FLIPPINO: A MOBILE APPLICATION ON READING FOR THE DYSLEXIC STUDENTS OF WORDLAB

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Abstract

Dyslexia is considered a cognitive disability and is the most common language-based learning disability. In the Philippines, the number of dyslexics have increased dramatically over the years. Having such condition affects a person's ability in terms of his learning skills such as reading, writing, processing information, and understanding. These disabilities can further interfere with higher level thinking skills such as abstract reasoning, planning, organizing, memory and attention. This resulted to only few of the students with dyslexia being able to reach secondary education or even graduate in college. This project explored the use of ICT in helping the students cope with the difficulties brought about by dyslexia. Such technology allows for the individualization of teaching and learning materials, making learning more focused rather than grasping from a typical classroom setup of one teacher to many.

Wordlab school is an institution which caters to students who have dyslexia while maintaining compliance with the Department of Education’s K-12 curriculum. The thesis project involved the development of a mobile application that addresses the learning problems of the dyslexic students of Wordlab’s Sling Class tutorial program. Aside from the innate problem of dealing with letter reversals, other challenges in learning include difficulty in spelling and placing phonograms in words correctly and the lack of learning tools in teaching the spelling and decoding class in Filipino.

Flippino is a mobile application that will aid students in Grades 1 to 3 in recognizing the different letters and sight words that make up the Filipino vernacular as well as to help these students in formulating basic Filipino sentence construction. The instructional design of the mobile application is based on the Madrasa, Slingerland, and Davis Dyslexia approaches, incorporating various multimedia elements and interactivities to enhance the learning experience, including demonstrations through animation, audio-visual letter sound associations, letter tracing, interactive storybook, and simple voice recognition. Dyslexic students are “picture thinkers”, hence using visual aids would help address disorientation and help them easily recall lessons. Means to allow for teacher interventions in the mobile app were also integrated. Additionally, the Gamification Theory was used for the design of assessment and evaluation activities in the application to further increase student motivation and lesson retention.

The ADDIE model was used throughout the project as the methodology for instructional systems development: from the Analysis Phase, where the proponents identified the learning problems, to Implementation and Evaluation, where positive feedback were gathered from the mobile application's intended users through user's acceptance testing.

Keywords: dyslexia, mobile application, courseware, language learning, Filipino.

1 INTRODUCTION

Dyslexia is a cognitive disability that affects problem solving, memory, math comprehension, reading, visual, verbal, and auditory comprehension [1]. According to the Department of Education (DepEd) in the Philippines, the number of dyslexics have increased dramatically over the years. This resulted to only few of them being able to reach secondary education or even to graduate in college. It is known to be a condition which does not go away, cannot be outgrown, or cannot be cured by any medical means. Adjusting the teaching method for people with dyslexia may reduce the symptoms of the disability, however not being able to treat it completely [2]. Nevertheless, dyslexia is not a hindrance for patients to become achievers. Despite all of these limitations, majority of dyslexic patients remain exceptionally bright and creative.

Wordlab is an institute that originally started as a clinic in 1996 practicing the one-on-one school setup to help dyslexic students who are enrolled in traditional schools. To be able to strictly monitor their students, the ratio of teachers to students is 1:2. Currently, the school handles a total of 80 students...
(75 boys and 5 girls) with 40 teachers to facilitate them. Wordlab offers primary, middle school and high school levels. They follow the DepEd Curriculum and teaches Social Studies, Science, Math, English, and Filipino. Since Wordlab is a private school, it additionally offers the Spelling and Decoding subject for all levels to focus on addressing dyslexia. The school also has developed a variety of teaching materials and adopted different methodologies for students with dyslexia, including the Orton-Gillingham Approach, the Madrasah Approach, the Slingerland Approach, and the Davis-Dyslexia Approach. The Madrasah Approach is particularly used by Wordlab in teaching Filipino, wherein rote memorization and chanting words and sentences repeatedly are used in order to obtain mastery of the language [3]. However, the implementation of these approaches can be further improved given the technologies and other contemporary teaching strategies available today.

