



Supporting Bilingual Children with Developmental Language Disorder Through Gamified Connected Play: A Case Study

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Abstract

Developmental Language Disorder (DLD) is a neurodevelopmental condition associated with persistent difficulties in language comprehension and expression, often impacting academic achievement, social participation, and emotional well-being [1]. This paper presents a single-case study investigating the implementation of "Olly's Adventures: The City of Two Languages", a bilingual Maltese-English board game and companion mobile app developed through the SALT-T-CITY project [2]. Unlike traditional therapeutic board games, Olly's Adventures integrates a physical game board with a companion application, allowing digital activities, audio-visual stimuli, language tasks, and game progression to interact within a single intervention experience. This connected design enables the delivery of targeted language-learning activities while maintaining the social and communicative benefits of face-to-face gameplay. The tool was designed through a user-centred, multidisciplinary approach involving speech and language pathologists, engineers, game developers, caregivers, educators, and children to provide an engaging phygital approach to language intervention [2]. The participant was a bilingual Maltese English child diagnosed with DLD who utilised the tool during speech and language therapy sessions targeting vocabulary development, semantic organisation, verbal reasoning, morphosyntax, and social communication skills. Data was collected through clinical observations, therapist field notes, gameplay performance, and qualitative reflections regarding engagement, participation, and responsiveness to intervention activities. The case study explored the extent to which a gamified connected tool could facilitate language elicitation and sustained engagement within a naturalistic therapeutic environment. Findings indicated high levels of motivation and active participation throughout the intervention process, with the physical and digital elements of the tool supporting turn-taking, collaborative interaction, and repeated exposure to language targets. The board game format fostered meaningful triadic communicative exchanges while maintaining the child's interest in the language-learning activities. These findings suggest that connected therapeutic games may provide an effective and motivating medium through which evidence-based language intervention can be delivered for bilingual children with DLD. Furthermore, the study highlights the potential of combining play, gamification, and connected technologies to bridge clinical and educational approaches to language support within multilingual contexts and provides preliminary evidence supporting the use of user-centred connected intervention tools in speech and language therapy practice [2].

Keywords: Developmental Language Disorder; bilingualism; gamification; speech and language therapy; educational technology; language intervention

1. Introduction

Developmental Language Disorder (DLD) is a neurodevelopmental condition associated with persistent difficulties in the acquisition and use of language that cannot be explained by a biomedical condition or known differentiating condition [1]. Children with DLD may experience difficulties across receptive and expressive language, including vocabulary, grammatical development, verbal reasoning, and discourse [3]. These difficulties can have implications for educational achievement, social participation, and wider well-being, highlighting the importance of appropriately tailored speech and language intervention [4]. Paediatric speech and language therapy frequently incorporates play as a context for intervention [5]. Play provides opportunities for children to communicate, practise language within meaningful interactions, and engage with communication partners in a motivating context. Therapeutic toys and games may further structure these interactions around specific



intervention goals [6][7]. Speech and language therapeutic toys (SALTTs) are specifically designed or adapted to support communication development, with resources targeting areas such as vocabulary, grammar, articulation, and social communication [6]. However, the increasing integration of digital technology into children's everyday lives has introduced new possibilities and challenges for therapeutic play [8]. Electronic toys and digital applications can provide engaging, interactive, and adaptable experiences, but research has also raised concerns that technology-mediated play may reduce the quantity and quality of adult-child linguistic interaction [9]. Consequently, there is increasing interest in approaches that combine the affordances of physical play with those of digital technology [10] [37].

Connected or "phygital" technologies provide one such approach by linking physical objects with digital content and interaction [11]. Within speech and language therapy, these technologies may offer opportunities for personalisation, multimodal input, repeated practice, and engagement while retaining the interpersonal nature of play [2]. Nevertheless, research specifically examining connected therapeutic technologies for paediatric language intervention remains limited, particularly within bilingual contexts [12].

This issue is especially relevant in Malta, where many children experience a bilingual Maltese-English linguistic environment [13] [14]. Maltese-English bilingual language use may involve code-switching, lexical borrowing, and variation in language dominance, creating additional considerations for assessment and intervention [15] [16]. Despite the need for linguistically and culturally appropriate resources, the availability of specialised bilingual therapeutic materials remains limited [17] [2]. The SALTT-CITY project was therefore developed to explore the potential of a connected, gamified therapeutic resource designed specifically for Maltese-English-speaking children [18] [2]. The present paper focuses on the clinical implementation of the resulting tool, *Olly's Adventures: The City of Two Languages*, through a single-case study involving a bilingual child diagnosed with DLD. Specifically, the paper examines how the connected board game and companion application functioned as a medium for language elicitation, therapeutic scaffolding, and social interaction during a naturalistic speech and language therapy session.

