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Reinforcing Blending and Segmenting Words Among EFL Taiwanese Pupils Through Dual-Coding Multisensory Approach

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ABSTRACT

This study determined the effectiveness of a dual-coding multisensory approach in reinforcing the blending and segmenting of consonant-vowel-consonant (CVC) words among third-grade EFL pupils at Dacun Elementary School in Changhua County, Taiwan. A true experimental pretest-posttest control-group design was used. Sixteen English-club pupils were included and randomly assigned through the fishbowl method to an experimental group (n = 8) and a control group (n = 8). Both groups received twelve 30-minute phonics sessions over six weeks; the experimental group used visual, auditory, tactile, and kinesthetic activities, while the control group received lecture-based phonics instruction. Performance was measured using a researcher-developed 15-item CVC Decoding Test validated by three experts. Data were analyzed using descriptive statistics, independent-samples t tests, paired-samples t tests, and Cohen's d at the .01 level of significance. The groups were equivalent at pretest, $t(14) = 0.068$, $p = .9467$. Both groups improved significantly from pretest to posttest: the control group increased from $M = 4.00$ to $M = 11.38$, $t(7) = -5.468$, $p = .0009$, $d = 1.933$, while the experimental group increased from $M = 4.13$ to $M = 12.50$, $t(7) = -6.763$, $p = .0003$, $d = 2.391$. Although the experimental group achieved a higher posttest mean and mean gain, between-group differences in posttest scores and gains were not statistically significant. The experimental group also showed lower posttest variability. The findings indicate that both structured phonics approaches improved CVC decoding, with the dual-coding multisensory approach showing a larger within-group effect and more consistent gains. The study supports the use of multisensory phonics as a promising reinforcement strategy while recognizing the need for larger and longer studies to establish comparative superiority.

Keywords: *blending, segmenting, dual coding, multisensory instruction, EFL pupils, phonics*

INTRODUCTION

Reading development depends on learners' ability to connect print with speech sounds. Unlike spoken language, reading requires explicit learning of the relationship between graphemes and phonemes, and beginning readers must develop decoding strategies before word recognition and comprehension can become efficient (Castles et al., 2018; Ehri, 2020). Within phonemic awareness, blending and segmenting are especially important because blending enables learners to combine phonemes into words, while segmenting enables them to break words into their constituent sounds (Brady, 2020; Ehri, 2022).

These processes are particularly demanding for EFL learners whose first language differs substantially from English. For Taiwanese pupils whose first language is Chinese, the transition from a logographic writing

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system to alphabetic sound-symbol mapping creates additional phonological demands. Research with Chinese-speaking learners shows that explicit phonics and phonological-awareness instruction can improve decoding, while differences between Chinese and English phonology can still constrain early word reading (Jiang et al., 2023; Li & Woore, 2021; Liang & Fryer, 2024). This concern is relevant to Taiwan's Bilingual 2030 initiative, which seeks to strengthen English proficiency across the education system (National Development Council, 2021).

At Dacun Elementary School in Changhua County, classroom observations described in the thesis showed that many third-grade EFL pupils relied heavily on memorized word forms and hesitated when encountering unfamiliar CVC words. The problem was not simply insufficient exposure to specific vocabulary; it reflected a broader gap in independent sound-symbol decoding. Because English exposure outside school was limited, classroom instruction had to provide deliberate opportunities for pupils to hear, see, manipulate, and produce English sounds.

Multisensory instruction offers one response to this need by engaging visual, auditory, tactile, and kinesthetic modalities together. Its theoretical rationale is consistent with Dual Coding Theory, which proposes that learning is strengthened when verbal and nonverbal representations are activated in coordinated ways (Paivio, 1971; Sadoski & Krasny, 2018). In early literacy, this means that pupils can hear a phoneme, see its grapheme, move or trace a representation, and physically manipulate sound units within the same learning episode.

The study therefore examined whether a dual-coding multisensory approach could reinforce third-grade pupils' blending and segmenting of CVC words more effectively than lecture-based phonics instruction. Specifically, it compared pretest and posttest performance between experimental and control groups, examined within-group changes, compared gain scores, and evaluated the practical magnitude of the observed differences through effect sizes. The study was intended to provide a classroom-based evidence base for phonics instruction in a Taiwanese EFL setting.

