



Kolka Application for Enhancing SPOK Sentence Construction in Deaf Students

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Article History:

Received: Apr 26, 2026

Revised: Aug 07, 2026

Accepted: Sep 08, 2026

Online First: Oct 03, 2026

Keywords:

Deaf Students,
Digital Learning Media,
KOLKA Application,
Sentence Construction,
Visual Learning.

Kata Kunci:

Aplikasi KOLKA,
Media Pembelajaran Digital,
Pembelajaran Visual,
Penyusunan Kalimat,
Peserta Didik Tunarungu.

How to cite:

Hermawan, A. F., Hernawati, T., Ratnengsih, E., Rakhmat, C., & Bagheri, F. F. (2026). Kolka Application for Enhancing SPOK Sentence Construction in Deaf Students. *Edunesia : Jurnal Ilmiah Pendidikan*, 7(3), 2116-2132.

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Abstract: This study aimed to develop and evaluate the KOLKA (Kolom Kata) application as a digital learning medium for improving SPOK (Subject, Predicate, Object, and Adverbial) sentence construction among deaf students. The study employed a mixed-methods approach with a sequential exploratory design. Six deaf students at SLB BC YPLAB Cibaduyut participated in the study. Qualitative data were collected through observation, interviews, and documentation, while quantitative data were obtained using a one-group pretest-posttest design. Data were analyzed using the Content Validity Ratio (CVR), Aiken's V, Cronbach's Alpha, and the Wilcoxon Signed-Rank Test. The results showed very high instrument validity (CVR > 0.99), good reliability (Cronbach's Alpha = 0.76), and high feasibility of the KOLKA application (Aiken's V > 0.94). Students' mean scores increased from 44.16 on the pretest to 85.83 on the posttest, with a significant difference ($p = 0.026$). The findings indicate that KOLKA provides promising support for visual-based sentence learning among deaf students.

Abstrak: Penelitian ini bertujuan mengembangkan dan mengevaluasi aplikasi KOLKA (Kolom Kata) sebagai media pembelajaran digital untuk meningkatkan kemampuan menyusun kalimat berpola SPOK (Subjek, Predikat, Objek, dan Keterangan) pada peserta didik tunarungu dalam konteks pendidikan khusus. Penelitian menggunakan pendekatan metode campuran dengan desain eksploratori sekuensial. Subjek penelitian terdiri atas enam peserta didik tunarungu di SLB BC YPLAB Cibaduyut. Data kualitatif dikumpulkan melalui observasi, wawancara, dan dokumentasi, sedangkan data kuantitatif diperoleh melalui desain one-group pretest-posttest. Data dianalisis menggunakan Content Validity Ratio (CVR), Aiken's V, Cronbach's Alpha, dan Wilcoxon Signed-Rank Test. Hasil penelitian menunjukkan validitas instrumen sangat tinggi (CVR > 0,99), reliabilitas baik (Cronbach's Alpha = 0,76), dan kelayakan aplikasi KOLKA sangat tinggi (Aiken's V > 0,94). Rata-rata skor peserta didik meningkat dari 44,16 pada pretest menjadi 85,83 pada posttest, dengan perbedaan yang signifikan ($p = 0,026$). Temuan menunjukkan bahwa KOLKA berpotensi mendukung pembelajaran kalimat berbasis visual secara lebih konkret bagi peserta didik tunarungu.

A. Introduction

Language proficiency is fundamental to communication, social interaction, and academic achievement. In Indonesian language learning, the ability to construct grammatically appropriate sentences provides an important foundation for expressing ideas clearly and systematically. One basic sentence pattern taught in Indonesian is SPOK, consisting of Subject, Predicate, Object, and Adverbial. Mastery of this pattern is important for effective written and everyday communication. For deaf students, however, sentence construction can be challenging because limited access to auditory information may affect vocabulary development, grammatical knowledge, and syntactic understanding (Hall, 2017).

Deaf students cannot rely fully on auditory input when receiving and processing language information. This condition may contribute to difficulties in vocabulary acquisition, affixation, word order, and understanding relationships among sentence elements. Consequently, some students may produce short or incomplete sentences, omit essential elements, or arrange words inappropriately. Sentence inversion may also occur, in which the intended meaning is understandable but the word sequence does not follow the expected Indonesian structure. These difficulties can affect not only academic performance but also students' ability to communicate ideas, needs, and experiences in daily life. Therefore, instructional approaches that accommodate the visual and linguistic characteristics of deaf students are needed.

In Special Education Schools (SLB), sentence construction using the SPOK pattern is an important component of Indonesian language learning. Nevertheless, classroom instruction may still depend on teacher explanations, written exercises, and static learning materials. Such approaches provide limited opportunities for repeated practice, interactive learning, and immediate feedback, even though game-based and interactive activities have been shown to support deaf students' engagement more broadly (Apendi et al., 2023). For deaf students, abstract grammatical concepts may be difficult to understand without concrete and visually accessible representations. Learning media that presents sentence elements systematically and allows students to arrange, practice, and correct their responses may therefore offer a more appropriate learning environment.

This need was identified in a preliminary study at SLB BC YPLAB Cibaduyut. The findings indicated that deaf students continued to experience difficulties in constructing coherent sentences according to the SPOK pattern. Some students could write only two or three words without a clear grammatical structure, while sentence inversion was frequently observed, such as writing "to school I walk" to express "I walk to school." Limited vocabulary, low concentration during instruction, and a lack of interactive learning materials also hindered the learning process. These conditions indicate a gap between expected sentence-construction skills and students' existing abilities and highlight the need for learning media that is concrete, interactive, systematic, and responsive to their characteristics.

