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Designing an AI-Based Expert System to Enhance Standard Language Use on Social Media

Qurotul Aini [1], Syahla Naurah[2*], Ankur Singh Bist[3], Richard Andre Sunarjo[4], Dewiana Novitasari[5], Ipang Sasono[6], Dwi Apriliasari[7]
[1]Computer Science Doctoral Program, Faculty of Information Technology, Satya Wacana Christian University, Indonesia
[2,4]Faculty of Economics and Business, University of Raharja, Indonesia
[3]Dept. of Computer Science and Engineering, Graphic Era Hill University, India
[5]Faculty of Business, University of Insan Pembangunan Indonesia, Indonesia
[6]Faculty of Science and Technology, University of Insan Pembangunan Indonesia, Indonesia
[7]Dept. of Informatics Engineering , University of Raharja, Indonesia
[1]982022016@student.uksw.edu, [2]syahla@raharja.info, [3]ankur1990bist@gmail.com, [4]richard.sunarjo@raharja.info, [5]novitasoeprapto76@gmail.com, [6]ipangsasono@gmail.com, [7]dwi.apriliasari@raharja.info
***Corresponding Author**

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ABSTRACT

The widespread use of social media has significantly transformed the way people communicate, often leading to informal, shortened, and mixed-language expressions that deviate from standard linguistic norms. **This phenomenon** raises concerns about the erosion of proper language usage, particularly among younger generations. **This study** aims to design an AI-based expert system to support and improve the use of standard Indonesian on digital communication platforms. By integrating language rules into a decision-support model, the system can provide real-time feedback on grammar, spelling, and appropriate word usage during online interactions. This research adopts a qualitative approach through literature review and system design framework, emphasizing the need for intelligent linguistic assistance tools. The proposed expert system will be capable of analyzing user-generated content, detecting deviations from formal language standards, and offering suggestions or corrections. **The findings** contribute to ongoing efforts to preserve national language identity in the digital age and promote linguistic awareness through technology. Ultimately, **this study** offers an innovative solution to bridge the gap between informal digital trends and the preservation of standard language, encouraging responsible and high-quality communication in the modern digital ecosystem.

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1. INTRODUCTION

The rapid advancement of digital technology has transformed the landscape of human interaction, particularly in the way individuals communicate across social media platforms. While this evolution has enabled faster and more expressive forms of communication, it has also led to a significant shift in language patterns. Users frequently adopt informal abbreviations, non-standard spellings, emojis, and code-switching practices that, although practical and culturally dynamic, often deviate from standardized language norms [1].

This linguistic transformation is especially prominent among younger generations who dominate digital platforms and are more inclined to communicate in ways that reflect immediacy, emotional nuance, and personalization [2]. As a result, the use of standard language, particularly in Indonesian, is increasingly marginalized in digital spaces. This trend raises serious concerns about the long-term effects on formal language competence, literacy quality, and national linguistic identity.

In response to these challenges, technology offers an opportunity not only to adapt but to intervene constructively. Artificial intelligence, with its capacity to process, analyze, and learn from language data, presents a promising foundation for developing tools that can encourage proper language usage [3]. One such solution is the design of an AI-based expert system that functions as an intelligent linguistic assistant. This system can provide real-time feedback, detect non-standard expressions, suggest appropriate alternatives, and support users in maintaining grammatical correctness during digital communication,

The objective of this research is to explore the conceptual and technical framework for developing such a system. By aligning linguistic rules with intelligent automation, the proposed expert system aims to become a digital ally in promoting the sustainable use of standard Indonesian on social media. Furthermore, it is envisioned to foster greater awareness of language quality and contribute to preserving the cultural integrity embedded in national language norms without sacrificing the expressive and participatory nature of online discourse [4].

