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Implementation of the TPACK Approach in Islamic Religious Education Learning at SMA Negeri Karanganyar

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ABSTRACT

This research aims to describe and analyze the implementation of the Technological Pedagogical and Content Knowledge (TPACK) approach in Islamic Religious Education (PAI) learning at SMA Negeri Karanganyar. TPACK is a conceptual framework that combines three main components in modern learning, namely content mastery, pedagogical strategies, and the use of technology. In the context of PAI learning, the application of this approach is important to address the challenges of the digital era without losing the essence of religious values. This study uses a descriptive qualitative approach with data collection techniques in the form of observations, in-depth interviews, and documentation involving teachers, students, and learning materials. The research results show that the teachers' mastery of content knowledge is quite good, but the pedagogical and technological aspects have not been optimally integrated. The learning strategies are still conventional and teacher-centered, while the use of technology is limited to non-interactive visual presentation media. The Lesson Implementation Plan (RPP) does not yet reflect a systemic synergy between technology, pedagogy, and content. The obstacles faced include a lack of practice-based technical training, limited technological infrastructure, and cultural resistance to the digitalization of religious education. In conclusion, the implementation of TPACK in PAI learning at SMA Negeri Karanganyar is still in its early stages and requires strengthening in the aspects of planning, execution, and institutional support. Improvement strategies are needed in the form of structured training, provision of digital facilities, and reform of pedagogical culture to encourage more contextual, participatory, and adaptive PAI learning in the digital era.

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INTRODUCTION

The transformation of technology in the world of education is an inevitability that cannot be avoided in the era of the Fourth Industrial Revolution and the transition to Society 5.0.The need for learning that is not only informative but also interactive and collaborative requires teachers to develop multidimensional competencies.In this context, mastery and application of the Technological Pedagogical and Content Knowledge (TPACK) approach become a prerequisite for the success of modern learning.The TPACK concept, as developed by Wijayanto, B, Utomo, unites three main components in teaching, namely: content knowledge, pedagogical knowledge, and technological knowledge within an integrated framework that supports the effectiveness of 21st-century learning [1].

Islamic Religious Education (PAI) is one of the fields of study that has strategic urgency in shaping the character and moral values of students.However, PAI learning often experiences stagnation in methods and minimal technological innovation, especially in public schools that tend to focus on exact subjects.This can be observed at SMA Negeri Karanganyar, where PAI learning is still limited to conventional methods with underutilized technology.Based on the initial observations, it was found that the use of technology by PAI teachers was limited to the use of presentation media and learning videos, without thorough pedagogical planning and deep content integration.Meanwhile, data from the Center for Data and Information Technology (Pusdatin) of the Ministry of Education, Culture, Research, and Technology in 2023 recorded that only about 34.5% of high school teachers in Central Java Province demonstrated high

competence in technology integration in TPACK-based learning.This indicates a significant gap between the demands of digital learning policies and teachers' competencies, including in PAI (Islamic Religious Education) [2].

Based on the background described above, this research focuses on the implementation of the TPACK approach in Islamic Religious Education (PAI) learning at SMA Negeri Karanganyar, specifically in terms of its effectiveness and contextual adaptability in responding to technological advancements. Additionally, there are obstacles and challenges encountered by PAI teachers when implementing the TPACK approach, which necessitate detailed identification and analysis to enhance the overall quality of instruction. Furthermore, it is essential to explore and describe the strategies adopted by PAI teachers to overcome these challenges, ensuring learning remains effective, contextual, and adaptive in the face of rapid technological development.

Several previous studies have examined the application of TPACK in the context of education, but most have focused on exact or science subjects.Research by Widodo shows that the use of TPACK in PAI learning at SMA Negeri Bantul increases student engagement, but has not yet delved deeply into the aspect of digital curriculum planning. Odiana in her research in Malang identified that teachers understand TPACK theoretically but have difficulty applying it due to a lack of training [3]. Rassool revealed that intensive TPACK training positively impacts teachers' creativity in developing teaching media based on Islamic applications [4]. Meanwhile, Dawana, I R Setiani emphasize the importance of collaboration among teachers in the development of TPACK-based digital teaching content [5]. Research by Kurniawan in the Pekalongan region shows that although the technical skills of PAI teachers are still limited, their enthusiasm for innovating with simple tools is quite high [6].Of the five studies, none have specifically examined the implementation of TPACK among PAI teachers in public schools in the Karanganyar region, creating a gap that warrants further in-depth investigation.

