Awetism: A User Ergonomic Learning Management System Intended for Autism Diagnosed Students in the Philippines

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Abstract

In the Philippines, the population of autism is vastly growing; males are most likely to be diagnosed with autism compared to females. Special Education (SPED) teachers experience difficulties in teaching autism diagnosed students due to their uncontrollable physical behaviors which is a major challenge for SPED teachers nowadays. Further assessment shows that ninety-percent (90%) of Filipino autism diagnosed students are using gadgets mostly and behaves through it. With an aim to help SPED teachers, researchers identified the factors significant to enhance the current learning system. To measure the learnability, learning preference checklist was deployed. After a keen assessment, autism diagnosed students were most likely to learn through visuals and video models. Through normality testing, data gathered implies a normal distribution with a p-value of 0.190. With correlation, the positive strong side are Adaptability (0.638), Illumination (0.753) and Phonics (0.679). With the aid of structural equation modelling (SEM), it resulted in the following estimates of significant factors: Adaptability (0.28), Sounds (0.32) and Videos and Films (0.14) preference. Recommendation presented in this research is an ergonomic design system which has an intention to promote life skills among autism students by eliminating uncontrollable behaviors thus making communication and learning process easier.

Keywords
Autism diagnosed students, Learning Management System, Special Education, learnability

1. Introduction

Children with autism spectrum disorder can be distinguished by social interaction difficulties, communication challenges, and repetitive behaviors. In connection, autism diagnosed-students experiences difficulties as interaction with people around them take part. Based on article "Person with disabilities in the Philippines", ninety-seven percent (97%) are not reached by the public school system; therefore it is evident that there is a large percentage of autism which needs educational achievement. [1] The children with autism are considered out of sync in terms of their sight, sound, smell, taste, and touch which may seem ordinary for people but are painful for people with autism spectrum disorder due to their sensory differences. According to an interview with special education (SPED) teachers, SPED teachers experience difficulties in providing instructions to autism-diagnosed students due to individual differences. In addition, children with autism are literal thinkers when it comes to communication, as these students are nonverbal people and visually oriented in terms of the mode of instructions. Autism diagnosed-students show signs (e.g tapping, pinching, and body language) to show or express what do children intend to tell and in terms of social capabilities, children experience difficulty in dealing with emotions and expressions.

Based on National Health Society (NHS) report in the year 2012, sixty to seventy percent (60-70%) of people which are diagnosed with autism disorders also experience learning disabilities which yield to a higher chance of learning deficiencies [2] as teachers experience difficulties in teaching because of the uncontrollable physical behaviors (e.g. naughty, hyper, distracted, tantrums etc.) manifested inside the classroom. A study conducted in the year 2013 states

that the percentage of children under eight (8) years old with access to a smartphone or tablet has jumped from half (52%) to three-quarters (75%), and the average daily time on the device has tripled from five (5) to fifteen (15) minutes. [3] It is evident that there is a large percentage of children who access the smartphone mostly, therefore children easily adapt through gadgets. With the implementation of technology inside the classroom, children with autism spectrum disorders tend not to exhibit unnecessary behaviors which can improve their learnability. [4]

In line with this, there it goes Assistive Technology, wherein it is used mainly in order to increase or improve the abilities of children with autism. [5] It also allows a person to work in his/her area of expertise. [6]. Technology-aided strategies are aimed at providing valuable experiences through instructional materials and devices that can be viewed and heard. Information such as recent discovery and invention, improved procedures in doing things and better products are communicated and learned through an aid of pictures and films. [7]

In order to solve the problem, it is relevant to assess the significant factors in order to enhance the existing learning system of children with autism and consequently develop an ergonomically designed Learning Management System which intends to improve both teaching and learning process. The study will limit its focus on improvement of the current system of learning of children with autism more especially with the one diagnosed in the Philippines. Facility Layout more especially with the design of the environment more especially with the classroom ambiance and time management especially with allotment and association of time with different task teachers intend to do will not be tackled out in the study. Hence, improvement of learning system was most likely take part.

