Bridging Physical and Digital: An Engaging Connected Board Game for Bilingual Language Instruction and Furthered Classroom Inclusion.

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Abstract

The use of gamified and "phygital" materials in language therapy and education is growing as an inclusive approach to reach varied learners in multilingual contexts [13]. Children with Developmental Language Disorder (DLD) and sequential bilinguals often struggle to integrate into mainstream bilingual classrooms where instructional materials may not be aligned with their language capacities and needs [6]. This study explores the evaluation of "Olly's Adventures: A City of Two Languages", a bilingual board game accompanied by a digital application, which was co-designed by speech and language pathologists with and for Maltese-English bilingual children aged 5–8. The game was initially intended for use in language therapy. Developed through the use of user-centred design principles [3], the tool aims to bridge play-based therapy and digital interaction, enhancing engagement and flexibility. Evaluated through a mixed-methods approach involving 127 participants (speech-language pathologists [SLPs], caregivers, and typically developing children), the study gathered data from focus groups, surveys, and observations of gameplay. Caregivers reported significantly greater satisfaction with the child's progress (mean rank = 19.65) compared to speech-language pathologists (mean rank = 7.20, $p < .001$). They also rated child satisfaction (mean rank = 19.68) and the companion app (mean rank = 19.83) significantly higher than SLPs (mean ranks = 7.15 and 6.85, respectively, $p < .001$). SLPs recognised the tool's therapeutic potential but requested further customisation options and clearer clinical guidance. Importantly, participants envisioned the tool's usefulness as a potential push-in support tool, facilitating language scaffolding and enrichment in the classroom without removing children with language difficulties from the mainstream learning environment. The game's language flexibility and relatable pictorial environments were considered to be particularly beneficial for those children learning Maltese or English as a foreign language, offering support for sequential bilinguals as well as children with DLD. Preliminary evidence suggests that the game promotes holistic language development. It encourages continuity across home, classroom, and therapy, supporting a collaborative model of intervention.

Keywords: *Bilingual Education, Speech and Language Therapy, User-Centred Design, Gamification, Connected Technology*

Introduction

In increasingly multilingual and multi-ability environments, the question is no longer whether children communicate in more than one language, but whether educational and clinical systems can adequately support their complex linguistic needs [7]. This challenge is particularly acute for children with Developmental Language Disorder (DLD) and sequential bilinguals, whose language development often deviates from monolingual norms. DLD is a neurodevelopmental condition affecting approximately 7% of children in the UK, characterised by persistent difficulties in understanding and/or using language despite typical development in other areas and no known biomedical cause [2]. In bilingual contexts such as Malta, marked by frequent code-switching and sociolinguistic fluidity, language interventions must be responsive not only to developmental profiles but also to the realities of multilingual acquisition [5]. Traditional play-based resources often fail to reflect these children's lived experiences, leading to frustration and disengagement ([6]; [11]). There is therefore a pressing need for adaptable, culturally grounded tools that bridge home, school, and clinical contexts. Gamified and "phygital" resources, those that blend physical gameplay with digital features, are gaining traction as inclusive solutions that support motivation, engagement, and individualised learning [13].
This article presents findings from the design and evaluation of *Olly's Adventures: A City of Two Languages*, a bilingual board game and app co-developed with SLPs, caregivers, and children. Created for Maltese-English-speaking children aged 5 to 8, the tool integrates language goals into playful, hybrid environments and supports both implicit and explicit intervention strategies [1] [4].

Grounded in user-centred design and aligned with tiered service delivery models [12], *Olly's Adventures* aims to function as a "push-in" support tool, scaffolding language development within inclusive classroom settings rather than isolating learners.

While interest in gamified and phygital tools is growing, few are designed for bilingual children with language difficulties, and even fewer are grounded in minority linguistic contexts like Malta. There is limited evidence on how such tools can support inclusive practice across therapy, the classroom, and the home. This study addresses that gap through the evaluation of *Olly's Adventures: A City of Two Languages*. The aforementioned study was funded by the Xjenza Malta (formerly known as the Malta Council for Science and Technology) Smart Cities Programme, under project reference no. SCP-2022-007.

