



Drone Intervention in Community-Based Digital Content Creation for Outcome-Based Learning in Indonesian Islamic Boarding Schools

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Abstract. The use of technology in *pesantren* education, particularly involving advanced tools such as drones, remains limited, despite the significant potential these technologies have in enriching the learning experience. This study explores the impact of drone usage in digital content creation on student engagement, technical skills, and achievement outcomes based on Outcome-Based Education (OBE) principles. Qualitatively, the research involved participatory observation and in-depth interviews with teachers and students at the Raudlatul Falah Tahfidzul Qur'an *Pesantren*, who were involved in drone-based video production. The findings reveal that using drones enhanced the visual quality of learning content and deepened student engagement in the learning process, both cognitively, psychomotorically, and affectively. Students developed technical skills in video production and collaboration and reported positive impacts on their motivation and pride. Furthermore, this process supports the principles of Outcome-Based Education by enriching a more holistic learning experience. This research contributes significantly to *pesantren* education by introducing digital technology to enhance religious instruction. These findings may encourage other *pesantren* to adopt technology in their educational activities and open avenues for further research into implementing technology in faith-based education.

Keywords: Drone technology, *pesantren* education, student engagement, Outcome-Based Education, digital content creation.

1. Introduction

In the contemporary era, the rapid advancement of digital technologies has significantly influenced educational practices, offering both new opportunities and challenges for institutions worldwide [1], [2], [3], [4]. Among these institutions, Indonesia's *pesantren* (Islamic boarding schools) face unique obstacles in adapting to the digital age [5]. Traditionally renowned for their emphasis on religious education and adherence to conventional pedagogies, *pesantren* have struggled to maintain relevance despite the growing importance of digital media and technology in modern education. This gap between traditional pedagogical methods and contemporary digital learning practices underscores the need for innovative approaches to enhance student engagement, ensuring *pesantren* remain aligned with the evolving educational needs of the 21st

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century. As such, integrating technology into the learning process—particularly through project-based learning (PBL) and digital content creation—has emerged as a promising solution to bridge this divide [6], [7], [8], [9], [10].

One such technological intervention that has shown promise in transforming educational experiences is using drones for content creation. Drones provide a unique opportunity to capture dynamic, high-quality visual content that can substantially enrich the learning experience [11], [12], particularly in *pesantren* environments where students are often involved in religious activities and community-based learning. Recent studies have underscored the growing significance of digital storytelling and visual media in education, with evidence indicating that integrating multimedia tools like drones can promote deeper learning and greater student engagement [13], [14]. However, despite the promising potential, a gap remains in understanding how drones and related digital technologies can be integrated into traditional educational frameworks like *pesantren* in Indonesia, and what specific impacts they may have on student engagement and academic outcomes [15], [16], [17], [18].

The central research question addressed in this study is how drone-assisted digital content creation can support Outcome-Based Education (OBE) in *pesantren*. Specifically, the study explores the effectiveness of drone technology in creating digital content that aligns with the educational goals and values of *pesantren*. Traditional teaching practices in *pesantren* typically prioritize rote memorization and passive learning, with limited focus on the development of technical or digital skills [19], [20], [21]. However, as the global educational landscape increasingly shifts toward more interactive and digital approaches, there is a pressing need to examine how technology can be leveraged to support not only religious knowledge but also 21st-century skills such as critical thinking, creativity, and digital literacy [22], [23], [24], [25], [26]. This research addresses this gap by investigating how drone-assisted content creation in *pesantren* settings contributes to students' educational and personal development outcomes.

Several solutions have been proposed in the literature to address these challenges. For instance, studies suggest the integration of digital technologies through blended learning or flipped classroom models, where online resources complement traditional in-person instruction [27], [28], [29], [30], [31]. These approaches use technology to enhance learning outcomes and foster student collaboration and engagement. However, while these methods have been successfully applied in various educational contexts, their use in *pesantren* remains underexplored. A key barrier is the cultural and institutional resistance to adopting new technologies in environments deeply rooted in tradition. Additionally, the lack of infrastructure and digital literacy among educators and students in *pesantren* exacerbates these challenges. Thus, there is a need for targeted interventions that can introduce technology in a way that respects the unique cultural and educational contexts of *pesantren* [32], [33], [34], [35].

