International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2025.0338
e ISSN: 2584-2854
Volume: 03
Issue:05 May 2025
Page No: 2138 - 2147

Mobile-Assisted Language Learning: A Novel Approach to Revitalizing the Endangered Irular Language

Abhinav Gosain[1], Anshuman Mishra[2], Uma Devi[3], Dr. Arul Dayananda[4]
[1,2,3]Department of Computing Technologies SRM Institute of Science and Technology, SRM Nagar Kattankulathur Chengalpattu District, Tamil Nadu, India.
[4]Department of English and Foreign Language SRM Institute of Science and Technology, SRM Nagar Kattankulathur Chengalpattu District, Tamil Nadu, India.
Email ID: *ar0737@srmist.edu.in[1], ab3586@srmist.edu.in[2]*

Abstract
This study addresses the revitalization of the endangered Irular language spoken by the indigenous Irula people in southern India through a novel Mobile-Assisted Language Learning (MALL) approach. The research develops a culturally responsive mobile application designed to preserve linguistic heritage while enhancing socioeconomic opportunities for community members. Utilizing participatory methodologies, the study engaged 20 native speakers from Tamil Nadu in iterative feedback cycles to ensure cultural appropriateness and pedagogical effectiveness. The resulting platform incorporates adaptive learning technologies, gamification elements, and culturally relevant content tailored to various proficiency levels. Preliminary findings from pilot testing demonstrated significant improvements in language retention and user engagement, particularly among younger generations. Challenges encountered include the absence of a standardized script, limited technological access within remote communities, and the relatively small participant sample. Despite these limitations, this research contributes valuable insights to endangered language revitalization efforts by demonstrating how mobile technologies can effectively support linguistic preservation while simultaneously empowering indigenous populations through improved digital literacy. The findings suggest potential applications for other endangered language communities facing similar challenges.
Keywords: *Irular language, Mobile-Assisted Language Learning (MALL), language revitalization, indigenous communities, digital literacy, cultural preservation, participatory design.*

1. Introduction
The Irular language, spoken by the indigenous Irula people who inhabit the southern regions of India, including Kerala, Tamil Nadu, and Karnataka, stands on the brink of extinction. This critical situation primarily stems from the increasing preference for mainstream languages such as Tamil and Kannada, which are perceived as offering better opportunities for education, employment, and mobility in a rapidly globalizing society (Galla, 2016). As a result, the Irular language is increasingly marginalized, with diminishing transmission of the language to younger generations. Preserving the Irular language is about more than maintaining India's rich linguistic diversity. It's about safeguarding the cultural identity and heritage of the Irula people. Language is more than just a means of communication. It's a fundamental medium for conveying cultural knowledge, oral traditions, and social practices, all integral to the distinct identity of Indigenous communities (Meighan, 2021). Without proactive efforts to revitalize the Irular language, there is a real risk that these cultural elements may be irretrievably lost. Current research underscores the complexities of language revitalization, indicating that successful efforts must address linguistic aspects and the broader socioeconomic challenges that Indigenous communities face. Poverty and low literacy rates are significant obstacles to revitalization efforts (Henne-

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Ochoa, 2022). Despite this, there remains a notable gap in the literature regarding the application of mobile technologies for language revitalization, especially for predominantly oral languages that need a standardized script (Yahuarcani et al., 2021). This study aims to bridge this gap by developing a mobile application that employs Mobile-Assisted Language Learning (MALL) methodologies to teach the Irular language to current and future speakers. This strategy, which utilizes the growing accessibility of mobile technologies, even in remote areas, is not just a solution. It's an innovative and unique approach to a complex problem (Burston, 2014). By tackling the intertwined challenges of language preservation, poverty, and literacy, the development of this app represents a crucial and innovative step towards securing the future of the Irular language. This study's primary research question is: How can a mobile application be effectively designed to teach the Irular language to its native speakers and future generations while simultaneously addressing the broader challenges of poverty and literacy? The hypothesis driving this research is that a MALL-based mobile application will not only aid in preserving the Irular language but also contribute to the socio-economic upliftment of the Irula community by enhancing literacy and educational opportunities (Gafni et al., 2017). The Introduction presents the purpose of the studies reported and their relationship to earlier work in the field. It should not be an extensive review of the literature. Use only those references required to provide the most salient background to allow the readers to understand and evaluate the purpose and results of the present study without referring to previous publications on the topic. [2] The Introduction presents the purpose of the studies reported and their relationship to earlier work in the field. It should not be an extensive review of the literature. Use only those references required to provide the most salient background to allow the readers to understand and evaluate the purpose and results of the present study without referring to previous publications on the topic. [1-4] The Introduction presents the purpose of the studies reported and their relationship to earlier work in the field. It should not be an extensive review of the literature. Use only those references required to provide the most salient background to allow the readers to understand and evaluate the purpose and results of the present study without referring to previous publications on the topic. [2&3]