Literature Review

Blending and Segmenting as Foundational Decoding Skills

Blending and segmenting are core phonemic-awareness skills because they allow learners to work directly with the sound structure of words. Blending combines individual sounds into a pronounceable word, whereas segmenting separates a spoken word into phonemes that can be mapped to letters. These abilities underpin systematic phonics and contribute to the development of independent word reading and spelling (Brady, 2020; Ehri, 2022).

Effective blending instruction requires more than naming isolated sounds. Gonzalez-Frey and Ehri (2021) found that connected phonation, in which sounds are held and merged smoothly, was more effective than segmented phonation for teaching beginning readers to decode unfamiliar words. Rehfeld et al. (2022) likewise reported meaningful benefits of phonemic-awareness instruction for learners with reading difficulties, especially when instruction explicitly targets phoneme-level skills.

Instructional design and dosage also matter. Stalega et al. (2024) reported that phonological instruction is more effective when it is connected with print rather than conducted only as oral sound work. This supports the use of activities that combine spoken phonemes with written letters, CVC word patterns, manipulatives, and repeated practice. For the present study, the emphasis on blending and segmenting was therefore developmentally appropriate and aligned with the decoding demands of early English reading.

EFL Taiwanese Learners and Phonological Challenges

EFL learners often require more explicit instruction because first-language phonology shapes how second-language sounds are perceived and produced. Learners whose first language uses a logographic writing system must develop alphabetic sound-symbol mapping that is not directly supported by their prior literacy experience. Research with native Chinese speakers has documented lower English phonological awareness relative to native

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English benchmarks and has emphasized the value of explicit phonological instruction (Jiang et al., 2023; Liang & Fryer, 2024).

Taiwanese evidence supports the same direction. Li and Chen (2016) found that phonological-awareness training improved English word reading among EFL children, while Li and Woore (2021) showed that explicit phonics instruction supported phonological decoding and vocabulary learning among Chinese EFL learners. These findings justify early intervention at the elementary level, particularly for pupils who can recognize memorized words but cannot yet decode unfamiliar CVC forms independently.

Dual Coding Theory and Multisensory Instruction

Dual Coding Theory provides the principal theoretical basis for the intervention. Paivio (1971) proposed that cognition uses interconnected verbal and nonverbal systems, and later applications to literacy emphasize that coordinated verbal and imagery-based representations can strengthen learning and memory (Sadoski & Krasny, 2018). In phonics instruction, auditory phonemes represent the verbal channel, while visual letters, gestures, movement, and tactile manipulation add nonverbal forms of representation.

Multisensory literacy instruction operationalizes this principle by engaging visual, auditory, kinesthetic, and tactile modalities together. Birsh and Carreker (2018) describe multisensory teaching as systematic instruction that connects language structures across multiple sensory pathways. Solichah and Fardana (2024) similarly identified multisensory programs as a useful early-literacy intervention because they make abstract phonological content more concrete and memorable for young learners.

The present intervention used sound boxes, hand motions, tactile letter materials, manipulatives, visual cues, and guided oral practice. These activities were intended to strengthen phoneme-grapheme associations by allowing learners to hear, see, touch, and move while blending and segmenting. The approach was not treated as a replacement for explicit phonics; rather, it added multiple sensory representations to the same target sound-symbol content.

Evidence for Structured Phonics and Multisensory Decoding

Empirical research generally supports structured phonics instruction for EFL and struggling readers. Le Roux et al. (2017) documented low phonemic-awareness performance among Grade 3 second-language learners before intervention and subsequent improvement following targeted instruction. Henry (2020) likewise reported gains in word-reading accuracy after a systematic multisensory phonics intervention among older struggling readers.

Comparative research suggests that multisensory additions may yield benefits, but they do not always produce statistically superior outcomes over well-structured phonics. Schlesinger and Gray (2017) found that both structured phonics and multisensory phonics improved foundational reading skills, with no consistent superiority for the multisensory condition. This distinction is important because a meaningful within-group gain does not, by itself, establish that one method is better than another.