Building on this need, drones present a specific solution that aligns well with the pedagogical goals of *pesantren* and the broader objectives of OBE. The integration of drone technology facilitates the creation of engaging, high-quality digital content that captures key aspects of the *pesantren* environment, such as student interactions, religious practices, and community life [14], [36], [37]. The process, which involves stages such as footage acquisition, video editing, and online sharing, provides students with opportunities to develop technical skills while engaging with content reflecting Islamic values. Previous studies have shown that drone-assisted learning

can lead to increased student motivation and a deeper connection to the subject matter [38], [39], [40], [41]. Research has demonstrated that when students are involved in the production of digital content, they not only acquire technical skills but also experience a greater sense of ownership and agency in their learning process [33], [42], [43], [44], [45]. This aligns with the OBE framework, which emphasizes achieving specific learning outcomes related to knowledge, skills, and attitudes.

In the context of *pesantren*, the application of drones for digital content creation serves several purposes. First, it offers a novel and engaging way to teach students about media production, a skill that is increasingly vital in the digital age [37], [40], [46]. Second, it enables the creation of content that reflects the values and teachings of Islam, ensuring that the use of technology aligns with the *pesantren's* educational goals. Third, it promotes a sense of community and collaboration among students and teachers as they work together to create and share digital content. Previous research on project-based learning in *pesantren* has shown that such collaborative efforts not only enhance technical skills but also foster interpersonal skills, communication, and teamwork—key outcomes of the OBE framework [47], [48], [49], [50].

A comprehensive literature review reveals several studies on using digital technologies in religious education, including multimedia tools, video production, and digital storytelling. These studies emphasize the positive impact of technology on student engagement, creativity, and learning outcomes [18], [51], [52], [53]. However, a gap remains in the literature regarding the use of drones within the context of *pesantren*. While drones have been explored in various educational environments, their application in Islamic boarding schools is still limited, particularly with project-based learning and OBE frameworks. This gap underscores the need for further research into how drone technology can effectively integrate into *pesantren's* unique cultural and educational environment.

This study aims to address this gap by examining the role of drone-assisted digital content creation in a *pesantren* setting, focusing on how it supports OBE outcomes. The research questions guiding this study include: How does using drones in content creation affect student engagement and learning outcomes in *pesantren*? What specific skills and competencies do students develop through participation in the drone-assisted content creation process? How does this process contribute to the broader objectives of Outcome-Based Education, particularly in terms of cognitive, psychomotor, and affective outcomes? This study seeks to contribute new insights into integrating technology into traditional educational settings and its potential to enhance students' academic and personal development outcomes by addressing these questions.

The novelty of this study lies in its focus on using drones as a tool for digital content creation within the specific context of *pesantren*. This area has not been extensively studied. The findings will contribute to the growing body of literature on the role of digital technologies in religious education, providing valuable insights for educators, policymakers, and researchers interested in integrating technology into traditional educational frameworks. Furthermore, this study aims to demonstrate the effectiveness of drones in enhancing student engagement, creativity, and digital literacy in *pesantren*, ultimately supporting the achievement of Outcome-Based Education goals.

2. Method

This study was conducted at *Pesantren* Anak-anak Tahfidzul Qur'an Raudlatul Falah, in Pati, Central Java. The *pesantren* aims to integrate Islamic religious education with modern technology development, including drones for digital content creation. This location was selected for the study because it has already incorporated technology into its learning process and digital da'wah activities, providing an opportunity to explore how technology can be applied within the context of traditional religious education. The study focuses on the technological intervention in the form of drone-based content creation produced by students, intending to evaluate its impact on student engagement in learning.

This study adopts a qualitative approach to gain an in-depth understanding of the impact of using drones for digital content creation in *pesantren* [54], [55]. The study aims to explore the perspectives of both students and teachers regarding the use of drones in education and their impact on learning outcomes based on Outcome-Based Education (OBE). Data were collected through in-depth interviews, participatory observation, and an analysis of the digital video content produced [56], [57].

The research subjects consisted of two main groups: teachers and students. Two teachers involved in digital content using drones were interviewed to gain insights into their experiences guiding content creation and teaching with this technology. Additionally, fourteen students (*Santri*) who participated in videos created using drones were interviewed to explore their perspectives on how this technology influenced their engagement in learning and the development of their technical and creative skills.

The students involved in this study were purposively selected based on their involvement in video production and their experience using drones in the production process. Their participation in content creation provides insights into how involvement in technology-based activities affects their learning motivation.