2. Basics Concepts/Technology Used

2.1. Mobile-Assisted Language Learning (MALL)

Mobile-Assisted Language Learning (MALL) is an approach that leverages mobile devices like smartphones and tablets to facilitate language learning. MALL has gained popularity due to the widespread accessibility of mobile devices, even in remote and under-resourced areas. The main advantage of MALL is its ability to deliver language learning content in a flexible, on-the-go manner, making it particularly effective for reaching communities with limited access to formal educational resources. In this project, MALL serves as the foundation for developing a mobile application aimed at teaching the Irular language to the Irula community. By incorporating audio-visual content and interactive exercises, the app provides an engaging and immersive learning experience

2.2. React Native for Cross-Platform Development

React Native is a popular open-source framework for building mobile applications using JavaScript and React. It allows developers to create applications for both Android and iOS from a single codebase, which significantly reduces development time and effort. In this project, React Native was chosen to ensure that the Irular language learning app is accessible to users across different mobile platforms. The framework's ability to integrate with native device functionalities, such as audio playback and local storage, makes it ideal for creating a feature-rich learning experience. Figures illustrate the architecture of the app and the interactions between various components like the user interface, audio modules, and data storage can provide a clearer understanding of the app's technical structure`

2.3. Function Overview of Learning Activities

Quiz Functionality: The quiz feature is designed to assess learning through interactive multiple-choice questions. Users are presented with questions in both

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English and Tamil, ensuring bilingual support. Each question includes text, images, and audio to help users understand words and phrases. When a user selects an answer: If correct, the system provides positive feedback. If incorrect, it offers hints or explanations to guide learning. The quiz progresses through three difficulty levels: Easy, Medium, and Hard. Users can retry quizzes to improve their score and understanding. (Figure 1)

Spin Wheel Functionality: Initial State The user sees a spin wheel with a button labelled "SPIN". Action: The user presses the "SPIN" button. Process: The wheel spins, and the data is shuffled. The wheel stops at a random section. The app plays the audio associated with the selected section. Output: The user hears the audio of the selected word, and the wheel visually indicates the selected section. (Figure 2)

