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Implementation of The Use of an Indonesian Language Learning Application Based on Telegram Bot for Students of Grade XI Jaya Negara Makassar

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Abstract

This study aims to describe the implementation of a Telegram bot-based learning application in Indonesian language learning, analyze students' responses, and identify supporting and inhibiting factors in its use among eleventh-grade students of SMA Jaya Negara Makassar. This research employed a descriptive qualitative approach using a case study design. The research subjects consisted of an Indonesian language teacher and eleventh-grade students. Data were collected through observation, questionnaires, interviews, and documentation. Data analysis was conducted through data reduction, data presentation, and conclusion drawing. The results indicate that the implementation of the Telegram bot was well integrated with classroom learning. The bot was used to deliver learning materials, assign tasks, conduct formative quizzes, send reminders, and provide learning feedback. Students' responses to the use of the Telegram bot were generally positive. Students perceived the application as easy to use, helpful in accessing learning materials, effective in improving task submission discipline, and supportive of learning motivation and learner autonomy. Supporting factors included ease of use, flexible access, concise material presentation, reminder features, and prompt teacher feedback. Inhibiting factors included unstable internet connectivity, differences in students' digital literacy, limited face-to-face interaction, and potential distractions from other applications. Overall, the Telegram bot contributed positively to the quality of Indonesian language learning.

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Keywords: Telegram Bot, Indonesian Language Learning, Student Responses, Digital Learning Media

INTRODUCTION

The development of information and communication technology in the modern era has increased significantly and influenced almost every aspect of human life, including the field of education. These changes have brought substantial impacts on the ways teachers and students conduct the learning process. Learning, which was previously conventional in nature, has gradually transformed into digital learning that is more flexible, interactive, and easily accessible. This transformation occurs because technology is capable of providing various learning resources that can be accessed anytime and anywhere according to students' needs.

The utilization of digital technology in education has become an unavoidable necessity. According to Mustofa (2021), the use of digital technology in learning is an urgent need in order to create an adaptive learning system that aligns with contemporary developments. Digital technology enables the learning process to become more effective because students not only receive information passively but can also interact directly with the learning media being used.

The shift in the learning paradigm has also been influenced by the emergence of the Industrial Revolution 4.0, which demands that the education sector produce human resources equipped with digital skills. In this context, teachers are required to integrate technology into learning so that students gain learning experiences relevant to the demands of the twenty-first century. The utilization of technology-based media has become one of the most important forms of innovation for improving the quality of learning in schools.

One form of technology that has rapidly developed and is closely related to students' daily lives is instant messaging applications. These applications are no longer used solely as communication tools but are also utilized as learning media. Telegram has become one of the applications with significant potential to support digital learning processes because it provides bot features that can be automatically programmed to accommodate students' learning needs.

According to Saputra and Hidayat (2020), Telegram bots have substantial potential in supporting online learning because they are easily accessible, flexible, and can be automated according to the needs of teachers and students. Telegram bots enable teachers to provide learning materials, exercises, quizzes, and feedback directly to students without always having to be synchronously present in online classrooms.

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Indonesian language learning, as one of the compulsory subjects at the senior high school level, has its own challenges in the implementation process. Many students perceive Indonesian language learning as less engaging because the teaching methods employed remain predominantly theoretical and monotonous. This condition leads to low student learning motivation in participating in Indonesian language classes.

Based on the researcher's preliminary observations at SMA Jaya Negara Makassar, it was found that students' learning motivation in Indonesian language learning was still relatively low. Most students demonstrated a lack of enthusiasm during the learning process. Discussions with Indonesian language teachers also indicated that students tended to be more interested when learning activities incorporated digital devices compared to conventional lecture methods.

The issue of low learning motivation needs to be addressed immediately so that learning objectives can be achieved optimally. One effort that can be undertaken is the introduction of innovative learning media that are more attractive and aligned with the characteristics of today's digital generation. The use of Telegram bot-based learning media represents a potential alternative for increasing students' interest and engagement in the Indonesian language learning process.

Telegram bots can be utilized as interactive learning media because they are capable of providing various learning services automatically. Teachers can use bots to distribute materials, assign tasks, present quizzes, and provide feedback on students' learning outcomes. Through these features, learning becomes more engaging, and students are able to learn independently according to their individual needs.

