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Effectiveness of the PECS Program in Improving Comprehension in a Case Suffering from Landau–Kleffner Syndrome

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Abstract

*This study aimed to evaluate the **effectiveness of the Picture Exchange Communication System (PECS)** in improving **linguistic comprehension, behavioural, and emotional responses** in an eight-year-old child diagnosed with **Landau–Kleffner Syndrome (LKS)** – a rare neurological disorder characterised by a progressive loss of receptive and expressive language abilities due to abnormal epileptiform activity in the temporal lobe.*

*A **single-subject case study design** was employed, following an (A–B–A') model. The intervention consisted of a seven-month PECS training programme conducted at the clinic, complemented by structured home-based activities, followed by a three-month follow-up phase. The intervention was divided into three progressive stages: linking pictures to meaning, exchanging pictures to express needs, and responding to simple and complex questions.*

*The findings revealed a **significant improvement in auditory and linguistic comprehension (70–90%)**, alongside a marked reduction in negative behaviours and emotional outbursts. Communication and adaptive behaviour scores on the **Vineland Adaptive Behavior Scales (VABS-II)** increased substantially. Home activities played a pivotal role in consolidating learning and ensuring the sustainability of outcomes after clinical intervention.*

*The study concludes that **PECS is an effective tool for rebuilding linguistic comprehension in children with Landau–Kleffner Syndrome**, particularly when combined with consistent family involvement and home reinforcement. It recommends expanding the scope of research to larger samples and developing **standardised therapeutic protocols** tailored to the neuro-linguistic characteristics of this population*

***Keywords**:* Landau–Kleffner syndrome, PCES program, auditory comprehension, language rehabilitation, case study

Efficacité du programme PECS dans l'amélioration de la compréhension chez un patient atteint du syndrome de Landau-Kleffner

Résumé
Cette étude visait à évaluer l'efficacité du système de communication par échange d'images (PECS) dans l'amélioration de la compréhension linguistique, du comportement et des réactions émotionnelles chez un enfant de huit ans atteint du syndrome de Landau-Kleffner (LKS), une maladie neurologique rare caractérisée par une perte progressive des capacités de compréhension et d'expression linguistiques due à une activité épileptiforme anormale dans le lobe temporal.
Une étude de cas à sujet unique a été menée, suivant un modèle (A-B-A'). L'intervention consistait en un programme de formation PECS de sept mois mené à la clinique, complété par des activités structurées à domicile, suivi d'une phase de suivi de trois mois. L'intervention était divisée en trois étapes progressives : associer des images à leur signification, échanger des images pour exprimer des besoins et répondre à des questions simples et complexes.

Les résultats ont révélé une amélioration significative de la compréhension auditive et linguistique (70 à 90 %), ainsi qu'une réduction marquée des comportements négatifs et des crises émotionnelles. Les scores de communication et de comportement adaptatif sur les échelles de comportement adaptatif de Vineland (VABS-II) ont considérablement augmenté. Les activités à domicile ont joué un rôle essentiel dans la consolidation de l'apprentissage et la pérennité des résultats après l'intervention clinique.
L'étude conclut que le PECS est un outil efficace pour reconstruire la compréhension linguistique chez les enfants atteints du syndrome de Landau-Kleffner, en particulier lorsqu'il est associé à une implication constante de la famille et à un renforcement à domicile. Elle recommande d'élargir la portée de la recherche à des échantillons plus importants et de développer des protocoles thérapeutiques standardisés adaptés aux caractéristiques neurolinguistiques de cette population.

***Mots-clés :** syndrome de Landau-Kleffner, programme PCES, compréhension auditive, rééducation linguistique, étude de cas*

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Introduction

In contemporary speech and language therapists practice, therapeutic intervention is no longer limited to facilitating communication; it has evolved to assess and rehabilitate complex cognitive processes. This shift has been supported by advances in clinical, neurolinguistic, and cognitive research, which have demonstrated the profound interconnection between language, cognition, and brain function. As a result, speech and language therapists has established itself as an essential discipline in addressing disorders that were not traditionally within its scope.