In line with these existing approaches, the proponents identified Gamification as an appropriate strategy for assessment and motivation. It incorporates fun elements into real-world or productive activities. Gamification is proven most effective for younger audiences and gamified delivery of lessons optimizes a person’s feelings, motivation, and engagement. [4]

Realizing the need to provide educational support for dyslexics and inspired by the current teaching endeavors of Wordlab, the students of De La Salle University – Manila, Philippines under the Bachelor of Science in Computer Science with specialization in Instructional Systems Technology took on the opportunity to enhance the learning experience of children with dyslexia by creating a mobile application that takes advantage of a handheld device’s ability to support multimedia and interactivities, while at the same time providing localized content in Filipino. Students in the undergraduate program are honed with knowledge and skills in order to determine ICT-based solutions that best addresses the educational requirements and/or problems of different types of learners and teachers within various disciplines or domains, given their existing learning environments. Consequently, the proponents underwent a series of instructional design phases in order to determine the learning needs of the target audience, design the mobile application and learning activities based on a learning theory and basic multimedia design principles, and evaluate the resulting application.

2 METHODOLOGY

The ADDIE model was used as the methodology in developing the project. It is a commonly used guide by instructional designers in developing educational content and materials. The name of the model stands for its five phases: Analysis, Design, Development, Implementation, and Evaluation. [5] The different phases are sequentially carried out during the proponents’ undergraduate thesis program, comprised of four stages: Methods of Research (Analysis & Design), Thesis 1 (Design), Thesis 2 (Development), and Thesis 3 (Implementation & Evaluation). Each thesis stage corresponds to one term in their academic year, with each term constituting 14 weeks. There are requirements at the end of each stage, while documentation is done all throughout the thesis program.

The analysis phase covers majority of the data gathering required in order to determine the current learning scenario and the different factors affecting it. In this phase, the proponents identified and studied the profile of the target students, subject coverage and instructional objectives, existing learning materials, as well as current teaching and assessment methodologies. By conducting interviews with Wordlab instructors and content experts, and by performing literature review, the proponents were also able to identify existing learning problems. Additionally, it is at this stage that the proponents identified the scope and limitations of the project.

During the design phase, the proponents conducted various activities that will lead to the conceptualization of the mobile application and its underlying instructional design. An initial instructional design was created during their Methods of Research through a theoretical framework, which will later on serve as the blueprint for the development of the app. In this succeeding phase, the following activities were performed: content analysis, media selection, storyboard creation, screen design, and scriptwriting.

Coding and the multimedia creation are part of the development phase. The platform that the researchers intend to deploy the software is for the Felta Tablets, which run Android OS. Android Studio was used as the development environment.

The implementation and evaluation phases were actually done while the mobile app development is in progress. During implementation, the application went through continuous modification to ensure quality upon the mobile software’s release. The developers made sure to have close coordination with
the partner institution as feedback from both the faculty and the students who will use the software is deemed necessary and important. Much of the work done in this stage involved continuous redesigning, updating or editing the content of the software for the lessons to be delivered to the students effectively and efficiently.

In the last stage of the ADDIE model, the software was subjected to meticulous final testing. The evaluation phase included the User Acceptance Testing process. The main goal of the evaluation stage is to determine whether the goals of the proposed mobile application was met and also to assess what will be needed to move forward to further increase the efficiency and success of the software project in a long-term basis.

The specific outputs for each phase will be discussed in detail in the following section.

3 RESULTS

The project, from conception to evaluation, took about one year and four months to accomplish. As the project was part of the student proponents' thesis requirement in their undergraduate program, the different phases and outputs using the ADDIE methodology were executed and produced at certain stages of the program and in accordance with the necessary outputs for the course.

3.1 Analysis

This section contains the details of outputs produced in the first phase of the ADDIE methodology.

3.1.1 Target Audience

The users of the proposed software will be the dyslexic students of Wordlab. The students who are in the foundational part of the Spelling and Decoding Sling class or tutorials (Grades 1 to 3) will be the students who will fully maximize the mobile learning software. Their ages will vary since the Spelling and Decoding course is separate from the Department of Education curriculum that the institution uses. In addition to this, these users are also Filipinos who use the Filipino vernacular since localized content will be the focus of the proposed mobile learning application.

Developmental dyslexia is a learning disability which affects the children’s ability to read. Given that they are dyslexic, they have the innate difficulty learning how to read compared to non-dyslexic students because of information processing problems. Dyslexic students usually have trouble grasping the basics due to the instances of reversals of numbers, letters and/or words. The traditional method of grade level reading is ineffective in teaching language-based subjects to these students that is why Wordlab incorporates the specialized Spelling and Decoding classes in their curriculum for their students.