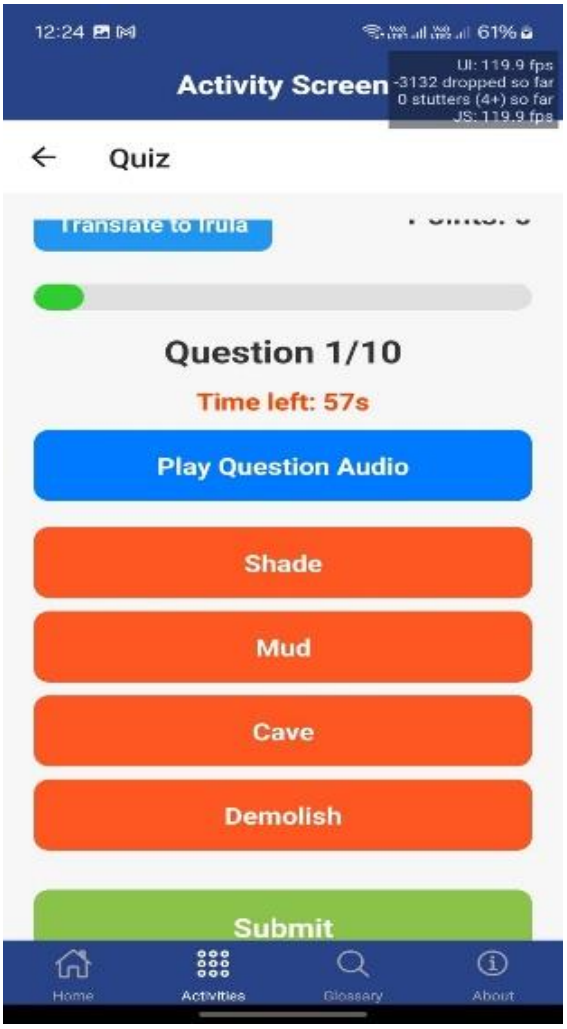

Figure 1 Quiz

Figure 2 Spin-Wheel

Jumble Word Functionality: Initial Setup: When the component mounts, it sets up the audio configuration and fetches data from an API. This data includes words in different languages and their meanings. Word Scrambling: The app shuffles the fetched words and selects one based on the current index. It then scrambles the letters of the selected word to create a jumbled version for the user to guess. User Input: Users are presented with the scrambled word and can type their guess into a text input field. Hints: Users can request hints by pressing a button, which opens a modal displaying (Figure 3) the meanings of the word in English and Tamil. Submission: Users submit their guess by pressing a "Submit" button. The app checks if the guess is correct and updates the state accordingly. Feedback: If the guess is correct, the app displays the correct word and provides options to play the word's audio in different languages. If incorrect, users can try again until they run out of attempts. Next Word: Users can proceed to the next word by pressing a "Next" button, which resets the input and prepares a new scrambled word.

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Figure 3 Jumble-Word

Crossword Functionality: Navigation: Users can navigate through different crossword puzzles using "Previous" and "Next" buttons. Alerts notify users when they reach the beginning or end of the crossword puzzles. Input and Submission: Users fill in the crossword grid with their answers. Upon pressing the "Submit" button, the app checks if the answers are correct. If all answers are correct, a Success alert is shown, and users can play audio for each word. If some answers are incorrect, an alert prompts users to try again. Audio Playback: Once the crossword is completed correctly, users can play audio for each word by pressing the "Play Audio" button. Hints: Users can view hints for each word in the crossword, which aids in solving the puzzle. (Figure 4)

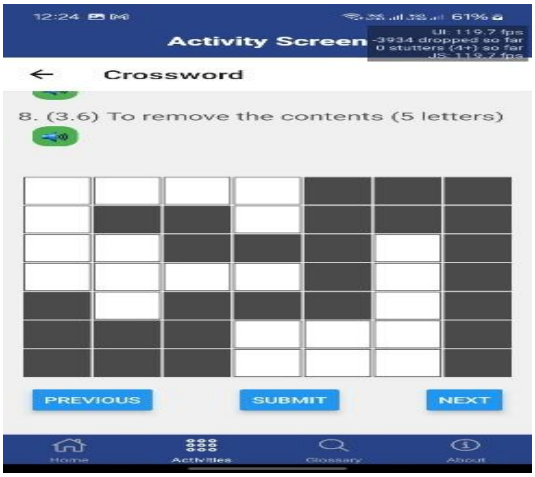

Figure 4 Crossword

2.4. Gamification for Enhanced User Engagement

Gamification involves incorporating game-like elements into non-game contexts to increase user engagement and motivation. In the context of the Irular language learning app, gamification features include quizzes, rewards, progress tracking, and interactive exercises like "fill-in-the-blank" and matching vocabulary. These features help maintain learner interest, especially among younger users, by turning the learning process into an enjoyable experience. The app also includes a points system where users earn rewards for completing lessons, which can encourage consistent practice. A figure illustrating the flow of a typical learning module with gamification elements can demonstrate how these components work together to enhance user engagement.

2.5. Adaptive Learning and Personalization

Adaptive learning technology is used to tailor the difficulty and pace of lessons to match the user's proficiency level. As users interact with the app, it tracks their progress and adjusts the complexity of exercises accordingly. For example, if a user demonstrates proficiency in basic vocabulary, the app may introduce more complex phrases or grammar rules. This approach ensures that learners remain challenged without feeling overwhelmed, making the learning experience more effective. A flowchart or block diagram illustrating how the adaptive learning algorithm adjusts lesson difficulty based on user performance can provide a visual representation of this concept.

2.6. Cloud-Based Data Storage and Offline Functionality

Given the remote locations of many Irula community members, ensuring data availability in low-internet areas is crucial. The app uses a cloud-based storage system for storing user data, progress, and audio files, which allows for easy updates and scalability. However, to ensure accessibility in regions with limited internet connectivity, the app includes offline capabilities. Users can download lessons and audio content, allowing them to continue learning even without an active internet connection. A diagram showing the interaction between the app, cloud

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storage, and offline data caching could illustrate how the app manages data to support continuous learning. Fig. 1 Crossword Game Fig. 2 Spin Wheel Game.