Previous studies have developed various media to support language learning among deaf students. Ismail et al (2024) used Wordwall through a game-based activity to support understanding of SPOK patterns among seventh-grade deaf students. Paramuditha & Marlina (2024) developed the Lakas Android application for structured sentence construction, while Rismawati (2019) used strip stories to support understanding of sentence structure. Hasadikin (2018) employed picture word cards, Andri (2017) developed a sentence-construction board, Muttaqin (2018) applied captioned instructional videos, and Syaputri & Efendi (2021) developed the I-CHAT application to strengthen recognition of SPOK patterns. These studies demonstrate the value of visual and structured media. However, most approaches remain conventional or relatively simple and provide limited opportunities for independent digital practice, progressive learning, and immediate feedback. Educational technology therefore offers an opportunity to integrate visual representation, scaffolding, interaction, and feedback into a more flexible learning environment.

Although previous studies have demonstrated the potential of visual media and interactive activities for supporting language learning among deaf students, research on digital applications specifically designed for SPOK sentence construction remains limited. Existing media have not sufficiently integrated progressive visual scaffolding, drag-and-drop sentence construction, gamification, learning levels, and immediate feedback within a single application. Opportunities for flexible practice through mobile devices and independent learning outside the classroom are also limited. This gap indicates the need for a digital learning medium that can guide students from basic to more complex sentence patterns while providing repeated, interactive, and visually accessible practice.

To address this gap, the present study develops the KOLKA (Kolom Kata) application as a digital learning medium specifically designed to support deaf students in constructing SPOK-patterned sentences. KOLKA integrates concrete visual presentation, gradual scaffolding, game-based activities, drag-and-drop interaction, a learning-level system, and immediate feedback in one learning environment. The learning sequence progresses from S-P to S-P-O and finally to S-P-O-K, allowing students to learn sentence structures incrementally. Colors, illustrative images, and interactive word-building activities further strengthen visual representation. Its mobile accessibility is intended to facilitate flexible practice and independent learning while responding to the visual learning characteristics of deaf students.

Based on the identified gap and proposed innovation, this study addresses three research questions: (1) What is the validity and feasibility of the KOLKA app-based digital learning medium for teaching SPOK-patterned sentence construction to deaf students? (2) How effective is the KOLKA application in improving deaf students' ability to construct SPOK-patterned sentences? and (3) How do visual interaction and step-by-step learning within the KOLKA application influence students' learning engagement? Accordingly, this study aims to develop, validate, and evaluate the KOLKA application for improving SPOK sentence-construction skills among deaf students at SLB BC YPLAB Cibaduyut. The study

is expected to contribute a practical digital learning medium and empirical evidence on visually oriented technology for Indonesian language instruction in special education.

B. Method

This study employed a mixed-methods approach with a sequential exploratory design. The qualitative phase was conducted first to identify students' learning needs, characteristics, difficulties in constructing SPOK-patterned sentences, and the need for appropriate digital learning media. The quantitative phase was subsequently conducted to evaluate changes in students' sentence-construction skills following the implementation of the KOLKA (Kolom Kata) application. This design was selected because the study aimed not only to develop and validate the learning medium but also to obtain preliminary evidence of its effectiveness.

The study was conducted at SLB BC YPLAB Cibaduyut during the second semester of the 2025/2026 academic year. The participants were six deaf students from SMPLB and SMALB, consisting of three males and three females aged 15–25 years. The participants were selected using purposive sampling based on preliminary observations, teacher assessments, and recommendations from the Indonesian language teacher. The students demonstrated difficulties in vocabulary use, sentence structure, word order, and the arrangement of sentence elements according to the SPOK pattern. The research procedure consisted of problem identification, needs analysis, application design, expert validation, revision, pretest, application implementation, posttest, data analysis, and conclusion.

The KOLKA application was developed as an interactive, visually oriented learning medium based on the principles of visual learning and scaffolding. Its instructional sequence progressed from the S-P pattern to S-P-O and finally to S-P-O-K. The application incorporated drag-and-drop activities, color-coded sentence elements, illustrative images, learning levels, and immediate feedback. Before implementation, the developed medium was evaluated by subject matter experts, media experts, and practitioners. The evaluation covered content accuracy, material presentation, language use, application design, visual appeal, usability, effectiveness, interactivity, efficiency, and creativity. Expert feedback was used to revise the application before classroom implementation.

The intervention was implemented in 11 sessions, with each session lasting 80 minutes. Learning activities began with the identification of sentence elements and continued progressively from simple S-P constructions to S-P-O and S-P-O-K constructions. During each session, students arranged words into sentences using the drag-and-drop feature and received immediate feedback when their responses were incorrect. Before the intervention, students completed a pretest to assess their initial sentence-construction ability. Following the intervention, a posttest was administered using indicators covering the appropriate use of subjects, predicates, objects, and adverbials, as well as the coherence of sentence structures.

