 2020; Burnard, 2007; Rexhepi et al., 2024). The effectiveness of a music learning medium is therefore determined not solely by its technological sophistication but by its ability to assist learners in achieving instructional objectives. Based on this perspective, the findings suggest that Soundtrap functioned effectively as a music learning medium because it enabled students to engage directly with music production activities while simultaneously supporting the achievement of course learning outcomes.

One of the most significant findings concerns the ability of Soundtrap to facilitate authentic learning experiences. Students were not merely introduced to theoretical explanations regarding recording, editing, and mixing processes; rather, they directly engaged in the complete workflow of digital music production. Through project-based activities, students experienced practical tasks similar to those commonly performed in contemporary music production environments. This finding is consistent with previous studies emphasizing that authentic learning experiences play a crucial role in music technology education because professional competencies are developed through direct engagement with realistic production contexts (Herrington & Oliver, 2000; King, 2008).

Another important indicator of Soundtrap's effectiveness as a learning medium was the achievement of essential DAW competencies. Observation and documentation data revealed that students were able to utilize recording tools, virtual instruments, editing functions, mixing controls, and project management features effectively. The completion of digital music projects demonstrated that students successfully integrated technical skills with musical creativity throughout the learning process (Coles & Zane, 2024). These findings suggest that Soundtrap provided sufficient technological affordances to support the development of practical competencies required in introductory DAW courses. From a TPACK perspective (Mishra & Koehler, 2006), however, this outcome cannot be attributed to the technology alone: competency attainment emerged from the interplay between the lecturer's content knowledge of music production, the pedagogical sequence of demonstration, guided practice, and project work, and the technological affordances of the platform. Bauer (2013) similarly emphasizes that effective technology integration in music education depends on teachers' integrated technological, pedagogical, and content knowledge.

The findings also revealed a high level of student engagement during learning activities. Observation data showed that students actively participated in classroom discussions, explored platform features independently, responded to lecturer feedback, and collaborated with peers during project development. Students frequently experimented with different virtual instruments, audio effects, and editing techniques beyond the minimum requirements of the assigned tasks. Such behaviors indicate active participation in the learning process, which is considered a key characteristic of effective student-centered learning environments (Alaba & Ajibola, 2026; Shehab, 2026). The active involvement observed throughout the course suggests that Soundtrap encouraged students to become active producers of knowledge rather than passive recipients of information. This engagement can be interpreted through the Community of Inquiry framework (Garrison et al., 2000): the

lecturer's demonstrations and feedback constituted teaching presence, peer interaction around shared projects constituted social presence, and iterative experimentation with instruments and effects reflected cognitive presence. Alternative explanations should also be acknowledged, as novelty effects, students' intrinsic motivation toward music production, and the lecturer's knowledge, confidence, and beliefs about technology, which strongly shape technology integration (Ertmer & Ottenbreit-Leftwich, 2010), may have contributed to engagement independently of the platform.

The cloud-based architecture of Soundtrap also emerged as a significant factor supporting learning effectiveness. Unlike conventional DAW software that often requires installation on laboratory computers and local storage systems, Soundtrap enabled students to access projects through internet-connected devices at any time and from any location. Documentation records revealed that students frequently continued project development outside scheduled laboratory sessions. Interview data further confirmed that students appreciated the flexibility provided by the platform because it allowed them to practice independently and revisit unfinished projects beyond classroom hours. This flexibility is particularly important in music production learning, where skill acquisition requires continuous practice, repetition, and experimentation. This mechanism is consistent with Dabbagh and Kitsantas (2012), who argue that cloud-based and social tools can function as personal learning environments that support self-regulated learning when instructors scaffold goal setting and self-monitoring. Because out-of-class practice in this study occurred within structured project assignments, the course design, and not only cloud access, appears to have supported learner autonomy (Zimmerman, 2002).

