

Analysis of Readiness for the Implementation of Coding and Artificial Intelligence Learning

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Abstract

Coding and artificial intelligence (AI) learning are part of Indonesia's digital transformation education policy, which has begun to be implemented at the elementary and secondary levels. The success of this policy largely depends on the readiness of teachers, who are the primary implementers of learning. This study aims to analyze the readiness of junior high school teachers in Buleleng District to implement coding and AI learning from various readiness aspects. The study employed a descriptive quantitative approach, using a survey method with a validated questionnaire instrument. The instrument was validated through the Pearson Product-Moment validity test and Cronbach's Alpha reliability test. Data analysis included descriptive statistics complemented by qualitative findings. The results indicated that the level of teacher readiness was in the very good category, with an average score of 4.17 on a 5-point scale, equivalent to 83.40%. All readiness indicators digital literacy, technology-based pedagogical skills, attitudes toward coding and AI, infrastructure readiness, curriculum integration, professional development, and teacher collaboration demonstrated very good achievement. These findings suggest that junior high school teachers in Buleleng District are sufficiently prepared to support the implementation of coding and AI learning, though ongoing efforts are necessary to ensure successful application in practical teaching.

1. Introduction

The massive development of digital technology, particularly in the programming domain, namely coding and artificial intelligence (AI), has brought fundamental changes in various aspects of human life, including the education sector (Adiman et al., 2024). This transformation demands strengthening digital literacy for students from an early age so that they are not only consumers of technology, but also able to become creators and innovators in the future (Awaluddin & Hadi, 2025; Mutoharoh et al., 2023). On the global stage, the integration of coding and AI into the school curriculum has become a new standard for increasing national competitiveness in the era of the Industrial Revolution 4.0 and Society 5.0 (Ren et al., 2021). The Indonesian government responded to this global challenge by establishing the implementation of coding and AI learning at the elementary and secondary education levels as one of the national priority programs for 2025. This policy is an integral part of the national education digital transformation roadmap which aims to prepare adaptive, creative, and competitive human resources in an all-digital global ecosystem (Suryaman, 2020). In the educational structure in Indonesia, the Junior High School level occupies a very strategic position. At this stage of development, students begin to develop adequate logical and abstract thinking skills, placing them in an ideal phase for understanding the basic principles of algorithms, programming logic, and fundamental concepts of artificial intelligence. Furthermore, the integration of this material is supported by the implementation of the Independent Curriculum, which places Informatics as a compulsory subject at the junior high school level, to foster computational thinking skills.

Ideally, the policy of introducing coding and AI in schools is expected to be implemented evenly, effectively, and sustainably across all educational units (Dewi et al., 2025). This expectation includes the availability of a comprehensive digital education ecosystem, where teachers not only possess high digital literacy but also master technology-based pedagogical competencies to design interactive and meaningful learning experiences for students (Rosyidah et al., 2025). Teachers are expected to have a positive and open attitude towards technological innovation, viewing coding and AI as a tool that improves learning efficiency, not as an additional administrative burden (Nurhikmah et al., 2024). In addition to human resources, institutional readiness is also a key pillar expected to be present in every school. This includes the availability of adequate information and communication technology (ICT) infrastructure, such as computer laboratories and a stable internet network, as well as leadership support from the principal through pro-technology internal policies (Irvani et al., 2024). With the synergy between technical readiness, a flexible curriculum, and a strong digital learning culture, it is

hoped that the implementation of coding and AI will produce a generation of young people with systematic problem-solving skills and ready to face the challenges of the 21st century (Whindayati et al., 2025).

However, the reality on the ground demonstrates significant challenges in translating this ambitious policy into practical learning. Although urban areas such as Buleleng District geographically have relatively better access to technology than rural areas, the level of readiness between schools remains disparate. Many schools still face classic obstacles such as limited supporting facilities and uneven teacher training (Afiyanti et al., 2025). Most previous research and interventions have tended to focus only on the technical aspects of developing teaching media or partially training teachers, without addressing the holistic readiness of schools as institutions (Pradnyana et al., 2025; Yulin & Danso, 2025). To date, there is no comprehensive empirical data available on the extent to which junior high schools in urban areas, particularly in Buleleng District, are truly ready to adopt the coding and AI curriculum. Without a clear mapping, planning for development programs, teacher training, and infrastructure allocation risks being misdirected (Hamdani et al., 2025). There are concerns that this policy will become merely an administrative formality if it is not supported by a deep understanding of the real conditions of teacher readiness as the primary implementers of learning and the support of school management as the resource provider (Guia, 2023).