2. Methods

2.1 Research Question and Study Design

The study explored the following research question: How did *Olly's Adventures: The City of Two Languages* function as a medium for language elicitation, therapeutic scaffolding, engagement, and social interaction during a naturalistic speech and language therapy session involving a bilingual child with DLD? An exploratory single-case study design was used to examine the clinical implementation of the BETA prototype of *Olly's Adventures* within a naturalistic speech and language therapy context. A single-case design was selected to allow detailed examination of the interaction between the child, clinician, caregiver, and connected game components during authentic therapeutic activity. The study was exploratory in nature and was not designed to evaluate treatment efficacy or establish causal effects.

2.2 Participant and Setting

The participant was one bilingual Maltese-English-speaking child, referred to using the pseudonym Mason, aged 5 years and 7 months at the time of data collection. Mason had a formal diagnosis of Developmental Language Disorder and had been receiving speech and language therapy since March 2022. His active intervention goals included word finding, Mean Length of Utterance, prepositions, syntax, speech intelligibility, and verbal reasoning. The observation took place during a speech and language therapy session in May 2024. The session involved a clinical triad comprising the child, the speech and language pathologist, and the child's mother. Mason predominantly expressed himself in English during the session. Speech intelligibility was part of his broader clinical profile but was not targeted during the observed session because the tool was designed as a language intervention resource.

2.3 Procedure and Data Collection



The session involved the use of the BETA prototype of Olly's Adventures, including its physical board-game components and companion application. Activities targeted vocabulary and semantic organisation, sentence formulation, morphosyntax, verbal reasoning, and social communication. The clinician used established therapeutic strategies, including questioning, modelling, prompting, recasting, and phonological and semantic cueing, in response to Mason's performance and communicative attempts. Data was collected through structured observation forms completed by the researcher and clinician, Mason's activity-level smile-o-meter self-ratings, adult self-report questionnaires, gameplay performance, and verbatim audio transcription of the session. These sources were used to document participation, communicative behaviours, responses to therapeutic activities, clinician scaffolding, and interactions between the child, clinician, and caregiver.

2.4 Analysis

The data were examined qualitatively to identify recurring patterns in the ways the connected game supported or constrained the therapeutic interaction. Observations, field notes, gameplay behaviours, and transcribed interactions were considered together to identify instances relating to language elicitation and scaffolding, child-led and multimodal communication, and engagement within clinician-controlled intervention. These patterns were subsequently organised into three analytically derived affordances. Examples of observed child responses, clinician prompts, and interactional behaviours are presented to illustrate each affordance.

2.5 Ethical Considerations

Ethical approval for the study was obtained from the University of Malta's Research Ethics Committee (Approval No. FHS-2023-00601). Written informed consent was obtained from the child's parent/therapist prior to participation, alongside informed assent from the child participant. The participant was assigned the pseudonym "Mason" in all research documentation and reporting to protect his identity.

3. Olly's Adventures: The City of Two Languages

3.1 Development and Rationale

Olly's Adventures: The City of Two Languages was developed through the SALTT-CITY project as a bilingual Maltese-English speech and language therapeutic resource for children aged approximately five to eight years [18] [2]. The project adopted a user-centred and multidisciplinary approach, involving speech and language pathologists, engineers, game developers, caregivers, and children in iterative stages of development and evaluation [6] [2].

The project built on earlier Maltese research into therapeutic technology, particularly SPEECHIE and its prototype *Olly Speaks* [17]. *Olly Speaks* incorporated Maltese-English language support and generated positive usability responses from 155 bilingual children [17], but its physical smart-toy format presented challenges related to manufacturing cost and accessibility [7].

Olly's Adventures consequently adopted a board-game format while retaining connected digital functionality [18] [2]. The BETA prototype used in this case study was fully functional but remained a developmental prototype. The design incorporated modelling, scaffolding, visual prompting, and reinforcement [19] [20]. Digital activities provided audiovisual cues, while physical components supported manipulation, turn-taking, and shared attention, with clinicians able to adapt support to the child's responses [21] [2].