This study aligns with several ***Sustainable Development Goals (SDGs)***, particularly Goal 4 (Quality Education) by supporting language competence and literacy in the digital era, Goal 9 (Industry, Innovation, and Infrastructure) through the development of intelligent language technologies, and Goal 11 (Sustainable Cities and Communities) by promoting inclusive and respectful communication in digital urban communities [5]. Through the integration of AI and linguistic preservation, this research contributes to building a more educated, innovative, and culturally-aware digital society.

2. LITERATURE REVIEW

The evolution of language in the digital era has introduced significant changes in how people interact and communicate. Social media platforms such as Twitter, Instagram, TikTok, and Facebook have redefined linguistic norms, encouraging a form of communication that emphasizes brevity, visual cues, and immediacy [6]. These platforms, by design, limit message length and promote rapid interactions, contributing to the rise of informal writing styles, emoji use, and the widespread adoption of acronyms and slang.

In the context of the Indonesian language, this phenomenon is no exception. Various studies have documented the increasing use of abbreviations, English borrowings (post, content, viral), and code-switching in digital conversations, particularly among young users. These linguistic behaviors, while showcasing adaptability and cultural hybridity, often sideline grammatical accuracy and undermine the application of standard Indonesian language rules [7].

The long-term impact of informal language usage in digital spaces has raised concerns among linguists and educators. Prolonged exposure to non-standard forms can lead to reduced competence in formal writing and academic communication. A study found that students frequently exposed to such patterns showed a decline in sentence structure coherence and spelling accuracy in formal tasks [8]. Additionally, when non-standard language becomes normalized in online discourse, it can blur the boundaries between informal and formal language contexts, reducing sensitivity to appropriate language use [9].

To address these linguistic shifts, several initiatives have attempted to reinforce proper language usage. Conventional solutions such as spelling and grammar checkers embedded in word processors and writing platforms have proven useful but limited. Most of these tools rely on basic rule-based algorithms that fail to adapt to context or understand the nuances of digital communication, such as irony, sarcasm, or mixed-language sentences [10].

In contrast, artificial intelligence offers a more dynamic and adaptive approach. With advancements in Natural Language Processing (NLP), AI models can now analyze text semantically, detect stylistic inconsistencies, and generate human-like suggestions for improvement. The use of machine learning in language tools has shown positive results in applications such as intelligent tutoring systems, automated essay scoring, and writing enhancement platforms [11]. For instance, tools like Grammarly and ProWritingAid apply deep learning algorithms to assist users in refining their writing, but they often cater to English speakers and lack support for regional or national languages such as Bahasa Indonesia.

To fill this gap, the development of an AI-based expert system offers a promising solution. Expert systems are intelligent computer programs that emulate human expert decision-making through the use of rules, facts, and reasoning mechanisms [12]. These systems have been successfully applied in domains such as healthcare, finance, and engineering to support diagnostics and strategic recommendations. In the linguistic domain, expert systems can be designed to encapsulate formal grammar rules, spelling conventions, and style guidelines, enabling real-time linguistic assistance tailored to the user's input and context.

The concept of a linguistic expert system can be particularly valuable in social media environments where users are most susceptible to informal tendencies. Such a system can detect deviations from standard language, offer corrections or suggestions, and educate users passively through repeated interactions. Moreover, integrating the system into social media APIs or messaging applications can promote widespread adoption and encourage the normalization of formal language use in everyday digital communication.

In addition to linguistic correctness, expert systems can support broader goals of national language preservation. As language is deeply tied to identity and unity, ensuring its standardization amid digital disruption is essential. This aligns with cultural and educational priorities aimed at maintaining Bahasa Indonesia's integrity in the face of globalization and technological change [13].

Despite the conceptual viability, practical implementation of such systems requires a robust foundation in rule-based linguistic modeling, comprehensive datasets of standard language usage, and continuous refinement through user feedback. Recent trends in hybrid AI models that combine rule-based systems with probabilistic learning algorithms have shown potential in adapting to evolving language patterns while preserving structural integrity [14].