Based on this gap between government policy and real conditions on the ground, this research presents a solution by providing a database through a comprehensive analysis of school readiness. This study offers a quantitative descriptive mapping approach to assess the level of readiness of junior high schools in Buleleng District for implementing coding and AI learning. The main focus of this study is directed at seven crucial indicators: teacher digital literacy, technology-based pedagogical competencies, attitudes and perceptions toward technology, infrastructure readiness, curriculum integration, continuous professional development, and a culture of collaboration within the community of practitioners.

2. Method

This study employed a quantitative approach with a descriptive research design. The purpose of using descriptive methods is to provide a systematic, factual, and accurate picture of the facts and characteristics of a specific population or region related to the level of school readiness (Furidha, 2023). This design was chosen because it is relevant to the primary objective of the study, which is to map the existing conditions of junior high schools in Buleleng District in preparation for the implementation of the coding and AI curriculum in 2025. Through this approach, the researcher did not administer treatment to the subjects but rather simply captured the current phenomena through numerical data, which were then interpreted in depth. The research procedure was conducted in several stages, including (1) instrument development based on theoretical frameworks, (2) content validation by expert judges, (3) empirical testing for validity and reliability, (4) data collection through online questionnaires, and (5) data analysis using descriptive statistics. These stages were carried out systematically to ensure the accuracy and credibility of the research findings.

The population in this study was all public junior high school educational units in Buleleng District. The sample was determined using a purposive sampling technique, with inclusion criteria focused on Informatics teachers and school leaders (principals or vice-principals in charge of curriculum). The respondents involved in this study consisted of 18 participants, including Informatics teachers and school leaders (principals or vice principals), with varying teaching experiences ranging from novice to senior levels. In terms of educational background, most respondents held a bachelor's degree in education or related fields, reflecting a representative profile of junior high school educators in Buleleng District. Subject selection was based on their strategic role as the vanguard of curriculum implementation and policymakers at the educational unit level. By involving representatives from various schools in the urban area of Buleleng, it is hoped that the data obtained will illustrate the disparities and similarities in the challenges faced across institutions.

To obtain comprehensive data on the readiness of junior high school teachers in Buleleng District to implement coding and AI learning, a research instrument was developed that refers to several key indicators. These indicators were developed based on various theoretical studies and current policies related to technology-based educational transformation, teacher digital literacy, and 21st-century educator competency standards. The indicators were compiled based on references from the UNESCO Digital Literacy Global Framework (Law et al., 2018) and the ISTE Standards for Educators (Crompton & Burke, 2021).

2.1. Determination of Instrument Indicators

This instrument includes seven main indicators deemed most relevant to describe teacher readiness as a whole, including:

Indicator 1: Digital Literacy: Digital literacy is a teacher's ability to understand, use, and manage digital technology effectively in the teaching and learning process. According to UNESCO Digital Literacy Global Framework, digital literacy includes technical skills (operating devices and applications), critical thinking skills

regarding digital information, and an understanding of digital ethics (Law et al., 2018). Teachers with high digital literacy will more easily adapt to changes in technology-based learning systems, including the coding and AI.

Indicator 2: Technology-Based Pedagogical Competence: Technology-based pedagogical competence reflects a teacher's ability to manage learning using ICT. Based on the ISTE Standards for Educators (Crompton & Burke, 2021) teachers need to master how to use technology to improve learning effectiveness, design interactive learning experiences, and support students to become active learners.

Indicator 3: Attitudes and Perceptions Toward Coding and AI: Teachers' attitudes and perceptions influence their readiness and willingness to adopt technological innovations. Based on research teachers who have a positive perception of artificial intelligence are more open to learning about it and integrating it into their lessons (Tan et al., 2025). Perceptions encompass interest, beliefs, and self-confidence.