Furthermore, the collaborative features available within Soundtrap contributed to the development of collaborative learning practices. Students were able to share projects, exchange ideas, provide feedback, and participate in group production activities through a shared online environment. Observation data demonstrated frequent interactions among students during project completion, while interview findings indicated that students considered collaborative features beneficial for improving project quality and facilitating communication. The lecturer also reported that collaborative functions simplified project monitoring and enabled more immediate feedback throughout the learning process. These findings support the view that digital music production learning should not only focus on individual technical competencies but also foster communication, collaboration, and teamwork skills that are increasingly required in contemporary music production settings (Voogt & Roblin, 2012). These results echo King (2008), who highlighted the role of peer interaction and shared problem-solving in collaborative learning in the music studio, and Black and Wilson (2025), who reported that Soundtrap enabled collaborative composing across continents. Unlike Black and Wilson's study, however, collaboration in the present course took place largely within co-located class groups, which may explain why coordination problems were less prominent. Conversely, Holdhus et al. (2023) observed that technical issues with Soundtrap permeated classroom work; in the present study, technical issues were also reported but were perceived as manageable, possibly because the participants were university students with greater autonomy and access to their own devices.

An additional indicator supporting the effectiveness of Soundtrap as a learning medium is the consistency of evidence obtained through multiple data sources and collection techniques. Positive perceptions reported by students during interviews and surveys were supported by observational evidence showing active participation and by documentation records demonstrating successful project completion. Likewise, the lecturer's evaluation of the platform corresponded with observable student performance and documented learning outcomes. This convergence of evidence strengthens the credibility of the findings and suggests that the effectiveness of Soundtrap was not merely based on subjective opinions but was reflected in actual learning behaviors and project achievements.

Despite the positive findings, several challenges were identified during implementation. Some students reported difficulties related to unstable internet connectivity, particularly when accessing large project files or synchronizing collaborative work. In addition, limitations associated with the free version of Soundtrap restricted access to certain advanced production features. Nevertheless, these constraints did not significantly impede students' ability to complete learning activities or achieve course outcomes. The overall findings indicate that the educational benefits of accessibility, flexibility, collaboration, authenticity, and learner autonomy outweighed the technical limitations encountered during implementation. Similar access-related constraints, particularly unstable internet connections and unequal availability of devices, have been widely reported in studies of online and digitally mediated music education (Daubney & Fautley, 2020; Camlin & Lisboa, 2021; Biasutti et al., 2022), indicating that the benefits of cloud-based DAWs remain contingent on infrastructure. Moreover, dependence on the free tier of a commercial platform raises questions of sustainability and equity (Bell, 2015) and supports critical perspectives that caution against assuming that digital tools automatically enhance learning (Kirkwood & Price, 2014). Students' positive perceptions of ease of use and usefulness also

correspond to the two core determinants of technology acceptance (Davis, 1989); however, acceptance of a tool should not be equated with learning gains.

Based on the findings, Soundtrap can be considered an appropriate learning medium for the Basic Digital Audio Workstation (DAW) course in this context. Its suitability is indicated by the achievement of DAW competencies, the successful completion of digital music projects, high levels of student engagement, expanded opportunities for independent learning, and the development of collaborative learning experiences. Furthermore, the consistency of findings obtained through observations, interviews, surveys, and documentation analysis provides consistent qualitative evidence that Soundtrap supports meaningful, authentic, and practice-oriented learning in music technology education. Therefore, the platform represents a relevant and innovative alternative for supporting Digital Audio Workstation instruction in higher education, particularly within music education programs seeking to integrate contemporary digital technologies into their learning environments.

Limitations and Recommendations for Future Research

This study has several limitations. First, it was conducted in a single course at one institution with 37 students and one lecturer; therefore, the findings are not statistically generalizable, and their transferability to other contexts should be judged on the basis of the contextual description provided. Second, the study did not include a control group or pre-test–post-test measures, so the attainment of DAW competencies cannot be causally attributed to Soundtrap rather than to other factors such as the lecturer's instructional quality, the curriculum design, or students' prior experience and motivation. Third, the presence of the researchers during the learning process may have produced a Hawthorne effect and socially desirable responses in interviews and surveys. Fourth, the survey was descriptive and was not based on a fully validated instrument. The claims of this study would be weakened if comparable competency attainment were found in conventional laboratory-based DAW instruction with similar levels of out-of-class practice, or if the quality of students' projects did not differ across levels of platform use. Future research is therefore recommended to (1) use quasi-experimental or mixed-method designs that compare Soundtrap-based instruction with conventional DAW instruction using validated competency rubrics and pre–post measures; (2) compare Soundtrap with other browser-based DAWs; (3) involve multiple courses and institutions; and (4) examine the longer-term effects on students' music production skills and their future teaching practice.