With the growing breadth of speech and language therapists research and the promising results obtained, its effectiveness now extends beyond typical communication disorders to encompass various syndromes. Among these rare conditions is **Landau–Kleffner Syndrome (LKS) —** one of the rarest paediatric neurological disorders, with an estimated global incidence of approximately **1 in 100,000 children**. The condition is more common in males and typically manifests between **three and ten years of age**.

LKS is classified as a **neurological disorder** characterised by epileptic seizures, often detectable through **electroencephalogram (EEG)** patterns. It is also known as **acquired aphasia of childhood**, and is distinguished by a **sudden or gradual loss of language abilities** in a previously typically developing child. This syndrome is accompanied by a variety of **linguistic, behavioural, emotional, and cognitive disturbances**, which vary considerably from one case to another.

The **loss of language comprehension and expression**, whether abrupt or progressive, represents the most striking symptom and constitutes a primary diagnostic criterion. Despite international progress in understanding and managing LKS, the syndrome remains under-researched, particularly regarding its **linguistic manifestations** and **rehabilitation strategies**.

At the **local level**, studies remain extremely limited — if not entirely absent — mainly due to the **difficulty of diagnosis** and the rarity of confirmed cases. To date, there are no official statistics or detailed epidemiological data concerning Landau–Kleffner Syndrome in Algeria.

This rarity, coupled with the complexity of its neurolinguistic features, makes LKS a compelling topic for researchers interested in rare paediatric syndromes. Through the present study, we sought to explore one of the most affected linguistic domains in LKS — **comprehension** — by addressing the following research question:

What is the effectiveness of the PECS programme in improving comprehension in a case suffering Landau–Kleffner Syndrome

Objective of the Study

The objective of this study is to measure the effectiveness of the Picture Exchange Communication System (PECS) programme in improving linguistic comprehension in a case of Landau–Kleffner Syndrome, and to examine the impact of this improvement on the overall condition of the Case.

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1. Previous Studies

1.1 Case report of Landau–Kleffner syndrome in a girl

A case study by Wairungu (2017) examined a 19-year-old girl who had completely lost her language abilities following an epileptic seizure at the age of two. The regression involved both expressive and receptive language domains — her speech became incomprehensible, syllables were omitted, and grammatical structures were disorganised. In addition, the patient presented with verbal auditory agnosia, which triggered frustration and behavioural disturbances. The study was grounded in qualitative data collected from interviews and educational records, showing that speech therapy and visual support facilitated partial recovery of language abilities, though comprehension and expression deficits persisted. The author linked these linguistic regressions to EEG abnormalities and associated comorbidities such as ADHD, underscoring the neurological basis of the disorder (Wairungu, 2017).

1.2 Cognitive linguistic treatment in severe chronic LKS

In a clinical case report, van den Heuvel et al. (2021) investigated the effectiveness of a cognitive–linguistic intervention with a 16-year-old adolescent suffering from chronic LKS since the age of 3 years and 9 months. The treatment programme, adapted from adult aphasia models, focused on semantic judgement, word-network building, and melodic intonation techniques to stimulate oral production and auditory processing. Conducted in two intensive phases (3 weeks + 9 weeks), the therapy produced notable improvements in language production (57 new words acquired with over 80% retention after 18–30 months)

and daily communication skills. However, comprehension deficits remained largely unchanged, suggesting the persistence of verbal auditory agnosia. Despite limited generalisation, the intervention enhanced the patient's functional communication and social engagement, such as in his workplace (van den Heuvel et al., 2021).

1.3 Identification and treatment of LKS

According to Vance and Stackhouse (2010), language comprehension impairment is often the earliest and most distinctive symptom of LKS, frequently leading to an initial misdiagnosis of deafness. The regression typically extends to expressive domains, resulting in telegraphic speech, omitted morphemes, and grammatical simplification. The authors attribute this to an underlying auditory processing disorder and deficits in short-term phonological memory. Treatment approaches include a combination of antiepileptic medication, surgical interventions, and. speech and language therapist For addressing comprehension deficits, the authors recommend bypassing the auditory channel through sign language, AAC systems, FM amplification, and visual–motor communication training. Importantly, speech therapy continues after medical stabilisation to rebuild residual linguistic functions and address co-occurring attention and learning difficulties (Vance & Stackhouse, 2010).