Data collection for this study was carried out using three main techniques: First, in-depth interviews, participatory observation, and document analysis [54], [58]. Interviews were conducted with two supervising teachers and ten students involved in video production using drones. These interviews aimed to explore their experiences in participating in the content creation process, their challenges, and their impact on their engagement in learning. The interviews also explored perceived changes in developing technical and creative skills through digital technology. Second, Participatory Observation, the researcher conducted participatory observation of the video production process using drones. Observations were made at each production stage, from filming and editing to the internal screening of videos at the *pesantren*. The researcher also observed the interactions between teachers and students and how they collaborated to produce the content. This observation provided insights into how technology is integrated into the learning process and its impact on classroom dynamics and student engagement. Third, document Analysis, the researcher analyzed 15 videos produced during the content creation. The analysis focused on technical aspects, such as image capture quality, editing, and alignment with Islamic values. Additionally, the researcher assessed how these

videos supported the objectives of Outcome-Based Education, particularly in developing the students' cognitive, psychomotor, and affective competencies.

Data obtained from interviews, observations, and document analysis were analyzed using thematic analysis [59], [60], [61], [62]. This technique was employed to identify key themes related to the experiences of students and teachers in using drones for digital content creation. The analysis process was inductive, with the researcher seeking patterns and relationships between using drones and their impact on student engagement in learning. After participating in the digital content creation process, interviews with teachers and students were analyzed to explore their perceptions of changes in technical skills and religious knowledge.

The video analysis examined the technical quality of the videos, their alignment with the Islamic values taught in the *pesantren*, and their impact on students' understanding of the material. This analysis provided insights into the relationship between the digital content produced and the achievement of Outcome-Based Education learning outcomes. To ensure the validity and reliability of the study's findings, the researcher employed data triangulation by collecting data from various sources, including interviews with teachers and students, observations of the video production process, and analysis of the produced videos [63], [64], [65]. The researcher also employed member checking, asking participants (teachers and students) to verify the interview results and the interpretations made by the researcher to ensure the accuracy and consistency of the data. As a result, the study is expected to provide a more profound and valid understanding of the impact of using drones in *pesantren* learning. This study uses a structured qualitative approach to provide deep insights into how technology, specifically drones, can support the achievement of outcome-based education in *pesantren* and identify the skills developed by students involved in digital content creation.

3. Results and Discussion

3.1 Result

This study aims to explore the impact of drone technology in digital content creation on student engagement, technical skills, and the achievement of learning outcomes based on Outcome-Based Education (OBE) at *Pesantren* Anak-anak Tahfidzul Qur'an Raudlatul Falah. Through drone-based video production, which involves six structured stages—drone footage acquisition, video editing using *CapCut Pro*, creative editing, internal screening, online uploading, and social media sharing—this research demonstrates significant results across pedagogical, technical, and social dimensions.

Drone Intervention Procedure

Drone-Based Footage Acquisition

Integrating drone-assisted digital content creation in the *pesantren* environment has notably transformed student engagement and educational outcomes. The six-stage process—drone footage acquisition, editing with *CapCut Pro*, creative editing, internal

screening, online uploading, and social media sharing—resulted in multifaceted outcomes across pedagogical, technical, and social dimensions.

The deployment of drones for footage acquisition provided dynamic aerial shots, greatly enhancing the cinematic quality of the produced videos. Four trained teachers operated the drone equipment, capturing scenes from the *pesantren* environment, student interactions, and Islamic activities. Introducing this advanced technology stirred excitement among the students, and 40 selected *Santri* (Islamic boarding school students) voluntarily participated as actors in the video content. This immersive experience contributed to their learning and strengthened their sense of identity and ownership in the educational process. The students could perceive themselves as active contributors to the learning process and content creation, fostering a deeper connection to their education.

Video Editing with CapCut Premium

Following footage acquisition, the editing phase utilized *CapCut Pro*, which facilitated high-resolution video processing, advanced visual effects, smooth transitions, and included Arabic and Indonesian subtitles. Additionally, background nasheeds or Quranic recitations were incorporated, aligning the content with the religious values of the *pesantren*. Teachers collaborated during this phase to ensure the final product reflected Islamic principles and the *pesantren's* pedagogical goals. Some *Santri* were introduced to basic video editing techniques, providing them with valuable technical skills that enhanced their learning experience. This skill-based approach contributed to their personal and academic growth, offering them practical skills in digital media production.

Internal Screening

After editing, the final videos were screened internally in the *pesantren* hall, with all participants in attendance, including the *kiai*, *ustadz*, and fellow *Santri*. This screening served as a platform for reflection and feedback. Oral reflections were gathered alongside structured observation checklists to assess the effectiveness of the video content. During this phase, students expressed feelings of pride and inspiration from viewing the content they helped create, while teachers observed significant improvements in communication and collaboration skills among participants. This phase highlighted the positive impact of collaborative video production in fostering a sense of community and enhancing interpersonal communication among students and teachers.