Indicator 4: School Infrastructure Readiness and Support: Institutional school readiness includes supporting facilities (computers, networks, laboratories), principal policies, and technical support for teachers. Digital transformation significantly enhances institutional performance in higher education by improving service quality, access to information, and decision-making efficiency. However, its success is largely determined by the synergy between robust digital infrastructure, competent human resources, and strong institutional leadership and management. Without this alignment, challenges such as limited funding, low technical skills, and resistance to change may hinder its effectiveness (Saeed & Taher, 2026).

Indicator 5: Integration of Coding and AI in the Curriculum: Integration of coding and AI in the curriculum is a fundamental component in analyzing the readiness of junior high schools, as it reflects how far schools have prepared pedagogically, technologically, and institutionally to adopt emerging digital competencies. Studies show that successful curriculum integration requires key readiness factors such as teacher competence, adequate infrastructure, and well-designed learning frameworks, which are also core indicators in assessing school readiness (Chaniago et al., 2025). Furthermore, the integration of coding and AI enhances students' digital literacy and computational thinking, making it a benchmark for evaluating whether schools are capable of implementing future-oriented learning systems (Farchan, 2025). Therefore, analyzing readiness in Buleleng junior high schools cannot be separated from how effectively coding and AI have been embedded into the curriculum, as both concepts are interdependent in determining implementation success.

Indicator 6: Teacher Professional Development: Teacher Professional Development (TPD) has a direct and critical relationship with the analysis of school readiness in implementing Coding and Artificial Intelligence (AI) learning, as it determines teachers' capacity to integrate these technologies effectively into classroom practices. Research shows that many teachers still lack adequate technological, pedagogical, and content knowledge (TPACK) related to AI, making professional development a key indicator of readiness (Yue et al., 2024). Furthermore, effective TPD programs enhance teachers' competencies, confidence, and adaptability in using AI, which in turn strengthens overall institutional readiness for digital innovation (Ngongpah & Oni, 2025). Studies also emphasize that without continuous and structured professional development, the adoption of AI in education remains limited due to insufficient training and pedagogical understanding (Mah et al., 2026). Therefore, in the context of junior high schools in Buleleng District, analyzing readiness for Coding and AI learning must include an evaluation of teacher professional development as a central factor influencing successful implementation.

Indicator 7: Collaboration and the Teacher Community of Practice: Collaboration and the Teacher Community of Practice play a crucial role in analyzing school readiness for implementing Coding and AI learning, as they foster continuous knowledge sharing, peer learning, and collective problem-solving among teachers. Research shows that teacher collaboration is an effective form of professional development that improves teaching practices and supports innovation in learning environments, making it a key indicator of institutional readiness (Wijarwadi et al., 2025). In the context of AI education, communities of practice enable teachers to share resources, co-develop instructional strategies, and adapt to rapidly evolving technologies, thereby strengthening their capacity to integrate AI into the curriculum (LI Zhen, 2024). Moreover, collaborative environments help build teachers' confidence and competence in using AI, which directly influences the success of implementation at the school level (Kim, 2024). Therefore, in analyzing the readiness of junior high schools in Buleleng District, the existence of strong teacher collaboration and active communities of practice becomes a critical factor in ensuring sustainable and effective Coding and AI learning implementation.

2.2. Instrument Drafting and Validation

Each indicator was then broken down into several positive and negative statements to explore teachers' attitudes, abilities, and perceptions regarding the readiness to implement coding and AI learning in the school environment. A total of 35 statements were developed, with each indicator represented by five items. After the draft was developed, the instrument's content validity was tested. This test was conducted by two expert judges to assess the relevance of each statement using a dichotomous scale (Relevant/Irrelevant). After cross-

tabulation, all 35 items were assessed as relevant by both experts, so that the Gregory index was at its maximum value, namely:

$$\text{Content validity coefficient} = \frac{A+D}{A+B+C+D} = \frac{35+0}{35+0+0+0} = 1.0 \tag{1}$$