Research conducted by Amelia (2022) demonstrated that the use of Telegram bots in learning increased student participation by 23% compared to conventional online learning methods. These findings indicate that interactive learning media can encourage students to become more active in participating in learning activities.

These research findings provide a strong basis indicating that the use of Telegram bots has significant opportunities to be implemented in Indonesian language learning at the senior high school level. Interactive technology-based learning can help students become more interested in understanding learning materials. In addition, the use of Telegram bots enables students to obtain more flexible and enjoyable learning experiences.

The utilization of Telegram bots in learning also supports the concept of self-directed learning. According to Dewi and Firmansyah (2021), the use of bots in learning helps students

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manage their own study time because learning materials can be accessed anytime according to their needs. Thus, learning is no longer limited to specific spaces and times.

The concept of self-directed learning is highly relevant to the demands of twenty-first-century education, which emphasizes the importance of learning independence and students' digital literacy. Through Telegram bots, students can review materials, complete exercises, and receive immediate feedback without having to wait for teachers' explanations in the classroom. This condition can help students develop responsibility for their own learning processes.

Nevertheless, the implementation of technology in learning is not free from various challenges. One of the primary challenges is the differing levels of students' digital literacy. Not all students possess the same abilities in utilizing technology as a learning tool; therefore, guidance and direction from teachers are required.

Research conducted by Pratama (2019) found that students' readiness in using digital media greatly influences the success of technology implementation in learning. Students with strong digital literacy skills tend to adapt more easily to technology-based learning media compared to students who still have limitations in using digital devices.

In addition to student-related factors, teacher competence also plays a crucial role in the successful implementation of technology-based learning media. Teachers no longer function merely as providers of knowledge but also as facilitators who assist students in utilizing technology optimally during the learning process.

According to Huda et al. (2020), teachers' competence in using digital technology is a key factor in the success of learning innovation. Teachers with strong digital competencies tend to be more creative in developing learning media, thereby making the learning process more effective and engaging for students.

The use of Telegram bots also provides convenience for teachers in conducting learning evaluations. Bots can be programmed to administer quizzes, assess students' answers, and automatically compile learning outcomes. Consequently, teachers can obtain data regarding students' learning progress more quickly and accurately.

In the context of Indonesian language learning, Telegram bots can be utilized to train various language skills such as reading, writing, listening, and speaking. Teachers can distribute reading texts, vocabulary exercises, comprehension questions, and audio recordings through Telegram bots so that students can learn in more diverse ways.

Furthermore, the use of Telegram bots aligns with the implementation of the Merdeka Curriculum, which emphasizes the importance of digital literacy mastery and technology-based

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learning. The Merdeka Curriculum encourages students to develop critical, creative, and independent thinking skills in utilizing technology as a learning tool.

In the Learning Outcomes document for Indonesian Language Phase E and F published by the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia (2022), it is explained that Indonesian language learning aims to develop students' abilities to understand and produce multimodal texts. This indicates that the use of digital media in Indonesian language learning is highly relevant to current curriculum demands.

Constructivist theory also supports the use of Telegram bots in learning. According to Jean Piaget, learning is an active process of constructing knowledge through experience. The use of Telegram bots allows students to explore learning materials independently and build understanding based on their own learning experiences.

In addition to constructivism, behaviorist theory is also relevant to the implementation of Telegram bots. According to B. F. Skinner, learning is a behavioral change that occurs through stimulus and response. In the use of Telegram bots, students receive stimuli in the form of exercises and reinforcement through automatic feedback provided by the bot after answering questions.

The use of Telegram bots in Indonesian language learning also offers several advantages. Telegram bots are flexible, easily accessible, multimedia-supported, and can be used anytime and anywhere. Teachers can distribute materials in the form of text, images, videos, audio, and PDF documents, making learning more engaging and interactive.

However, the use of Telegram bots also has several limitations. Bots cannot completely replace the role of teachers in providing in-depth explanations or assessing responses that require high levels of interpretation. In addition, internet connectivity, digital devices, and data security are also challenges that need to be considered in implementing technology-based learning.

In the context of SMA Jaya Negara Makassar, research regarding the use of Telegram bots is important because it can provide solutions to the low learning motivation of students in Indonesian language subjects. This study is expected to provide an overview of the implementation of Telegram bots, students' responses to the learning media, as well as supporting and inhibiting factors influencing its success.