Upload and Sharing

Following the internal screenings, the finalized videos were uploaded to various digital platforms, including *YouTube*, *TikTok*, and the *pesantren's* official Instagram account. Within the first week of upload, the average view count per video exceeded 2,000

views, demonstrating the broad appeal and engagement the videos garnered. The content attracted attention from a diverse audience, including alumni and Muslim youth communities. This increased visibility elevated the *pesantren's* digital presence, positioning it as an active participant in the digital landscape. In turn, the *Santri* began to view themselves as agents of *dakwah* (Islamic outreach) through digital storytelling. The ability to share their work on these platforms expanded their understanding of how digital media can be harnessed for religious and educational purposes, instilling a sense of empowerment.

Additional Applications Used

In addition to *CapCut Pro*, several other supporting applications were used throughout the video creation process: 1) *Canva Pro*: Used to design engaging video thumbnails and social media posters to attract viewers and enhance the visual appeal of the content. 2) VN Video Editor: Employed as a secondary tool for adding voiceovers, enabling the incorporation of supplementary narration or explanations within the video. 3) Google Drive: Served as a collaborative platform for file sharing among teachers, ensuring smooth communication and coordination during the editing and production stages. 4) *YouTube Studio*: Utilized to manage video analytics, track viewer engagement, and evaluate the effectiveness of the videos across various digital platforms.

These applications, combined with *CapCut Pro*, facilitated the efficient production, sharing, and evaluation of the content, contributing to the project's success and alignment with educational goals (see Fig. 1).

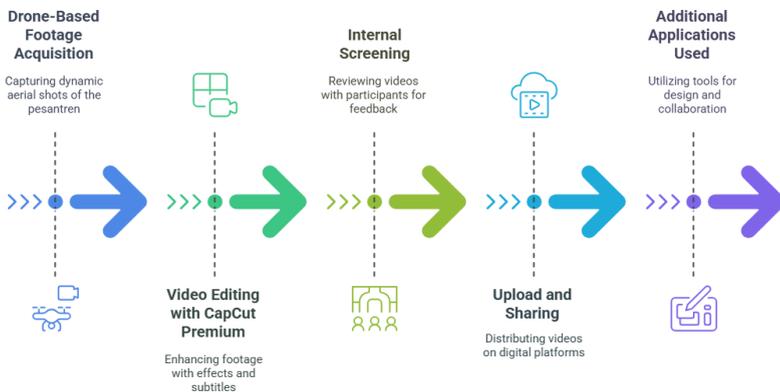


Fig. 1. Drone Intervention Procedure in *Pesantren* Education

Integrating drone-assisted digital content creation in the *pesantren* led to significant changes in student engagement, skill development, and educational outcomes. Through a structured process of footage acquisition, editing, internal screening, and online sharing, students acquired valuable technical skills in video production while deepening their understanding of Islamic teachings. The intervention also fostered a sense of

community and collaboration among students and teachers. The final videos, widely shared across digital platforms, enhanced the *pesantren's* digital presence and empowered the *Santri* to see themselves as active participants in modern religious and educational outreach. These outcomes underscore the effectiveness of integrating digital media into traditional academic settings, offering new pathways for student engagement and learning.

Drones allowed for dynamic shots that added cinematic value to the video content. In interviews with two teachers, they noted that drone technology was invaluable in providing a more captivating and in-depth view of the *pesantren* life, which could not be achieved with traditional filming methods. Teacher 1 added, "With drones, we can showcase the *pesantren* from a wider perspective, making the *Santri* prouder of their environment."

Table 1. Interview results: event selection and drone use in the video production process

Theme	Informant	Frequency	Interpretation
Event selection based on Islamic values	Teacher 1, Teacher 2	2/16	Selecting a theme aligned with Islamic values is a priority in video production.
Use of drones	Teacher 1, Teacher 2	2/16	Drones were used to provide a new visual perspective, enhancing video quality.
<i>Santri's</i> perception of the video	<i>Santri</i> 1, <i>Santri</i> 5, <i>Santri</i> 7	3/16	<i>Santri</i> found the video engaging and profoundly impacted the <i>pesantren's</i> lives.