Data were collected through observations, interviews, tests, documentation, and expert-validation questionnaires. Observation data focused on students' engagement,

concentration, participation, and responses during learning, while teacher interviews provided information about students' learning needs and changes observed during implementation. Documentation included photographs, students' work, and application screenshots. Quantitative data were analyzed using descriptive statistics and the Wilcoxon Signed-Rank Test to compare pretest and posttest scores, considering the small sample size. Qualitative data from observations, interviews, and documentation were analyzed thematically through data reduction, data presentation, and conclusion drawing. Data credibility was supported through triangulation by comparing information obtained from multiple data sources.

The study was conducted with permission from the school, and informed consent was obtained from students' parents or guardians. The researchers also maintained the confidentiality of participants' identities and research documentation.

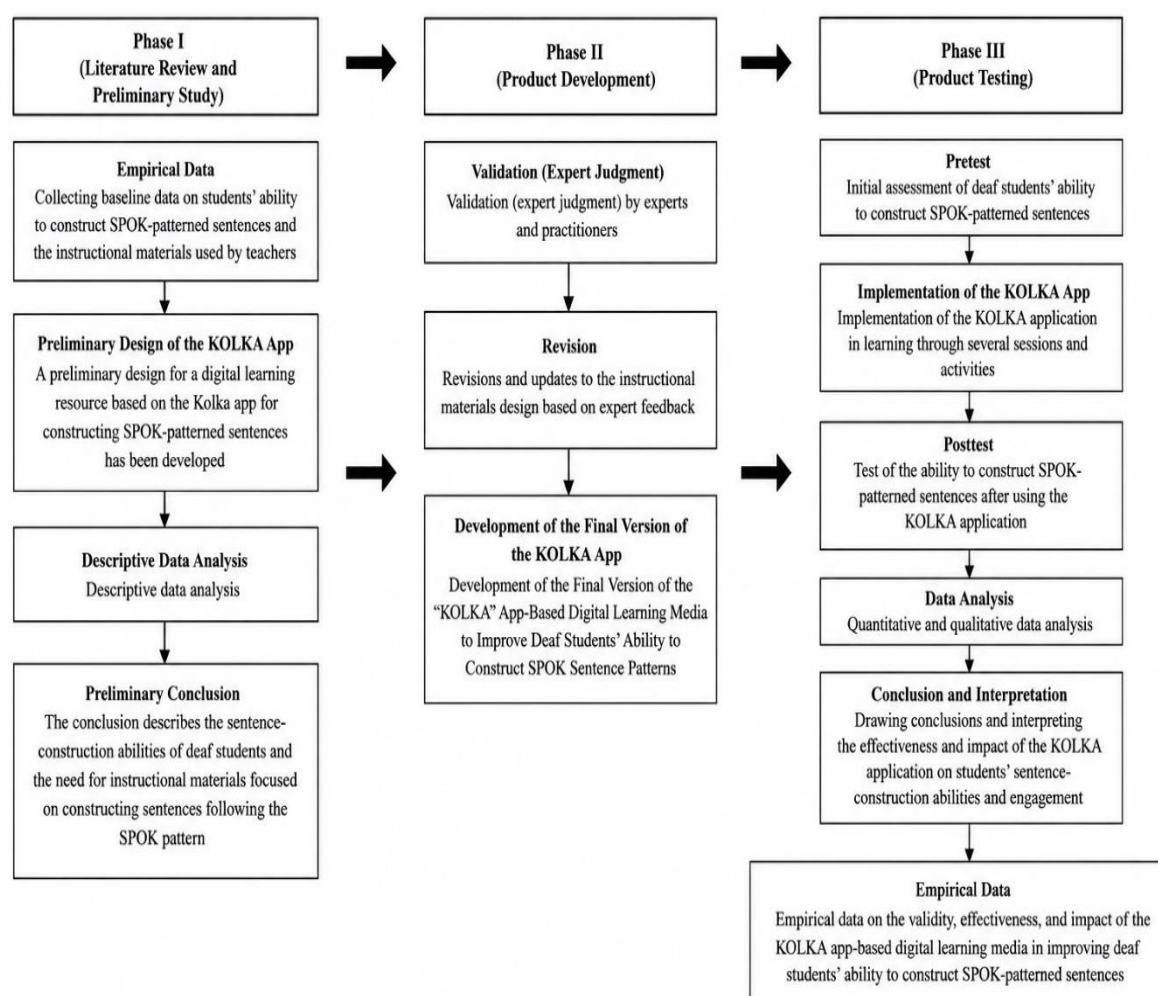


Figure 1. KOLKA Digital Learning Media Development Flow

C. Result

Design and Features of the KOLKA Application

The KOLKA (Kolom Kata) application was developed as a digital learning medium to support deaf students in learning to construct sentences using the SPOK (Subject, Predicate, Object, and Adverbial) pattern. The application was designed with a structured and visually oriented learning approach that corresponds to the learning characteristics of deaf students (Haliza et al., 2020). The learning content is organized progressively, beginning with the S-P pattern, followed by S-P-O, and progressing to the complete S-P-O-K pattern. This sequence provides students with gradual opportunities to identify and arrange sentence elements.

The application consists of several main features, including a login interface, main menu, user guide, SPOK Smart Dictionary, and interactive learning activities. The SPOK Smart Dictionary provides explanations, examples, and visual representations of sentence elements. The learning activities include sentence-completion and sentence-ordering tasks. In the sentence-completion activity, students select the appropriate answer and receive immediate feedback. In the sentence-ordering activity, students arrange words into the appropriate sentence pattern using a drag-and-drop mechanism. The activities are presented at different difficulty levels, and students receive a score and feedback after completing each activity. These features provide the core instructional functions of the KOLKA application and were subsequently evaluated for validity, feasibility, and learning outcomes.