Based on the explanation above, this study was conducted to further explore the implementation of Telegram bot-based Indonesian language learning applications among eleventh-grade students at SMA Jaya Negara Makassar. This research is expected to contribute to the development of digital learning media, improve the quality of Indonesian language learning,

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and serve as a reference for teachers and schools in optimizing the utilization of technology in education.

RESEARCH METHOD

This study employed a qualitative approach with a descriptive design. The qualitative approach was selected because the study aimed to gain an in-depth understanding of the phenomenon of implementing a Telegram bot-based Indonesian language learning application, including students' responses and the factors influencing its implementation. Qualitative research focuses on meaning, interpretation, and understanding of a phenomenon within its natural context without manipulating variables (Creswell, 2018). Through this approach, the researcher was able to obtain a comprehensive overview of the learning process occurring in the field.

The type of research applied in this study was a case study. A case study enables researchers to explore a phenomenon deeply within a specific and bounded context (Yin, 2018). In this research, the case examined was the implementation of Telegram bots in Indonesian language learning among eleventh-grade students at SMA Jaya Negara Makassar. This approach provided opportunities to obtain detailed and contextual data related to technology-based learning practices.

This study was conducted at SMA Jaya Negara Makassar, located in Makassar City, South Sulawesi, Indonesia. The selection of this site was based on the consideration that the school had integrated digital media into the learning process, including the use of Telegram bots as a learning innovation. Furthermore, support from the school administration was an important factor in facilitating the research process, particularly in conducting direct data collection in the field.

The research subjects consisted of one Indonesian language teacher of grade XI and 20 eleventh-grade students involved in learning activities using Telegram bots. The subjects were selected purposively by considering their direct involvement in the use of the learning media. This number of participants was considered sufficient to provide an in-depth description of the implementation process, students' responses, as well as supporting and inhibiting factors in the use of Telegram bots (Sugiyono, 2021).

The data collection techniques employed in this study included observation, questionnaires, interviews, and documentation. Observation was conducted to directly examine the learning process, including interactions between teachers and students as well as the use of Telegram bots during learning activities. Observation enabled the researcher to obtain factual empirical data related to learning behaviors and activities (Moleong, 2021).

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In addition to observation, questionnaires were used to collect data regarding students' responses to the use of Telegram bots. The questionnaires consisted of both closed-ended and open-ended statements covering aspects of perception, ease of use, and students' learning experiences. The use of questionnaires in qualitative research can strengthen the data by providing a general overview of participants' response tendencies (Sugiyono, 2021).

The interviews conducted in this study were semi-structured interviews. Interviews were carried out with the teacher and several students to obtain more in-depth information regarding experiences, opinions, and challenges in using Telegram bots. Semi-structured interviews provided flexibility for the researcher to explore participants' responses more broadly while still maintaining the focus of the study (Creswell, 2018).

Documentation was also utilized as a data collection technique to complement and validate the data obtained from observations, questionnaires, and interviews. The documentation included screenshots of learning activities, learning materials, and records of students' learning outcomes. This technique was important in providing concrete evidence regarding the implementation of Telegram bot-based learning (Moleong, 2021).

The primary instrument in this study was the researcher, who functioned as the planner, data collector, analyst, and interpreter of the data. In addition, supporting instruments such as observation guidelines, interview guidelines, and documentation sheets were utilized. In qualitative research, the presence of the researcher as the main instrument is highly important because the researcher interacts directly with the participants and the research setting (Sugiyono, 2021).

The data analysis technique was conducted descriptively and qualitatively through three main stages: data reduction, data display, and conclusion drawing. Data reduction was carried out by simplifying and focusing on data relevant to the study. Data presentation was conducted in the form of descriptive narratives, while conclusion drawing was performed through verification using triangulation techniques to ensure data validity. Triangulation was conducted by comparing data from various sources and techniques so that the research findings would be more valid and accountable (Miles, Huberman, & Saldaña, 2014).

RESULT AND DISCUSSION

This study was conducted over eight weeks during the second semester of the 2024/2025 academic year at SMA Jaya Negara Makassar, involving eleventh-grade students. The implementation of learning through a Telegram bot was carried out systematically through the

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integration of face-to-face instruction and independent digital-based learning. Data were collected through observations, questionnaires, interviews, and documentation of students' learning outcomes. This approach provided a comprehensive overview of the effectiveness of using a Telegram bot in Indonesian language learning.