The purpose of this research is to describe the implementation of the TPACK approach in PAI learning by teachers at SMA Negeri Karanganyar, identify the obstacles and challenges faced by teachers in the process of TPACK implementation, and formulate strategies to strengthen TPACK competencies for PAI teachers in order to improve the quality of technology-based learning and Islamic values [7].

The significance of this research lies in its focus on PAI teachers in public school environments, which has not been extensively studied in TPACK implementation research.In addition, this research not only captures the level of teachers' understanding of the TPACK concept but also empirically examines the practice of technology integration in teaching Islamic values, including lesson planning, assessment strategies, teaching media, and student responses [8]. This research is expected to provide conceptual and practical contributions to the development of TPACK-based PAI learning models that are adaptive to the times and remain grounded in strong spiritual values.

LITERATURE REVIEW

The TPACK concept was first introduced by Sianturi in response to the need for the integration of content, pedagogical, and technological knowledge in educational practice [9]. TPACK has become an important conceptual framework for teachers in developing learning that not only focuses on mastering the content (Content Knowledge/CK), but also understanding how the content is taught (Pedagogical Knowledge/PK) and supported by the appropriate use of technology (Technological Knowledge/TK). These three elements must synergize to produce an effective, contextual, and responsive learning process to the demands of the times [10].

According to Alfiana the implementation of TPACK in Islamic Religious Education requires teachers not only to convey religious material but also to present it in a form relevant to digital developments.Teachers need to have lesson plans (RPP) that incorporate elements of technology, teaching strategies, and Islamic content in an integrated manner

[11]. Japar, This creates a deeper, more critical, and meaningful learning experience for Muslim students in the digital era [12].

The important components in TPACK include seven domains: CK, PK, TK, PCK (Pedagogical Content Knowledge), TPK (Technological Pedagogical Knowledge), TCK (Technological Content Knowledge), and TPACK as a form of full integration. Each plays an important role in building a framework for teachers to design and implement technology-based learning systematically [13].

Research by Pradana shows that most Religious Education teachers in Indonesia have understood the importance of the TPACK framework, but still face difficulties in implementing technology creatively and contextually [14]. Setemen This is due to the lack of structured training and minimal supporting facilities in schools, especially at the secondary level in rural areas [15].

Thus, mastery of TPACK is not only technical but also conceptual and contextual.Teachers need to understand the basic philosophy of education, Islamic values, and the psychological dynamics of students in order to choose the right technology and not just follow trends [16]. This is where the importance of practice-based training tailored to the characteristics of the subject matter and school culture comes in.

The TPACK framework requires teachers not only to 'use' technology but to 'integrate' with technology in packaging materials and teaching strategies.The use of applications like Canva, Padlet, or interactive videos is not just a visual aid, but should be part of instructional strategies that foster student engagement, creativity, and collaborative learning [17]. Unfortunately, many teachers still do not understand that the use of technology is not the goal, but rather a means to deepen content understanding.

These studies emphasize that the TPACK approach is a strategic approach that must be developed through long-term training, critical reflection, and continuous evaluation in learning practices, especially in fields considered "conventional" such as Islamic Religious Education [18]. Therefore, TPACK can serve as a foundation for reforming religious teaching approaches to be more adaptive and contextual to the challenges of the times.

The integration of the TPACK approach in Islamic Religious Education (PAI) learning becomes a strategic step in addressing the needs of 21st-century education [11]. Islamic Religious Education (PAI) learning not only emphasizes cognitive aspects but also shapes students' character, spirituality, and morality.Therefore, PAI teachers must be able to design learning that integrates mastery of religious material (Content Knowledge/CK), contextual and reflective delivery strategies (Pedagogical Knowledge/PK), and appropriate technological support (Technological Knowledge/TK) [19]. TPACK bridges the three, enabling teachers to convey Islamic teachings in a way that is relevant to students' lives and their digital environments.