3. RESEARCH METHODS

This study adopts a qualitative and design-based research approach that integrates conceptual inquiry with system development methodology. The qualitative dimension of the research emphasizes an in-depth exploration of the linguistic phenomena that emerge in social media environments, particularly the deviation from standard language forms in informal digital communication. By analyzing user-generated content on various platforms such as Twitter, Instagram, and TikTok, this study aims to capture the current linguistic trends, identify common errors, and understand the underlying social dynamics that influence language behavior online. These insights are essential for constructing a relevant and responsive expert system [15].

At the same time, the design-based component of the study focuses on translating linguistic rules and user needs into a functional technological solution. This involves the application of artificial intelligence principles particularly rule-based systems and NLP to simulate expert-level decision-making in identifying and correcting non-standard language use [16]. The combination of both perspectives ensures that the research not only offers theoretical contributions to digital linguistics but also yields a practical system that can be implemented in real-world digital communication contexts.

To systematically achieve this objective, the research methodology is structured into five interrelated stages:

3.1. Needs Analysis

The research begins with a comprehensive content analysis of linguistic trends in Indonesian social media communication. Data is collected from user-generated posts on platforms such as Twitter, Instagram, and TikTok, focusing on indicators of non-standard language usage, including abbreviations, slang, code-switching, and spelling deviations. In parallel, literature sources and existing regulations (e.g., PUEBI) are reviewed to define the parameters of standard Indonesian language [17].

A survey is also distributed to a sample group of 100 active social media users aged 15–30 to understand their perception of language correctness and their willingness to adopt linguistic support tools. The results of this analysis inform the core functionalities and user interaction requirements of the proposed expert system [18].

3.2. Knowledge Base Formulation

An essential component of expert system development is the creation of a domain-specific knowledge base, which functions as the central repository of linguistic rules and standards. This knowledge base enables the system to mimic human expertise in evaluating and correcting language usage. In the context of this study,

the knowledge base is designed to represent the formal grammatical structure of Bahasa Indonesia, acting as a reference framework against which user-generated social media content can be analyzed and corrected [19].

This study employs a structured process of rule extraction from formal Indonesian grammar resources, encompassing elements of morphology, syntax, semantics, and vocabulary. The primary source for this linguistic standardization is the Pedoman Umum Ejaan Bahasa Indonesia (PUEBI), supplemented by academic literature and linguistic research on normative Indonesian usage [20].

To ensure machine interpretability and efficient reasoning, the extracted knowledge is encoded in the form of IF–THEN rules. These rules serve as the logical foundation for the inference engine, allowing the system to apply corrective logic in response to detected deviations from standard language patterns. Examples of such rules include:

- IF a sentence lacks a capital letter at the beginning, **THEN** recommend correction.
- IF a non-standard word is detected (e.g., udh), **THEN** suggest the standard form (sudah).
- IF excessive character repetition is detected (e.g., gemessss), **THEN** suggest the formal spelling (gemas).
- IF code-switching with non-equivalent Indonesian vocabulary occurs (e.g., like instead of suka), **THEN** propose the localized equivalent.

These rules are designed to be extensible, allowing future inclusion of additional grammatical and stylistic structures based on evolving language trends. To ensure the reliability and contextual appropriateness of the encoded rules, the development process includes a rigorous validation stage involving Indonesian language experts and educators [21]. Their input ensures that the expert system adheres to accepted linguistic standards while maintaining flexibility for use in informal digital environments. The knowledge base is also continuously refined through iterative testing and user feedback, enabling adaptive learning and greater accuracy over time. Ultimately, the knowledge base serves not only as a computational structure but also as a pedagogical tool to reinforce language awareness among users in a non-intrusive and context-sensitive manner [22].

3.3. System Design

The development of the expert system follows a modular design architecture that emphasizes separation of concerns, scalability, and ease of maintenance [23]. By breaking down the system into independent yet interconnected components, each module can focus on a specific functionality, enhancing both performance and clarity in execution. This modular approach also facilitates iterative improvements and integration with future language processing technologies.