In general, the findings revealed that the use of the Telegram bot had a positive impact on the learning process, particularly in terms of student engagement, discipline, learning outcomes, and learning autonomy. These findings are consistent with the concept of technology-based learning, which emphasizes flexibility and accessibility as key factors in improving the quality of education (Anderson, 2008).

The implementation of the Telegram bot in Indonesian language learning demonstrated a significant increase in student engagement. This was reflected in the increased frequency of material access and participation in bot-based learning activities.

Table 1. Student Engagement in Learning

Week	Number of Active Students	Percentage
1	25	78.1%
4	28	87.5%
8	31	96.9%

The data presented in Table 4.1 indicate that student engagement increased consistently throughout the implementation period. This suggests that the use of the Telegram bot was able to enhance students' intrinsic motivation to learn. According to learning motivation theory, active engagement is an important indicator of successful learning (Deci & Ryan, 2000).

In addition to engagement, the punctuality of assignment submission also improved significantly following the implementation of the Telegram bot.

Table 2. Timeliness of Assignment Submission

Stage	Percentage Submitted on Time
Pre-implementation	56.3%
Assignment 3	81.3%
Assignment 8	93.8%

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This improvement indicates that the automated reminder feature within the Telegram bot played an important role in enhancing student discipline. These findings align with behaviorist theory, which emphasizes the importance of reinforcement in shaping learning behavior (Skinner, 1953).

Students' learning outcomes also improved significantly in both assignments and formative quizzes.

Table 3. Average Student Scores

Type of Assessment	Before	After
Assignments	72.3	79.4
Quizzes	71.5	76.8

The data demonstrate a consistent improvement in learning outcomes. This indicates that Telegram bot-based learning was able to improve students' conceptual understanding more effectively.

The distribution of student scores also showed positive changes, marked by an increase in the number of students achieving scores above 80 and a decrease in the number of low-achieving students. This suggests that the Telegram bot not only improved the class average but also reduced the achievement gap among students.

From the perspective of constructivist theory, this improvement occurred because students actively constructed knowledge through interaction with learning materials and immediate feedback (Vygotsky, 1978).

Students' writing skills also improved significantly based on the pre-test and post-test results.

Table 4. Improvement in Writing Skills

Aspect	Pre-test	Post-test
Text Structure	2.6	3.4
Coherence	2.4	3.2
Language Use	2.5	3.1
Content	2.7	3.3
Mechanics	2.3	3.0

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The improvement in writing skills indicates that the feedback provided through the Telegram bot was effective in helping students improve the quality of their writing. This finding is consistent with formative assessment theory, which highlights the importance of feedback in the learning process (Black & Wiliam, 1998).

Students' learning autonomy also increased significantly after the use of the Telegram bot.

Table 5. Students' Learning Autonomy

Indicator	Before	After
Average Score	61.4	78.3

This increase indicates that students became more independent in managing their learning processes. The Telegram bot enabled students to learn at their own pace, which is a central principle of self-regulated learning (Zimmerman, 2002).

From the perspective of student responses, questionnaire results showed that the majority of students responded positively to the use of the Telegram bot.

Table 6. Student Responses

Aspect	Positive Response Percentage
Ease of Use	88.9%
Learning Materials	88.9%
Assignments & Quizzes	88.9%

These positive responses indicate that the Telegram bot possessed a high level of usability. According to Nielsen (1993), systems that are easy to use enhance effectiveness and user satisfaction.

Nevertheless, the study also identified several obstacles, particularly related to internet network limitations.

Table 7. Internet Network Constraints

Category	Percentage
Frequently	25.0%
Occasionally	47.2%

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Category	Percentage
Rarely	19.4%
Never	8.4%

These findings indicate that the success of technology-based learning is determined not only by the learning media itself but also by the availability of adequate infrastructure. This is consistent with the findings of Dewi (2022), who emphasized the importance of digital literacy and technological support.

Furthermore, teacher competence was also found to be a key factor in the successful implementation of the Telegram bot. Teachers who are able to integrate technology with appropriate pedagogical strategies can create more effective learning experiences (Huda et al., 2020).

Overall, the findings demonstrate that the use of a Telegram bot in Indonesian language learning was effective in improving student engagement, learning outcomes, learning autonomy, and the overall quality of instruction. These findings reinforce the idea that pedagogically designed digital technology integration can serve as an innovative learning approach that is relevant to the demands of twenty-first-century education.

