



# The Effectiveness of Digital Interactive Media (Live Worksheets) in Improving SPOK Sentence Structure Understanding among Deaf Students

Nadia Syifa Azzahra<sup>1\*</sup>, Budi Susetyo<sup>2</sup>, Iding Tarsidi<sup>3</sup>  
<sup>1,2,3</sup>Universitas Pendidikan Indonesia, Bandung, Indonesia

## ARTICLE INFO

### Article history:

Submitted: April 23, 2026  
 Final Revised: May 16, 2026  
 Accepted: May 17, 2026  
 Published: May 18, 2026

### Keywords:

Live Worksheets; Deaf Students; SPOK Sentence Structure; Digital Interactive Media.



## ABSTRACT

This study aims to examine the effectiveness of Live Worksheets as digital interactive media in improving SPOK (Subject, Predicate, Object, Adverb) sentence structure understanding among deaf students in special education. This study employed a quantitative approach using a pre-experimental one-group pretest–posttest design involving 13 deaf students at the SMALB level of SLB Negeri Pangeran Cakrabuana selected through random sampling. Data were collected using multiple-choice and essay tests and analyzed using the Wilcoxon Signed Rank Test and N-Gain analysis. The findings showed a significant improvement in students’ understanding of SPOK sentence structure after the implementation of Live Worksheets, with the average score increasing from 52.04 in the pretest to 80.84 in the posttest and an N-Gain score of 61% categorized as moderate improvement. The Wilcoxon test result showed a significance value of 0.001 ( $p < 0.05$ ), indicating a statistically significant difference between pretest and posttest scores. These findings imply that Live Worksheets can serve as an effective interactive learning medium to support Indonesian language learning, particularly sentence structure instruction for deaf students in special education settings. The originality of this study lies in the application of Live Worksheets specifically to improve SPOK sentence structure understanding among deaf students, an area that has received limited attention in previous studies.



Doi: <https://doi.org/10.61255/jupiter.v4i2.997>

## INTRODUCTION

Language plays a crucial role in human communication, enabling individuals to express ideas, interact socially, and participate in academic and social activities. In Indonesian language learning, sentence construction generally follows the SPOK pattern (Subject, Predicate, Object, Adverb), which is essential for producing coherent and meaningful written communication. Mastery of sentence structure is particularly important for deaf students because limitations in auditory input often affect language acquisition, especially in grammar, syntax, and written expression (C. Mayer & Trezek, 2019; Novogrodsky et al., 2023). Deaf learners tend to rely on visual learning modalities, including sign language and visual representations, which may influence their understanding of formal sentence structures and result in incomplete, reversed, or unstructured sentences (Kilpatrick & Wolbers, 2020; Wolbers et al., 2022).

In addition, differences between sign language structures and formal written language contribute to challenges in constructing grammatically appropriate sentences. Sign language emphasizes visual-gestural communication patterns that may differ from standard written Indonesian sentence structures, causing difficulties for deaf students in organizing SPOK sentence elements systematically (Nugraheni et al., 2023; Périni et al., 2024). These difficulties not only affect written communication skills but also influence academic performance and classroom participation.

To address these challenges, learning media that align with the visual characteristics of deaf learners are needed. Previous studies have shown that visual-based and interactive learning approaches can improve comprehension, engagement, and learning outcomes among deaf students (Birinci & Sariçoban, 2021; Yasin & Mohamad, 2024). Furthermore, digital interactive media have been reported to support accessibility and provide more effective learning experiences for students with hearing impairments (Bell & Foiret, 2020; Alit et al., 2025). One interactive medium that has gained attention in educational settings is Live Worksheets, which provides features such as drag-and-drop activities, matching exercises, and immediate feedback that support active and visually oriented learning processes.

These features are consistent with multimedia learning principles that emphasize the integration of visual and interactive elements to facilitate understanding (Mayer, 2020).