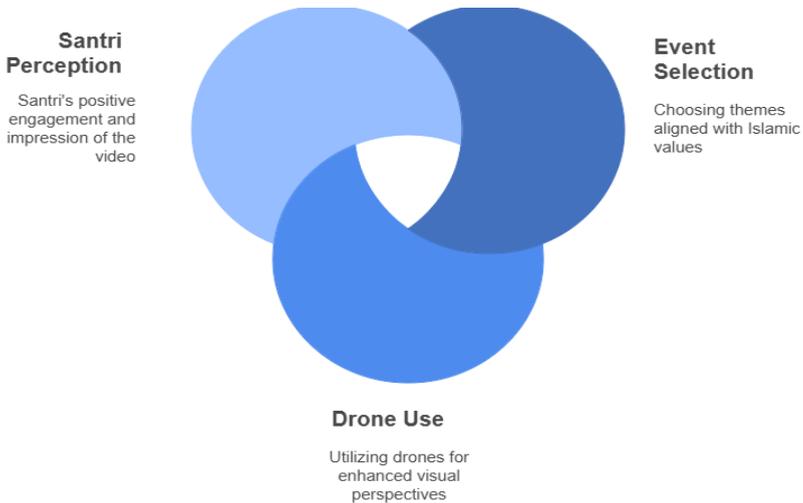


Fig. 2. Enhancing video production with Islamic values

The interview results show that teachers and *Santri* recognized the importance of selecting events that reflect Pesantren values. At the same time, drone usage added visual appeal and instilled a sense of pride among the *Santri* for their Pesantren environment.

The Role of *Santri* as Actors in the Video

Although the *Santri* were not involved in the content creation or editing processes, they played an essential role as video actors. They actively participated in the filming, portraying students, teachers, or other roles in line with the teacher's chosen theme. In interviews, many *Santri* expressed their pride in being part of the video, which depicted their life at the *pesantren*. 1 *Santri*, *Santri* 6, stated, "*I am very proud to be part of this video because I can show others how we learn and worship at the pesantren.*"

Table 2. Interview Results: The Role of *Santri* in Video Production

Theme	Informant	Frequency	Interpretation
The active role of <i>Santri</i> in the video	<i>Santri</i> 1, <i>Santri</i> 3, <i>Santri</i> 6	3/16	<i>Santri</i> felt more involved in the learning process through their roles in the video.
<i>Santri</i> satisfaction with their roles	<i>Santri</i> 4, <i>Santri</i> 8, <i>Santri</i> 10	3/16	Being involved in video production brought personal satisfaction and pride in the process.
Engagement in representing the <i>pesantren</i>	<i>Santri</i> 2, <i>Santri</i> 5	2/16	<i>Santri</i> felt they had a role in representing <i>pesantren</i> life to the audience.

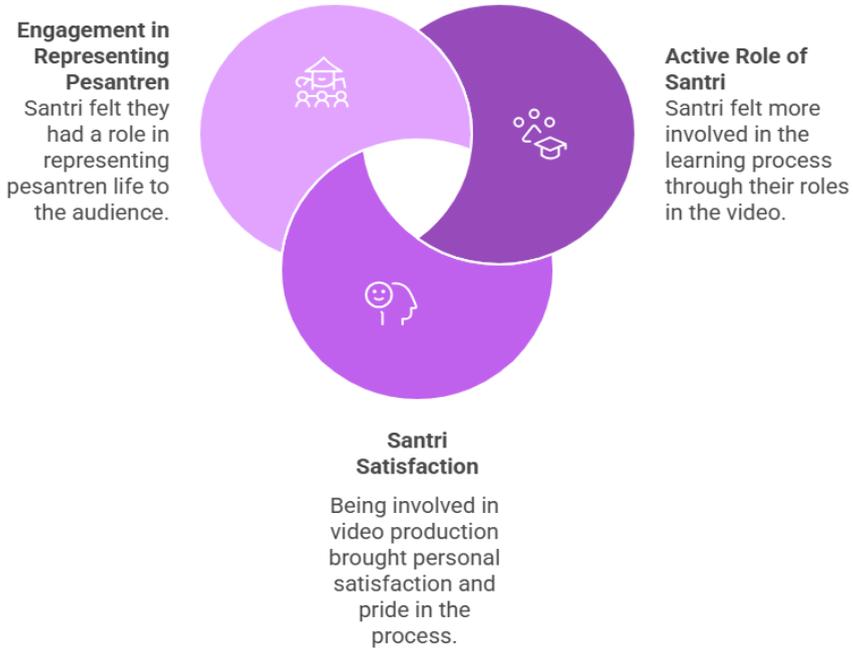


Fig. 3. *Santri* involvement in video production

The interview results indicate that while the *Santri* were not technically involved in content creation, they felt more connected and had a role in the representation of the *pesantren* through the video. This increased their sense of involvement and ownership of the learning outcomes.