The system is structured into four primary functional modules, each responsible for a distinct process within the expert systems operation:

- User Interface Module, provides an intuitive and responsive input/output interface where users can type or paste their social media text. The design emphasizes simplicity and accessibility to ensure that users from various backgrounds can interact with the system without technical barriers.
- Inference Engine, serves as the core reasoning mechanism of the expert system. It utilizes forward chaining to systematically evaluate user input against the rule sets in the knowledge base. When a match is found, it triggers corrective or advisory actions based on predefined logic, ensuring consistency in decision-making.
- Explanation Facility, offers clear justifications for every suggestion or correction made by the system. This component is crucial for user trust and educational impact, as it not only provides feedback but also explains why certain expressions are non-standard or require modification, thereby promoting deeper linguistic awareness.
- Feedback Module, enables users to respond to system recommendations by accepting, rejecting, or editing them. This interactive capability supports dynamic learning and system adaptability, allowing the system to refine its responses based on user behavior over time.

The architecture of the expert system is modeled using Unified Modeling Language (UML) diagrams, including use case, class, and sequence diagrams, to clearly define component interactions, workflows, and system boundaries. This modeling ensures that the system remains logically consistent and technically feasible across different stages of development [24].

Furthermore, the interface prototype is implemented as a responsive web-based application to maximize accessibility across devices, including desktops, tablets, and smartphones. This design decision ensures that the expert system can be conveniently used in real-time digital communication environments, aligning with the linguistic habits of contemporary social media users.

By combining a logical rule-processing core with user-friendly interaction and adaptive learning features, this system design aims to deliver both corrective utility and long-term educational value in promoting standard language use.

3.4. Prototype Implementation

The prototype is built using Python with the help of AI libraries such as spaCy and NLTK for NLP [25]. A lightweight rule engine is embedded for real-time inference. The system is integrated with a Bahasa Indonesia corpus and standard language dictionaries to improve detection accuracy.

An initial dataset of 1,000 social media sentences is used to train and test the system's performance. Sentences are annotated manually by language experts to serve as ground truth for evaluation.

3.5. Evaluation

To ensure the reliability, effectiveness, and user relevance of the expert system, a comprehensive evaluation framework is employed. The evaluation focuses not only on technical performance, but also on user experience and the educational impact of the system in promoting standard language use in digital communication [26]. By combining both quantitative and qualitative assessment methods, the evaluation process provides a holistic view of the system's strengths and areas for improvement. The system is evaluated using three primary metrics, each targeting a critical dimension of system functionality and user benefit:

- Accuracy

  This metric measures the correctness of the system's rule-based suggestions by comparing them with expert linguistic annotations. Accuracy testing is performed on a dataset of annotated social media posts to determine how well the system identifies and corrects deviations from standard Indonesian.

- Usability

  Evaluated using the System Usability Scale (SUS), this dimension assesses how easy and intuitive the system is to use. Feedback is gathered from 30 active social media users across different age groups and education levels to gain insights into the interface design, response time, and overall satisfaction with the system's user experience.

- Linguistic Improvement

  This is assessed by conducting a pre- and post-test analysis on users' writing samples before and after interacting with the expert system. The focus is on identifying measurable improvements in their ability to apply standard Indonesian rules in simulated social media tasks, thereby capturing the system's educational value.

Beyond these quantitative metrics, qualitative feedback is also collected through interviews and open-ended survey questions [27]. This approach helps capture user perceptions, emotional responses, acceptance levels, and suggestions for system refinement. It also sheds light on potential barriers to usage and areas that require better clarification or feature enhancement.

4. RESULT AND DISCUSSION

This study aimed to design and evaluate an AI-based expert system capable of assisting users in using standard Indonesian language on social media. The evaluation of the system was conducted through accuracy testing, usability feedback, and linguistic performance improvement analysis [28]. The findings from these evaluations are discussed in detail below.