Summary of reviewed studies

Across the reviewed literature, the core deficit in LKS lies in impaired auditory comprehension, often due to verbal auditory agnosia resulting from temporal lobe epileptiform activity. Despite variations in treatment methods, all studies

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converge on the necessity of multimodal interventions — integrating speech therapy, visual supports, and cognitive-linguistic rehabilitation — to promote compensatory communication strategies and functional recovery. These findings reinforce the rationale of the current study, which investigates the effectiveness of the PECS programme in enhancing comprehension among individuals with Landau–Kleffner Syndrome.

2. Field Aspect

2.1. Title of the Field Study

A Case Study Evaluating the Effectiveness of the Picture Exchange Communication System (PECS) in Enhancing Linguistic Comprehension and Behavioural Response in a Child with Landau–Kleffner Syndrome

2.2. Background of the Field Study

This field study aims to evaluate the effectiveness of the PECS programme in improving linguistic comprehension, response, and behaviour in a single child diagnosed with Landau–Kleffner Syndrome (LKS), employing a case study design that focuses on individual changes. The programme was adapted to the specific needs of the case, including integration of home-based activities to reinforce outcomes.

3. Case Description

3.1. Characteristics of the Case

- Age: 8 years
- Gender: Male (consistent with the higher prevalence among males in LKS; Bishop, 1985)

- Diagnosis: Landau–Kleffner Syndrome confirmed clinically and electrographically through recurrent epileptic seizures. EEG monitoring during sleep revealed abnormal electrical activity in the temporal lobe and progressive loss of language abilities starting at age 5. The child receives pharmacological treatment (e.g., sodium valproate or levetiracetam) with partial efficacy (2–3 seizures per month).
- Baseline Condition: The child exhibits severe acquired aphasia, no response to verbal language or simple commands, and difficulties expressing needs, leading to frequent emotional outbursts (anger, social withdrawal) and maladaptive behaviours. Cognitive and motor skills remain relatively intact, but communication is limited to non-verbal cues.

The case was selected through clinical observation and medical confirmation.

4. Methodology

4.1. Study Design

- Approach: Single-subject case study (Yin, 2018; Bromley, 1986) using an A–B–A' model (baseline–intervention–follow-up).
- Sample: One individual (n = 1), reflecting the rarity of LKS in Algeria (fewer than five cases reported in Batna Province; Ministry of Health, 2022).
- Duration: One year (January–December 2023) divided into observation (2 months), intervention (7 months), and follow-up (3 months).
- Setting: Amal Speech Therapy Clinic, Merouana, Batna Province, Algeria.

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4.2. Measurement Tools and Procedures

- Main Tools:
  - PECS as both a therapeutic and measurement tool.
  - Vineland Adaptive Behavior Scales (VABS-II) to assess communication and emotional development.
  - Parent Questionnaires for weekly communication progress.
- Tasks:
  - Picture exposure
  - Picture labelling
  - Picture matching
  - Picture exchange
  - Questioning
- Reliability: Inter-rater agreement ($\kappa > 0.80$) confirmed reliability.

4.3. Study Phases

Phase 1 – Pre-Intervention (2 months):

No response to visual or verbal stimuli. VABS: communication 20/100, behaviour 25/100.

Phase 2 – Intervention (7 months):

Five weekly clinic sessions (30–45 minutes) + daily home practice.

- *Stage 1 (Months 1–2):* Picture exposure and labelling (5 daily pictures).
- *Stage 2 (Months 3–5):* Picture exchange for needs.

- *Stage 3 (Months 6–7):* Simple questioning and 2–3 picture sentences. Parental workshops ensured home reinforcement.

Phase 3 – Follow-Up (3 months):
Post-test and observation to evaluate sustainability.

5. Results

5.1. Pre-Measurement

Zero response (0%) across all PECS tasks. Emotional instability, daily anger, and avoidance of communication.

