

INTERACT: Interactive E-Learning for Children with Autism

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Abstract— Mainstreaming is a combination of regular and special education classes. Regular classes are for those students with usual time-phasing schedules, while special classes are focused on special education (SPED) that involves students with difficulty in their motor skills and academics. One of the problems faced by SPED is the students struggle with lesson retention. This is due to a limitation in methods to practice, review and recall their lessons after classroom period. Thus, the researchers created an interactive e-Learning website for children with Autism, that will serve as a supplementary tool for special classes. Lessons provided in the website are designed by skilled teachers who are experts in special education. Since SPED teachers have access to the website, they can check the students' performance from the evaluation records. Also, guardians of special children can actively participate in the students' journey towards learning

Index Terms— Autism; E-learning; Interactive; Special Education.

I. INTRODUCTION

A program is interactive when it presents options based on the user needs and feedbacks. Based on different requirements, a user can control, edit and modify the outcome of a program. These programs are currently more effective through the world wide web, as it is the prime platform for learning [1]. Interactive programs are very beneficial to these children as they are granted freedom and have fun while learning a particular subject matter.

E-learning is electronic learning, and typically this means using a computer to deliver the part, or all of a course in digital form which can be done in schools or through a far distance learning course [2].

A new way of teaching has been introduced, where a student is given more engagement to the subject rather than passivity. The more passive the content is, the less attention the student gives. E-learning provides a lot of interaction and experience. It enables students to experience real life scenarios that can help acquire knowledge actively. There are three (3) factors that make a difference when it comes to e-learning. Personalization, interactivity and engagement. Personalization gives the student a specific pace according to their learning ability. Different students have different learning abilities as some grasp the subject faster than others. Interactivity gives students unique learning experience by letting them learn through experience. Compared to traditional teaching where the content is simply consumed, e-learning can engage students actively. Engagement enables a student to be involved in real life scenarios; therefore, increasing their confidence when it comes to acquiring knowledge [3]. E-learning systems can also be effectively used for children with special needs. The three (3) factors that make e-learning good, is highly applicable to special

children. Those three (3) factors are important when it comes to teaching them. It helps to make the progression of acquiring a certain skill faster and more fun. Such systems can also be used to enforce the knowledge that has been learned at school or special institutions [4].

Educational rights of Filipinos with disabilities and special needs is acknowledged by the laws of the State. The 1987 Philippine Constitution guarantees every Filipino's educational right. Section 1 of Article XIV declares that "The State shall protect and promote the right of all citizens to quality education at all levels, and shall take appropriate steps to make such education accessible to all." Republic Act 7277 or the Magna Carta for Disabled Persons, enacted in 1992, this law is guided by some principles has stated that disabled persons are part of Philippine society and they have the same rights as other people. The welfare and development of these people is also a concern of the State. According to the Section 12 of this law, "The State shall ensure that disabled persons are provided with access to quality education and ample opportunities to develop their skills. It shall take appropriate steps to make such education accessible to all disabled persons." This section and the succeeding ones require the government to provide other educational services to children with special needs [5].

The current trend of e-learning is based on cloud computing which creates a pool of computing resources which has been adopted in various applications such as education, government and business [6]. Various companies are currently utilizing e-learning to provide world-class training to their employees from various sectors [7]. In addition, diverse transfer of knowledge is being adopted by various universities in providing education as it demonstrates advantages in the form of 24 hours accesses, cost-effective and user paced learning [7]. The application of E-learning is diverse ranging from the corporate sector, education sector, social and collaborative learning, customer service sector, sales sector, IT sector and health care sector [8]. E-learning has also been currently utilized to teach English as a second language [9] and at higher institute [10] Thus, in this work, the authors would like to focus on the application of E-learning for autism children.

A program is interactive when it presents options based on the user needs and feedbacks. Based on different requirements, the challenge for the authors was to create a solution to address the problem of special education activities reinforcement. The authors created an e-learning system that can be used by the students, with the aid of their parents, for reinforcement activities which is fun and easy to use.

The main purpose of developing web-based e-learning system for children with autism, is to assist the teachers in reinforcing their lessons to the student even after class which is accessible anywhere. The lessons included comprises of

number skills, communication skills, and pre-vocational skills. This e-learning system will serve as a reinforcing tool for teachers and parents, that will enable the students to recall the lessons after school hours.

The study is aimed to create a supplementary educational tool for children with autism that will be available online. The system was designed and aligned with special education curriculum to synchronize the students learning and comprehension of a subject.

The developed system contains lesson to develop the student's number skill, communication skill and pre-vocational or motor skill. The interactive web-based lesson also has assessment history and user account management. Lessons were presented based on special learning method in the form of games. Different lesson modules were developed at various levels of learning. The e-learning system was primarily designed for students who suffer from autism. It included the basic curriculum that was derived from the special education curriculum given to each school by the department of education. Teachers can add, edit or remove remarks on students' assessment page. The website was hosted on an offshore hosting service.