Skill Development of *Santri*: From Active Roles to Technical Skill Enhancement

Although the *Santri* were not directly involved in video editing or drone operation, their participation in video production allowed them to develop new skills. Interviews with several *Santri* revealed that they better understood how the video production process works, including communicating in front of a camera and how their activities at the *pesantren* would be visually represented.

Table 3. Interview results: Skill development of *santri* through video production

Theme	Informant	Frequency	Interpretation
Communication skills	<i>Santri</i> 2, <i>Santri</i> 4, <i>Santri</i> 7	3/16	<i>Santri</i> learned to communicate better in front of the camera and contribute to video content creation.
Teamwork skills	<i>Santri</i> 5, <i>Santri</i> 9, <i>Santri</i> 10	3/16	Collaboration in video production enhanced the <i>Santri</i> 's teamwork skills.

Understanding visual technology	<i>Santri 3, Santri 6</i>	2/16	<i>Santri gained insights into how technology is used to document pesantren life.</i>
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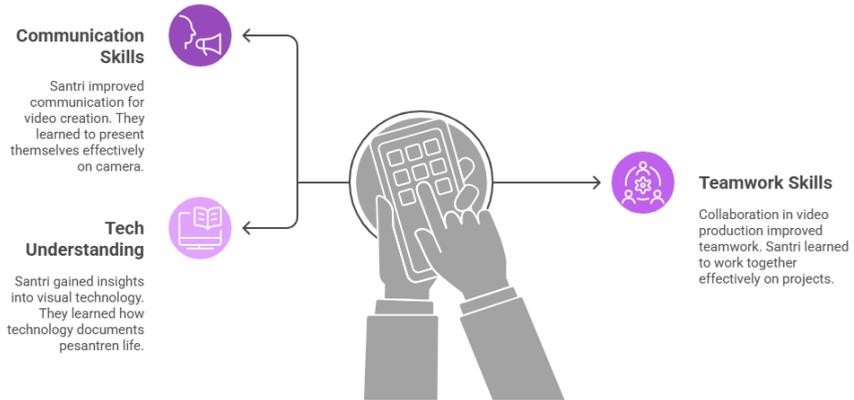


Fig. 4. *Santri* skill development

The interview findings demonstrate that although *Santri*'s involvement was limited to their roles as actors, they still developed essential skills relevant to the video production process, such as communication and teamwork. Despite not operating the drone or editing the video, they understood the entire process comprehensively.

Impact of Drone Use on Outcome-Based Education (OBE)

The drone-based video production process significantly impacted the achievement of learning outcomes grounded in Outcome-Based Education (OBE). Interview results revealed that this technology helped develop the *Santri*'s cognitive, psychomotor, and affective skills. First, cognitive, *santri* understood how to create narratives, act, and work with technology in digital content creation, which expanded their understanding of the concepts being taught. Second, psychomotor, although they were not involved in drone operation, their participation in video production enhanced their communication and collaboration skills. Third, effectively, *Santri* felt more motivated, confident, and inspired to actively engage in religious learning and digital *dakwah* (Islamic outreach) through the videos they helped create.

Table 4. Interview results: impact of drone use on OBE

OBE Dimension	Informant	Frequency	Interpretation
Cognitive	<i>Santri 1, 4, 8</i>	3/16	<i>Santri</i> gained a deeper understanding of narrative concepts and visual media in learning.

Psychomotor	<i>Santri</i> 2, 5, 9	3/16	Participation in video production helped <i>Santri</i> develop communication and teamwork skills. <i>Santri</i> felt more confident and motivated to participate in digital <i>dakwah</i> activities.
Affective	<i>Santri</i> 3, 7, 10	3/16	