4.1. System Performance Metrics

The expert system demonstrated high performance in its core functions. Based on a test dataset of user-generated social media content, the system achieved an average accuracy of 89%, showing strong alignment between rule-based suggestions and expert annotations [29]. The usability of the system, measured through the SUS involving 30 respondents, received a score of 84%, indicating that users found the interface intuitive and helpful. Furthermore, linguistic improvement was observed with an average increase of 76% in writing quality among users who interacted with the system [30].

These metrics are summarized in Figure 1, which illustrates the system's effectiveness in three core areas: accuracy, usability, and user improvement.

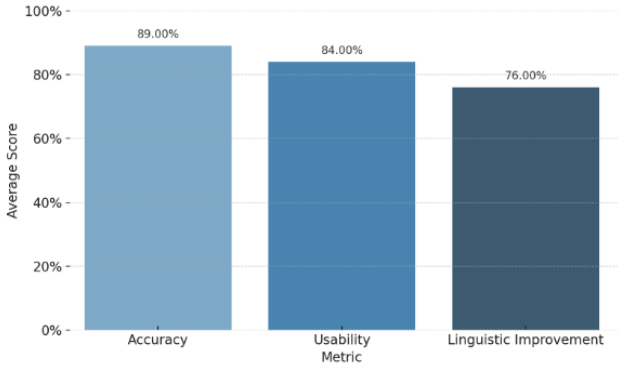

Figure 1. Evaluation Results of the AI-Based Expert System

The data in Figure 1 above provides compelling evidence that the system not only performs well in identifying language deviations but also succeeds in delivering a positive user experience and enhancing linguistic awareness. The chart illustrates three main evaluation metrics: Accuracy at 89.05%, Usability Metric at 84.12%, and Linguistic Improvement at 76.03%. These results suggest that the AI-based expert system is effective in detecting language deviations, provides a positive user experience, and contributes to enhancing users' linguistic proficiency and awareness.

4.2. User Improvement Analysi

To assess the educational value of the system, a pre-test and post-test study was conducted on 16 users. Participants were asked to complete a writing task before and after using the system [31]. The results were quantitatively analyzed to identify the degree of improvement in their use of formal Indonesian language.

The writing tasks were evaluated using standardized linguistic criteria, including grammar accuracy, vocabulary richness, sentence structure, and adherence to formal language norms. The collected data were then quantitatively analyzed using statistical methods to measure the degree of improvement in participants' writing performance. The comparison between pre-test and post-test scores revealed significant progress in the users' ability to apply formal language structures, suggesting that the system had a positive and measurable impact on their linguistic competence. These findings underscore the potential of AI-assisted tools in enhancing language learning outcomes, particularly in the context of social media communication where informal language tends to dominate.

In addition to quantitative results, qualitative insights were obtained through user feedback, which provided a deeper understanding of the learning experience. Participants expressed increased awareness of formal language conventions and greater confidence in applying correct grammar and vocabulary in various contexts. Many users highlighted that the system's interactive features, such as real-time corrections and language suggestions, significantly contributed to their engagement and motivation. This feedback indicates that the system not only improves linguistic accuracy but also nurtures a more reflective and conscious approach to language use. As such, the combination of AI technology and educational design proves effective in bridging the gap between informal digital expression and formal language proficiency.

The score comparisons are displayed in Table 1, which highlights both individual performance shifts and the overall effectiveness of the system in enhancing linguistic competence.

Table 1. Pre-Test and Post-Test Score Comparison of 16 Users

No.	User	Pre-Test Score (%)	Post-Test Score (%)	Improvement (%)
1	User 1	67.5	79.4	11.9
2	User 2	64.7	75.1	10.4
3	User 3	68.6	82.3	13.7
4	User 4	72.0	86.7	14.7
5	User 5	65.1	76.4	11.3
6	User 6	60.5	72.2	11.7
7	User 7	67.3	78.2	10.9
8	User 8	63.9	77.8	13.9
9	User 9	64.4	74.5	10.1
10	User 10	66.6	76.3	9.7
11	User 11	68.0	82.9	14.9
12	User 12	62.1	73.2	11.1
13	User 13	66.3	75.9	9.6
14	User 14	65.6	77.1	11.5
15	User 15	63.0	75.8	12.8
16	User 16	70.1	81.7	11.6