Methods

The development and evaluation of *Olly's Adventures: A City of Two Languages* followed a user-centred, mixed-methods approach. The research design involved collaboration with key stakeholders, SLPs, caregivers, and children, and included iterative prototyping, gameplay observation, surveys, and focus groups. The following section outlines the methodology used to assess the tool's usability, perceived value, and potential for integration across therapy and classroom contexts.

Design Overview

This study followed an exploratory sequential mixed-methods design, grounded in user-centred principles. This paper will discuss the study's first three phases of data collection, which focused on input from SLPs, caregivers, and typically developing (TD) children. Typically developing children were involved in early evaluations to assess the game's developmental appropriateness and ease of use. This allowed the research team to refine the design and mechanics before introducing the tool to the more vulnerable population of children with DLD. These phases corresponded to different prototype stages of the tool and involved a combination of interviews, observations, surveys, and focus groups.

Phase 1: Dyadic Interviews and Questionnaires with Slps (AIpha Prototype)

The aim of Phase 1 was to gather expert input from SLPs on the ALPHA prototype of the game. This included dyadic interviews and questionnaires focused on the prototype's activities, clinical relevance, and linguistic targets. Participants were recruited through national SLP associations and government health intermediaries, as approved by the University of Malta's Research Ethics Committee (Approval no: FHS-2023-00601). Interviews were conducted online via Zoom and were guided by open-ended prompts. These discussions helped refine the tool's design for the following stages, ensuring its clinical appropriateness and alignment with practice-based evidence.

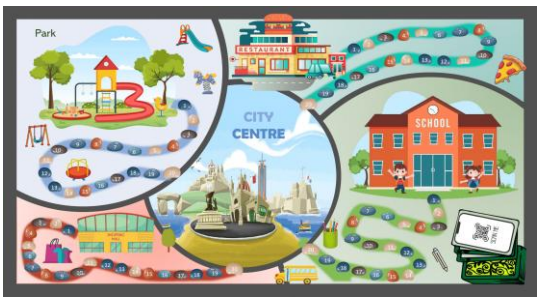

Figure 1 ALPHA Prototype

Phase 2: Observed Gameplay and Caregiver Questionnaires (Beta Prototype)

In Phase 2, the BETA prototype was tested with typically developing children aged 5–8 and their caregivers. Participants interacted with the game in public venues for 30–45-minute-long sessions, during which structured observations were recorded by the researchers and trained assistants. After gameplay, caregivers completed questionnaires capturing perceptions of user satisfaction, game engagement, and perceived developmental value. A total of 115 individuals participated (62 children

and 36 adults interacted with the game, while another 3 children and 14 adults spectated). 20% of the participating adults were reported to be educators.

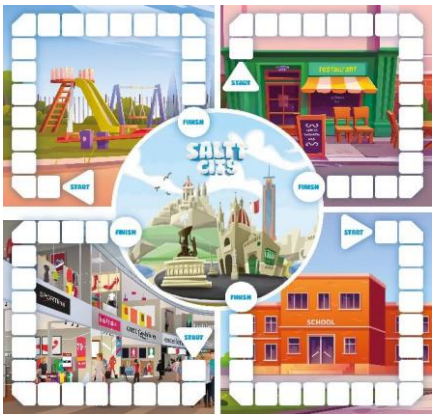

Figure 2 BETA prototype

Phase 3: Focus Groups and Mini-Surveys with SIps (Beta Prototype)

This phase involved 10 SLPs participating in gameplay workshops. Clinicians interacted with the BETA prototype and took part in structured focus group discussions accompanied by mini surveys. Each group was also assigned a fictitious case study, adapted from [9], and asked to generate clinical goals based on that child's profile. This approach was designed to simulate real-world clinical application and elicit detailed practitioner feedback on the tool's relevance, usability, and design features from a clinical perspective.