Fig. 1. *Olly's Adventures: The City of Two Languages*



Fig. 2. BETA Prototype in use during fieldwork

3.2 Therapeutic Activities

The tool incorporated activities targeting vocabulary and semantic relationships, sentence construction, descriptive language, relational language, verbal reasoning, and social interaction [2]. For example, activities involving categories required children to identify relationships between objects and concepts [22], while association-based activities encouraged children to explain functional relationships between items. Sentence-based activities supported the construction and expansion of utterances [23], while activities involving adjectives and possessive pronouns provided opportunities to practise specific grammatical structures [24]. Importantly, the activities were not intended to replace clinician-directed intervention. Rather, they provided a structured context in which the clinician could apply established therapeutic techniques. The clinician could adjust prompting, modelling, and questioning based on the child's responses, abilities, and attention during the session.

4. The Maltese-English Context

The development of *Olly's Adventures* was grounded in the linguistic context of Malta [13] [14]. Maltese-English bilingual children may navigate two linguistic systems within their everyday lives, with patterns of language use influenced by exposure, context, and individual language dominance [25] [14]. Code-switching and lexical borrowing are also features of the Maltese sociolinguistic environment [13] [15]. These characteristics are particularly important when considering children with DLD. Difficulties observed in bilingual children must be interpreted within their overall linguistic experience rather than assuming that variation from monolingual expectations necessarily reflects disorder [26] [16]. At the same time, bilingual children with DLD may experience difficulties in vocabulary organisation, word retrieval, semantic relationships, and morphosyntactic development, creating a need for intervention that can accommodate their linguistic environment [35] [14]. The local availability of specialised therapeutic resources represents an additional consideration [17]. The SALTT-CITY project identified a scarcity of bilingual Maltese-English materials specifically designed for language intervention, with clinicians consequently needing to adapt resources available to them [6] [2]. The development of *Olly's Adventures* therefore sought not only to incorporate technology but to create a resource that was culturally and linguistically situated within the population for whom it was intended [18].

5. Case Study: Clinical Implementation and Affordances

5.1 Case Context and Clinical Profile

The SALTT-CITY study evaluated the BETA prototype within a clinical setting involving a clinical triad: a clinician, a child diagnosed with DLD named Mason, and his mother. Mason was 5 years and 7 months old, bilingual in Maltese and English (predominantly expressing himself in English during the session), and formally diagnosed with Developmental Language Disorder. Having received speech



and language therapy since March 2022, his active intervention goals included addressing word-finding difficulties, Mean Length of Utterance (MLU), prepositions, syntax through *Colourful Semantics* [23], speech intelligibility via the *Core Vocabulary Approach* [34], and verbal reasoning (which was added in March 2024). The session was conducted in May 2024 and evaluated using structured observation forms completed by the researcher and clinician [33], Mason's activity-level smile-o-meter self-ratings [32], adult self-report questionnaires, and verbatim audio transcription. Although speech intelligibility was part of Mason's overall profile, it was not targeted during this session because *Ollly's Adventures* was designed specifically as a language intervention tool rather than a speech-sound intervention tool [18] [2].

The analysis focused on identifying patterns in how the physical and digital components of the tool functioned within the clinical interaction. Observations recorded during the session were reviewed alongside therapist and researcher field notes, gameplay performance, and the verbatim audio transcription. Instances in which particular features of the game appeared to facilitate language elicitation, child participation, social interaction, or engagement were identified and grouped according to the function they served within the therapeutic interaction. These recurring patterns formed the basis for the three affordances presented below: (1) elicitation and scaffolding of targeted language, (2) child-led, triadic, and multimodal communication, and (3) engagement within clinician-controlled intervention. The affordances therefore represent analytically derived observations of how the tool was used within this specific clinical context, rather than claims about treatment efficacy or generalisable effects.

To support the interpretation of the findings, Table 1 presents selected observational evidence from the child's interactions with the game activities. The table brings together the child's responses, the prompts or support provided by the clinician or adult, and the resulting interpretation of how specific game features supported communication and language use. These observations formed the basis for identifying the affordances discussed in the following section.