Although previous studies have demonstrated the effectiveness of digital interactive media in improving learning outcomes (Weddyastuti, 2022), research specifically examining the effectiveness of Live Worksheets in improving SPOK sentence structure understanding among deaf students remains limited. This condition indicates a research gap in the integration of interactive digital media and language structure instruction in special education contexts. Therefore, the problem addressed in this study is whether the use of Live Worksheets as digital interactive media can improve SPOK sentence structure understanding among deaf students. Based on this problem, the study aims to examine the effectiveness of Live Worksheets in improving SPOK sentence structure understanding among deaf students in special education settings.

## METHOD

This study employed a quantitative approach using a pre-experimental one-group pretest–posttest design to examine the effectiveness of Live Worksheets in improving SPOK sentence structure understanding among deaf students. This design was selected to identify changes in students’ understanding before and after the implementation of the intervention. However, this study acknowledges that the absence of a control group may limit the internal validity of the findings because improvements cannot be fully attributed solely to the intervention.

The population of this study consisted of all deaf students at the SMALB level of SLB Negeri Pangeran Cakrabuana. A random sampling technique using a lottery method was applied to determine the research sample. From a total of 17 students in grades 10 to 12, four students were excluded because they had multiple disabilities, such as deafness accompanied by intellectual disability or Down syndrome. Therefore, the final sample consisted of 13 deaf students, including 7 males and 6 females.

Data were collected using written tests consisting of multiple-choice and essay items designed to measure students’ ability to construct sentences based on the SPOK (Subject, Predicate, Object, Adverb) pattern. The instruments were developed based on Indonesian language learning indicators related to sentence structure understanding and were reviewed by the supervising lecturer and teacher to ensure content suitability. The research procedure consisted of five sessions, including one pretest session, three treatment sessions using Live Worksheets, and one posttest session. Each treatment session focused on SPOK sentence structure exercises using interactive features such as drag-and-drop, matching activities, and sentence completion tasks supported by drill techniques and visual learning approaches.

The pretest was administered to identify students’ initial understanding of SPOK sentence structure, while the posttest was conducted after the intervention to measure improvement in students’ understanding. Data analysis was conducted using the Wilcoxon Signed Rank Test to determine the significance of differences between pretest and posttest scores. In addition, the N-Gain test was used to measure the level of improvement in students’ understanding after the implementation of Live Worksheets.

## RESULTS

This study aims to examine the effect of Live Worksheets media on improving deaf students’ understanding of SPOK (Subject, Predicate, Object, Adverb) sentence structure. The results are presented based on pretest and posttest data, as well as statistical analysis. The pretest results showed that the initial ability of students in understanding SPOK sentence structure was relatively low. The average pretest score was 52.04, indicating that most students had not yet mastered the arrangement of SPOK sentence elements. The distribution of scores varied across students, with several students scoring below 50.

Table 1. Pretest Scores

Nu.	Research Sample	Class	Comparing Sentences That Have SP, SPO, and SPOK Sentence Structures	Make A SPOK Sentence According to the Picture.	Total	Scores
1	AL	10	8	10	18	51,4
2	LI	10	12	13	25	71,4
3	RA	10	10	5	15	42,8
4	ADI	11	7	5	12	34,2
5	WU	10	9	11	20	57,1
6	YF	10	13	13	26	74,2
7	IU	11	9	5	14	40

The Effectiveness of Digital Interactive Media (Live Worksheets) in Improving SPOK Sentence Structure...

Nadia Syifa Azzahra, Budi Susetyo, Iding Tarsidi

Vol 4, No 2, 2026

Nu.	Research Sample	Class	Comparing Sentences That Have SP, SPO, and SPOK Sentence Structures	Make A SPOK Sentence According to the Picture.	Total	Scores
8	FI	10	8	6	14	40
9	DA	12	12	4	16	45,7
10	FA	10	13	3	16	45,7
11	RN	12	15	11	26	74,2
12	SA	10	9	14	23	65,7
13	AI	12	12	0	12	34,2
<b>Average</b>						<b>52,04</b>

Figure 1 illustrates the distribution of pretest scores, showing that most students obtained relatively low scores, which indicates limited initial understanding of SPOK sentence structure before the intervention.