The implementation of the Telegram bot in Indonesian language learning within this study demonstrates that digital technology integration can create a learning environment that is more adaptive to the needs of the digital generation. The increase in student engagement from 78.1% at the beginning of the implementation to 96.9% at the end of the study indicates that chatbot-based learning media possess a strong appeal for senior high school students. This finding is consistent with the Technology Acceptance Model (TAM) proposed by Fred Davis (1989), which states that users' acceptance of technology is influenced by their perceptions of its ease of use and usefulness. In the context of this study, students perceived the Telegram bot as easy to operate and beneficial in supporting Indonesian language learning. Therefore, the high level of student engagement can be interpreted as a form of positive acceptance of digital learning innovation.

The increased student engagement also indicates a shift in learning patterns from teacher-centered learning to student-centered learning. Students were no longer merely passive recipients of information from teachers; instead, they became active participants in exploring learning materials through the features provided by the Telegram bot. This condition aligns with

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the constructivist perspective proposed by Lev Vygotsky (1978), which states that knowledge is actively constructed by learners through interaction with their learning environment. The Telegram bot provided a learning space that enabled students to learn independently, engage in discussions, and access materials according to their individual needs. Thus, technology functioned not merely as a supporting tool but also as a medium for developing more active and meaningful learning experiences.

The success of the Telegram bot in improving the punctuality of assignment submission indicates that the automated reminder system played an important role in fostering student discipline. From the perspective of behaviorist psychology, periodic reminders can be understood as stimuli that encourage the emergence of desired learning behaviors. B. F. Skinner (1953) explained that human behavior can be shaped through consistent reinforcement. In this study, the automated reminders sent by the bot functioned as external reinforcement that helped students develop more organized learning habits. The increase in on-time assignment submission to 93.8% demonstrates that digital reminder systems are effective in improving students' academic discipline.

In addition to improving discipline, the automated reminder feature also helped students develop time management skills. Many senior high school students still experience difficulties in setting learning priorities due to social activities and the use of digital media for entertainment purposes. Through regular task notifications, students became more aware of their academic schedules. This finding is relevant to Zimmerman's (2002) view that self-regulated learning involves the ability to manage time, set goals, and monitor task completion. The Telegram bot assisted students in developing self-regulation through a structured and consistent system.

The improvement in students' learning outcomes in this study indicates that the use of the Telegram bot supported a more effective learning process. The average assignment score increased from 72.3 to 79.4, while formative quiz scores increased from 71.5 to 76.8. These findings support the study conducted by Nugroho (2023), which found that Telegram bot-based learning improved students' understanding of Indonesian language materials through interactive exercises and immediate feedback. In this study, students were able to access materials repeatedly, providing opportunities to strengthen their understanding before completing quizzes or assignments.

The improvement in students' ability to answer cognitive-level C4 and C5 questions indicates that Telegram bot-based learning not only supported memorization skills but also higher-order thinking skills. In the revised Bloom's Taxonomy developed by Lorin Anderson and

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David Krathwohl (2001), analytical and evaluative abilities are categorized as higher-order thinking skills (HOTS), which are essential in twenty-first-century learning. Through interactive quizzes and text analysis exercises, students were trained to understand text structures, evaluate content, and draw conclusions from the materials studied. Thus, the Telegram bot effectively supported the development of students' critical thinking abilities.

The findings also revealed that the quality of students' writing skills improved across all assessment aspects. The greatest improvement was observed in text structure and coherence. This indicates that Telegram bot-based learning provided students with opportunities to learn gradually through repeated practice and self-revision. According to the process writing theory proposed by Ken Hyland (2003), effective writing skills are developed not instantly but through processes of drafting, revising, editing, and continuous feedback. In this study, the teacher feedback feature provided through the Telegram bot supported these processes, enabling students to improve the quality of their writing more systematically.

The provision of personalized feedback through the Telegram bot also enhanced students' confidence in writing. Some students reported feeling more comfortable asking questions or requesting clarification through the bot rather than directly in the classroom. This phenomenon can be understood through Albert Bandura's (1997) theory of self-efficacy, which states that individuals' confidence in their abilities increases when they receive support and gradual experiences of success. When students received specific and constructive comments from teachers, they felt more capable of correcting mistakes and improving the quality of their writing.

The increase in students' learning autonomy from a moderate to a high category indicates that the Telegram bot successfully promoted independent learning. According to Malcolm Knowles (1975), self-directed learning is a process in which individuals take the initiative to plan, implement, and evaluate their own learning. In this study, students became accustomed to studying learning materials before face-to-face sessions took place. They also became more active in seeking additional information and evaluating their own work before submission.