2.7. User Interface (UI) Design for Accessibility

The design of the user interface plays a significant role in making the app accessible to a population with varying levels of digital literacy. The UI focuses on simplicity and intuitive navigation, using icons and audio cues to guide users through the lessons. This is especially important for older members of the community who may not be familiar with digital interfaces. The app uses large buttons, clear icons, and minimal text to ensure ease of use. A visual representation of the app's UI screens can demonstrate the design considerations that were made to ensure that the app is user-friendly for the Irula community. [1]

3. Study of Similar Projects

3.1. Overview of Language

Language revitalization has become a crucial area of research as many indigenous languages face the threat of extinction. Various approaches have been employed to address this challenge, from community-led initiatives to technology-based solutions. Traditional methods often include language immersion programs, community workshops, and cultural centers that teach the language to younger generations (Hinton, 2018). However, with the advent of digital technologies, there is a growing interest in utilizing online platforms and mobile applications to reach wider audiences. These digital tools aim to provide a scalable solution, making language learning more accessible and engaging (Grenoble & Whaley, 2006).

3.2. Technology-Based Language Platforms

Several mobile applications have gained popularity in the field of language learning, such as Duolingo, Babbel, and Rosetta Stone. These platforms are designed to teach widely spoken languages like Spanish, French, and Mandarin, using structured lesson plans and gamified learning experiences (Golonka et al., 2014). However, they often fall short in addressing the unique needs of endangered languages that lack a standardized written script. For example, Duolingo's rigid lesson structure is not well-suited for teaching languages that rely heavily on oral traditions and community-based learning (Galla, 2016). Studies indicate that while these apps are effective in teaching vocabulary and grammar, they often miss the cultural context necessary for true language revitalization (Wardhaugh & Fuller, 2021).

3.3. Mobile-Assisted Language Learning (MALL) for Indigenous Languages

Research has shown that Mobile-Assisted Language Learning (MALL) can be particularly effective in the context of indigenous languages. MALL allows learners to access language lessons anytime and anywhere, making it ideal for communities with limited access to formal education (Burston, 2014). A study by Burston (2014) highlights that MALL can significantly improve learner engagement through multimedia content, such as audio recordings and video tutorials. The study emphasizes the importance of adapting learning materials to the cultural and linguistic context of the target community (Godwin-Jones, 2011). For the Irular language, integrating audio recordings of native speakers is critical, as it ensures the preservation of pronunciation and oral traditions (Hinton & Hale, 2013). Unlike standard MALL applications, the Irular language app emphasizes the cultural relevance of content, ensuring that it aligns with the daily lives and traditions of the Irula people. [2]

3.4. Challenges in Adapting MALL for Endangered Languages

While MALL provides a flexible platform for language learning, it faces challenges when applied to endangered languages. A significant issue is the lack of comprehensive linguistic resources, such as dictionaries or grammatical descriptions, which are often taken for granted in more widely spoken languages (Austin & Sallabank, 2011). Yahuarcani et al. (2021) point out that the success of MALL in language preservation depends on close collaboration with native speakers to ensure linguistic accuracy. Additionally, MALL platforms must be adapted to include cultural narratives, oral histories, and context-specific vocabulary, which are often absent in conventional language learning applications (Kukulska-Hulme & Viberg, 2017). The Irular language app addresses these challenges by using

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participatory observation methods to gather linguistic data directly from community members, ensuring that the content is both accurate and culturally resonant (Hermes et al., 2012) [3]

3.5. Existing Community-Based Language Preservation Initiatives

There are several community-led projects that have successfully revitalized indigenous languages using technology. For instance, the Hawaiian language revitalization movement integrated digital resources like podcasts and mobile apps to complement in-person classes, leading to a resurgence in the number of native speakers (Meighan, 2021). Similarly, the Maori community in New Zealand has embraced technology by developing language apps and digital archives to preserve their language (Keegan et al., 2015). These projects highlight the importance of community involvement and cultural relevance in the design of language learning tools (Hinton, 2018). Inspired by these examples, the Irular language app integrates feedback from community elders and cultural experts to ensure that the app remains relevant and effective in its mission. [4-5]

3.6. Comparison of the Irular Language App with Similar Projects

Compared to other language revitalization projects, the Irular language app takes a unique approach by focusing on both linguistic preservation and socio-economic upliftment. While many existing projects prioritize language learning alone, this app aims to enhance literacy in both Irular and Tamil, offering broader educational benefits (Grenoble & Whaley, 2006). The app's focus on offline accessibility further differentiates it, as it addresses the connectivity challenges faced by remote Irula communities (Eisenlohr, 2004). Moreover, the adaptive learning feature, which adjusts the difficulty of lessons based on user progress, is designed to cater to users with varying levels of proficiency, from complete beginners to advanced learners (Burston, 2014).