Other studies have nevertheless found strong multisensory effects in specific populations. Gohar (2019) reported large gains in phonological awareness and spelling among dyslexic EFL pupils, while Sapi'ee and Tan (2020) found positive effects on phonological awareness among young ESL learners in a rural setting. Together, these studies support testing multisensory phonics in new linguistic contexts while also requiring careful interpretation of between-group evidence.

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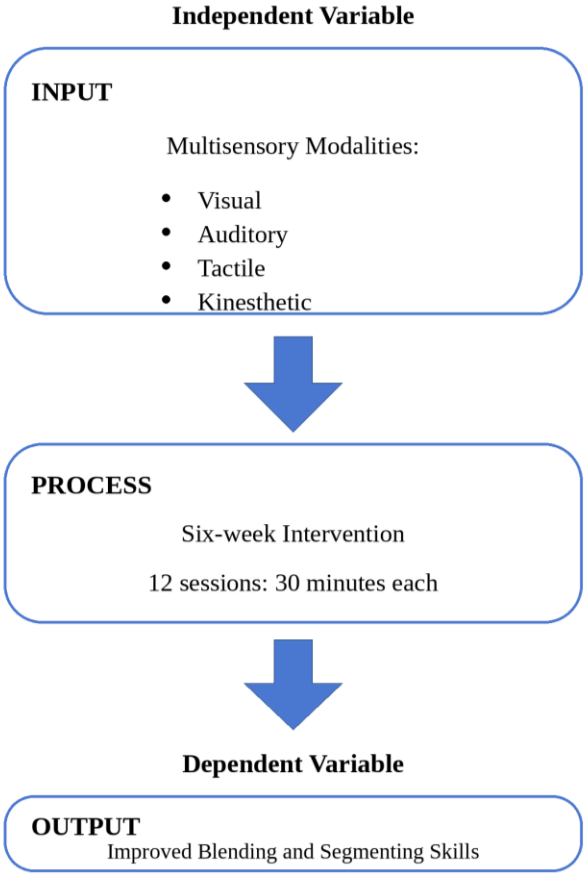
Figure 1. *Paradigm of the Study*



METHODS

Research Design

The study used a true experimental pretest-posttest control-group design. Two groups were formed: an experimental group that received dual-coding multisensory phonics instruction and a control group that received lecture-based phonics instruction. Both groups completed the same pretest, covered the same target CVC content during a six-week intervention, and completed the same posttest. Random assignment was used so that post-intervention differences could be examined in relation to instructional condition (Creswell & Creswell, 2018).

Research Locale

The study was conducted at Dacun Elementary School, a public bilingual elementary school in Changhua County, Taiwan (R.O.C.), during Academic Year 2025-2026. The school participates in English-language development initiatives aligned with Taiwan's Bilingual 2030 policy. The locale was appropriate because the third-grade EFL pupils had limited English exposure outside formal instruction and demonstrated difficulty decoding unfamiliar CVC words independently.

Participants and Sampling Technique

The participants were 16 third-grade members of the school's English club. The eligible group was purposively defined by English-club membership, third-grade enrollment, and availability for the full six-week intervention, and all 16 eligible pupils were included. Random assignment was then carried out through the

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fishbowl method: eight names were drawn for the experimental group and the remaining eight formed the control group. The pretest confirmed that the two groups were statistically equivalent before instruction.

Research Instrument

A researcher-developed 15-item CVC Decoding Test measured blending and segmenting performance. The test contained eight real words and seven pseudo-words and targeted seven consonants (f, m, n, p, r, s, and t) together with the five short vowel sounds. Pseudo-words were included to assess phonetic decoding without reliance on memorized vocabulary (Ehri, 2020).