This means that the instrument has very high content validity (perfect agreement) between the two experts (Retnawati, 2016). However, based on qualitative input, there are 6 statement items that are recommended for revision in terms of clarity of meaning, wording, and sentence neutrality. After going through a content validation process using the Gregory approach and making wording improvements to several statement items, the instrument was declared suitable for use in empirical trials. The empirical trial stage aims to test the construct validity and internal reliability of each established indicator, to ensure that the instrument truly measures the construct of teacher readiness in implementing coding and AI learning. To facilitate the data collection process, the revised instrument will be converted into a digital format using Google Forms (<https://forms.gle/pWwHvwFQRbiMg6gB6>). This format allows for wider and more efficient distribution and makes it easier for respondents to provide answers. The empirical trial will be conducted with teachers, especially Informatics teachers, from all public junior high schools in Singaraja City, which is the representative area of the study.

2.3. Item Validity Testing Using Pearson Product Moment

Table 1 shows the analysis results that all 35 items have Pearson correlation coefficients (r-count) greater than r-table, with correlation values ranging from 0.64 to 0.91. This indicates that each item has a strong to very strong relationship with the total instrument score (Turney, 2022). Therefore, all items are statistically valid and suitable for use in measuring junior high school teachers' readiness to implement coding and AI learning.

Table 1. Item Analysis Using the Pearson Product Moment Formula

Item No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Pearson Correlation	0.789	0.641	0.858	0.809	0.810	0.833	0.884	0.697	0.671	0.840	0.830	0.808
r-Table	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468
Status	valid	valid	valid	valid	valid	valid	valid	valid	valid	valid	valid	Valid
Item No.	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24
Pearson Correlation	0.808	0.758	0.805	0.810	0.849	0.671	0.836	0.827	0.808	0.863	0.774	0.827
r-Table	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468
Status	valid	valid	valid	valid	valid	valid	valid	valid	valid	valid	valid	valid
Item No.	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	
Pearson Correlation	0.786	0.831	0.895	0.821	0.872	0.722	0.835	0.823	0.761	0.891	0.727	
r-Table	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	
Status	valid	valid	valid	valid	valid	valid	valid	valid	valid	valid	valid	

2.4. Internal Reliability Test Using Cronbach's Alpha

The instrument reliability test was conducted to determine the level of internal consistency of the items in measuring the construct of junior high school teachers' readiness to implement coding and AI learning. Reliability testing used the Cronbach's Alpha method, involving 18 respondents and 35 items. Based on the Case Processing Summary results (see Table 2), all respondent data was declared valid (100%), and no data was excluded, thus all data could be used in the analysis. The reliability analysis results showed a Cronbach's Alpha value of 0.983 (see Table 3), which is well above the recommended minimum reliability limit ($\alpha \geq 0.60$). This value indicates that the instrument has very high reliability (Saputra, 2025). This means that all items in the instrument have very strong internal consistency and stably measure the construct of teacher readiness.

Table 2. Case Processing Summary

Cases	N		%	
	Valid	Excluded ^a	18	100.0
		0		.0
	Total		18	100.0

a. Listwise deletion based on all variables in the procedure.

Table 3. Reliability Statistics

Cronbach's Alpha	N of Items
.983	35

3. Results and Discussion

3.1. Results

The instrument, which was declared valid and reliable, was then used to measure junior high school teachers' readiness in implementing coding and AI learning. The analysis was conducted on 18 respondents, using 35 items on a Likert scale of 1-5. All respondent data was deemed complete and suitable for analysis. The average percentage score was used to determine the level of teacher readiness achievement compared to the maximum ideal score. The formula used is:

$$\text{Percentage of Readiness} = \frac{\bar{x}}{x_{maks}} \times 100\% \tag{2}$$

Based on the recapitulation of respondent data, the average actual score (\bar{x}) was 4.17, and the maximum scale score was 5. Therefore, based on Formula 2, the following results were obtained:

$$\text{Percentage of Readiness} = \frac{4.17}{5} \times 100\% = 83.4\% \tag{3}$$

The percentage of readiness was interpreted using the following criteria in Table 4.

Table 4. Teacher Readiness Representation Table

Percentage	Category
81% - 100%	Very Good
61% - 80%	Good
41% - 60%	Fair
21% - 40%	Poor
≤ 20%	Very Poor

Based on Table 4, it can be concluded that the overall level of junior high school teachers' preparedness in implementing coding and AI learning falls into the Very Good category. When broken down into each indicator, the results are as shown in Table 5.