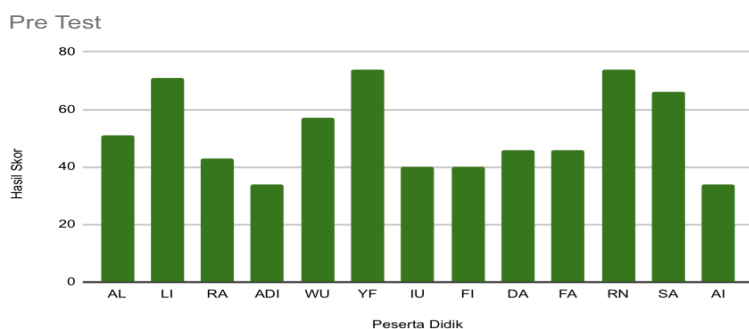


Figure 1. Pretest Results Graph

After the implementation of the learning intervention using Live Worksheets, the posttest results showed an increase in students' scores. The average posttest score reached 80.84, indicating an improvement in students' ability to construct sentences using the SPOK pattern. The increase in scores occurred in all research subjects, with varying levels of improvement.

Table 2. Posttest Scores

Nu.	Research Sample	Class	Comparing Sentences That Have SP, SPO, and SPOK Sentence Structures	Make a SPOK Sentence According to the Picture	Total	Scores
1	AL	10	12	12	24	68,5
2	LI	10	15	13	28	80
3	RA	10	14	8	22	62,8
4	ADI	11	15	14	29	82,8
5	WU	10	15	13	28	80
6	YF	10	15	20	35	100
7	IU	11	10	14	24	68,5
8	FI	10	15	15	30	85,7
9	DA	12	14	17	31	88,5
10	FA	10	15	15	30	85,7
11	RN	12	15	20	35	100
12	SA	10	10	20	30	85,7
13	AI	12	14	8	22	62,8
<b>Average</b>						<b>80,84</b>

Figure 2 shows an increase in students' posttest scores after the implementation of Live Worksheets, indicating improved understanding of SPOK sentence structure.

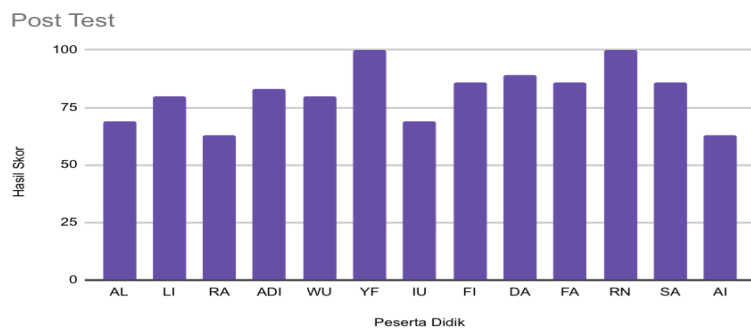


Figure 2. Posttest Results Graph

The comparison between pretest and posttest scores showed an average increase of 28.8 points. The detailed comparison of individual scores is presented in Table 3.

Table 3. Comparison of Pretest and Posttest Scores

Nu.	Research Sample	Class	Pretest Score	Posttest Score	Increased Number of Scores
1	AL	10	51,4	68,5	17,1
2	LI	10	71,4	80	8,6
3	RA	10	42,8	62,8	20
4	ADI	11	34,2	82,8	48,6
5	WU	10	57,1	80	22,9
6	YF	10	74,2	100	25,8
7	IU	11	40	68,5	28,5
8	FI	10	40	85,7	45,7
9	DA	12	45,7	88,5	42,8
10	FA	10	45,7	85,7	40
11	RN	12	74,2	100	25,8
12	SA	10	65,7	85,7	20
13	AI	12	34,2	62,8	28,6
<b>Average</b>			<b>52,04</b>	<b>80,84</b>	<b>28,8</b>

Figure 3 demonstrates a consistent increase between pretest and posttest scores across all participants, indicating the positive effect of Live Worksheets on students' understanding of SPOK sentence structure.