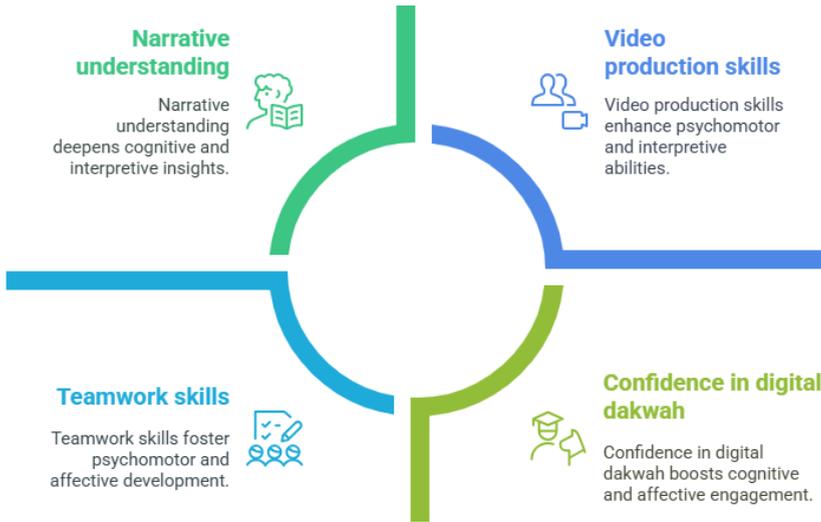


Fig. 5. *Santri* Learning Outcomes by dimension

The interview results suggest that using drones positively impacted all three OBE dimensions: cognitive, psychomotor, and affective. The *Santri* developed new understandings of digital media and technical skills and felt more engaged and motivated in their learning process.

Based on the research findings, it can be concluded that using drones in digital content creation at the *pesantren* positively impacted the *Santri*'s involvement in their learning. Although their role was limited to acting in the video, they felt more connected to the learning process and acquired new skills in communication, teamwork, and understanding of technology. The drone-based video production process supported learning outcomes across cognitive, psychomotor, and affective dimensions and strengthened the *pesantren*'s role in technology-based education.

3.2 Discussion

This study aims to explore the impact of drone technology in digital content creation on student engagement, technical skills, and the achievement of learning outcomes based on Outcome-Based Education (OBE) at *Pesantren* Anak-anak Tahfidzul Qur'an

Raudlatul Falah. The findings demonstrate a positive impact of drone usage in enhancing student engagement, enriching their learning experience, and supporting technical and affective skills development. This chapter will discuss these findings in light of related theories, compare them with previous studies, and identify elements that bring novelty to technology-based education.

Impact of Drone Use on Student Engagement

Student engagement in the drone-based video content creation process was more intensive than conventional learning approaches. According to the research findings, the video production process, which involved drone footage acquisition, advanced editing software, and collaboration between teachers and students, fostered a more dynamic learning environment. This aligns with the engagement theory in education proposed by [2], [66], which posits that student engagement involves cognitive, affective, and behavioral aspects that can be enhanced through technology-based learning.

The study shows that student engagement in the video production process was not limited to technical aspects but also enriched their affective experiences. As [67], [68], [69], [70] explain, emotional engagement in learning is closely related to increased motivation and student identity, as reflected in the pride expressed by students after viewing the videos they helped create. In this context, drones function not only as a technological tool but also as a catalyst for building emotional connections between students and their learning material.

Development of Technical Skills and Collaboration

One of the key findings of this study is the development of technical skills among the students, even though they were not directly involved in operating the drones. The students' involvement as actors in the videos and their participation in the collaborative process allowed them to learn about visual communication and digital content creation techniques. According to the constructivist learning theory proposed by Piaget and Vygotsky, learning focused on social interaction and practical experience, such as in video production, can enhance technical and social skills [71], [72].

Additionally, involvement in drone-based video production also improved collaboration skills among students. As [73], [74], [75] emphasize, collaborative learning can enhance students' ability to work together, share ideas, and solve problems collectively. In this case, the video production process enabled students to interact within teams, work alongside teachers, and share ideas and opinions about the content being created. These skills are highly relevant in the digital world, which increasingly prioritizes teamwork in technology-based projects.

Impact on Outcome-Based Education (OBE)

The use of drones in video content production also significantly impacted the achievement of learning outcomes based on Outcome-Based Education (OBE). The study's findings indicate that drones enhanced student engagement in learning and

enriched OBE's cognitive, psychomotor, and affective dimensions. As [76], [77], [78] explained, OBE focuses on achieving measurable learning outcomes and developing students' competencies in various aspects. This study supports this concept by demonstrating that students developed new skills in visual storytelling, digital technology usage, and communication in front of a camera.

The cognitive dimension involved students' understanding of narrative structures, filming techniques, and video editing processes. Students engaged in video production comprehended how visual media is used to communicate messages, which aligns with the OBE principles that emphasize students' mastery of skills and knowledge [72], [79]. On the other hand, students' psychomotor skills are also developed through practical experiences such as working in production teams and communicating via visual media.

From an affective perspective, students' involvement in drone-based video creation led to increased motivation and self-confidence. This aligns with previous research by Skinner and Belmont (1993), which found that student engagement in activities that provide a sense of achievement can enhance self-confidence and intrinsic motivation.

Use of Drone Technology in *Pesantren* Education Context

One significant contribution of this study is introducing drone technology in the *pesantren* educational context, which is traditionally known for its religious education approach. The use of drones as a tool to enhance video content quality represents an innovative step that connects religious education with modern technology. This demonstrates the potential for *pesantren* to adapt to contemporary developments without sacrificing their traditional values.