2. Literature Review

Children with autism often express their emotions inarguable and unusual ways. It is significant to learn how to express their feeling in more usual and conventional ways. [8] Children with autism have a lifetime of adapting to and coping with others in terms of environmental conditions, routines and activities.[9] Different conditions such as noise, sensory stimulation, overload, novel situations, sudden unexpected changes, and transitions cause the stage to set for frequent meltdowns.[10] Lightings should include and as much as possible it must only be a natural light because some children with autism find fluorescent lights/bulbs bothersome which tends children to lose concentration or focus on the lessons which are provided by their teachers.[11] In relation to sounds, the exposure therapy is used to treat sound sensitivities in several children who are diagnosed with autism. As commonly reported in ASD, the children had problems with certain and specific types of sounds. [12]

The value of developing instructional materials as an aid to effective communication, materials involved in the form of teaching aids are motion pictures and computers.[13] Information such as recent discovery and invention, improved procedures in doing things and better products are communicated and learned through pictures and films. [7] Technology has huge benefits for students with autism since they can learn well with visuals, making technology a good option for their learnability. [14] Usage of visual system utilizes pictures or words can serve a new way to convey or presents information and augment verbal instruction, which makes it accessible for children with autism. [15] Picture Communication System developed the children verbally. The idea is aiming or pointing to a picture so the children can communicate by using a picture. [16] Through the use of technology as a medium, it can improve play skills, decrease challenging behaviors, provide video models, and help with speech for students with autism. [17] There is no reason for ignoring phonics while using initially sight reading since children can learn what each letter entails, and match individual letters in the words do autism diagnosed students clearly recognize or understand, sounding out the word as they go. [18]

3. Research Design and Methodology

Through data collection, researchers gathered multiple variables such as behavior, feelings, capabilities, adaptability, illumination and noise which draw an effect in the existing learning system of autism diagnosed students. Learning Preference Checklist is utilized to measure the learnability of children with autism through measurement of the modality of learning preference. Moreover, testing and analyzation of the gathered data was done through the Minitab 18 statistical software.
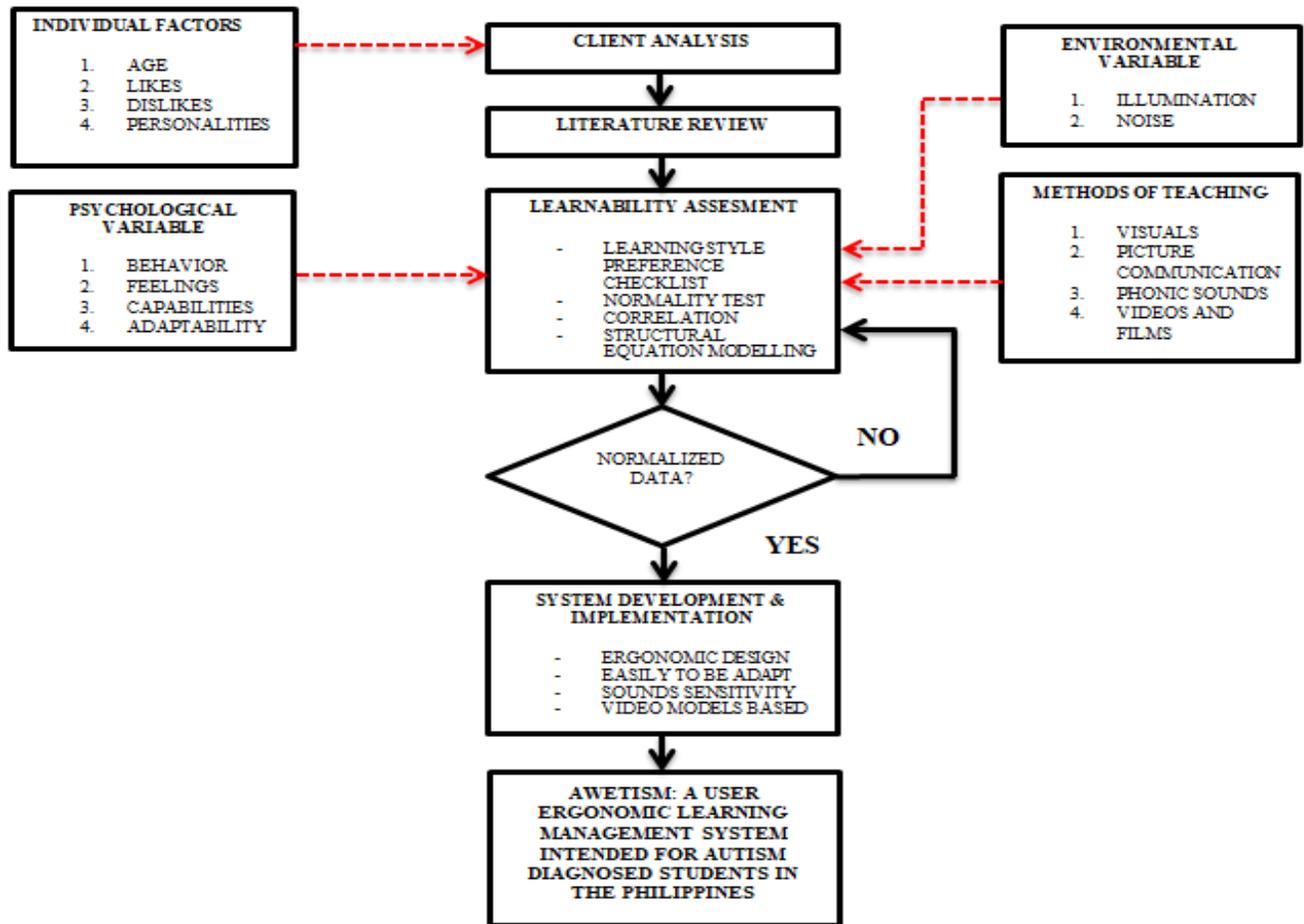
Figure 1. Model Framework