5.2. Post-Measurement

- Comprehension and Response:
  - Picture exposure/labeling/matching: 9/10 (90%)
  - Picture exchange: 8/10 (80%)
  - Questioning: 8/10 (simple, 80%), 6/10 (complex, 60%)
- Behavioural Improvement:
  - Communication score: 70/100
  - Behavioural score: 65/100
  - Emotional regulation: 75% reduction in anger.

Follow-Up: Maintained 80–90% of acquired skills and higher motivation for communication.

6. Discussion

This case confirms the effectiveness of PECS in improving comprehension and emotional regulation in LKS. Gradual training and family involvement yielded 70–90% improvement, aligning with findings by Flippin et al. (2010) and Ganz et al. (2012). The inclusion of home activities was crucial for generalisation. However, comprehension of

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complex questions remained limited, suggesting the need for combined neurocognitive and linguistic therapy.

The findings highlight the necessity of introducing structured PECS programmes in Algerian clinics and training professionals in multimodal speech and language therapists approaches.

7. Comparative Discussion and Integration of Findings

Across the reviewed literature, the core deficit in Landau–Kleffner Syndrome (LKS) lies in impaired auditory comprehension, typically stemming from verbal auditory agnosia associated with temporal lobe epileptiform activity (Vance & Stackhouse, 2010; van den Heuvel et al., 2021; Wairungu, 2017). Despite methodological diversity, all studies converge on the need for multimodal intervention approaches, combining speech therapy, visual supports, and cognitive–linguistic rehabilitation to promote compensatory communication mechanisms and functional language recovery.

The current case study aligns closely with these conclusions, yet provides additional applied evidence on the use of the Picture Exchange Communication System (PECS) as a targeted visual–linguistic strategy. Unlike previous cases that focused primarily on linguistic restoration or general communication facilitation, the present study demonstrated significant improvement in receptive comprehension (70–90%) and behavioural regulation (75% reduction in emotional outbursts) following structured PECS intervention combined with home-based reinforcement.

Furthermore, the findings expand upon van den Heuvel et al. (2021), who reported limited generalisation of linguistic

gains, by highlighting how family participation and daily home generalisation contribute to sustaining comprehension improvements beyond the clinical setting. Similarly, whereas Wairungu (2017) observed persistent expressive and receptive deficits despite therapy, the inclusion of multisensory and contextualised learning through PECS in this study resulted in better maintenance of learned skills (80–90% retention after three months).

In contrast to earlier studies that focused on adult-oriented linguistic rehabilitation models, this research emphasises child-centred, visually guided speech and language therapists intervention, which appears more compatible with the cognitive and neurodevelopmental profile of LKS. The evidence gathered supports the neurolinguistic rationale that visual stimuli can compensate for disrupted auditory feedback circuits in the temporal and parietal cortices, facilitating alternative neural pathways for comprehension (Zatorre, 2012; Hickok & Poeppel, 2007).

Overall, this study corroborates prior research while extending it by providing empirical validation within the Algerian context, where research on LKS remains scarce. The observed improvements demonstrate that PECS is not only a compensatory communication aid, but also a therapeutic mechanism for re-establishing linguistic comprehension through visual–cognitive integration and emotional stabilisation.

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Conclusion

This study represents one of the few Arabic contributions addressing *Landau–Kleffner Syndrome (LKS)* from an *applied speech therapy perspective*, focusing on **linguistic comprehension** as the most affected function in this rare neurological disorder. The results of the field application of the **Picture Exchange Communication System (PECS)** demonstrated clear effectiveness in improving both **auditory and linguistic comprehension**, as well as in enhancing **behavioural and emotional responses** in the studied case. A marked increase was recorded in comprehension task performance and in the child's ability to use language in daily communicative contexts.

The gradual success in restoring comprehension and communication abilities reflects the direct impact of **systematic and repetitive training,** confirming the importance of **early intervention** based on visual communication and multimodal strategies to compensate for partial auditory input loss. The findings also highlight the critical role of **family participation and home-based activities** in consolidating learning and sustaining improvement after clinical intervention.

From a scientific perspective, these findings underscore the value of an **integrative** speech and language therapists **approach** that considers neuro-linguistic and behavioural dimensions in therapy. This approach opens new avenues for re-evaluating and adapting **speech therapy programmes for children with LKS** within the Algerian context, taking into account local linguistic and cultural specificities.