Table 1. Observational Evidence Underpinning the Identified Affordances

Observed feature/activity	Child response/behaviour	Clinician/adult support	Interpretation/affordance
Labelling concrete nouns	Difficulty naming item; produced "Arm?" → "Armchair"	Phonological cue "It's called an ah-"	Supported lexical retrieval through immediate scaffolding
Categorisation	Grouped bus, motorcycle and car	Activity structure provided visual/physical materials	Supported semantic categorisation
Conceptual Association	"The dog wants a ball"	Semantic relationship task	Elicited explanation of semantic relationships
Possessive activity	"Hers"	Clinician recast: "So the dog is hers"	Provided opportunity for morphosyntactic production and recasting
Sentence frame	"The boy is wearing a shirt"	Visual sentence frame	Supported sentence formulation
Verbal reasoning	"Because he jumped in the mud"	Open-ended question	Elicited causal reasoning
Adjectives	Independently selected adjective and noun pairing	Adult scaffolding followed child choice	Supported child-led participation
Multiplayer activity	Instructed mother, corrected researcher, encouraged mother	Shared game roles	Supported triadic social communication

5.2 Affordance 1: Elicitation and Scaffolding of Targeted Language

The game acted as a structured delivery context through which the SLP embedded established intervention techniques targeting Mason's active goals. For word-finding goals, the activity context involved categories and visual naming. When Mason struggled to name an item, the SLP provided a phonological cue ("It's called an ah-"), which successfully elicited "Arm?" and subsequently "Armchair". Indeed, across gameplay, Mason produced spontaneous and elicited vocabulary such as *chef*, *teacher*, *T-shirt*, *pants*, *kite*, *cleaner*, *chair*, *shirt*, *basketball*, and *motorbike*. Phonological cueing reliably resolved lexical difficulties; when initially asked to name an item, Mason responded, "Yes! So we can sit down", prompting the clinician to provide targeted phonological scaffolding. Semantic organisation was targeted through *Categories* and *What Goes Together?* activities. Mason



demonstrated categorical sorting by physically selecting and grouping transport items, including a bus, motorcycle, and car [22]. Furthermore, when matching a dog with a ball in *What Goes Together?*, he successfully verbalised the semantic relationship, producing *"The dog wants a ball"*. Morphosyntax was supported using concrete physical penguin pieces that rendered ownership concrete [24]. This physical manipulation elicited the possessive pronoun *"Hers"*, which the SLP then recast as *"So the dog is hers"* [20]. Visual sentence frames (*"The boy is..."*) supported sentence formulation (*"The boy is wearing a shirt"*) [23], while conjunctions were also elicited during gameplay (*"The dog and the ball"*). Finally, verbal reasoning was addressed through adjectives and open-ended questioning [27]. When the SLP asked why a cat needed washing, Mason produced the reasoned causal explanation, *"Because he jumped in the mud"*, directly reflecting progress on his verbal reasoning goal introduced in March 2024.

5.3 Affordance 2: Child-Led, Triadic, and Multimodal Communication

Non-verbal communication was consistently rated as "good" to "excellent" across observational forms. Three specific activities, *Categories*, *Matching Pairs*, and *Odd One Out*, enabled non-verbal responding through pointing and physical gestures. This allowed Mason to maintain active participation even when verbal production was not immediately required. Furthermore, during the *Adjectives* task, Mason independently selected an adjective card and decided which noun to pair it with before adult prompting. This shifted decision-making to the child, establishing a natural sequence of child choice followed by adult scaffolding and interaction. Although he frequently used non-specific terms such as *"this"* and *"that"*, no conversational breakdowns occurred. Mechanics in multiplayer activities like *Let's Guess* created structured roles where Mason acted as the supporting player and his mother as the active player. Mason initiated conversations, instructed his mother on how to scan cards, corrected the researcher regarding point distribution, and demonstrated perspective-taking by asking the clinician how many points his mother needed to win while actively encouraging her.

5.4 Affordance 3: Engagement within Clinician-Controlled Intervention

High participation was maintained throughout the session through tangible rewards, digital audio-visual feedback, physical piece movement, traffic-light progress mechanics, and bonus points. However, Mason experienced difficulty decoding instructions provided by the game guide, clinician, and researcher, requiring multiple repetitions. This demonstrated that connected technology did not eliminate processing demands; rather, adult mediation remained necessary to structure the interaction and support comprehension throughout gameplay.

5.5 Clinical Constraints and Design Implications

Several clinical constraints and corresponding design implications emerged during the session. First, regarding randomised prompt generation, preposition targets were not reliably generated during picture-description tasks. This points to the need for clinician override controls that allow SLPs to manually select or lock specific target structures to maintain consistent dose frequency [36]. Second, a reward pacing conflict occurred when the rapid accumulation of bonus points allowed Mason to reach the end of the game board early, thereby reducing his engagement with the remaining language targets. This indicates that progression mechanics and rewards must remain subordinate to clinical goals and therapist-controlled pacing [25]. Third, concerning semantic accuracy, Mason labelled a *basketball* as a *football*, an error that was not corrected by the software interface. This highlights the essential clinical role of the SLP, who remains vital for error detection, recasting, and targeted feedback [20] [21].