A. Individual Factors

The individual factors are related to the basic information associated with children with autism. It mainly includes the age of children with autism, likes and dislikes of the children such as noise, hugging, gadgets, and music, dislikes, and individual personalities do autism diagnosed students possess. These set of variables have a direct effect on the existing learning process of children with autism since the said factors will significantly help in outlining a good and usable system which intends to take charge of both teaching and learning system.

B. Psychological Variable

Psychological Variable is related to the mental and emotional state of autism diagnosed students. This is correlated with behavior, autism children show upon the learning process, autism students' capabilities, feelings and adaptation towards the environment. These set of variables is relevant since it assessed how a certain children acts upon the process of learning.

C. Environmental Variable

Environmental Variable is related to the surroundings of autism diagnosed students. This is correlated with Illumination of the room being used, and the noise being heard upon the learning process. These set of variables are related to all environment aspect. It is measured through Digital Light Meter and Sound Level Meter. Values may vary depending on the noise being acted upon the learning process.

D. Methods of Teaching

Methods of Teaching are related to the way of teaching used and the preference style of learning of autism diagnosed students. This is correlated with their preference in terms of learning, it may be through visuals, picture communication, phonic sounds, and video models (videos and films). These set of variables is significant for it measure on what certain area do autism diagnosed students learn inside the classroom. Values may vary depending on the taste/preference of learning of autism diagnosed students.

4. Results and Discussion

This part shows further discussion/analysis of the gathered data.

Students with autism spectrum disorder are all male and most of the respondents belong to the 1-6 years old age bracket. Table 1 reflects the children's likes, dislikes, and personalities. Seventy-three percent (73%) of the students like gadgets while thirty-three (33%) of the respondents dislikes noise. In terms of personalities of autism diagnosed students, most of the students are usually distracted in terms of the noisy environment, moody since autism diagnosed students are mostly subject to tantrums, and impatient since autism diagnosed students hates waiting time.

Table 1. Descriptive Analysis of Students' Demographic, Likes, Dislikes, and Personalities Data

Demographics	Frequency	Percentage
Gender		
Male	28	100
Female	0	0
Age		
1-6 y/o	8	53
7-12 y/o	7	47
Likes		
Gadgets	11	73
Books	2	13
Music	2	13
Dislikes		
Noise	5	33
Food Variety	2	13
Hugging	1	7
Long Conversation	2	13
Repetitive Words	1	7
Waiting	1	7
Being Touch	1	7
Sitting for A Long Period	1	7
Crowded Places	1	7
Personalities		
Inpatient	2	13
Distracted	5	33
Picky Eater	1	7
Obedient	1	7
Lack of Recognition	1	7
Moody	3	20
Dependent	1	7
Independent	1	7

The graph and tabulated data below determines if the sample data entails normal distribution or not. In this tool commonly known as Anderson- Darling Normality test, given data can be concluded a normal distribution if the p-value resulted is greater than the alpha level of 0.05. As seen above, with the total of twenty eight (28) respondents derived from Cochran's Formula, it resulted to a p-value of 0.190. With this connection, it can be concluded that the given sample possess a normal distribution.

Table 2. Minitab Result – Normality Test Results (Tabulated)

Factors	Frequency	Mean	Std. Deviation	AD	P-Value
Learnability	28	57.21	4.202	0.502	0.190
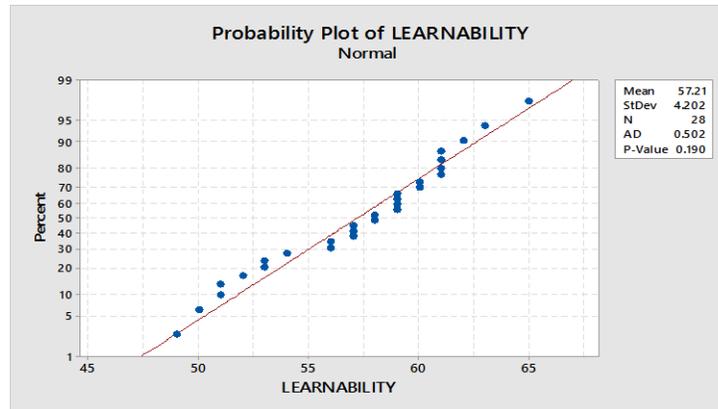
Figure 2. Normality Test Graph

The tabulated data below implies the correlation coefficient obtained through an aid of Minitab. As per the result, it ranges from negative very weak which is Picture Communication side up to positively strong which is Adaptability, Illumination, and Phonic Sounds respectively. Adaptability, Illumination, and Phonic Sound results to positive strong strength wherein they are the most significant factors in terms of children's learnability.