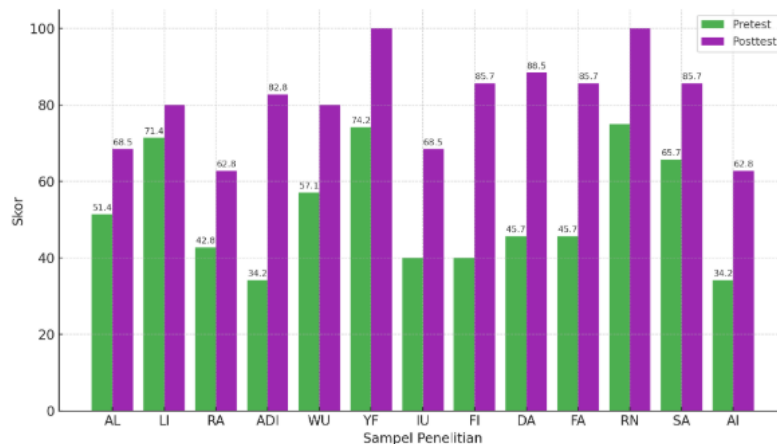


Figure 3. Graph Comparison of Pretest and Posttest Scores

To determine the level of improvement, the N-Gain test was conducted. The results showed an N-Gain value of 0.61 (61%), which is categorized as moderate improvement.

Table 4. N-Gain Test Data

Score	Pretest	Posttest	N-Gain	Percentage
Highest	74,20	100,00	1,00	100%
Lowest	34,20	62,80	0,43	43%
Average	52,04	80,84	0,61	61%

Furthermore, the Wilcoxon Signed Rank Test yielded a significance value of 0.001 ( $p < 0.05$ ), indicating a statistically significant difference between pretest and posttest scores and confirming that H1 is accepted, with a significant improvement observed after the intervention.

Table 5. Wilcoxon Signed Rank Test

		Ranks		
		N	Mean Rank	Sum of Ranks
Post – Pre	Negative Ranks	0 <sup>a</sup>	.00	.00
	Positive Ranks	13 <sup>b</sup>	7.00	91.00
		0 <sup>c</sup>		

Table 6. Test Statistics

		Post –Pre
Z		-3.182 <sup>b</sup>
Asymp.Sig		.001

## DISCUSSION

The findings of this study indicate that the use of Live Worksheets has a significant effect on improving deaf students' understanding of SPOK sentence structure. This is evidenced by the increase in the average score from 52.04 in the pretest to 80.84 in the posttest, as well as the statistical results showing a significant difference after the treatment. This improvement reflects that the integration of interactive digital media in learning can effectively facilitate students in understanding sentence structure, particularly for learners with hearing impairments who rely on visual input.

The improvement in students' understanding can be interpreted as the result of the alignment between the characteristics of Live Worksheets and the learning needs of deaf students. Deaf learners tend to process information visually; therefore, the use of visually rich and interactive media plays an important role in supporting their comprehension. The features available in Live Worksheets, such as visual displays, structured exercises, and interactive tasks, enable students to directly engage with sentence components, thereby helping them recognize and organize SPOK elements more systematically. This finding supports previous studies which state that visual-based and interactive learning media can enhance engagement, conceptual understanding, motivation, and learning outcomes among students with hearing impairments (Ramadani et al., 2024; Ratnawulan et al., 2021).

Furthermore, the results of this study are consistent with previous research showing that the use of Live Worksheets can improve students' learning outcomes across different subjects (Wedyastuti, 2022). However, this study extends these findings by demonstrating that Live Worksheets are not only effective in general subject learning but also specifically effective in improving sentence structure understanding in special education contexts. This indicates that interactive digital media can be adapted to support more complex linguistic skills, such as sentence construction, which is often a major challenge for deaf students.