3.7. Insights and Recommendations from the Literature

Literature suggests that for language revitalization to be successful, it must be rooted in the community's cultural practices and daily life (Hinton, 2018). Wilson (2024) emphasizes that language learning should not be seen as a separate academic pursuit, but as an integral part of cultural activities and social interactions. This insight has guided the development of the Irular language app, which includes stories, proverbs, and cultural references familiar to the Irula people (Hermes et al., 2012). Additionally, feedback from project mentors and community leaders has highlighted the need for continuous engagement with users to keep the content fresh and aligned with their needs (Austin & Sallabank, 2011). Future versions of the app will continue to incorporate user feedback, ensuring that it evolves in tandem with the community's language learning journey (Keegan et al., 2015). [6-9]

4. Results and Discussion

4.1. Project Outcomes

Language revitalization has become a crucial area of research as many indigenous languages face the threat of extinction. Various approaches have been employed to address this challenge, from community-led initiatives to technology-based solutions. Traditional methods often include language immersion programs, community workshops, and cultural centers that teach the language to younger generations (Hinton, 2018). However, with the advent of digital technologies, there is a growing interest in utilizing online platforms and mobile applications to reach wider audiences. These digital tools aim to provide a scalable solution, making language learning more accessible and engaging (Grenoble & Whaley, 2006).

4.2. Satisfaction Dimension

Initial feedback from individuals outside the Irula community has been somewhat mixed. While many appreciate the app's concept and its potential for cultural preservation, some have needed help engaging with the material. Several users noted that their lack of familiarity with the Irula language made it difficult to navigate the app and understand the content. Some suggested incorporating more interactive elements, such as games or quizzes, to make learning more engaging and accessible to those unfamiliar with the language. Others desired more contextual information about the Irula culture and language. While the dictionary provides definitions and pronunciations, some users felt that additional

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resources, such as historical background or cultural insights, would enhance their understanding and appreciation. There were also suggestions for improving the app's visual design, with some finding it too simplistic and lacking in visual appeal. Despite these criticisms, there was also positive feedback from those outside the community. Many admired the app's mission and its potential to promote cultural awareness and understanding. Some were particularly impressed with the audio pronunciations, which they found helpful in learning the sounds of the Irula language. Overall, the feedback from those outside the community suggests that the LearnIrula app has the potential to reach a wider audience. Still, it needs further refinement to make it more accessible and engaging for those unfamiliar with the Irula language and culture. (Figure 5) [10-13]