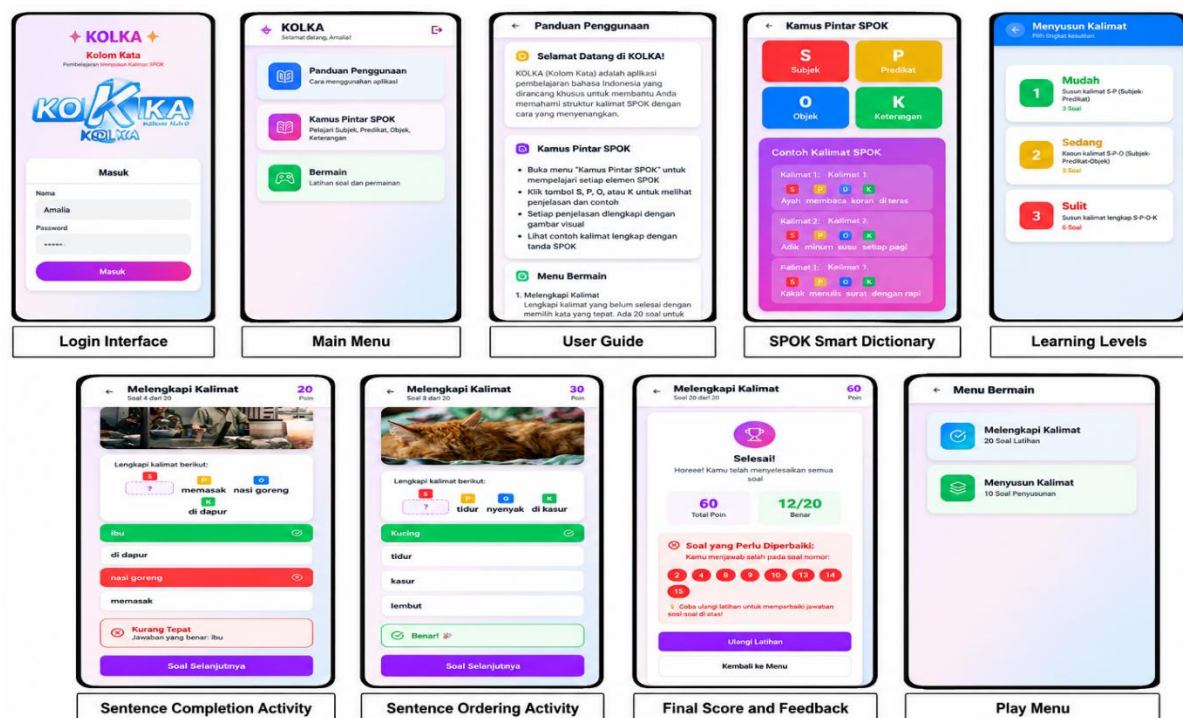


Figure 2. Main Features of the KOLKA Application
Validation and Feasibility of the KOLKA Application

The validation results showed that the KOLKA application met the criteria for use as digital learning media for deaf students. The evaluation covered the quality of learning content, presentation, language, interface design, visual appeal, usability, interactivity, efficiency, and creativity. The results from subject matter experts, media experts, and practitioners were categorized as highly feasible. These findings indicate that the developed application satisfied the required criteria before its implementation with students.

Table 1. Validation and Feasibility Results of the KOLKA Application

Validator	Assessment Focus	Mean	Percentage	Category
Subject Matter Experts	Content, presentation, and language	4.8	96%	Highly feasible
Media Experts	Design, visual appeal, and usability	4.6	92%	Highly feasible
Practitioners	Effectiveness, interactivity, efficiency, and creativity	4.7	93%	Highly feasible

Pretest and Posttest Results

The pretest and posttest were administered to six deaf students to measure their ability to construct SPOK-patterned sentences before and after the implementation of the KOLKA application. The pretest scores ranged from 35 to 50, while the posttest scores reached 75–85 across the reported assessment sessions. The overall mean score increased from 44.16 in the pretest to 85.83 in the posttest, representing a gain of 41.67 points. All six students demonstrated higher posttest scores than their pretest scores. The individual scores and mean results are presented in Table 2.

Table 2. Pretest and Posttest Results

Student	Pretest	Posttest
ISA	40	80
NS	45	80
MFS	35	75
SP	50	85
MGF	45	80
WYR	45	85
Mean	44.16	85.83

The pretest and posttest scores of the six students were compared to identify changes in their ability to construct SPOK-patterned sentences following the implementation of the KOLKA application. As presented in Table 2, all students obtained higher scores in the posttest than in the pretest. The mean score increased from 44.16 in the pretest to 85.83 in the posttest, indicating a 41.67-point improvement. The individual and mean scores are presented in Table 2, while the overall comparison is illustrated in Figure 3.