The development of learning autonomy through the use of the Telegram bot suggests that digital technology can serve as a medium for fostering lifelong learning. Students no longer depended entirely on teachers' presence in the classroom; instead, they began to develop responsibility for their own learning processes. This condition is highly relevant to the demands of the Merdeka Curriculum, which emphasizes flexible, reflective, and student-centered learning. Therefore, the implementation of the Telegram bot supported the development of students who are more independent and adaptive to contemporary changes.

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From the teachers' perspective, the implementation of the Telegram bot significantly improved the efficiency of learning management. The automation of material distribution, assignment submission records, and grade recapitulation reduced teachers' administrative workload. These findings are consistent with the study conducted by Huda et al. (2020), which stated that the use of digital technology can improve teachers' work efficiency when supported by adequate digital competence. With reduced administrative burdens, teachers had greater opportunities to focus on pedagogical activities such as individualized guidance and providing high-quality feedback.

The efficiency of learning management also affected the quality of academic interaction between teachers and students. Through the consultation feature provided by the Telegram bot, learning communication was no longer limited to formal classroom hours. Teachers could respond to students' questions more flexibly, while students had opportunities to ask questions without fear or embarrassment. This more open interaction supported the development of a supportive and communicative learning climate.

Although the implementation of the Telegram bot provided numerous benefits, this study also identified challenges related to limited internet connectivity. Some students experienced difficulties accessing learning materials due to unstable internet signals at home. These findings indicate that the success of digital learning is strongly influenced by the readiness of technological infrastructure. According to Mark Warschauer (2004), the digital divide is not only related to device ownership but also to the quality of internet access and the ability to utilize technology effectively. Therefore, infrastructure support is an important factor in the successful implementation of technology-based learning.

In addition to infrastructure factors, students' levels of digital literacy also influenced the effectiveness of Telegram bot usage. Students who were accustomed to using technology for academic purposes tended to adapt more quickly than those who primarily used digital devices for entertainment. This finding is consistent with the study conducted by Pratama (2021), which stated that digital literacy is an essential prerequisite for the success of technology-based learning. Therefore, schools need to develop digital literacy programs that focus not only on technical skills but also on the productive and responsible use of technology.

Overall, the findings of this study indicate that the Telegram bot has substantial potential as a learning medium for Indonesian language instruction at the senior high school level. The integration of learning materials, quizzes, automated reminders, consultation features, and feedback mechanisms created a learning environment that was more interactive, flexible, and

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student-centered. The successful implementation of the Telegram bot in this study demonstrates that digital technology can serve as a medium for pedagogical transformation when designed according to students' learning needs and supported by adequate teacher competence. Therefore, the development of Telegram bot-based learning deserves consideration as an innovative learning strategy that is relevant to supporting education in the digital era.

CONCLUSION

Based on the research findings, it can be concluded that the implementation of the Telegram bot-based Indonesian language learning application for eleventh-grade students at SMA Jaya Negara Makassar was conducted systematically, structurally, and effectively in supporting the learning process. The Telegram bot functioned not only as a medium for delivering learning materials but also as a digital learning system capable of facilitating assignments, formative quizzes, automated reminders, and continuous learning feedback. Students' responses to the use of the Telegram bot showed a highly positive tendency, as reflected in increased learning motivation, greater discipline in submitting assignments, and improved autonomy in managing their learning processes. In addition, the main supporting factors, namely the ease of application use and the flexibility of learning access (each receiving a positive response rate of 88.9%), further strengthened the effectiveness of the bot as a learning medium that is adaptive to the characteristics of the digital generation.

Based on the research findings, it is recommended that the use of Telegram bots in learning be further developed as part of technology-based learning innovation in schools. Teachers are expected to continuously improve their digital and pedagogical competencies in designing interactive and student-centered learning experiences. Schools also need to provide adequate infrastructure support, particularly stable internet access, in order to minimize the technical obstacles still experienced by some students. Furthermore, efforts to enhance students' digital literacy through training or mentoring programs are necessary so that all students can adapt optimally to the use of educational technology. Future research is recommended to examine the development of more innovative bot features, such as the integration of instructional videos, collaborative discussion platforms, and data-based learning analytics, in order to improve the quality of learning more comprehensively.

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