Table 5. Representation of Teacher Readiness in Each Indicator

Indicator	Percentage	Category
Digital Literacy	82.67%	Very Good
Technology-Based Pedagogical Competence	83.33%	Very Good
Attitudes and Perceptions Toward coding and AI	83.56%	Very Good
School Infrastructure Readiness and Support	86.22%	Very Good
Integration of Coding and AI in the Curriculum	83.11%	Very Good
Teacher Professional Development	81.56%	Very Good
Collaboration and the Teacher Community of Practice	84.00%	Very Good

3.2. Discussion

The quantitative analysis results indicate that the level of preparedness of junior high school teachers in Buleleng District for implementing coding and AI learning is in the very good category. This finding is supported by qualitative data obtained through open-ended responses and brief interviews with teachers and principals. In general, respondents stated that government policies regarding coding and AI learning are viewed as relevant and visionary, in line with the needs of students in the digital age. Teachers' statements demonstrate a collective awareness that mastering coding and AI is not only important as a technical skill, but also as a means of strengthening students' logical thinking, creativity, and problem-solving abilities. These findings are consistent with previous studies indicating that teacher readiness is a key determinant in the successful implementation of AI and coding education policies (Ngongpah & Oni, 2025; Tan et al., 2025).

Regarding digital literacy, the qualitative findings confirm the quantitative results, which indicated a very good category. Teachers stated that the use of digital devices, online learning platforms, and interactive media has become part of their daily learning practices. Several teachers stated that previous educational technology training experiences were very helpful in increasing their confidence in utilizing technology in the classroom. However, the qualitative data also revealed a need for further guidance, particularly in the use of technology more specifically for coding and AI learning. This indicates that although basic digital literacy has been well established, reinforcement at the application and contextual levels is still needed. This finding aligns with previous research highlighting that strong digital literacy significantly supports teachers in adapting to technology-enhanced learning environments (Du et al., 2024; Yue et al., 2024).

Qualitative findings on technology-based pedagogical competency indicators show that teachers no longer view technology as an additional burden, but rather as a tool to improve the quality of learning. Teachers stated that project-based approaches and contextual learning are most appropriate for integrating coding and AI at the junior high school level. This statement aligns with the quantitative results, which showed high scores on the pedagogical competency indicator. However, several teachers also highlighted time constraints and busy administrative demands as major challenges in consistently designing innovative, technology-based learning. This is in line with studies emphasizing that technology-integrated pedagogical competence plays a crucial role in improving learning effectiveness and innovation in digital classrooms (Chaniago et al., 2025; Farchan, 2025).

Regarding the attitude and perception indicator toward coding and AI, qualitative data demonstrates a predominance of positive attitudes and teacher enthusiasm. Many respondents expressed interest in learning more about coding and AI, especially if it is accompanied by simple and relevant application examples related to the subjects they teach. However, some teachers expressed concerns regarding the complexity of the material and student readiness. These findings provide context for the high quantitative results, demonstrating that teachers' positive attitudes still need to be supported by a gradual implementation strategy to avoid creating resistance or excessive anxiety in teaching practices. Previous studies also confirm that positive teacher attitudes toward AI significantly influence their willingness to adopt and integrate emerging technologies into teaching practices (Tan et al., 2025).

The qualitative data also reinforces the quantitative results on the infrastructure readiness and school support indicator, which achieved the highest percentage. Principals and teachers stated that support from internal school policies, such as the provision of ICT facilities and permission to participate in training, is a crucial factor in fostering teacher readiness. However, respondents also highlighted that the quality and stability of internet access remain a challenge in some schools. This finding indicates that although the infrastructure is generally considered ready, efforts to improve the quality of facilities and infrastructure are still needed to ensure optimal and equitable implementation of coding and AI learning. This finding is supported by prior research showing that adequate infrastructure and institutional support are critical factors in ensuring successful digital transformation in education (Saeed & Taher, 2026).