Three English-language teaching experts evaluated the instrument across content, construct, face-validity, and language criteria. The thesis reported a combined validation score of 200 out of 204 (98.0%), with criterion-level Content Validity Index values above .95, exceeding the .80 benchmark used in the study (Polit & Beck, 2006). A pilot administration with five fourth-grade learners confirmed that the instructions, timing, and difficulty were usable. The thesis also reported KR-20 = -0.54 for the five-learner pilot and attributed the estimate to restricted item variance because eight of the 15 items were answered correctly by all pilot participants; accordingly, this coefficient does not provide positive internal-consistency evidence and should be interpreted cautiously.

Data Gathering Procedure

After pilot testing, the 16 participants were randomly assigned to the two groups and individually completed the pretest. The intervention then ran for six consecutive weeks, with two 30-minute sessions per week, totaling 12 sessions and six hours of instruction. The experimental group used visual, auditory, tactile, and kinesthetic activities such as sound boxes, hand gestures, tactile letter work, manipulatives, blending mats, and guided oral practice. The control group covered the same letters, vowel contrasts, and CVC patterns through teacher-led explanation, flashcards, reading drills, spelling drills, and repetition without tactile or kinesthetic components.

After the final session, all pupils completed the posttest individually under conditions comparable with the pretest. Responses were scored for pronunciation accuracy, and pretest, posttest, and gain scores were then prepared for statistical analysis.

Data Analysis

Descriptive statistics were used to summarize the distribution of scores. Independent-samples t tests compared the two groups at pretest, posttest, and on gain scores, while paired-samples t tests examined pretest-posttest change within each group. Statistical significance was evaluated at the .01 level. Cohen's d was computed to estimate practical significance, using the thresholds specified in the thesis: negligible below .20, small from .20 to .49, medium from .50 to .79, and large at .80 and above (Cohen, 1988).

Ethical Consideration

The study protected participants' privacy and welfare throughout the intervention. English-club participation was voluntary, parents were informed through the school's regular communication channel, and the school administration reviewed and approved the arrangement. Identifying details were excluded from public reporting, data were stored securely, and both groups were treated fairly so that no pupil was disadvantaged by group assignment.

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RESULTS AND DISCUSSION

Pretest and Posttest Performance

Both groups began with low CVC-decoding performance and improved substantially after six weeks. The control group increased from a pretest mean of 4.00 out of 15 (26.7%) to a posttest mean of 11.38 (75.8%), for a mean gain of 7.38 points. The experimental group increased from 4.13 (27.5%) to 12.50 (83.3%), for a mean gain of 8.38 points. The experimental group therefore finished 1.12 points higher and gained one point more on average.

Table 1. *Descriptive Performance of the Control and Experimental Groups*

Group	Pretest M (SD)	Posttest M (SD)	Mean Gain	Posttest Variance	Posttest Range
Control	4.00 (4.24)	11.38 (3.16)	7.38	9.98	10
Experimental	4.13 (3.00)	12.50 (2.07)	8.38	4.29	6

The descriptive pattern indicates that both forms of structured phonics produced substantial improvement. The experimental group's higher posttest mean and gain are consistent with the rationale for multisensory instruction, but the more distinctive descriptive result is the lower posttest variance (4.29 versus 9.98) and narrower range (6 versus 10). This suggests more consistent outcomes within the experimental group, a pattern that the thesis interpreted as fewer pupils being left behind.

Between-Group Differences

The pretest comparison confirmed that the groups were equivalent before the intervention, $t(14) = 0.068$, $p = .9467$, $d = .034$. At posttest, the experimental group scored higher, but the difference was not statistically significant at the .01 level, $t(14) = 0.842$, $p = .4137$, $d = .421$. The difference in gain scores was also not statistically significant, $t(14) = 0.546$, $p = .5936$, $d = .273$. Thus, the study did not establish statistical superiority of multisensory instruction over lecture-based phonics within this sample.

Table 2. *Between-Group Comparisons*

Comparison	t	df	p	Cohen's d	Decision at α = .01
Pretest	0.068	14	.9467	.034 (Negligible)	Not significant
Posttest	0.842	14	.4137	.421 (Small)	Not significant
Gain scores	0.546	14	.5936	.273 (Small)	Not significant

This result is consistent with comparative research showing that multisensory features may not always yield statistically greater outcomes than well-structured phonics alone (Schlesinger & Gray, 2017). The effect sizes nevertheless show a small practical advantage for the experimental group at posttest and on gains. Because each group contained only eight pupils, the study had limited ability to detect small between-group differences.