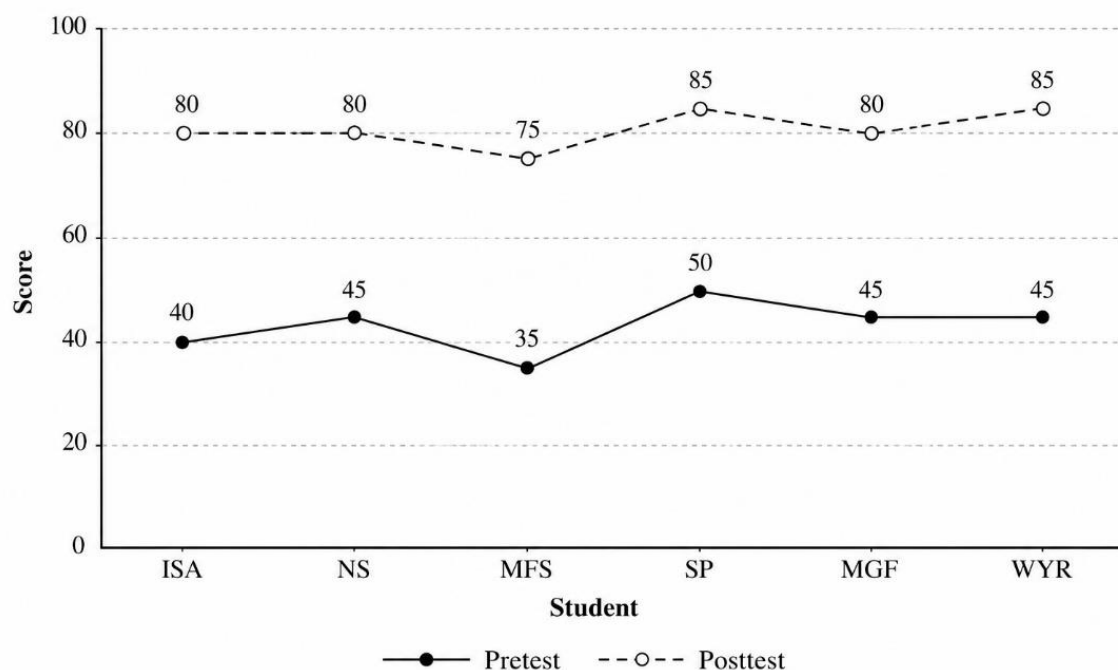


Figure 3. Comparison of Pretest and Posttest Scores

Statistical Analysis and Effect Size

The Wilcoxon Signed-Rank Test was used to examine the difference between the paired pretest and posttest scores. All six cases were included in the analysis, with no missing data. The Shapiro-Wilk test produced significance values of 0.581 for the pretest and 0.212 for the posttest. The Wilcoxon analysis showed six positive ranks, with no negative ranks or ties. The test produced a Z value of -2.232 and an Asymp. Sig. (2-tailed) value of 0.026. Since $p = .026 < .05$, the difference between the pretest and posttest scores was statistically significant.

The gain score was 41.67 points, calculated from the difference between the pretest mean of 44.16 and the posttest mean of 85.83. The original analysis categorized the effect size as "Strong" however, the numerical effect-size value and calculation procedure should be reported to support this classification.

Table 3. Wilcoxon Signed-Rank Test and Gain Results

Measure	Result
Pretest Mean	44.16
Posttest Mean	85.83
Gain Score	41.67
Z	-2.232
p-value	.026
Positive Ranks	6
Negative Ranks	0
Ties	0

Students' Learning Engagement

Observation data indicated changes in students' participation during the implementation of the KOLKA application. Before the intervention, students were observed to be relatively passive, less responsive, and dependent on teacher instructions. During and after the implementation, students demonstrated greater participation, enthusiasm, and confidence in sentence-construction activities. Students also showed improvement in identifying word positions according to sentence-element functions and arranging words into SPOK-patterned sentences.

Table 4. Observed Changes in Students' Learning Engagement

Indicator	Observation
Participation	Increased
Responsiveness	Increased
Confidence	Increased
Dependence on teacher	Decreased
Identification of sentence elements	Improved
Sentence arrangement	More accurate

D. Discussion

The findings demonstrate that the KOLKA application was associated with a substantial improvement in deaf students' ability to construct SPOK-patterned sentences. The mean score increased from 44.16 in the pretest to 85.83 in the posttest, representing a gain of 41.67 points. The Wilcoxon Signed-Rank Test also showed a statistically significant difference between the paired scores ($Z = -2.232$, $p = .026$), with all six students obtaining higher posttest scores than their pretest scores. Observational findings further indicated increased participation, responsiveness, and confidence during sentence-construction activities. Students also demonstrated greater accuracy in identifying sentence elements and arranging words according to their grammatical functions. Thus, the quantitative and qualitative findings consistently indicate improvement in sentence-construction performance following the implementation of KOLKA. However, because the study used a one-group pretest-posttest design, these findings should be interpreted as preliminary evidence of the application's effectiveness rather than definitive causal evidence.

The improvement may be explained by the close alignment between the instructional design of KOLKA and the learning needs of deaf students. Before the intervention, students experienced difficulties identifying sentence elements, determining word order, and constructing complete SPOK sentences. KOLKA transforms these relatively abstract grammatical relationships into visible and manageable components by presenting Subject, Predicate, Object, and Adverbial as distinct elements. The application also introduces sentence construction progressively, beginning with S-P, continuing to S-P-O, and finally reaching S-P-O-K. This progression allows students to process sentence construction in smaller stages rather than dealing with the complete structure simultaneously. Repeated

practice, illustrative images, drag-and-drop activities, and immediate feedback further provide opportunities for students to identify errors and revise their responses. The observed improvement may therefore reflect the combined contribution of structured visual representation, gradual practice, and repeated opportunities for correction.