3.1.2 Existing Teaching Methodology, Learning Materials, and Environment

The proponents focused on Wordlab's Spelling and Decoding subject in Filipino, which involves phonics, basic symbols, sounds, writing letters on air, writing letters using crayons, letter reversals, and phonograms and spelling exceptions. The level of Spelling and Decoding of each student is based on a student's level of acquired learning.

Teaching technique is more hands on, but still practices the pen-paper method. Hands on practices focus on engaging the students actively through kinetism. These practices involve the students being given tasks which requires the use of their different senses. In this manner, students will be able to remember the lesson easier since action or active learning contribute to their memory. Active learning involves writing using different paraphernalia, collaboration among other students or group activities, and working in a specialized environment wherein tools are provided for their use.

For Math subjects, the institute makes use of the Orton-Gillingham Approach, Madrasah Approach for Filipino, and Slingerland Approach for the Reading and Spelling subject. Students are later tested through written exams for their written assessment.

As for the learning materials, the institute particularly stated that they make use of the Geo Slab, Comic Sans and Century Gothic font if technology is needed. Additionally, labels in shelves in the classrooms are written bilingually, in English and Filipino. For example, a shelf containing books is labeled as “books - aklat” with a picture of a book in the middle. The books are created by Wordlab with references from electronic books and school library books. As of the moment, the institute uses
teaching materials such as flash cards, handouts, and custom made books for their lesson delivery. These materials are not far different from those that are being used in normal schools. The school also provide worksheets which requires the primary students to trace letters and words in order to practice their mastery on the symbols and also to address dysgraphia. Some worksheets provide illustrations for the students to match the words with their corresponding drawing or symbol.

Currently, sets of flashcards serve as the main learning tool in teaching Spelling and Decoding. The flashcards serve as a visual representation to supplement the verbal instruction given to the students. For example, in teaching the letter ‘A’, the teacher would repeat the sound of the letter by emphasizing the specific letter in a word associated to the it. The flashcard depicting an image of the ‘apple’ fruit is used as the connection to the sound of the letter ‘A’ thus establishing visual and auditory connection which is needed for these students. The teacher would then let the student draw the letter ‘A’ in conjunction with reciting the letter sound to establish kinesthetic and auditory connection. This way of teaching is their multi-sensory approach so that the students can remember the given letter.

3.1.3 Learning Problems

First, dyslexic students have the innate problem of dealing with letter reversals therefore having trouble recognizing different word appearances. This problem occurs because of the similarity in appearances of some letters in the modern Filipino alphabet. Wrong visualization of letters will affect a student’s ability in linguistic related areas such as spelling, writing, reading and comprehension.

Second, students with dyslexia have difficulty in spelling and placing phonograms in words correctly. When an individual spells a word, the word would be deconstructed, broken down into its individual sounds and then transform those sounds into letters which represent those sounds. Phonograms, which is the term being used to describe the group of letters that represent a sound, should be mastered in order to successfully spell a certain word. Spelling a word would entail knowing which phonogram should be used in order for the student to spell that specific word correctly.

Lastly, there is a lack of learning tools in teaching the Spelling and decoding class in Filipino. Wordlab currently uses learning materials that help manage disorientation and learning difficulties of dyslexic students. The said institution applies the Madrasah approach in teaching in Filipino, which has its limitations because it only uses rote memorization. When learning a language, an individual must be familiarized with letters, construction and deconstruction of words, and mastery of spelling patterns and syllables, all of which are tasks that require mastery and understanding not memorization. Dyslexic students must be able to know how to manipulate language in order for them to apply it in linguistic related areas such as spelling and simple sentence construction.

3.1.4 Scope and Limitations

<table>
<thead>
<tr>
<th>Main Topic</th>
<th>Lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Letters &amp; Word</td>
<td>• <em>Patinig</em> (Vowels)</td>
</tr>
<tr>
<td>Formation</td>
<td>a, e, i, o, u</td>
</tr>
<tr>
<td></td>
<td>• <em>Katinig</em> (Consonants)</td>
</tr>
<tr>
<td></td>
<td>b, d, g, h, k, l, m, n, p, r, s, t</td>
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<tr>
<td></td>
<td>• <em>Hiram na Letra</em> (Borrowed Letters)</td>
</tr>
<tr>
<td></td>
<td>c, f, j, ñ, q, v, w, x, y, z</td>
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<tr>
<td></td>
<td>• Letter Sounds</td>
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<td>• Letter Formation and Structure</td>
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<td>• Letter Orientation &amp; Reversals</td>
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<tr>
<td></td>
<td>• Phonograms</td>
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<td></td>
<td>ex. ba-, be-, bi-, bo-, bu-</td>
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<tr>
<td>II. Words</td>
<td>• Sight Words</td>
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<td></td>
<td>ang mga, ang, si, sina, ni, nina, ikaw, ka, ditto, diyang, doon</td>
</tr>
<tr>
<td>III. Sentence Formation</td>
<td>• Integrating phonograms into forming simple sentences</td>
</tr>
</tbody>
</table>
The topics indicated in Table 1 comprise the lessons in the mobile application. These were identified in consultation with the institution and content experts.