Regarding the integration of coding and AI into the curriculum, qualitative data revealed that teachers understand the importance of the flexibility of the Independent Curriculum as a platform for integrating technology-based learning. Teachers stated that coding and AI are easier to implement when linked to cross-subject projects. However, there are still doubts regarding the development of appropriate teaching materials and assessments. This finding complements the quantitative results, illustrating that teachers' conceptual readiness has been established, but implementation readiness still requires practical guidance and examples of applicable learning modules. This result is consistent with studies indicating that effective curriculum integration of coding and AI requires not only conceptual understanding but also practical teaching frameworks and resources (Chaniago et al., 2025).

Finally, regarding the indicator of teacher professional development and collaboration, qualitative data indicates that teachers feel motivated to learn together and share good practices, particularly through informal communities and discussions among teachers. Respondents considered collaboration key to overcoming individual limitations in understanding coding and AI. However, the sustainability of this collaboration is highly dependent on the support of schools and the education office. This finding reinforces the strong quantitative results and emphasizes the importance of strengthening communities of practice as a long-term strategy in supporting coding and AI -based learning transformation. This aligns with research emphasizing that continuous professional development and collaborative teacher communities are essential to sustain innovation in AI-based learning environments (Kim, 2024; Mah et al., 2026).

The research results indicate that the readiness of junior high school teachers in Buleleng District to implement coding and AI learning is in the very good category, both quantitatively and supported by qualitative findings. The implications of these findings confirm that schools have strong initial capital to implement national policies effectively. Therefore, practical recommendations are directed at schools and education offices to focus follow-up programs on project-based application training, curriculum integration assistance, and strengthening the teacher practice community. This step aims to maintain the sustainability of teacher readiness and ensure that the implementation of coding and AI learning is contextual, equitable, and oriented to the real needs of educational units. However, it is important to note that the relatively small number of respondents ($n = 18$) may introduce potential bias and limit the generalizability of the findings. Despite this limitation, the use of purposive sampling targeting key stakeholders (teachers and school leaders) ensures that the data still provide meaningful insights into the actual readiness conditions in the studied context.

3.3. Implications

The findings of this study theoretically reinforce the concept of teacher readiness as a key factor in the successful implementation of technology-based learning, particularly coding and AI, while practically providing

a foundation for schools and policymakers to design more targeted training, mentoring, and infrastructure support programs. Furthermore, at the policy level, these results serve as a strategic reference to ensure that digital education transformation is implemented effectively, sustainably, and can be adapted across broader educational contexts.

3.4. Limitations

This study is limited by its use of a descriptive design and a relatively small sample size confined to junior high schools in Buleleng District, which may restrict the generalizability of the findings to other regions or educational levels. Additionally, the reliance on self-reported data may introduce response bias, suggesting the need for future studies to incorporate broader samples and mixed methods for more comprehensive validation.

4. Conclusion

Based on the results of data analysis, it can be concluded that the level of readiness of Junior High School teachers in Buleleng District in implementing coding and AI learning is in the "Very Good" category. This is evidenced by the average score of 4.17 on a scale of 5, which is equivalent to a readiness percentage of 83.40%. All measured indicators show consistent achievement above the 81% threshold, with the Infrastructure Readiness and School Support indicator achieving the highest score (86.22%), followed by the Collaboration and Community of Practitioners indicator (84.00%), and Attitudes and Perceptions towards coding and AI (83.56%). These findings indicate that fundamentally, junior high school teachers in Buleleng District have a foundation of digital literacy and internal motivation that is very adequate to support the national digital transformation in 2025. Although already at a very good level, continuous strengthening through professional training is still needed so that this theoretical mastery can be effectively translated into interactive learning practices in the classroom. The results of this study provide empirical validation of the Technology Readiness Level and serve as an important reference for policy makers to begin moving to the more technical implementation stage of the coding and AI learning model.

Author Contributions

All authors have equal contributions to the paper. All the authors have read and approved the final manuscript.

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Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration on AI Use

The author declares that artificial intelligence (AI) tools were used solely to assist in language refinement, grammar checking, and improving the clarity of writing in this manuscript. All ideas, research design, data collection, analysis, and interpretation of results are the original work of the author. The author takes full responsibility for the content and integrity of this study.

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