Although the N-Gain score was categorized as moderate (61%), this finding still indicates meaningful improvement in students' understanding of SPOK sentence structure. The moderate category may be influenced by several factors, including students' initial language limitations, differences in individual learning abilities, and the relatively short duration of the intervention. Considering that deaf students often experience challenges in syntactic development and written language acquisition, achieving moderate improvement through interactive digital media can still be considered a positive educational outcome.

Another important finding is related to students' learning engagement and motivation. During the implementation of Live Worksheets, students showed high enthusiasm and active participation in the learning process. This increased engagement contributes to better learning outcomes, as students are more focused and motivated to complete tasks. The use of attractive visual elements and interactive activities creates a more meaningful learning experience compared to conventional methods, which tend to be less engaging for deaf learners. This finding reinforces the idea that learning media play a crucial role not only in delivering content but also in shaping students' learning experiences and motivation.

In terms of theoretical contribution, this study provides evidence that the integration of interactive digital media with drill-based learning techniques can support the development of syntactic understanding among deaf students. This suggests that combining visual interaction with repetitive structured practice can serve as an effective approach in teaching sentence structure. Practically, the findings imply that Live Worksheets can be used as an alternative learning medium in Indonesian language instruction for deaf students, particularly in improving their ability to construct systematic and meaningful sentences.

Despite these positive findings, this study has several limitations. The use of a one-group pretest–posttest design without a control group limits the ability to fully attribute the improvement solely to the implementation of Live Worksheets. In addition, the relatively small sample size ( $n = 13$ ) may limit the generalizability of the findings to broader populations of deaf students. Therefore, future studies are recommended to involve larger samples and experimental designs with control groups to obtain more comprehensive evidence regarding the effectiveness of interactive digital media in special education contexts.

The novelty of this study lies in its focus on the use of Live Worksheets to improve SPOK sentence structure understanding among deaf students, a topic that has received limited attention in previous research. While prior studies have examined the effectiveness of Live Worksheets in general learning contexts, this study specifically highlights its application in special education and language structure learning. Therefore, this research contributes to the development of more inclusive and adaptive instructional strategies that are tailored to the needs of deaf learners.

## CONCLUSION

Based on the findings, the implementation of Live Worksheets as an interactive digital learning medium contributed positively to improving deaf students' understanding of SPOK sentence structure at the SMALB level of SLB Negeri Pangeran Cakrabuana. The improvement in pretest and posttest scores, supported by the moderate N-Gain result, indicates that visually interactive and drill-based learning activities can effectively support syntactic comprehension among deaf learners. These findings reinforce the importance of integrating visual and interactive learning approaches in special education, particularly in language instruction that requires structured sentence construction. Theoretically, this study contributes to the development of technology-assisted language learning for deaf students by demonstrating that interactive digital media can support the acquisition of sentence structure understanding in special education contexts. Practically, Live Worksheets may serve as an alternative instructional medium to facilitate more engaging and accessible language learning for deaf students. Nevertheless, considering the limitations of the one-group pretest–posttest design and the small sample size, future studies are recommended to employ more robust experimental designs, such as quasi-experimental studies with control groups and larger participant samples, to strengthen the validity and generalizability of the findings.