The findings are strongly consistent with Mayer (2009) Multimedia Learning Theory, which emphasizes the value of presenting information through coordinated verbal and visual representations. KOLKA combines written linguistic information with visual labels, illustrations, color-coded sentence elements, and interactive activities. For deaf students, this multimodal presentation is particularly relevant because visual information provides an important channel for accessing instructional content. The application does not merely display sentence rules but represents the relationships among sentence elements visually and allows students to interact with those representations. This may help students establish clearer associations between a word and its grammatical function. The present findings therefore provide contextual support for multimedia learning principles in Indonesian language instruction for deaf students, particularly when grammatical concepts that are otherwise abstract are translated into structured visual representations. The application's design also reflects the principle that instructional technology becomes more meaningful when its features are directly connected to pedagogical and content objectives. In this respect, the findings are consistent with the Technological Pedagogical Content Knowledge (TPACK) framework proposed by Mishra & Koehler (2006), because KOLKA integrates technological affordances with pedagogical scaffolding and specific Indonesian language content rather than using technology merely as a substitute for conventional materials.

The findings can also be interpreted through Cognitive Load Theory (Sweller, 1988). Sentence construction requires learners to coordinate several elements simultaneously, including lexical choices, word order, and grammatical functions. For students who already experience difficulties with language processing, presenting all of these elements at once may create unnecessary processing demands. KOLKA addresses this challenge by separating sentence components visually and introducing them sequentially. The S-P, S-P-O, and S-P-O-K levels enable students to focus on increasingly complex structures while maintaining a clear representation of each element. This design may reduce extraneous processing associated with identifying and organizing sentence components, allowing greater attention to be directed toward the learning task itself. However, cognitive load was not directly measured in this study; therefore, the relationship between KOLKA and cognitive load should be understood as a theoretical interpretation rather than a directly tested mechanism. This interpretation is consistent with the existing theoretical discussion in the study, which relates structured visual presentation to reduced processing demands during language learning.

Another important explanation is provided by Vygotsky (1978) Zone of Proximal Development (ZPD) and the concept of scaffolding. Students were not required to immediately produce complete SPOK sentences independently. Instead, KOLKA provides graduated support through examples, sentence-element labels, increasingly difficult levels,

and immediate feedback. Such support allows learners to perform tasks that may initially be difficult and gradually develop greater independence. The repeated transition from S-P to S-P-O and S-P-O-K can therefore be understood as a form of digital scaffolding. The observation that students became more capable of identifying sentence elements and arranging words more accurately is consistent with the expected function of scaffolding: temporary instructional support is gradually reduced as learners gain competence. This interpretation is consistent with evidence-based literacy research in deaf education more broadly, which similarly emphasizes structured, systematic instructional support for deaf learners (Luckner et al., 2005). Thus, KOLKA demonstrates how scaffolding principles can be embedded directly into a digital learning environment rather than relying exclusively on teacher-mediated assistance.

The interactive and feedback-oriented features of KOLKA provide another possible explanation for the observed changes in student participation. The application allows students to complete sentence tasks, receive immediate information about whether their responses are correct, and repeat activities when necessary. This creates a cycle of attempt-feedback-correction-repetition, which gives students more opportunities to learn from errors during the activity itself. The increase in participation, enthusiasm, and confidence observed during implementation is consistent with this interactive learning process. The findings correspond with Fadilah et al (2025), who reported that a website-based application supported sentence-structure writing skills among deaf students. They also support Ismail et al (2024), who found that game-based learning using Wordwall improved sentence-structure abilities among seventh-grade deaf students through visual and interactive activities. Similarly, Aji & Minarsih (2026) reported improvement following the use of a web-based scramble activity, while Ilham (2023) and Rusyani et al (2022) found that scramble- and puzzle-based games improved simple sentence-structure ability among students with hearing impairment. Alghifari & Wagino (2023) reported comparable gains using a picture-word inductive model, and Hasadikin (2018) further showed that picture word cards could provide concrete visual support for understanding sentence structure.

Although these findings are consistent with previous research, KOLKA extends the literature in several respects. Previous studies have generally examined individual media or specific activities, including picture word cards, activity books, strip stories, scramble activities, sentence-scramble games (Yeta & Iswari, 2018), interactive digital books (Marthadiputri et al., 2025), website-based sentence puzzles (Sholehah & Wagino, 2025), and web-based platforms. KOLKA integrates several instructional functions into one application: a SPOK Smart Dictionary, visual explanations, progressive learning levels, sentence-completion tasks, sentence-ordering activities, drag-and-drop interaction, immediate feedback, repeated practice, and score reporting. The application therefore moves beyond simply digitizing existing exercises by organizing sentence learning as a progressive instructional sequence. Its mobile-based format also provides opportunities for practice beyond the immediate classroom context. More importantly, the application is designed specifically around the grammatical structure of SPOK and the visual learning

needs identified among the participating deaf students. The contribution of the study consequently lies in demonstrating how technological, pedagogical, and content considerations can be integrated into a specialized digital learning medium for Indonesian language instruction.