Use of the mobile application is intended to supplement the student’s Spelling and Decoding Sling class to further improve their mastery of letter writing skills and word comprehension. The proposed learning software was developed as a mobile educational application for the Felta Intel Tablet, therefore these students were expected to know how to operate the said Felta Tablet. Non-locomotor skills such as tapping, tracing and dragging is needed to operate the proposed mobile application.

3.2 Design

This section contains the details of outputs produced in the second phase of the ADDIE methodology.

3.2.1 Theoretical Framework

The conceptual instructional design of Flippino was initially visualized through the theoretical framework (see Fig. 1), which shows the learning problems to be addressed, learning theories to be used, multimedia selection, lesson delivery techniques, and assessment methods to be implemented.

The main learning theory to be used is the Slingerland Multisensory approach. This approach makes use of auditory, visual and kinesthetic-motor aspects in the lessons to supplement the student. Furthermore, the Davis Dyslexia approach, which states that dyslexic students are picture-thinkers, is used in presenting lessons in the lesson delivery of the different letters and assessment through letter recognition. Another concept that will be used is the Madrasah Approach, currently being used in Wordlab when teaching lessons in the Filipino vernacular. The Madrasah approach makes use of rote memorization and chanting of words and sentences repeatedly in order for a student to be familiar with the basic words and simple sentences. Since the Madrasah approach only utilizes an individual’s skill of memorization and repetitive chanting, the research group will improve its implementation on the mobile application by accompanying it with kinesthetic skills such as tapping and tracing in order to make the mobile learning application specialized for dyslexic students.
One of the methods used in the mobile application which demonstrates the use of multimedia is storytelling. In the application, the letters are grouped and will be associated with a story which makes use of words that can be easily associated with these letters. The intended target users of the mobile application are on their preoperational stage therefore interactivity should play a huge role in order to assist them in learning. In this stage, students are more curious in manipulating symbols such as images. Curiosity and imagination is also widely present in students at this stage thus, using storytelling to integrate the different activities is deemed effective for better retention of learning. Gamification is implemented throughout the app through different elements such as scoring and unlocking of lessons.

3.2.2 Storyboards

The storyboard produced from this instructional design process is different from those created for animation or film (see Fig. 2). The project storyboard resembles a flowchart, which shows the hierarchy of modules and screens in the mobile app. This is used as a guide by the developers in constructing the individual nodes, especially for navigation, and integrating them into a single application.

3.2.3 Screen Designs & Media Scripts

Screen designs are drafted based on the storyboards. Thereafter, detailed scripts are created to guide the media developers on what to produce and present in each main screen or module. Each section of the script individually describes specific text, static visuals, audio, and video (none were used for the project). Interactive components are also described in the script as to the screens they lead to or the actions they perform. Since dyslexics are considered to be visual learners, the mobile application contains multimedia elements such as audio, animation and graphics. These multimedia elements were used in order to enhance visual and auditory connection which is very much needed to be developed on by the dyslexic students. All graphics and audio used in the mobile app are original and created by the proponents. Furthermore, the activities included in the software are interactive and on a per participant basis, meaning each individual will have his or her own account or profile.

3.3 Development

The actual screen designs were implemented in the mobile application during the development phase.
The Log-in screen will allow the user to enter the software. An existing user can access the previously saved progress by clicking the *Magpatuloy* button whereas a new user can register an account by clicking the *Magsimula* button. The main menu includes two options *Maglakbay* and *Magsanay*. For the *Maglakbay* option, all of the lessons can be accessed here while as for the *Magsanay* option, this can only be accessed only when the user was able to accomplish a certain lesson and has already gained enough stars in order to unlock the practice set (see Fig. 3).