Andri Nirwana suggest that the integration of TPACK in Islamic Education (PAI) can be achieved by developing a Lesson Plan (RPP) that explicitly includes the use of technology as a pedagogical tool [7]. For example, the use of interactive Islamic history videos to explain the prophetic biography, or the utilization of digital quizzes based on applications like Quizizz to assess students' understanding of moral verses. Ardiansyah In this study, teachers who consciously integrate technology are able to enhance student engagement and strengthen understanding of religious values [20].

Furthermore, the integration of TPACK in PAI allows for the delivery of abstract material to become more concrete.As examined by Indiani, the use of visual digital media can reduce misconceptions in understanding the conceptual teachings of fiqh or creed [21]. For example, digital simulations of the ablution procedure or animations related to the pillars of faith can facilitate students in effectively internalizing these values [22].

The TPACK approach also encourages teachers to innovate in developing project-based or collaborative learning materials.In a study by Kadis, the TPACK-based Project-Based Learning (PJBL) model in Islamic Education (PAI) proved

effective in increasing students' interest in learning while also fostering 21st-century skills such as critical thinking and teamwork.With this integration, students are not only invited to understand Islam as a dogma but also as a practical guide for various contexts of modern life [23].

However, the integration of TPACK in PAI is not merely about adding technology to the learning process.As emphasized by Amin, A et al, teachers must understand pedagogical principles based on Islamic values and align them with the use of technology.In many cases, integration failures occur because teachers use technology without pedagogical and spiritual considerations, causing learning to become detached from the goal of Islamic character building [16].

Furthermore, the integration of TPACK in Islamic Education (PAI) can open up dialogue spaces among students to discuss contemporary issues from an Islamic perspective, for example through online discussion forums or reflective vlogs [24]. This not only enhances students' critical thinking skills but also shapes an inclusive and contemporary Islamic identity.With TPACK, PAI teachers are no longer the sole source of knowledge, but rather facilitators in the process of value exploration by students.

Therefore, the integration of TPACK in PAI is a necessity.It not only updates teaching methods but also expands the meaning of religious learning into active, reflective, and contextual activities [25]. Successful integration requires a balanced combination of technical, pedagogical, and spiritual competencies, as well as the commitment of teachers to continuously adapt and innovate.

The implementation of the TPACK approach in public schools has its own urgency, considering the characteristics of these educational institutions as implementers of the national curriculum with uniform standards and diverse resources [26]. The relevance of TPACK in public schools, particularly in PAI (Islamic Religious Education) learning, is evident from the need for learning innovations that can address the challenges of the digital era without diminishing the substance of spiritual values. PAI teachers in public schools often face limitations both in technology mastery and infrastructure support, so the TPACK approach can be a solution to optimize the teaching and learning process more effectively [27].

According to the research by Alfiana et al, although some PAI teachers in public schools have a fairly good understanding of the TPACK components, their implementation is still weak due to the lack of practice-based training and limited technological resources in schools. Teachers often only use technology as a visual supplement, rather than as part of an integrated instructional design [11].

Infrastructure limitations, such as internet access, projectors, or digital classrooms, also serve as major obstacles to the implementation of TPACK in public schools [19]. This is reinforced by the findings of Setyo, which show that the effectiveness of TPACK-based learning highly depends on school administrative support, including the provision of facilities and policies for ongoing teacher training.

The relevance of this approach in public schools is also marked by the heterogeneity of the students. On one hand, the diversity of students' social, economic, and digital literacy backgrounds presents its own challenges [28]. However, on the other hand, this actually emphasizes the importance of the TPACK approach to ensure that every student has access to contextual and inclusive learning. Teachers must be able to adjust technology to the students' abilities and create a fair and participatory learning environment.

METHODOLOGY

This research uses a descriptive qualitative approach aimed at deeply illustrating the implementation of the TPACK (Technological Pedagogical and Content Knowledge) approach in Islamic Religious Education (PAI) learning at SMA Negeri Karanganyar. This approach was chosen because it allows researchers to understand the learning phenomenon

in a holistic and contextual manner from the perspective of educational practitioners, especially teachers.The research location was set at SMA Negeri Karanganyar, Karanganyar Regency, Central Java Province, with the implementation period from March to April 2025. The selection of the location is based on the consideration that this school is a public educational institution that has begun to implement digital learning, but it is not yet known to what extent the TPACK approach is integrated into the Islamic Religious Education subject [31].