Regarding the research questions, the findings provide evidence addressing the three aspects investigated in this study. First, the KOLKA application demonstrated high validity and feasibility based on expert and practitioner evaluations of its content, presentation, language, design, usability, interactivity, efficiency, and creativity. Second, the application was associated with improved SPOK sentence-construction performance, as demonstrated by the increase in the mean score from 44.16 to 85.83 and the statistically significant Wilcoxon result ($p = .026$). Third, observational findings indicated positive changes in learning engagement, particularly in participation, responsiveness, confidence, and students' willingness to complete sentence-construction activities. Therefore, the findings suggest that KOLKA is a promising digital learning medium for supporting SPOK sentence construction and engagement among deaf students. Nevertheless, the small sample and absence of a control group limit the generalizability and causal interpretation of the findings. Future research should therefore examine KOLKA with larger and more diverse samples, comparison groups, longer interventions, and validated measures of learning engagement to determine whether the observed improvements can be replicated across different special-education contexts.

E. Implication

The findings have theoretical, practical, and social implications for language learning among deaf students. Theoretically, KOLKA demonstrates the potential of visual and structured digital media to support the understanding of SPOK sentence patterns through progressive learning, interaction, and feedback, consistent with the broader value of Wordwall- and scramble-based digital approaches reported in general classroom settings (Dwitayanti & Wirahyuni, 2024; Apriani et al., 2026). Practically, the application can serve as a complementary medium for teachers by presenting grammatical concepts more concretely and providing opportunities for repeated practice. Schools can support its implementation by providing appropriate digital facilities and teacher training, while educational media developers can use visual clarity, simple interfaces, structured activities, and immediate feedback as key design principles. Socially, improved sentence-construction skills may help deaf students express ideas, needs, and experiences more clearly, participate more confidently in communication, and develop greater independence. Overall, KOLKA offers a potential technology-based approach for promoting accessible, engaging, and inclusive Indonesian language learning for deaf students.

F. Limitation and Suggestion for Further Research

This study has several limitations that should be considered when interpreting the findings. The small sample of six deaf students from a single school and the relatively short intervention period limit the generalizability and understanding of long-term learning outcomes. In addition, the one-group pretest-posttest design without a control group limits causal interpretation because other factors, such as repeated practice, student motivation, and teacher support, may have contributed to the observed improvement. The study also focused specifically on SPOK sentence construction and did not examine broader language abilities, while the current KOLKA application has limited adaptive, gamification, and intelligent learning features.

Future research should involve larger and more diverse samples across educational levels and schools and employ quasi-experimental or controlled designs to provide stronger evidence of effectiveness. Longitudinal studies are also recommended to examine whether improvements are sustained over time. Further development of KOLKA could incorporate adaptive learning, AI-based performance analysis, richer gamification, and personalized difficulty levels. Future studies may also examine the application's potential to support other language skills, including reading comprehension, paragraph writing, social communication, and digital literacy, to provide a more comprehensive understanding of its contribution to language development among deaf students.

G. Conclusion

The KOLKA (Kolom Kata) application provides a promising digital learning medium for supporting deaf students in constructing SPOK-patterned sentences. The application demonstrated high validity and feasibility through expert and practitioner evaluations and was associated with a significant improvement in students' sentence-construction performance, with the mean score increasing from 44.16 to 85.83 ($p = .026$). Its visual, interactive, progressive, and feedback-based features support students in understanding sentence elements more concretely and systematically while encouraging greater participation and confidence during learning. The study therefore contributes a technology-based approach to Indonesian language learning in special education, particularly for developing syntactic skills among deaf students. Although the findings are preliminary because of the small sample and one-group design, KOLKA has potential for further development through adaptive learning, enhanced gamification, and AI-supported features to provide more personalized, accessible, and inclusive language learning experiences.

Acknowledgment

The author gratefully acknowledges the Universitas Pendidikan Indonesia for its academic support throughout the research and preparation of this article, as well as SLB BC YPLAB Cibaduyut for granting permission and supporting the research process.

Appreciation is also extended to the subject matter and media experts for their valuable input and evaluation of the KOLKA application, and to the teachers and deaf students who participated and contributed to the successful implementation of this study.

References

- Aji, R. K., & Minarsih, N. M. M. (2026). Pengaruh Media Scramble Berbasis Aplikasi Web dalam Meningkatkan Kemampuan Menulis Kalimat Peserta Didik Tunarungu dengan Struktur SPOK. *Jurnal Pendidikan Khusus*.
- Alghifari, L. G., & Wagino. (2023). Model Induktif Kata Bergambar terhadap Kemampuan Menyusun Kalimat bagi Siswa Tunarungu. *Jurnal Pendidikan Khusus*.
- Andri, S. P. (2017). Pengembangan Media Papan Konstruksi Kalimat untuk Meningkatkan Kemampuan Menyusun Struktur Kalimat pada Anak Tunarungu Kelas Dasar di SLB Kota Cimahi (Tesis Magister, Universitas Pendidikan Indonesia). Repositori UPI.
- Apendi, M., Maharin, H., & Sutarno, S. K. (2023). Meningkatkan Keterampilan Sosial melalui Permainan Tradisional pada Anak Tunarungu di SLB-B Beringin Bhakti Talun. *Prophetic: Professional, Empathy, Islamic Counseling Journal*, 6(2), 212–221. <https://doi.org/10.24235/prophetic.v6i2.16667>
- Apriani, N. L., Giri, I. M. A., & Suryawan, I. G. A. J. (2026). Pengembangan Media Scramble Berbantuan Wordwall untuk Materi Kalimat SPO Kelas II SD. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 11(2), 274.
- Dwitayanti, M. T., & Wirahyuni, K. (2024). Penerapan Model Scramble Berbantuan Media Word Wall dalam Meningkatkan Pemahaman Menyusun Kalimat Berpola SPOK di SMA. *SANDIBASA: Seminar Nasional Pendidikan Bahasa dan Sastra Indonesia*, 2(1), 209.
- Fadilah, N., Wagino, & Sujarwanto. (2025). Pengembangan Aplikasi Website untuk Meningkatkan Keterampilan Menulis Struktur Kalimat pada Siswa Tunarungu di SLB. *IQRO: Journal of Islamic Education*, 8(1). <https://doi.org/10.24256/igro.v8i1.6770>
- Haliza, N., Kuntarto, E., & Kusmana, A. (2020). Pemerolehan Bahasa Anak Berkebutuhan Khusus (Tunarungu) dalam Memahami Bahasa. *Metabasa: Jurnal Bahasa, Sastra dan Pembelajaran*, 2(1), 36–41.
- Hall, W. C. (2017). What You Don't Know Can Hurt You: The Risk of Language Deprivation by Impairing Sign Language Development in Deaf Children. *Maternal and Child Health Journal*, 21(5), 961–965. <https://doi.org/10.1007/s10995-017-2287-y>
- Hasadikin, R. (2018). Penggunaan Media Kartu Kata dan Gambar untuk Meningkatkan Kemampuan Menyusun Kalimat Berpola SPOK pada Anak Tunarungu Kelas 4 di SLB B Prima Bhakti Mulia Kota Cimahi (Skripsi sarjana, Universitas Pendidikan Indonesia). Repositori UPI.