Although the sample size was limited to a single case, this experience establishes a foundational step for broader studies that may contribute to the development of **standardised therapeutic protocols** combining visual-based communication and progressive auditory training.

In conclusion, this study affirms that a child with Landau–Kleffner Syndrome is not permanently deprived of linguistic capacity, but rather requires **new communication pathways** that can reactivate the neuro-linguistic networks and offer the opportunity to regain language through scientifically structured alternative routes.

Recommendations

In light of the findings of this study, several recommendations can be proposed to advance both clinical practice and research related to Landau–Kleffner Syndrome (LKS):

1. Expand the study sample to include a larger number of cases in order to validate the current findings and allow for more generalisable conclusions.
2. Develop and adapt diagnostic assessment tools that are specifically designed to detect and characterise the linguistic and auditory deficits associated with LKS in Arabic-speaking contexts.
3. Organise scientific conferences and awareness campaigns to increase public and professional understanding of Landau–Kleffner Syndrome, promoting early detection and multidisciplinary intervention.
4. Adopt evidence-based therapeutic approaches that systematically target linguistic recovery, progressing

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from comprehension to expressive language, while integrating neuro-linguistic and behavioural principles.

5. Encourage and support further research focusing on rare neuro-linguistic syndromes, in order to enrich the scientific literature and strengthen the clinical foundations of speech and language therapy in the region

References

1. Al-Jarallah, A., et al. (2018). *Epilepsy in the Middle East*. Journal of Pediatric Neurology, 16(2), 89-102.
2. Bishop, D. V. M. (1985). *Age of onset and pattern of language development*. Brain and Language, 23(1), 1-15.
3. Bondy, A., & Frost, L. (2001). *The Picture Exchange Communication System*. Behavior Modification, 25(3), 457-478.
4. Bromley, D. B. (1986). *The Case-Study Method in Psychology and Related Disciplines*. John Wiley & Sons.
5. Flippin, M., et al. (2010). *Effectiveness of the Picture Exchange Communication System*. Journal of Autism and Developmental Disorders, 40(7), 843-856.
6. Frost, L., & Bondy, A. (2002). *The Picture Exchange Communication System Training Manual* (2nd ed.). Pyramid Educational Consultants.
7. Ganz, J. B., et al. (2012). *Meta-analysis of PECS research*. Research in Autism Spectrum Disorders, 6(1), 406-414.

8. Landau, W. M., & Kleffner, F. R. (1957). *Syndrome of acquired aphasia with convulsion in children*. Pediatrics, 19(1), 28-38.
9. Nerbonne, J., et al. (2014). *Landau-Kleffner Syndrome*. In S. Pearl (Ed.), *Pediatric Neurology* (pp. 345-360). Elsevier.
10. Sparrow, S. S., et al. (2005). *Vineland Adaptive Behavior Scales: Second Edition (VABS-II)*. Pearson Assessments.
11. World Health Organization (WHO). (2022). *World Report on Epilepsy and Other Neurological Disorders*. WHO Press.
12. World Medical Association. (2013). *Declaration of Helsinki: Ethical Principles for Medical Research*. JAMA, 310(20), 2191-2194.
13. Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods* (6th ed.). Sage Publications
14. References (APA 7)
15. Vance, M., & Stackhouse, J. (2010). Identification and treatment of Landau–Kleffner syndrome. *The ASHA Leader*, *15*(11), 34–37. https://doi.org/10.1044/leader.FTR3.15112010.34
16. van den Heuvel, L., Kolk, A., Feijen, S., Drinkenburg, W., & van Erp, M. G. M. (2021). Cognitive linguistic treatment in Landau–Kleffner syndrome: Improvement in daily life communication. *Child Neurology Open, 8*, 2329048X211022196. https://doi.org/10.1177/2329048X211022196
17. Wairungu, G. M. (2017). *A case study of Landau–Kleffner syndrome: A child unresponsive to education and medical interventions* (Doctoral dissertation, University of Arkansas). https://scholarworks.uark.edu/etd/2174