II. METHODOLOGY

Iterative Life Cycle Mode was utilized for this work and it is explained in several subsections.

A. Requirement Gathering and Analysis

The Requirements gathering and analysis phase included interview and observation at the Las Piñas Elementary School Central that offers special education class for children with autism.

The requirement specifications from the first phase were studied in analysis and design phase of software development of the study. System design helped in specifying hardware and system requirements, and also helped in defining overall system architecture. Figure 1 shows the conceptual diagram of the e-learning system.

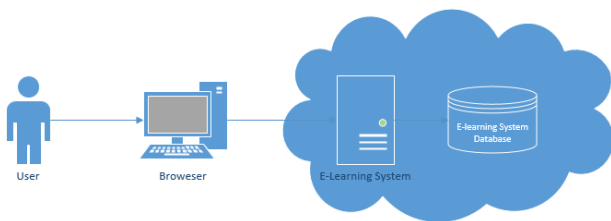


Figure 1: Conceptual Diagram of the E-learning Website

B. Analysis and Design

The developed system has a log-in feature for user accounts and teachers on the website. The URL is <http://www.lpsc-autism.com>.

The user needs to select a module (communication, number or pre-vocational) based on the desired topic. When the user chose the communication module, another screen will appear and request the user on the level they are in (1, 2 or 3). In every level per module, there are several lessons that students need to accomplish. When they accomplish the task, a star icon will flash on the screen, which displays the score and a background sound that will confirm it. If the user cannot get the correct answer in a particular game, the program will

continue to the next game. This method will continue until the student finishes the level of assessment. There will be a point given to the student in each skill games if the correct answer is attained. The student will get his/her accumulated score at the end of the level. Once the student achieves a total score of seventy percent (70%), then they can proceed to the next level

Once the user has chosen the topic of desires, there will be a video regarding the topic and a short demonstration clip which last for 1-2 minutes. The user will then be prompted on whether they wish to replay the video.

The Number Skills Module teaches the special children how to identify objects by their: color, shape, size, weight, and distance, to recognize numbers and to count numbers using flash cards and videos which aids the teachers in teaching their students.

The researchers developed the use of flash cards based on the one used by teachers in class to avoid confusion among students. These were created to assist some students that could not cope up with the fast method of teaching with the flash cards in a regular class setting. Figure 2 shows the number skill module on the website.

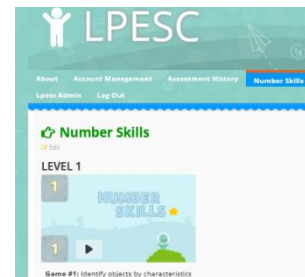


Figure 2: Number Skill Module

In Level 1, the student will be assessed if he/she can identify object color, shapes, size, weight and distance, recognize numbers from 1 – 10 and count numbers from 1 – 10. In Level 2, the student will be assessed if he/she can discriminate object by color, shapes, size weight and distance, read and write from 0 – 50, solve word problems with sums of up to fifty (50), solve word problems with difference of fifty (50) or less, recognize part of a whole, tell time to the hour, identify units of measurement for weight, height, distance and temperature and count money bills and coins from one peso to fifty pesos (P0.01 – P50.00).

In Level 3, the student will be assessed if he/she can apply concept of color, shapes, size, weight and distance in everyday living, read and write numbers from 1 – 100, solve word problems with sums of up to one hundred (100), solve word problems with differences of one hundred (100) or above, apply concepts of parts of a whole in daily living situations, compute time by adding and subtracting, measurement for weight, height, distance and temperature using appropriate measuring implements and compute required money values.

The Communication Skills Module helps the special children to learn by following commands or instructions, identify similar/dissimilar sounds and points/names particular: places, objects, persons, or animals using activities like sitting, standing, etc. and also by using flash cards as well.

In Level 1, the student will be assessed if he/she can follow one-step commands or instructions, identify similar/dissimilar sounds and point names, particular objects,

places, persons and animals. Figure 3 shows the communication skills module on the website.



Figure 3: Communication Skills Module

In Level 2, the student will be assessed if he/she can give simple responses independently and follow two steps command or instructions. In Level 3, the student will be assessed if he/she can give appropriate responses and follow commands or instructions in sequence and in detail.

The Pre-Vocational Skills Module aids special students to study and practice the usage of both hands and fingers skillfully, usage of eye-hand coordination and finishing their task at a given time based on activities like carrying objects, drawing, copying notes, and others. The authors made a game that will support the children to use and achieve the skills. The game will have activities like typing, catching a game, etc. with time limit wherein the student need to accomplish the task that is given within the time frame in the game. Figure 4 shows the screenshot of pre-vocational skills module of the website.