Overall, the findings indicate that Soundtrap plays a meaningful role in supporting digital music learning by providing opportunities for students to develop fundamental DAW competencies through authentic, collaborative, and technology-enhanced learning experiences. The integration of cloud-based accessibility, project-based activities, and collaborative features enables students to engage actively in music production while fostering creativity, communication, and independent learning. These findings highlight the potential of cloud-based Digital Audio Workstation platforms to enrich music technology instruction and support the implementation of contemporary pedagogical approaches in higher education, particularly within music education programs that emphasize project-based learning and digital literacy. These findings also suggest that cloud-based Digital Audio Workstation platforms can serve not only as technological tools but also as pedagogical environments that facilitate authentic, collaborative, and student-centered music learning, providing valuable insights for the integration of digital technologies into higher music education.

Conclusions

This study concludes that the implementation of Soundtrap as a learning medium in the Basic Digital Audio Workstation (DAW) course was successfully integrated into the learning process at the Music Education Study Program, Faculty of Languages and Arts, Universitas Negeri Padang. Based on data obtained through observations, interviews, surveys, and documentation involving one course lecturer and 37 students, Soundtrap provided a cloud-based learning environment that supported practical music production activities throughout the course. In this study, effectiveness was operationalized as (1) the completion of digital music projects demonstrating the five fundamental competencies stated in the course learning outcomes, (2) observable student participation in learning activities, and (3) the perceptions of students and the lecturer regarding the usefulness and ease of use of the platform. The findings demonstrate that Soundtrap facilitated the achievement of fundamental DAW competencies, including audio recording, MIDI and virtual instrument utilization, audio editing, mixing, and project exporting. Evidence from student project outputs, classroom observations, and documentation records indicates that students were able to complete the essential stages of digital music production and produce musical works that reflected the intended learning outcomes of the course. These findings suggest that Soundtrap supported the development of both technical and creative competencies required in introductory DAW instruction.

From the perspective of music education, the study further reveals that Soundtrap fulfilled important characteristics of a suitable learning medium. The platform promoted accessibility, interactivity, learning flexibility, independent practice, and collaborative learning. Students were able to access projects beyond classroom hours, engage actively in practical activities, explore platform features independently, and collaborate with peers throughout the music production process. These characteristics contributed to increased student engagement and created a more student-centered learning environment.

The credibility of these findings is strengthened through the convergence of evidence obtained from multiple sources and data collection techniques. Consistent patterns identified through observations, interviews, surveys, and documentation indicate that the effectiveness of Soundtrap was reflected not only in participants' perceptions but also in observable learning behaviors and documented project achievements. Therefore, Soundtrap can be considered both a viable Digital Audio Workstation platform for developing fundamental music production competencies and a suitable music learning medium that supports meaningful, authentic, and practice-oriented learning experiences in higher education. Although challenges related to internet connectivity and limitations of the free version were identified, these constraints did not substantially hinder the achievement of learning outcomes. However, because the study involved a single course without a control group, these conclusions are context-specific and do not establish that Soundtrap is superior to conventional DAW software; the lecturer's instructional quality, the curriculum design, and students' motivation may also have contributed to the outcomes. Overall, the findings suggest that Soundtrap represents a relevant and innovative alternative for supporting Digital Audio Workstation instruction within music education programs, particularly in contexts seeking to integrate cloud-based technologies into contemporary music learning environments. Future studies are recommended to employ quantitative or mixed-method approaches to measure the impact of Soundtrap on learning achievement more comprehensively. Further research may also investigate its implementation across different music courses, educational levels, and institutional contexts to broaden the understanding of cloud-based Digital Audio Workstation platforms in music education.

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