## REFERENCE

- Alit, N. A., Ellias, Mohd. S., & Ahmad, A. D. (2025). Technology Application In Teaching And Learning For Hearing Impaired Students: A Recent Systematic Review. *International Journal of Education, Psychology and Counseling*, 10(58), 541–561. <https://doi.org/10.35631/IJEPC.1058036>
- Bell, D., & Foiret, J. (2020). A rapid review of the effect of assistive technology on the educational performance of students with impaired hearing. *Disability and Rehabilitation: Assistive Technology*, 15(7), 838–843. <https://doi.org/10.1080/17483107.2020.1775317>
- Birinci, F. G., & Sarıođoban, A. (2021). The effectiveness of visual materials in teaching vocabulary to deaf students of EFL. *Journal of Language and Linguistic Studies*, 17(1). <https://jlls.org/index.php/jlls/article/view/1551>
- Kilpatrick, J. R., & Wolbers, K. A. (2020). Beyond the red pen: A functional grammar approach to evaluating the written language of deaf students. *Psychology in the Schools*, 57(3), 459–474. <https://doi.org/10.1002/pits.22289>
- Mayer, C., & Trezek, B. (2019). Writing and Deafness: State of the Evidence and Implications for Research and Practice. *Education Sciences*, 9(3), 185. <https://doi.org/10.3390/educsci9030185>
- Mayer, R. (2020). *Multimedia Learning* (3rd ed.). Cambridge University Press. <https://doi.org/10.1017/9781316941355>
- Novogrodsky, R., Stamp, R., & Shaban-Rabah, S. (2023). Word order in simple sentences of tri-lingual tri-modal deaf students\*. *Sign Language & Linguistics*, 26(1), 37–63. <https://doi.org/10.1075/sll.22002.nov>
- Nugraheni, A. S., Husain, A. P., & Unayah, H. (2023). Optimalisasi Penggunaan Bahasa Isyarat Dengan Sibi Dan Bisindo Pada Mahasiswa Difabel Tunarungu Di Prodi Pgmi Uin Sunan Kalijaga. *Jurnal Holistika*, 5(1), 28. <https://doi.org/10.24853/holistika.5.1.28-33>
-

- Périni, M., Dadone, A., & Garcia, B. (2024). Deaf Signers' Processing of the Sentence: An Indicator of Their Specific Pathway to the Written Word? *Languages*, 9(3), 69. <https://doi.org/10.3390/languages9030069>
- Ramadani, S. D., Nadila, P., & Utami, F. P. (2024). How does an animated video on human sense improving students' with hearing impairment a concept understanding? *Research and Development in Education (RaDEn)*, 4(2), 1017–1029. <https://doi.org/10.22219/raden.v4i2.35262>
- Ratnawulan, T., Ridwan, P. G., Santoso, Y. B., Astuti, E. Y., Mastiani, E., Sulistyorini, I. W., Mustika, A., & Romadhona, P. (2021). The Effect of Interactive Web-Based Learning (LWL) Model on Learning Outcomes Students with Visual Impairment and Students with Hearing Impairment at Universitas Islam Nusantara. *Journal of ICSAR*, 5(2), 46–53.
- Wedyastuti, R. (2022). Upaya Meningkatkan Hasil Belajar Polinomial menggunakan Media Interaktif Live Worksheet. *Ideguru: Jurnal Karya Ilmiah Guru*, 8(2), 171–178. <https://doi.org/10.51169/ideguru.v8i2.427>
- Wolbers, K., Dostal, H., Graham, S., Branum-Martin, L., & Holcomb, L. (2022). Specialized Writing Instruction for Deaf Students: A Randomized Controlled Trial. *Exceptional Children*, 88(2), 185–204. <https://doi.org/10.1177/00144029211050849>
- Yasin, M. M., & Mohamad, M. (2024). The Use of Visual Aids to Improve Deaf Students' English Vocabulary: A Literature Review. *SHS Web of Conferences*, 182, 02001. <https://doi.org/10.1051/shsconf/202418202001>

---

**\*Nadia Syifa Azzahra (Corresponding Author)**

Department of Special Education Faculty of Education,  
Indonesia University of Education  
Jl. Dr. Setiabudhi 229, Bandung, West Java, 60237, Indonesia  
Email: [nadiasyifa018@upi.edu](mailto:nadiasyifa018@upi.edu)

**Budi Susetyo**

Department of Special Education Faculty of Education,  
Indonesia University of Education  
Jl. Dr. Setiabudhi 229, Bandung, West Java, 60237, Indonesia  
Email: [budisusetyo@upi.edu](mailto:budisusetyo@upi.edu)

**Iding Tarsidi**

Department of Special Education Faculty of Education,  
Indonesia University of Education  
Jl. Dr. Setiabudhi 229, Bandung, West Java, 60237, Indonesia  
Email: [idingtarsidi@upi.edu](mailto:idingtarsidi@upi.edu)

---