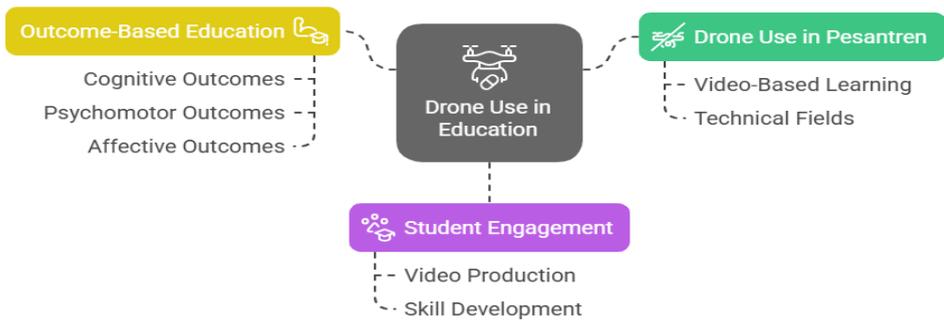
Technological innovations in *pesantren* education can enrich the teaching and learning process, increase student engagement, and help *pesantren* expand their outreach through digital media. The use of drones in video content production at *Pesantren* Anak-anak Tahfidzul Qur'an Raudlatul Falah not only introduced new technology but also provided students with the opportunity to develop skills relevant to today's digital world [17], [80], [81], [82], [83].

Novelty of the Study and Its Contributions

One of the novel aspects of this study is the application of drone technology in *pesantren* education, an area that has been underexplored in existing literature. Most research related to drones has focused on technical or artistic fields, while its application in religious education remains limited. By combining drone technology with an OBE approach, this study paves the way for further development in technology adoption in *pesantren*, particularly in enhancing digital skills among students.

Table 5. Comparison of Findings in This Study with Previous Research

Theme	This Study	Previous Research	Novelty
Drone Use in Education	Drones used in video-based learning content in <i>pesantren</i>	Drones used in technical or artistic fields [84]	Application of drones in <i>pesantren</i> education and OBE
Student Engagement	Students involved in video production and skill development	Student involvement limited to theory or conventional activities [85]	Emotional and social engagement through digital media
Outcome-Based Education (OBE)	Impact on cognitive, psychomotor, and affective learning outcomes	Focus on technical and academic skill development [78]	Integration of OBE in <i>pesantren</i> education with digital technology

**Fig. 6.** Santri Drone use in Education

This study provides valuable insights into the impact of drone technology in *pesantren* education, particularly in enhancing student engagement and achievement of Outcome-Based Education learning outcomes. While the study was limited to one *pesantren*, the findings demonstrate a significant potential for others to adopt technology in their teaching, especially to improve students' technical and affective skills. Thus, integrating technology into religious education could become an effective model for enriching the student learning experience and strengthening the role of *pesantren* in digital *dakwah* (Islamic outreach).

4. Conclusion

This study explores the impact of drone technology in digital content creation on student engagement, their technical skills, and the achievement of learning outcomes based on Outcome-Based Education (OBE) at *Pesantren* Anak-anak Tahfidzul Qur'an Raudlatul Falah. This research's main findings indicate that using drones in digital video production significantly enhanced student engagement in the learning process across cognitive, psychomotor, and affective dimensions. Students' involvement in

video production, though limited to acting roles, enhanced their collaboration, communication, and understanding of digital technology. Additionally, drones positively enriched OBE-based learning, allowing students to develop technical skills while fostering an appreciation for religious values in the digital context.

The implications of these findings suggest that drone technology functions not only as a visually engaging learning aid but also contributes to deeper and more contextual learning, particularly in religious education. Implementing drones in *pesantren* allows students to engage in activities relevant to the evolving digital world while maintaining religious values. This opens avenues for other *pesantren* to adapt technology in their educational processes, especially to increase student engagement in digital *dakwah* and introduce new skills required in an increasingly connected technological world.

This study contributes to the existing body of knowledge by introducing drone technology in *pesantren* education, a field previously limited to technological use in engineering or the arts. The research not only enriches the understanding of the impact of technology in religious education but also provides new insights into the use of Outcome-Based Education (OBE) in the *pesantren* context. Further research could examine the long-term effects of this technology in enhancing the quality of *pesantren* education and expand understanding of how technology can be more integrative in teaching religious values. However, this study is limited to a single *pesantren*, so additional research across various *pesantren* is needed to explore broader implementations and impacts.

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