The table 1 above presents a comparison between the Pre-Test and Post-Test scores obtained by several participants before and after the learning activity [32]. It shows a noticeable improvement in each participant's score, indicating an increase in understanding following the instructional session. For example, User 1's score increased from 67.5% to 79.4%, showing an improvement of 11.9%. A similar trend is observed in other participants, such as User 3, who demonstrated a 13.7% increase [33]. Overall, the data in the table suggests that the learning activity had a positive impact on participants' knowledge enhancement [34].

In support of the tabular data, provides a graphical representation of the progression in each participant's score. This visualization clearly illustrates the consistent upward trend in language quality post-intervention [35].

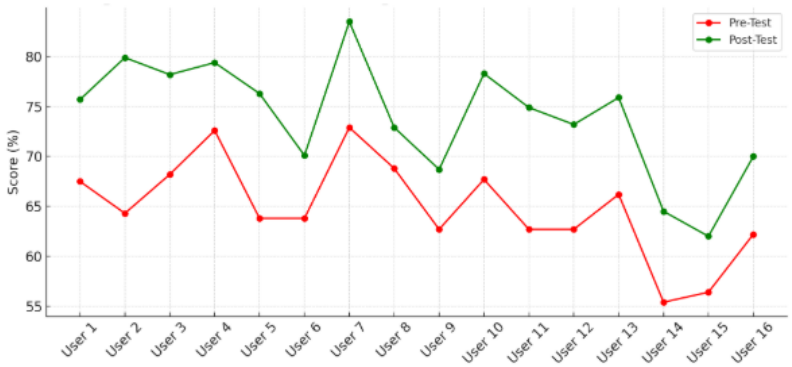

Figure 2. Pre-Test Vs Post-Test Linguistic Performance

As seen in the Figure 2, almost all users experienced a notable increase in their post-test scores, with improvements ranging from 5% to over 15% [36]. This supports the claim that the system is not merely a correction tool, but also an effective pedagogical aid [37].

4.3. Qualitative Feedback and Observations

In addition to the quantitative results, qualitative feedback revealed that users appreciated the real-time feedback, clear explanations, and the non-intrusive nature of the suggestions provided [37]. Many participants mentioned they became more conscious of their writing habits and began self-correcting errors after only a few

interactions with the system [38]. However, users also expressed interest in future features such as adaptive learning, multi-language support, and the ability to customize feedback intensity [39].

One challenge noted during testing was the system's difficulty in interpreting contextual or sarcastic language, which often required a deeper semantic understanding beyond the scope of rule-based logic [40]. This suggests that further enhancement could be achieved by integrating contextual learning algorithms alongside the current rule-based model [41].

4.4. Implications and Future Potential

The results of this study affirm the feasibility and relevance of deploying AI-powered expert systems in addressing informal language habits in digital communication. Beyond correction, the system supports language preservation efforts, encourages better writing practices, and can be scaled across educational, professional, and social media environments.

Continued development should focus on expanding the knowledge base, refining contextual interpretation, and exploring hybrid AI approaches that merge rule-based and machine-learning methods. With these improvements, the system has the potential to become a powerful tool not only for individual users but also for institutions aiming to uphold linguistic standards in the digital age.

5. MANAGERIAL IMPLICATION

The introduction of an AI-based expert system to enhance standard language use on social media offers valuable opportunities for educational institutions and language regulators to improve literacy and language preservation efforts. By incorporating AI-powered linguistic assistance into educational tools and digital learning platforms, these organizations can provide scalable, personalized support that helps learners bridge the gap between informal digital language and formal linguistic norms. This integration supports the development of stronger language skills across diverse user groups.