In Level 1, the student will be assessed if he/she can use both hands with minimum assistance, use fingers skillfully and do hand and eye coordination. In Level 2, the student will be assessed if he/she can use simple tools on the screen and finish given task. In Level 3, the student will be assessed if he/she can use both hands independently.



Figure 4: Pre-Vocational Skills Module

The website has an assessment module. The assessment will be displayed after every topic. If a child successfully completes the assessment, they will be given a point. These points will be accumulated at the end of the module and can be viewed at the assessment history module. The total scores will be converted to a percentage. Then depending on the result, an adjectival rating will be displayed. Figure 5 shows the adjectival rating that will be displayed for each student's learning activity.

Legend	Percentage	Raw Score
O	Outstanding	91% - 100%
VS	Very Satisfactory	81% - 90%
S	Satisfactory	71% - 80%
FS	Fairly Satisfactory	66% - 70%
NI	Needs Improvement	0% - 65%

Figure 5: Assessment Module

C. Implementation

In the implementation phase, the researchers built the components of the system from the composition made from

the design phase. The website was uploaded on hosting services on the Internet. The authors conducted 10 User Acceptance Testing surveys for to the following users: teachers and parents of special students of Las Piñas Elementary School Central. At the time all modules were done, each was tested. Personal computer and mobile device hardware and software minimum requirement were set as well as cross-browser testing. The system should be capable of running on different browsers such as Google Chrome, Mozilla Firefox, Safari and Internet Explorer with its function running properly with the basic computer settings. The minimum requirement needed to run this software is at least Pentium 233-megahertz (MHz) processor ,64 megabytes (MB) of RAM and 1.5 gigabytes (GB) of available space on the hard disk with any operating system and with a basic Internet connection.

D. Testing

In testing, the last phase of development, the researchers conducted unit, functional, integration and acceptance testing. These testing were made to check the system on whether it passed the constraints or it has some error that needs to be rectified. The prototypes were evaluated in the same manner as the previous designs, and then another design was developed from it. Thus, the tests included three iterations.

III. RESULT AND DISCUSSION

The authors first scheduled an interview with regards to phases and deliverables that need to be done. Before starting the first phase, they have created a Gantt chart and an action plan. In the first phase, they have conducted an interview with the client and questioned regarding the current business process, teaching process and their background. The special education class contained different levels, comprising of low level and high level. The teachers said in the interview that students tend to forget the lessons that were taught that day and thus making it hard for the student to comprehend the next topics in their subject. At the end of the interview, they have come up with the idea to propose a reinforcement system and created a project proposal. Three iterations make up the planning phase. The first interview was with the head principal of the school. It was conducted online. In this interview, they asked about the business process, teaching process, current process and the number of students and teachers under special education. Unfortunately, the data that was gathered was not sufficient to be the basis of the authors of the system. They decided to have a second interview. In the second interview, they had a chance to talk with the actual teachers in the special education department wherein they were given the idea of how the students were taught in class. They also had a chance to observe. The teachers also gave a more precise on the teaching process and how they handle their students. In the third interview, they provided a copy of the actual curriculum that the students use. The curriculum was used as a guide to create the individual games that are part of the reinforcement system. The sitemap shows the different parts of the website that the reinforcement system is on. During the design phase, they listed the database schema, entity relationship diagram that was used. Lastly, the authors started the testing phase where the system is checked for errors and usability and making sure that the system works accordingly as intended. In deploying the website, they

subscribed to the hosting services of Go Daddy. Word press was used as a content management system where the reinforcement system is on. They also used cPanel for configuring the server and site capabilities.

The approval of the users was needed to end the deployment phase. This is where the authors have conducted the User Acceptance test to test the system’s functionality, correctness and design according to the user’s perspective.

The system has (3) types of users. These are the Student/Parent, Teachers and the Admin. The system was tested using the students from the special students of Las Piñas Elementary School Central. The student can only access the lessons (games) and their history. While the teacher can see the games and the students that have played the game. The administrator can see both and can add, edit and delete users accordingly. Figure 6 shows system’s functionality and correctness test results.