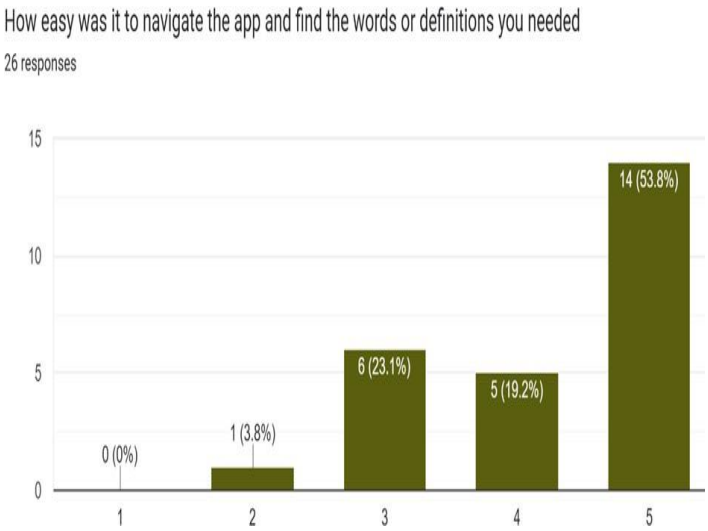

Figure 5 User Satisfaction with Navigation of Words

User navigation experience analysis yielded significant findings regarding the interface's usability. A total of 26 participants responded to the survey question, "How easy was it to navigate the app and find the words or definitions you needed?" Responses were collected on a 5-point scale, where 1 represented the lowest ease of navigation, and 5 represented the highest. The data exhibited a strong positive skew towards high usability, with 53.8% (n=14) of respondents selecting the highest rating of 5, indicating optimal navigation experience. The remaining responses were distributed as follows: 19.2% (n=5) selected 4, 23.1% (n=6) chose 3, and only 3.8% (n=1) reported a rating of 2. Notably, none of the participants selected the lowest rating of 1, suggesting an absence of severe navigation difficulties. The cumulative results indicate that 73% of the users rated the navigation experience above average (4 or 5 on the scale), whereas only a small minority (3.8%) reported below-average navigation difficulty. These findings suggest that the application's interface design meets the users' expectations for intuitive navigation and efficient access to words and definitions. The high proportion of positive responses supports the conclusion that the current navigation design effectively serves the intended purpose. However, some scope remains for minor improvements to address the concerns of approximately a quarter of the users who report moderately. These results provide valuable insights for both stakeholders and developers. They indicated that although the current navigation design is largely successful, targeted refinements could enhance the experience of a subset of users with moderate satisfaction levels. Analyzing user satisfaction regarding the application's performance metrics, specifically focusing on page loading times and result display speeds, revealed a notably positive user sentiment. Among the 26 respondents surveyed, the overwhelming majority expressed high satisfaction with the application's speed capability. Specifically, 53.8% of the users (n=14) indicated the highest possible satisfaction level (5 out of 5), while an additional 19.2% (n=5) reported the second- highest satisfaction level (4 out of 5). This culminates in 73% of the users reporting above-average satisfaction with The distribution of responses exhibited a clear positive skew, with moderate satisfaction (3 out of 5) reported by 19.2% of the users (n=5). Only a minimal portion of respondents, 7.7% (n=2), expressed lower satisfaction levels (2 out of 5), and notably, no users reported the lowest satisfaction level (1 out of 5). This distribution pattern strongly suggests that the application speed optimization strategies successfully met user expectations. These findings indicate that the current implementation of the application's loading and display mechanisms

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effectively serves the user base, with only a small minority expressing significant concerns about performance. The absence of extremely dissatisfied users (level 1) further reinforces the robustness of the application performance infrastructure. An analysis of user satisfaction regarding the visual design appeal of the application, with a specific focus on aesthetic elements and interface layout, revealed a predominantly positive user sentiment. Among the 26 participants surveyed, most expressed satisfaction with the application's visual design. Specifically, 42.3% of the users (n=11) reported the highest possible satisfaction level (5 out of 5), while an additional 11.5% (n=3) reported the second-highest satisfaction level (4 out of 5). This resulted in 53.8% of the users expressing above-average satisfaction with the application design. The distribution of responses exhibited a positive skew, with 23.1% of the users (n=6) reporting moderate satisfaction (3 out of 5). A smaller proportion, 19.2% (n=5), expressed lower satisfaction (2 out of 5), whereas only 3.8% (n=1) indicated the lowest satisfaction level (1 out of 5). This pattern suggests that the current visual design aligns effectively with user expectations, with the majority rating favorably. These findings indicate that the application's core design elements resonate efficaciously with its user base, whereas a smaller segment may benefit from targeted enhancements. The low percentage of users expressing strong dissatisfaction (1 out of 5) further corroborates the robustness of the visual design framework. (Figure 6,7,8) [15-16]