The research subjects are Islamic Religious Education teachers at the school, who were purposively selected based on criteria including: actively teaching, using technology in the learning process, and being willing to serve as informants.To enrich the data and strengthen its validity, additional informants were also taken from students and the vice principal in charge of the curriculum.Data collection techniques were carried out through three main methods, namely observation, in-depth interviews, and documentation [32]. Participatory observation is used to directly observe the implementation of classroom learning, especially the use of technology and pedagogical strategies applied by the teacher.In-depth interviews were conducted in a semi-structured manner to explore the understanding, experiences, and challenges faced by teachers in implementing the TPACK approach.Meanwhile, documentation studies are used to complement the data by analyzing syllabi, lesson plans, teaching media, and other supporting documents.

The collected data is analyzed using the interactive model from Miles and Huberman, which includes three stages: data reduction, data presentation, and conclusion drawing or verification.Data reduction is carried out to filter and focus on relevant information, data presentation is done in the form of descriptive narratives and thematic matrices, while conclusion drawing is done gradually and continuously verified to ensure the validity of the results [14]. To enhance data validity, source and technique triangulation were conducted, as well as member checks by confirming preliminary findings with the relevant informants.With this approach, it is hoped that the research can produce a comprehensive understanding of how PAI teachers implement TPACK in classroom learning practices, as well as identify the supporting and inhibiting factors encountered in the process.

RESULTS

Based on classroom observations and in-depth interviews with five Islamic Religious Education (PAI) teachers at SMA Negeri Karanganyar, it was found that teachers' understanding of the Technological Pedagogical and Content Knowledge (TPACK) framework remains largely conceptual and has not yet been fully implemented in practice. While teachers are aware of the importance of integrating content, pedagogy, and technology, this integration is not yet systematically evident in either lesson planning or classroom instruction.

In terms of Content Knowledge (CK), PAI teachers demonstrated strong mastery of the subject matter. This is evident in their ability to design curriculum-aligned lesson plans and deliver content on creed (aqidah), worship (ibadah), and ethics (akhlak) using textual approaches based on the Qur'an and Hadith. One teacher remarked during the interview, "*We understand the core content of PAI very well, but often struggle to connect it with technology because we're not used to it*." This strong content foundation provides a solid base for future TPACK integration, though synergy with pedagogical and technological elements remains underdeveloped.

Regarding Pedagogical Knowledge (PK), the teaching strategies employed are still predominantly lecture-based and involve conventional discussions. Classroom observations in three grade XI classes showed that instruction was teacher-centered, with limited student engagement or active participation. This method was chosen because it is seen as most appropriate for the nature of the subject matter. However, collaborative strategies such as project-based or inquiry-based learning, especially those incorporating technology, have not yet been introduced. One teacher explained, "*Lecturing is our go-to method because it's efficient and matches the content, but we acknowledge that we haven't tried many student-centered or tech-enhanced methods*."

Table 1. Teachers' Mastery of TPACK Components

TPACK Component	Mastery Indicators	Key Findings	% of Teachers
Content Knowledge (CK)	Ability to prepare curriculum-based lesson plans; mastery of creed, worship, ethics	High	100%
Pedagogical Knowledge (PK)	Use of active strategies, collaborative methods	Low (lecture-dominated)	20%
Technological Knowledge (TK)	Use of interactive tech and digital platforms	Low (basic tools only)	40%
TPACK Integration	Integration of the 3 components in planning and instruction	Not yet systemic	10%

In terms of Technological Knowledge (TK), teachers use basic technology tools such as PowerPoint and educational videos, but these are primarily one-way and lack interactivity. Analysis of lesson plans (RPP) and syllabi revealed that technology was not yet a structured component of lesson planning. There were some references to digital media, but no clear indicators of TPACK-based learning objectives. Digital platforms like Google Classroom, Quizizz, or other learning management systems (LMS) were not consistently used. Technology is still viewed as a supplementary tool rather than an integrated part of instructional strategy.