Results

Thematic analysis of data gathered during Phases 1 to 3 produced five overarching themes and 14 subthemes, reflecting key insights into the design, usability, therapeutic potential, and broader implications of *Olly's Adventures: A City of Two Languages*. While the themes were synthesised across all phases, each reflected recurring patterns and priorities specific to stakeholders. The qualitative data collected across Phases 1-3 were analysed using a manual approach. This process began with repeated readings of interview transcripts, observation notes, and questionnaire responses to ensure familiarisation with the data. Initial codes were generated by identifying recurring patterns, similarities, and contrasts across stakeholder feedback. These codes were then grouped into broader thematic categories through iterative comparison, visual mapping, and colour-coded highlighting. No qualitative software was employed; instead, organisation was maintained manually using thematic charts.

Theme 1: Elevated Play

Participants emphasised that the design and presentation of the tool significantly contributed to its success as a learning and therapeutic medium. The game's vibrant visuals, locally inspired imagery, and intuitive mechanics were noted as central to its appeal, particularly for children. Elements such as colourful artwork, familiar landmarks, and engaging audio cues helped reinforce the connection between play and learning.

Theme 2: Unfamiliar Approaches

This theme captured the tension between innovation and adoption. For many participants, especially clinicians, phygital, game-based therapy represented a novel approach. While the majority of participants embraced the potential benefits, others expressed hesitation due to limited familiarity with connected technologies. The need for training, guidance, and evidence of effectiveness emerged as key concerns, highlighting the importance of onboarding support before the introduction of similar tools in clinical environments.

Theme 3: Future Possibilities

Although originally conceptualised for therapeutic use, the tool was perceived to have significant cross-sector potential. Participants envisioned applications in mainstream classrooms, home-based learning, and even in informal educational settings. Its adaptability and cross-linguistic features were seen as strengths in supporting continuity across contexts, reducing fragmentation in intervention efforts.

Theme 4: Language Learning

Stakeholders frequently referenced the tool's value in supporting expressive and receptive language development. The bilingual and code-switching capabilities of the game allowed for personalised, linguistically responsive interactions. Activities embedded within the game were seen to promote vocabulary acquisition, sentence structuring, and narrative skills, particularly beneficial for sequential bilinguals and children with DLD.

Theme 5: Negative Views

Not all feedback was unequivocally positive. Some clinicians and caregivers voiced concerns around overstimulation, game complexity, and the need for cultural contextualisation. There was also debate about whether gamification could truly replace more traditional therapy practices. These insights pointed to the need for careful moderation in gameplay, age-appropriate calibration, and clearer clinical framing.

Quantitative Findings and Statistical Analysis

Statistical analyses were conducted alongside qualitative feedback to compare perceptions between caregivers (CG) and speech-language pathologists (SLP). These focused on key areas including overall satisfaction, perceived child engagement, developmental progress, and digital usability. Significant differences were found across several measures, reflecting the distinct expectations and experiences of the two stakeholder groups. Given the discrepancy in sample sizes, a randomly selected subset of CG responses was used to enable a more balanced comparison.

a. Board Game Features

Table 1

U Mann Whitney comparison between CG (Caregivers) and SLP considering the board game features

Board Game Features	Group	N	Mean Rank	U	Z	p-value
Effectiveness of the design of the board game in attracting the child's attention	CG	20	18.43	45.500	-3.079	**.002**
	SLP	10	9.65			
Effectiveness of the reward system and incentives used in the board game	CG	20	20.10	8.000	-4.362	**.000**
	SLP	10	6.30			
Satisfaction of the parent/guardian in view of the child's progress	CG	20	19.65	17.000	-4.132	**.000**
	SLP	10	7.20			
Perceived satisfaction of the child using this concept as a learning tool	CG	20	19.68	16.500	-4.155	**.000**
	SLP	10	7.15			
Satisfaction of using the companion app	CG	20	19.83	13.500	-4.261	**.000**
	SLP	10	6.85			