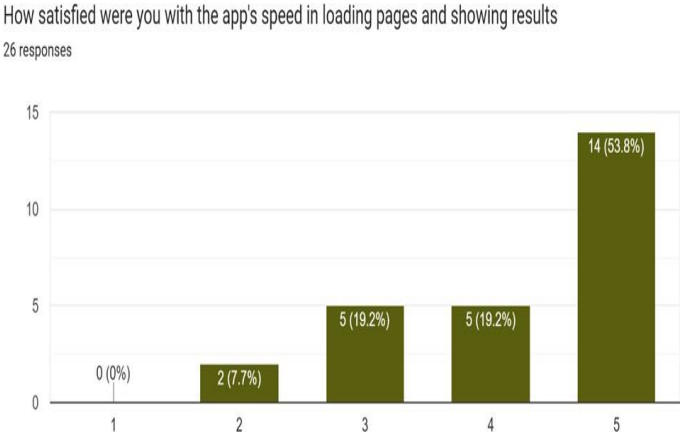

Figure 6 User Satisfaction with App Loading Speed

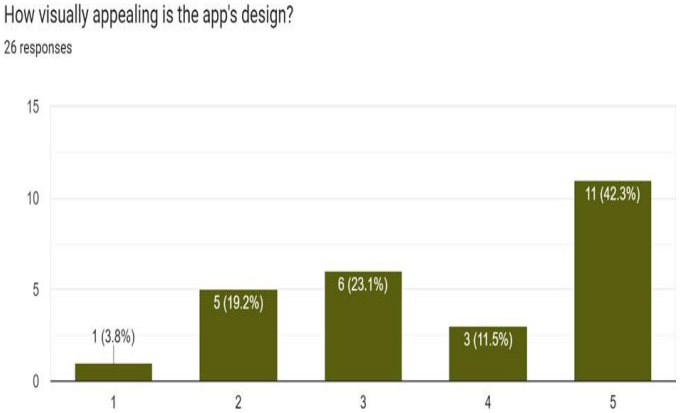

Figure 7 User Satisfaction with App Design

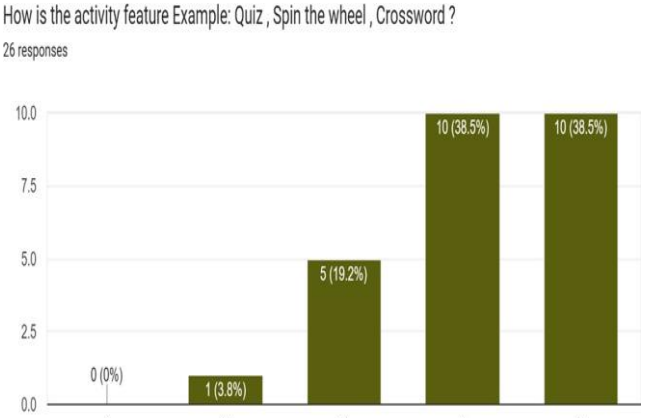

Figure 8 User Satisfaction with Features of App

Conclusion

The Irular language learning app exemplifies a successful integration of modern technology and community engagement in the effort to preserve an endangered language. This project involved a systematic approach to development, beginning with the collection of authentic linguistic data directly from native Irular speakers. By utilizing React Native for cross-platform functionality, the app became accessible to a broader audience within the Irula community, ensuring that both Android and iOS users could benefit from its features. The implementation of interactive elements, such as audio recordings and gamified learning modules, significantly enhanced user engagement. Feedback from pilot testing with community members revealed marked improvements in vocabulary retention and pronunciation skills among users. Notably, the

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storytelling component not only facilitated language learning but also reinforced cultural connections, allowing users to engage with their heritage through traditional narratives. Despite the project's successes, several challenges were encountered. The logistics of gathering data from remote communities necessitated careful planning and collaboration with local organizations. Additionally, ensuring an intuitive user interface for individuals with varying levels of digital literacy requires iterative design and testing. The adaptive learning feature, which adjusts lesson difficulty based on user performance, proved vital in personalizing the learning experience for users at different proficiency levels. Looking ahead, the project aims to expand its reach to approximately 10,000 members of the Irula community. Future enhancements will focus on refining the app's user interface, introducing more advanced language modules, and broadening the vocabulary database to include additional cultural and practical contexts. There is also an opportunity to extend this model to support other endangered languages, applying the same principles of Mobile-Assisted Language Learning (MALL) that have proven effective for the Irular language. In summary, the Irular language app serves as an innovative model for language preservation, addressing both linguistic and socio-economic challenges faced by the Irula community. By promoting cultural heritage alongside educational advancement, the project sets a precedent for future initiatives aimed at revitalizing endangered languages. Continued research and development in this area will be essential to ensure that the richness of indigenous languages, such as Irular, is preserved for generations to come. [17-18]

Acknowledgements

I would like to express my sincere gratitude to my mentor, professors, and colleagues for their invaluable guidance and support throughout this research. Their insights and encouragement have been instrumental in shaping this work. I extend my heartfelt appreciation to SRM Institute of Science and Technology for providing the necessary resources and a conducive environment for research. I am also grateful to my peers for their constructive feedback and discussions, which have helped refine my ideas. Lastly, I would like to thank my family and friends for their unwavering support and motivation throughout this journey.

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