In the first iteration, letter reversals are addressed. In this module, the basics of proper differentiation of each letter and their sounds are introduced to the primary level audience through animation demonstration. Special words are used in the different stories in the mobile application. These words will start with the letter which are introduced and will be taught in the lesson or story. Letters are shown on the screen and will further be emphasized in terms of how they look like and how they are written. The differences of orientation of directionality for each letter pair are also demonstrated through the use of animation. Through this method, students will be able to master the strokes in writing a specific symbol (see Fig. 4).
In the second iteration, words are taught by using images and by avoiding the use of repetition and rote memorization in its implementation. Images are used by associating it with a corresponding letter sound. The lesson implements letter tracing in the software, contrary to the current way of teaching letters and words in the proponents’ partner institution in which the teachers let the students trace a letter up in the air, both of the methods that would encourage symbol mastery. In this module, words which are spelled with the letters with visual similarities would also be tackled (see Fig. 5).

In the third iteration, construction of simple sentences are taught through the help of a visual storybook. The lesson implements an auditory storybook in which the students will try to understand and write down the correct words and letters that should satisfy the follow-up question after every story line. The user must fill in the blanks in the storybook with the correct letter or word, depending which is being asked in the story. If it in case the dyslexic student was not able to pronounce and write his answer well, the tutor will aid the student or will be the one to pronounce and write the student’s answer on the mobile application. Furthermore, if the voice recognition module failed to recognize the student’s answer, the tutor could intervene in the situation and could clarify the student’s problem which occurred. Visual clues will help him fill in the missing blanks in order for him to finish answering the story.

The student’s progress is monitored through the total number of gold stars they have received after correctly answering an assessment after every module instead of showing them their raw score at the end of every level. After collecting the correct amount of gold stars, the Magsanay module which contains additional exercises will automatically be opened. Each assessment corresponds to a number of gold stars. Furthermore, a badge will be given to the student after completing a lesson, an exercise or an assessment. The progress of the student can also be tracked by the number of badges he has collected all throughout the module. Assessment of modules can be repeated to improve their mastery.

3.4 Implementation & Evaluation

Both the designers and developers constantly analyzed, redesigned, and enhanced the application technically to ensure efficient performance and delivery to the users of the proposed software. Ideally, when the subject matter expert and the users actively contribute their feedback during the
implementation stage, instantaneous modifications can be made to the software project thus making the program more effective and successful.

User Acceptance Testing (UAT) was conducted together with students from grades 1 to 3 (see Fig. 7) and a few facilitators handling Spelling and Decoding classes from the partner institution. Comments and suggested revisions by the partner institution were implemented in order to develop a high quality and competent educational mobile application.

![Figure 7. Sample Section from the UAT Questionnaire.](image)

Positive feedback was received from both the school's faculty as well as the students who were sampled for user assessment testing. Reports from the testing mainly conclude that user engagement of the student increased and that the very kid-friendly graphics were very appealing to the eyes of the users. The content choice in the application also catered to the student's learning level.

## 4 CONCLUSIONS

Adjustments both in the content and features were made in order to fully develop the entire educational tool. The Madrasah approach was the primary learning theory used in order to implement the learning modules in the mobile application. The content of the mobile application was properly planned, developed and created by the proponents since this will be the feature which will make the software fit to cater the needs of the Dyslexic students. After a thorough planning of the content, the multimedia elements which were used in the mobile application was also carefully studied. Sensory overload was one of the problems faced by the proponents. An example of sensory overload problem is the use of moving text, voiceover and an animated object on a screen viewed by the user all at once. In order to avoid this, the proponents consulted with the partner institution so that the proper mix of multimedia elements on each screen was created. Another problem faced by the proponents was information overload. Due to the implementation of the storytelling in the entire mobile application, audio, text and animation occurred at the same time in one screen. In order to address this problem, the proponents studied multisensory readings, articles and studies which provide guidelines on how multimedia elements should be used in educational tools.

The mobile application catered for the dyslexic students of Wordlab’s Sling class program is recommended as a viable learning tool in helping these students learn the basics of the Filipino vernacular given their disability. The Madrasah way of teaching helped improved on the target user’s difficulty with letter reversals and phonogram awareness. The mode of delivery of the lessons was linear and somehow repetitive. In this way, rote memorization, repetition and mastery of the basics such as letters and syllables were successfully targeted at the early parts of the application. With the aid of multimedia and an interactive tool that allowed for student participation, this manner of learning helped the students go through the more complex levels of the lessons such as word and simple sentence formation.
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