Table 1 presents a comparison of board game features between the CG and SLP groups, using the U Mann-Whitney test, which reveals significant differences across multiple aspects. CG rated the design's effectiveness in attracting the child's attention higher (mean rank = 18.43) than SLP (9.65), U = 45.500, Z = -3.079, p = .002. The reward system showed an even greater disparity (CG = 20.10, SLP = 6.30), U = 8.000, Z = -4.362, p < .001, indicating more positive evaluations from CG. Similarly, CG reported significantly higher satisfaction regarding the child's progress (U = 17.000, Z = -4.132, p < .001), perceived child satisfaction (U = 16.500, Z = -4.155, p < .001), and use of the companion app (CG = 19.83, SLP = 6.85), U = 13.500, Z = -4.261, p < .001.

b. Game Use

Table 2

U Mann-Whitney Comparison between CG and SLP considering the game use

Game Use	Group	N	Mean Rank	U	Z	p-value
How often would you use the board game with your child if this was available at home? (CG) **vs** If the board game was available at	CG	20	17.68	56.600	-2.045	**.041**
	SLP	10	11.15			

your clinic, how often would you use the board game during therapy? (SLP)

Table 2 shows the comparison between CG and SLP regarding game usage frequency. The mean ranks reveal a significant difference, with CG having a mean rank of 17.68 and SLP having a mean rank of 11.15 (U = 56.600, Z = -2.045, p = .041). This indicates that CG participants were more likely to use the board game frequently compared to SLP participants.

c. Board Game Properties

Table 3

U Mann Whitney comparison between CG and SLP considering the board game properties

Board Game Properties	Group	N	Mean Rank	U	Z	p-value
Board Game Quality	CG	20	16.25	85.000	-.777	.437
	SLP	10	14.00			
User-Friendliness	CG	20	17.65	57.000	-2.068	**.039**
	SLP	10	11.20			
Time Efficiency	CG	20	19.00	30.000	-3.217	**.001**
	SLP	10	8.50			
Strategic Value	CG	20	18.10	48.000	-2.608	**.009**
	SLP	10	10.30			
Player Interaction	CG	20	16.70	76.000	-1.365	.172
	SLP	10	13.10			
Fun Factor	CG	20	16.08	89.500	-.627	.531
	SLP	10	14.35			
Satisfaction	CG	20	17.30	64.000	-1.966	**.049**
	SLP	10	11.90			
Directions for use	CG	20	17.75	55.000	-2.174	**.030**
	SLP	10	11.00			
Visual Design	CG	20	15.43	98.500	-.083	.934
	SLP	10	15.65			

Table 3 presents the U Mann-Whitney test results comparing perceived board game properties between the CG and SLP groups. No significant difference was found in perceived board game quality (U = 85.000, p = .437). However, user-friendliness was rated significantly higher by CG (mean rank = 17.65) than SLP (11.20), U = 57.000, Z = -2.068, p = .039. Time efficiency showed a larger difference (CG = 19.00, SLP = 8.50), U = 30.000, Z = -3.217, p = .001. Strategic value also differed significantly, favouring CG (U = 48.000, Z = -2.608, p = .009). No significant differences emerged for player interaction, fun factor, or visual design. However, CG reported greater satisfaction with overall satisfaction (U = 64.000, Z = -1.966, p = .049) and directions for use (U = 55.000, Z = -2.174, p = .030).

d. Board Game Mechanics

Table 4

*Crosstabulation - Group * Do you feel the game mechanics are easy to follow?*

			Do you feel the game mechanics are easy to follow?		
			Yes	No	Total
Group	CG	Count	20	0	20
		Expected Count	18.0	2.0	20.0
	SLP	Count	7	3	10
		Expected Count	9.0	1.0	10.0
Total		Count	27	3	30
		Expected Count	27.0	3.0	30.0

Table 5

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.667[a]	1	**.010**		
Continuity Correction[b]	3.750	1	.053		
Likelihood Ratio	7.288	1	.007		
Fisher's Exact Test				**.030**	.030
Linear-by-Linear Association	6.444	1	.011		
N of Valid Cases	30				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.00.

b. Computed only for a 2x2 table

Table 4 presents a crosstabulation comparing whether participants felt the game mechanics were easy to follow. CG reported that all 20 participants found the game mechanics easy to follow, whereas in the SLP group, 7 reported ease of use, while 3 did not. The Pearson Chi-Square test presented in ***Table 5*** was significant ($\chi^2 = 6.667$, p = .010), indicating that the ease of following game mechanics was significantly higher for CG. Fisher's exact test confirmed this result with $p = .030$.