- Ilham, N. (2023). Penggunaan Scramble dalam Meningkatkan Kemampuan Menyusun Kalimat Anak Tunarungu Kelas IV di SLB B YPPLB Makassar. *PINISI Journal of Art, Humanity & Social Studies*, 4(3), 143–153.
- Ismail, A. F., Mustafa, & Zulfitrah. (2024). Peningkatan Kemampuan Struktur Kalimat melalui Pembelajaran Berbasis Game pada Anak Tunarungu Kelas Tujuh di Sekolah Luar Biasa. *Pinisi Journal of Education*, 105.
- Luckner, J. L., Sebal, A. M., Cooney, J., Young, J., & Muir, S. G. (2005). An Examination of the Evidence-Based Literacy Research in Deaf Education. *American Annals of the Deaf*, 150(5), 443–456. <https://doi.org/10.1353/aad.2006.0008>
- Marthadiputri, F. T., Sartinah, E. P., & Wagino. (2025). Pengembangan Buku Digital Interaktif Marbelis untuk Meningkatkan Keterampilan Menulis Kalimat SPOK bagi Peserta Didik Disabilitas Rungu. *Lingua Franca*, 4(1), 81–97. https://doi.org/10.37680/lingua_franca.v4i1.7588
- Mayer, R. E. (2009). *Multimedia Learning* (2nd ed.). Cambridge University Press. <https://doi.org/10.1017/CBO9780511811678>
- Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teachers College Record*, 108(6), 1017–1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- Muttaqin, W. G. (2018). Penggunaan Media Video Berteks untuk Meningkatkan Pemahaman Struktur Kalimat Bahasa Indonesia pada Anak Tunarungu (Skripsi sarjana, Universitas Pendidikan Indonesia). Repositori UPI.
- Paramuditha, W. K. J., & Marlina. (2024). Lakas Application to Improve Sentence Construction Skills for Deaf Students. *Jurnal Penelitian dan Pengembangan Pendidikan Luar Biasa*, 11(1), 7–12. <https://doi.org/10.17977/um029v11i12024p7-12>
- Rismawati, S. (2019). Keefektifan Media Pembelajaran Strip Story terhadap Kemampuan Menyusun Kalimat pada Anak Tunarungu Kelas V SD di SLB Negeri 1 Kulon Progo. *Widia Ortodidaktika* (E-Journal Mahasiswa PLB Universitas Negeri Yogyakarta).
- Rusyani, E., Maryanti, R., Rahayu, S., Ragadhita, R., Al Huseini, D. F., & Susetyo, B. (2022). Application of Scrabble Game in Improving Learning of Simple Sentence Structure on the Student with Hearing Impairment. *ASEAN Journal of Science and Engineering Education*, 2(1), 75–86. <https://doi.org/10.17509/ajsee.v2i1.37619>
- Sholehah, F. A., & Wagino. (2025). Pengaruh Penerapan Media Puzzle Kalimat Berbasis Website dalam Meningkatkan Kemampuan Menulis Kalimat Siswa Tunarungu. *Jurnal Pendidikan Khusus*, 20(2).
- Sweller, J. (1988). Cognitive Load during Problem Solving: Effects on Learning. *Cognitive Science*, 12(2), 257–285. https://doi.org/10.1207/s15516709cog1202_4

Syaputri, V., & Efendi, J. (2021). Efektivitas I-CHAT (I Can Hear and Talk) untuk Meningkatkan Keterampilan Menyusun Pola Kalimat bagi Anak Tunarungu di SLB Wacana Asih Padang. *Jurnal Penelitian Pendidikan Kebutuhan Khusus*, 9(2), 148.

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.

Yeta, R. A., & Iswari, M. (2018). Efektivitas Media Sentence Scramble Games dalam Meningkatkan Kemampuan Sintaksis bagi Anak Tunarungu. *Jurnal Penelitian Pendidikan Kebutuhan Khusus*, 6(1), 100.

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