Table 2. Comparison of Lesson Plans vs. Classroom Practice

Learning Element	In Lesson Plan	In Practice (Observation)	Alignment
TPACK-based Objectives	Not present	Not observed	Low
Use of Digital Media	Mentioned vaguely (videos)	Only PowerPoint & YouTube	Moderate
Active Learning Strategies	Not mentioned	Not implemented	Low

Interviews revealed several challenges in implementing the TPACK framework. A key issue identified by all teacher participants was the lack of specific, hands-on training related to digital tools for teaching PAI. Most professional development activities were too general and failed to address the specific pedagogical needs of Islamic education. One teacher noted, "*We often attend ICT training, but it focuses more on digital administration rather than how to teach PAI using technology.*"

Infrastructural limitations also hinder effective TPACK integration. Observations showed that only about 40% of classrooms were equipped with projectors, and internet connectivity across the school was unreliable. Several teachers reported using their own mobile data to access and present digital content. These disparities contribute to the inconsistent use of technology in daily lessons.

On the student side, interviews with eight students from grades X and XI revealed a generally positive attitude toward the use of technology in PAI classes. Students mentioned that visual media like videos and animations helped them better understand abstract religious concepts. One student stated, "*When there's a video, I understand the material better than just listening to a lecture, but it's used only occasionally*." However, they also noted that the use of digital tools varied greatly and depended on the individual teacher.

Table 3. Students' Perceptions of Technology in PAI Learning

Statement	Agree (%)	Disagree (%)	Qualitative Notes
Videos help me understand better	87.5% (7 of 8 students)	12.5%	Appreciated when used regularly
Technology is used consistently	25%	75%	Depends on the teacher
I prefer interactive learning	62.5%	37.5%	Want more digital activities like quizzes

Overall, field data indicate that the implementation of the TPACK approach in PAI learning at SMA Negeri Karanganyar is still in its early stages. Teachers show potential and enthusiasm for adopting this framework, but their efforts are limited by structural, technical, and training-related constraints. The TPACK model has not yet become a dominant paradigm in the teaching of Islamic education and still requires strengthening across the dimensions of lesson planning, instructional practice, and assessment. Systematic interventions—such as contextualized training, improved infrastructure, and ongoing mentorship—are essential for achieving comprehensive and sustainable TPACK integration in public school settings.

DISCUSSION

The research results show that the mastery of PAI teachers in the aspect of Content Knowledge (CK) is in the good category [5]. The teacher is able to deliver Islamic material systematically according to the curriculum, and relate it to the social and moral conditions of the students. This is important considering that CK is the foundation in the TPACK approach, where a deep understanding of the subject matter becomes the starting point for integration with pedagogical and technological elements. However, success in CK has not been accompanied by the ability to optimally integrate technology, as required by the TPACK approach [31].

From the aspect of Pedagogical Knowledge (PK), the teaching strategies used are still dominated by lecture, discussion, and question-and-answer methods. This strategy is indeed commonly used in PAI learning, considering the normative and reflective nature of the material [24]. However, the lack of variation in pedagogical approaches, such as project-based or collaborative learning, indicates that teachers have not fully internalized the principles of modern pedagogy that support active, critical, and creative learning. This becomes a weakness in developing Pedagogical Content Knowledge (PCK), which is the bridge between mastery of the material and effective teaching methods [33].

From the aspect of Technological Knowledge (TK), this research found that teachers are still in the early stages of actively using technology [34]. Teachers utilize visual media such as PowerPoint and YouTube videos as teaching aids, but have not yet reached the stage of using Learning Management Systems (LMS), online evaluation applications, or other interactive media. This fact indicates that Technological Pedagogical Knowledge (TPK) and Technological Content Knowledge (TCK) have not yet developed optimally. This also confirms the findings of Muhamad, N et al. (2024), which state that PAI teachers still face difficulties in integrating technology into their lesson designs [35].

The absence of technology as an explicit element in the lesson plans also indicates that the process of TPACK integration has not yet been systematically implemented [36]. Ideally, every lesson plan designed should reflect the synergy between CK, PK, and TK, both in core activities, learning media, and evaluation methods. The absence of the TPACK framework in planning results in technology-based learning being merely supplementary, rather than a primary strategy in achieving learning objectives.