Discussion

Interpreting Key Findings

The findings from this study suggest that *Olly's Adventures: A City of Two Languages* has strong potential as a bilingual language support tool that bridges therapy, classroom, and home settings. The themes revealed broad support for its visual design, interactive appeal, and cultural relevance, particularly among caregivers. The positive reception by children and their caregivers, combined with SLPs' recognition of its linguistic utility, demonstrates the value of co-designing tools that reflect both clinical goals and user preferences. However, the theme *Unfamiliar Approaches* indicates that while innovation is welcome, it must be accompanied by clear, accessible training. Clinicians expressed a need for structured onboarding, including guidance on session integration, goal targeting, and appropriate dosage of use. This reflects a broader trend in the literature, where digital and phygital tools, despite their promise, often face barriers to adoption due to a lack of professional development resources, inconsistent device availability, or uncertainty around evidence-based integration [8]. In the context of speech and language therapy, where caseloads are heavy and time is limited, practitioners may be hesitant to adopt new tools unless they are confident the resource is easy to use, clinically aligned, and offers evident benefits for their clients.

Therapeutic and Educational Implications

Participants highlighted the tool's adaptability to different delivery models, including potential use within push-in therapy frameworks. This aligns with current trends in inclusive education that seek to reduce pull-out interventions in favour of classroom-based support (Terreberry et al., 2021). The cross-linguistic flexibility of the game, particularly its embedded support for code-switching and bilingual scaffolding, also speaks to its value in small multilingual communities like Malta, where sequential bilingualism is common and culturally complex [5]. Participating caregivers who reported themselves as educators additionally highlighted the tool's dual potential in classroom settings: both as a resource to bring together entire classes during mainstream language instruction, and as an accessible entry point for children who are new to Maltese and/or English. In the latter context, the tool was seen as particularly valuable for initiating foundational language learning in a playful, visually grounded way. The theme *Future Possibilities* further suggests that such tools could extend beyond therapy into

informal learning spaces, promoting continuity of support across domains. This reinforces calls in the literature for more collaborative, home-inclusive intervention models [10].

Contrasting Perspectives

Quantitative results revealed statistically significant differences between caregivers and SLPs in their evaluations of the tool's satisfaction and usability. While caregivers tended to view the game as highly effective and enjoyable, clinicians offered more tempered responses, often pointing to practical concerns such as the need for customisability and clearer goal alignment. These differences underline the importance of integrating both professional and familial perspectives in tool evaluation, especially for early-phase prototypes.

Limitations

Several limitations should be acknowledged. Educator involvement was minimal, and therefore, the tool's classroom applicability remains speculative and warrants further exploration. Additionally, although child feedback was observed and reported by caregivers and researchers, direct data collection from children was limited by ethical and practical constraints. Finally, while the initial response to the preproduction prototype was favourable, ongoing commercial evaluation means that the most recent version could not be assessed as part of this study.

Future Directions

Future research should include direct classroom testing, with the involvement of educators and children, to assess real-world impact in inclusive education settings. There is also a need for continued refinement of digital components and the provision of optional training modules for clinicians.
Given its modular design and flexible language architecture, the tool could be adapted and localised to support a wider range of bilingual combinations and minority language contexts, further expanding its relevance across multilingual learning environments.

Conclusion

Olly's Adventures: A City of Two Languages demonstrates the potential of bilingual, phygital tools to support inclusive language development in multilingual settings. Through a collaborative, user-centred approach, the project responded to the practical needs of both caregivers and speech-language pathologists, offering a resource that bridges home, therapy, and school environments. While further research and refinement are needed, particularly with direct classroom involvement, the early findings suggest that tools like this can play a meaningful role in promoting equitable, engaging, and culturally relevant language support for children with diverse profiles.

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