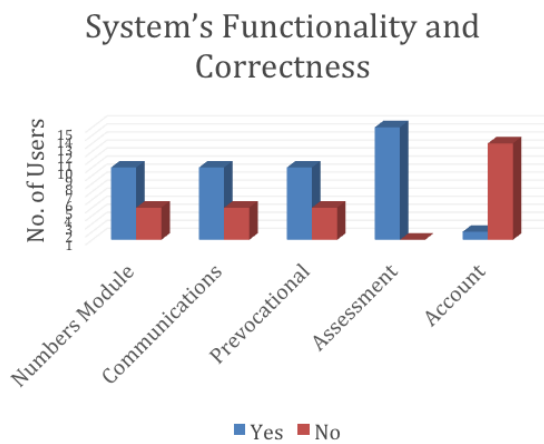


Figure 6: System’s functionality and correctness test results

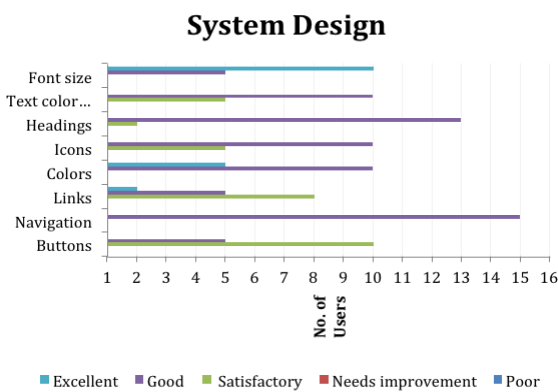


Figure 7: System Design Test Results

Based on the user acceptance test conducted, each of the users (Teachers, Student/Parent, Admin) validated that the functions of the system are working accordingly with regard to the requirement. The parent and students were happy about the looks of the game and its lessons. The teachers and admin also commended the accessibility of the website and its games across different platforms such as computers, tablets and mobile devices. Almost all of the users rated the system design highly. The authors can tell that the users are satisfied with the interface of the system with the result of the test. The

test showed has the students were able to adapt to the system. The system design was good overall. The text and pictures are clear across different platforms. The game screen resizes according to the size of the device it is on. Touch controls are easy to identify. Navigation links are accurate. The combinations of the site’s color are consistent and is specifically designed for special children. Thus, overall the system has shown promising output based on the test and feedback received. Figure 7 shows the System Design Test Results.

IV. CONCLUSION

The objective of the study is to create a web-based e-learning system that will serve as a supplementary tool for learning by children with autism in their own time or during they are at home. a system was created that would help the students have a much exciting way to reinforce the things that they have learned instead of reviewing the lessons in a traditional manner. The study’s objective was addressed by designing and creating a website that will host the system. The system is developed to help children with autism to further develop their skills in numbers, communications and pre-vocational through interactive games. These games were created to simulate real world activities like counting money, conversation and responses to people and body coordination (how to use their hands, fingers and eyes). The contribution of this work is based on the E-learning system developed for children with autism for easy learning and revision. Further enhancement of the system will be done to improvise, monitor and validate the improvement on the children with autism through the application of this system.

REFERENCES

- [1] T. Berners-Lee, M. Fischetti, and M. L. Foreword By-Dertouzos, Weaving the Web: The original design and ultimate destiny of the World Wide Web by its inventor. HarperInformation, 2000.
- [2] M. J. Rosenberg, E-learning: Strategies for delivering knowledge in the digital age, vol. 9. McGraw-Hill New York, 2001.
- [3] E. T. Welsh, C. R. Wanberg, K. G. Brown, and M. J. Simmering, “E-learning: emerging uses, empirical results and future directions,” *Int. J. Train. Dev.*, vol. 7, no. 4, pp. 245–258, 2003.
- [4] D. R. Garrison, E-learning in the 21st century: A framework for research and practice. Taylor & Francis, 2011.
- [5] V. J. L. L. Alcazar, A. N. M. Maulana, R. O. Mortega, and M. J. C. Samonte, “Speech-to-visual approach e-learning system for the deaf,” in *Computer Science & Education (ICCSE)*, 2016 11th International Conference on, 2016, pp. 239–243.
- [6] A. Alshwaier, A. Youssef, and A. Emam, “A new trend for E-learning in KSA using educational clouds,” *Adv. Comput.*, vol. 3, no. 1, p. 81, 2012.
- [7] A. Vanve, R. Gaikwad, and K. Shelar, “A NEW TREND e-LEARNING IN EDUCATION SYSTEM,” 2016.
- [8] R. C. Clark and R. E. Mayer, E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning. John Wiley & Sons, 2016.
- [9] P.W. Tsai, P.-S. Tsai, P. Ku, V. Istanda, and T. Gabe, “Application of E-Learning in Teaching of English as a Second Language,” in *The Euro-China Conference on Intelligent Data Analysis and Applications*, 2016, pp. 163–170.
- [10] M. M. Saleh and H. A. S. Alhuwayji, “Challenges Facing the Application of E-Learning At the Higher Institute For Comprehensive Professions of Garahbully Libya,” *Glob. J. Comput. Technol.*, vol. 4, no. 1, pp. 208–212, 2016.