Within-Group Improvement

Both groups showed statistically significant pretest-posttest improvement. The control group gained 7.38 points, $t(7) = -5.468$, $p = .0009$, $d = 1.933$. The experimental group gained 8.38 points, $t(7) = -6.763$, $p = .0003$, $d = 2.391$. Both effect sizes were large, and the experimental condition produced the largest effect size reported in the study.

Table 3. *Within-Group Pretest-Posttest Comparisons*

Group	Pretest M	Posttest M	Mean Gain	t(7)	p	Cohen's d
Control	4.00	11.38	7.38	-5.468	.0009	1.933 (Large)
Experimental	4.13	12.50	8.38	-6.763	.0003	2.391 (Large)

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The control-group result confirms that explicit, structured phonics practice alone can markedly strengthen CVC decoding. This is consistent with the established role of systematic phonics in early word reading (Castles et al., 2018; Ehri, 2020). The experimental group's larger effect is also consistent with studies reporting strong multisensory gains in phonological awareness and decoding (Gohar, 2019; Henry, 2020; Sapi'ee & Tan, 2020). The appropriate interpretation is therefore not that lecture-based phonics was ineffective, but that multisensory phonics showed promising added value within the experimental group without demonstrating statistically significant between-group superiority.

Implications for Taiwanese EFL Phonics Instruction

The findings are particularly relevant in a Taiwanese EFL setting because pupils have limited opportunities to encounter English phonemes outside school and may rely on visual memorization rather than independent decoding. The substantial gains in both groups show that focused phonics instruction can address this gap, while the experimental group's larger within-group effect and lower variability suggest that adding tactile and kinesthetic supports may help make sound-symbol relationships more accessible to a wider range of learners.

The results also align with the theoretical logic of Dual Coding Theory. Multisensory activities did not change the target content; rather, they provided multiple coordinated representations of the same sounds and letters. For classrooms with limited materials, the control-group findings show that explicit phonics remains valuable. Where resources and teacher preparation permit, sound boxes, gestures, tactile letters, and manipulatives can be incorporated as low-cost reinforcement strategies rather than treated as a separate curriculum.

CONCLUSION

The study found that both lecture-based structured phonics and dual-coding multisensory phonics significantly improved the blending and segmenting of CVC words among third-grade EFL pupils at Dacun Elementary School. The groups began at comparable and generally low levels, then achieved substantial gains after twelve instructional sessions. The experimental group obtained the higher posttest mean, the larger mean gain, the largest within-group effect size, and lower posttest variability.

Consistent with the thesis conclusion, the dual-coding multisensory approach can be considered an effective reinforcement strategy for blending and segmenting. However, the present evidence does not establish that it is statistically superior to lecture-based phonics because neither the posttest difference nor the gain-score difference between groups reached significance. The study therefore contributes promising classroom evidence rather than a definitive comparative conclusion. Its small sample, single-school setting, six-week duration, immediate posttest, and limited pilot reliability evidence should be considered when interpreting the findings and planning larger replications.

Recommendation

English teachers working with beginning EFL readers are encouraged to integrate sound boxes, hand motions, tactile letter materials, manipulatives, and other multisensory activities into explicit phonics lessons. These techniques can be added to existing instruction without changing the target content and may be especially useful for pupils who need additional support linking English sounds with written letters.

School administrators, academic coordinators, and language departments may provide teacher training and practical materials for multisensory phonics and may consider extending the approach beyond English-club settings into regular lower-grade English classes. Progress monitoring in blending and segmenting should accompany implementation so that instruction can be adjusted to pupils' needs.

Future research should replicate the intervention with larger samples, additional schools, longer instructional periods, and delayed posttests. Larger studies are particularly important for determining whether the small between-group advantages observed here become statistically reliable. Future work may also examine individual sensory components and expand decoding outcomes beyond three-letter CVC words.

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