IDR
Integrated
Design Research

Bridging Accessibility Gaps for Lazy Eye Disease Patients in Sri Lanka through Gamified Vision Therapy

JAYAKODY J.A.N.A.[1*] **and SAMARAWICKRAMA S.**[2]
[1,2]*Department of Integrated Design, Faculty of Architecture, University of Moratuwa, Sri Lanka*
[1]*nethmiashinka@gmail.com* , [2]*sumanthris@uom.lk*

Abstract — *Amblyopia, commonly referred to as lazy eye, is a primary cause of visual impairment among children and remains largely preventable if diagnosed and treated in a timely manner (Blair et al., 2024). Characterised by poor coordination between the eyes, amblyopia typically arises when the brain suppresses the input from one eye, leading to a gradual decline in its functionality. Early intervention through continuous vision therapy is essential; however, current treatment practices in Sri Lanka face significant obstacles. Access to therapy is restricted primarily to urban centres, posing a barrier for families in rural areas, while patient compliance remains low due to the unappealing nature of traditional methods like eye-patching. Moreover, the lack of nationwide awareness in the ophthalmic community about amblyopia and its treatment methods contributes to a poor track record in achieving successful therapeutic outcomes (Wimalasundera, 2021). This situation highlights the critical need for innovative, accessible, and child-friendly vision therapy solutions to support children with amblyopia in Sri Lanka. This academic project introduces 'Coordinate', a mobile application designed to bridge these gaps by providing a novel, gamified approach to vision therapy. By incorporating "dichoptic binocular treatment methods" (Vedamurthy et al., 2015) through interactive gaming, Coordinate aims to increase accessibility, enhance treatment compliance, and ultimately improve outcomes for children with mild amblyopia. Dichoptic gaming, which utilises red and blue anaglyph goggles to separate visual input for each eye, fosters perceptual learning by requiring the brain to process both sets of information as a single cohesive image. In this way, Coordinate provides an immersive therapeutic experience that engages children and helps stimulate their weaker eye, leading to potential improvements in their visual function. A significant component of this project lies in its culturally resonant design; it draws upon Sri Lankan folklore by introducing Andare, a beloved folk character, as the centrepiece of the game environment. This cultural integration offers psychological relevance and familiarity, which supports children's socialisation and boosts their interest in the therapy (Koklanis et al., 2006). The objectives of Coordinated are threefold: to democratise access to vision therapy by creating an affordable and mobile-based solution, to enhance patient compliance through an engaging gamified format, and to empower parents to administer therapy*

conveniently from any location. These aims are driven by a user-centred design process that involves close collaboration with parents and children. Through participatory research sessions, children and their caregivers actively shaped the app's visual style, gameplay elements, and narrative structure, ensuring the design resonates with its target users. Insights gained from preliminary gaming sessions highlighted essential elements, such as children's colour and character preferences, gaming behaviours, and responses to interactive stimuli. This input informed the character design for Andare and the overall user interface, allowing for a culturally relevant, appealing, and functional experience that accommodates both the therapeutic and entertainment aspects of the application. Throughout the development process, key design steps were taken to uphold this participatory approach. Initial sketching activities with children from the Thushara Art School provided a foundation for understanding children's visual perception of the Andare character and preferences in colours, which were then used as a base for the app's visual elements. This was followed by creating paper wireframes to prototype the interface, which helped refine the visual proportions and layout. The final digital wireframes reflected the children's feedback, integrating storyboards for each game to enhance their connection to Andare's storyline and increase their engagement with the therapy. Based on feedback, three primary games were selected to maximise therapeutic value and enjoyment: a platformer game called 'Little Hoppers for Little Andare', a shooting game called 'The Troubling Frog', and a maze navigation game called 'The King's Horse'. Each game challenges children in different ways that stimulate both eyes, providing a variety of visual and interactive exercises to help improve their binocular coordination. The project also identified areas for future improvement and expansion. These include introducing a Tamil language option to broaden accessibility, integrating additional folktales to diversify cultural representation, and enhancing the rewards system to increase motivation. Additionally, a multi-profile feature will enable families with multiple children undergoing therapy to track each child's progress within a single application. Plans to establish connectivity with clinical settings would allow for remote monitoring by ophthalmologists, ensuring that children's therapy outcomes can be observed and managed professionally even from a distance. Through these elements, Coordinate aspires to become a comprehensive and inclusive platform for vision therapy in Sri Lanka. In summary, Coordinate leverages gamification, cultural storytelling, and participatory design to address the gaps in amblyopia treatment accessibility in Sri Lanka. According to the feasibility study by Gambacorta et al. (2018), transforming therapy into an engaging, mobile-based experience, such as the Coordinate app, empowers both children and their caregivers. Additionally, it provides a promising model for paediatric ophthalmology solutions. The culturally resonant design of the application, which incorporates both local folklore and user-driven elements, underscores its potential as an adaptable framework for similar interventions in diverse healthcare settings. Coordinate thereby contributes to both academia and industry by demonstrating the value of user-centred, participatory design approaches in the field of health and therapeutic mobile applications, ultimately setting a foundation for more inclusive and effective digital healthcare interventions.

Keywords: *Amblyopia, dichoptic therapy, gamified vision therapy*

Figure 1

Participatory empathy activities conducted with children aged 6–11 to explore their visual projection and cohesive thinking, to create a framework for the user interface and app element design for Coordinated.

Note. Created by the author

Figure 2

Physical prototypes tested with children aged 6–11 to gather ground-level feedback, enhancing the design and usability of the digital version for Coordinated.

Note. Created by the author

References

Gambacorta, C., Nahum, M., Vedamurthy, I., Bayliss, J., Jordan, J., Bavelier, D., & Levi, D. M. (2018). An action video game for the treatment of amblyopia in children: A feasibility study. *Vision Research*, *148*, 1–14. https://doi.org/10.1016/j.visres.2018.04.005

Koklanis, K., Abel, L. A., & Aroni, R. (2006). Psychosocial impact of amblyopia and its treatment: a multidisciplinary study. *Clinical and Experimental Ophthalmology*, *34*(8), 743–750. https://doi.org/10.1111/j.1442-9071.2006.01317.x

Packwood, E. A., Cruz, O. A., Rychwalski, P. J., & Keech, R. V. (1999). The psychosocial effects of amblyopia study. *Journal of American Association for Pediatric Ophthalmology and Strabismus*, *3*(1), 15–17. https://doi.org/10.1016/s1091-8531(99)70089-3