Structural constraints are the main factor behind the low implementation of TPACK. Teachers face limitations in facilities such as projectors, internet connections, and a lack of practice-based training. These findings align with Muslih, who state that infrastructure limitations are the main barriers to the adoption of learning technology, especially

in public schools that have not yet fully transformed into digital-based schools [37]. Therefore, the success of TPACK does not only rely on the competence of teachers but also on systemic support from the institution.

In addition to structural barriers, cultural challenges also play a significant role. Some PAI teachers still believe that technology is not very relevant to religious education [38]. They are concerned about the potential secularization of Islamic meaning or disruption of spiritual values if technology dominates learning too much. This view, although valid in terms of values, needs to be re-evaluated because fundamentally, technology is merely a tool that can either strengthen or weaken values, depending on how it is used pedagogically [39].

However, the teachers' enthusiasm for adapting to technology becomes an important asset for the development of TPACK. Some teachers have tried using interactive learning videos and Islamic digital resources to enrich the teaching materials [40]. This indicates motivation and awareness of the importance of transforming teaching methods.If facilitated through continuous and practice-based technopedagogical training, PAI teachers can develop their abilities to create transformative learning that is relevant to students' digital lives.

Students as subjects of learning also show a high interest in the use of technology. They feel more interested and find it easier to understand the material when it is presented with the help of digital visuals [41].These findings reinforce the importance of building Technological Pedagogical Content Knowledge (TPACK) as an integrated approach that is not only enjoyable but also effective in enhancing students' understanding of religious values.

From the overall findings and analysis, it can be concluded that the implementation of the TPACK approach in PAI learning at SMA Negeri Karanganyar is still partial and not yet systemic. The three main components of TPACK have indeed been recognized and used, but their integration has not yet occurred comprehensively in the learning practice. The weaknesses lie in the aspects of planning, technological limitations, and the lack of strengthening teachers' digital competencies. Therefore, the improvement strategy is not sufficient with theoretical training alone, but must involve a hands-on approach and context-based mentoring.

By addressing these structural and cultural barriers, and developing an adaptive training system, the implementation of TPACK in public schools can proceed more effectively. The teaching of PAI will also be able to meet the challenges of the times while maintaining the substance of Islamic spirituality values, but packaged in a more attractive, participatory, and meaningful format for the current digital generation. Furthermore, collaboration between educational stakeholders—such as school leaders, policymakers, and technology providers—will be essential in ensuring sustainable integration. Building a culture of innovation among PAI teachers and encouraging peer learning communities can further support the ongoing development and application of TPACK in diverse classroom contexts.

CONCLUSION

The implementation of the TPACK (Technological Pedagogical and Content Knowledge) approach in Islamic Religious Education (PAI) learning at SMA Negeri Karanganyar has not yet been optimally integrated. Teachers demonstrate a strong mastery of Content Knowledge (CK), evident in their systematic delivery of Islamic material aligned with the curriculum. However, the aspect of Pedagogical Knowledge (PK) remains predominantly traditional, characterized by teacher-centered methods that do not fully engage students in active learning approaches suitable for the 21st century. Additionally, Technological Knowledge (TK) represents the weakest dimension in the integration of TPACK; technology is primarily employed as a supplementary visual aid rather than an integral element of instructional strategies. Teachers still lack proficiency in utilizing advanced technological tools, such as online learning platforms, interactive quiz applications, or Learning Management Systems (LMS), and their lesson planning documents do not explicitly incorporate the TPACK framework, leading to fragmented and less collaborative learning experiences.

The main obstacles encountered in implementing the TPACK approach include insufficient technical training tailored specifically to Islamic Religious Education (PAI), limited technological infrastructure within the school, and

entrenched pedagogical resistance rooted in traditional perceptions of religious education. Despite these barriers, teachers exhibit strong motivation to adapt to technological advancements, and students generally respond positively to technology integration, particularly when grappling with abstract concepts. Consequently, to achieve a comprehensive integration of the TPACK components—conceptual, structural, and technical—systematic efforts are necessary. Continuous professional development, improvement of technological infrastructure, and a cultural shift in pedagogical approaches are critical steps toward making PAI learning more effective, contextual, and adaptive in response to digital-era dynamics.

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Author Contribution

All authors contributed equally to the main contributor to this paper, some are as chairman, member, financier, article translator, and final editor. All authors read and approved the final paper.

Conflicts of Interest

All authors declare no conflict of interest.

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