6. Discussion

This case study provides preliminary insight into how a connected therapeutic game functions within speech and language therapy sessions involving a bilingual child with DLD [2]. The findings do not demonstrate treatment efficacy; rather, they illustrate how the tool was used, the types of language and social behaviours it elicited, and the opportunities and challenges that emerged during implementation. A central finding was the compatibility between gameplay and established



therapeutic strategies. The SLP did not need to abandon familiar intervention approaches in order to use the tool. Questioning, modelling, prompting, recasting, semantic cueing, and reinforcement were all incorporated into the session. The game therefore acted as a delivery context for intervention rather than as an intervention technique in isolation. The triadic nature of the interaction is another notable feature [28] [29]. Much technology-mediated intervention risks positioning the child in front of a device while the adult assumes a peripheral role [30] [9]. In contrast, Mason's use of the tool involved continuous interaction with the SLP and caregiver. The physical board game required shared participation, while the application provided stimuli around which the participants could communicate. The resulting interaction extended beyond task completion and included requesting assistance, giving instructions, correcting others, and discussing the outcome of the game. Nevertheless, the case also reinforces the importance of maintaining clinical flexibility. The tool's randomised content occasionally limited the frequency with which specific therapeutic targets could be addressed, while its reward system could influence the pacing and direction of the session. These limitations do not necessarily undermine the value of gamified therapy; rather, they demonstrate that therapeutic games require mechanisms through which clinicians can maintain control over intervention intensity, target selection, and pacing. The findings therefore support a view of connected therapeutic games as tools within clinical practice rather than autonomous therapeutic agents [21]. Their greatest potential may lie in their ability to provide an engaging, structured, and adaptable environment in which evidence-informed therapeutic strategies can be delivered through meaningful interaction [31] [2].

7. Limitations

Several limitations should be considered when interpreting these findings. First, due to recruitment difficulties the study involved a single bilingual child with DLD and therefore provides an in-depth account of one individual's interaction with the tool rather than evidence that can be generalised to the wider population of bilingual children with DLD. The child's linguistic profile, therapeutic history, communication abilities, and responses to the activities may not be representative of other children. Second, data were collected during a single speech and language therapy session. Consequently, the observations provide a snapshot of the tool's use within one clinical context and cannot establish whether the observed patterns would be maintained across repeated sessions or over time. In particular, the study cannot determine whether the language behaviours observed during gameplay represent changes in underlying language ability or treatment-related outcomes. Third, the analysis was primarily exploratory and qualitative. Although multiple sources of information were considered, including structured observations, field notes, gameplay performance, self-report measures, and audio transcription, interpretation of interactional behaviours may be influenced by observer and clinician perspectives. The findings should therefore be understood as exploratory observations of clinical implementation rather than objective measures of intervention effectiveness. Finally, the BETA prototype itself was still under development at the time of observation. Some of the constraints identified, including randomised target generation and reward pacing, may therefore reflect characteristics of the prototype rather than limitations that would necessarily remain in a final version of the tool. Taken together, these limitations mean that the identified affordances should be interpreted as preliminary, context-specific observations. They provide hypotheses regarding how connected gamified tools may support clinical interaction, but further research using larger samples, repeated sessions, systematic outcome measures, and multiple observers is required before conclusions regarding generalisability or therapeutic effectiveness can be drawn.

8. Conclusion

This case study explored the implementation of *Olly's Adventures: The City of Two Languages*, a bilingual Maltese-English connected therapeutic board game and companion application, within a speech and language therapy session involving a child with DLD [18] [2]. The observed session demonstrated opportunities for vocabulary retrieval, semantic organisation, verbal reasoning, morphosyntactic development, sentence expansion, and social communication. Importantly, these opportunities occurred alongside naturalistic interaction between the child, SLP, and caregiver. The physical and digital components of the tool worked together to support engagement, visualisation, turn-taking, and repeated language opportunities. At the same time, the case identified challenges associated with randomised content, reward pacing, and the need for clinician control. It is concluded



that these findings reinforce that gamification should complement rather than compete with therapeutic objectives [25]. Although conclusions regarding treatment efficacy cannot be drawn from a single case, the findings provide positive preliminary evidence regarding the clinical feasibility and potential utility of connected gamified play for bilingual children with DLD [2]. Further research involving larger clinical samples, systematic outcome measures, and repeated intervention sessions is required to establish whether these observed affordances translate into measurable language outcomes.

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