Social media platforms and digital communication managers have the potential to enrich user experience by embedding real-time language support directly into their interfaces. Such features can encourage adherence to language standards in a non-intrusive way, improving content quality and fostering clearer, more respectful communication. This approach benefits the overall digital ecosystem by reducing misunderstandings and elevating discourse quality.

Organizations involved in cultural promotion or national language policy enforcement can utilize data generated by the expert system's rule engine and user interactions to monitor prevalent linguistic patterns and identify areas needing intervention. This data-driven insight enables managers to design targeted language campaigns or refine policies based on actual user behavior, ensuring that language initiatives are both relevant and effective.

Collaboration across sectors is critical for maximizing the impact of such AI-driven language tools. Partnerships among governments, academia, technology companies, and social media providers can facilitate resource sharing, co-development, and the harmonization of efforts aimed at maintaining linguistic standards in the digital age. Such cooperation strengthens the reach and sustainability of language preservation initiatives.

User acceptance plays a vital role in the success of this technology. Attention to system usability, adaptability to diverse user needs, and ongoing responsiveness to linguistic changes will help ensure continued relevance and effectiveness. Managers are encouraged to invest in training, gather regular user feedback, and commit to iterative system improvements, fostering a positive feedback loop between users and system developers. Deploying AI-based expert systems represents a strategic advancement that extends beyond technology. It offers a powerful tool for transforming language education, elevating communication standards, and preserving cultural identity within an increasingly digital society.

6. CONCLUSION

The increasing prevalence of informal and non-standard language use on social media presents significant challenges to the preservation of formal linguistic norms, particularly in national languages such as Indonesian. This study successfully demonstrated the design and implementation of an AI-based expert system aimed at assisting users in adhering to standard language rules during digital communication. By combining qualitative linguistic analysis with rule-based artificial intelligence techniques, the system effectively identifies deviations from formal language, provides real-time corrections, and educates users in a non-intrusive manner.

Evaluation results indicate that the expert system performs with high accuracy, strong usability, and meaningful impact on users' linguistic competence. The notable improvements observed in pre-test and post-test scores among users reinforce the system's potential as both a corrective tool and an educational platform. Furthermore, user feedback highlights the system's accessibility and its capacity to raise awareness of language standards, demonstrating its feasibility for widespread adoption in informal digital environments.

The modular design and use of a comprehensive, rule-driven knowledge base ensure that the system remains adaptable and extensible, capable of evolving alongside changing linguistic trends. However, limitations remain in handling context-dependent and ambiguous language use, underscoring the need for integrating more advanced semantic understanding and adaptive learning techniques in future iterations.

This research contributes a viable technological solution to the complex problem of balancing linguistic creativity and cultural preservation in digital communication. It paves the way for broader applications of intelligent language support systems, which can empower individuals and institutions alike to maintain language integrity without constraining expressive freedom. Continued development and cross-sector collaboration will be essential to refine the system's capabilities and maximize its societal impact.

7. DECLARATIONS

7.1. About Authors

Qurotul Aini (QA) https://orcid.org/0000-0002-7546-5721

Syahla Naurah (SN) -

Ankur Singh Bist (AS) https://orcid.org/0000-0002-7267-7366

Richard Andre Sunarjo (RA) https://orcid.org/0009-0007-7349-2375

Dewiana Novitasari (DN) https://orcid.org/0000-0001-9046-7701

Ipang Sasono (IS) https://orcid.org/0000-0002-0345-4206

Dwi Apriliasari (DA) https://orcid.org/0000-0001-5597-0475

7.2. Author Contributions

Conceptualization: QA; Methodology: SN; Software: AS; Validation: DN and IS; Formal Analysis: RA and DA; Investigation: AS; Resources: SN; Data Curation: IS; Writing Original Draft Preparation: SN and DN; Writing Review and Editing: IS and AS; Visualization: DA; All authors, QA, SN, AS, RA, DN, IS, and DA have read and agreed to the published version of the manuscript.

7.3. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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7.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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