Table 3. Minitab Result – Correlation

FACTORS	CORRELATION COEFFICIENT	STRENGTH
Behavior	0.317	Positively Weak Correlation
Capabilities	0.597	Positively Moderate Correlation
Feelings	0.397	Positively Weak Correlation
Adaptability	0.638	Positively Strong Correlation
Illumination	0.753	Positively Strong Correlation
Sounds	0.536	Positively Moderate Correlation
Visuals	0.475	Positively Moderate Correlation
Picture Communication	-0.158	Negative Very Weak Correlation
Videos and Films	0.309	Positively Weak Correlation
Phonic Sounds	0.679	Positively Strong Correlation

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4.1 Structural Equation Modelling

The figure below entails the path analysis relationship of two factors which is dependent and independent factors and variables respectively in relation to the learnability of children with autism spectrum disorder. This means that the independent factors have significant relationships to each other and significantly influences three (3) dependent factors which are Psychological Factors, Environmental Factors, and Methods of Teaching respectively.
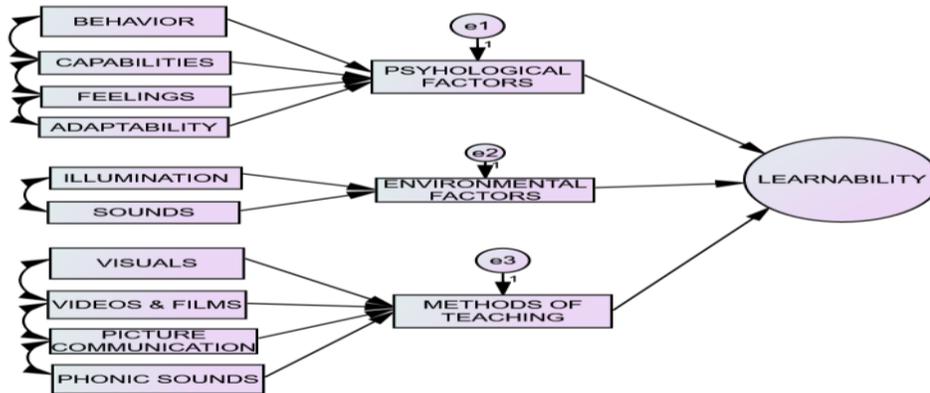

Figure 3. SPSS Amos - Path Analysis

The table below shows the results provided by the SEM software, it entails the regression weights which imply that the P-value is lower than the confidence interval of 0.05 in which will assess and determine if the combination has direct and significant relationship between the dependent and independent variable specifically. Based on the table above which shows the results, some values are less than 0.05 in the P value side. Therefore there is no direct relationship in the combination between the two (2) variables. In table number 4, it entails the values of estimation wherein the dependent variable estimation value is obtained in Regression Weights of SEM model.

Table 4. SPSS Amos Result – Regression Weights

			Estimate	S.E.	C.R.	P	Label
LEARNABILITY	<---	BEHAVIOR	-3.726	1.570	-2.373	.018	
LEARNABILITY	<---	CAPABILITIES	-4.154	1.527	-2.721	.007	
LEARNABILITY	<---	FEELINGS	.267	1.627	.164	.870	
LEARNABILITY	<---	ADAPTABILITY	2.383	1.250	1.906	.057	
LEARNABILITY	<---	ILLUMINATION	.809	.392	2.064	.039	
LEARNABILITY	<---	SOUNDS	1.149	.519	2.215	.027	
LEARNABILITY	<---	VISUALS	.588	1.406	.418	.676	
LEARNABILITY	<---	PICTURECOMMUNICATION	-.197	1.409	-.140	.889	
LEARNABILITY	<---	VIDEOSANDFILMS	.363	.408	.889	.374	
LEARNABILITY	<---	PHONICSOUNDS	-.019	.268	-.071	.943	
PSYCHOLOGICAL FACTORS	<---	LEARNABILITY	-.048	.038	-1.285	.199	
ENVIRONMENTALFACTORS	<---	PSYCHOLOGICALFACTORS	-.157	.400	-.392	.695	
METHODS	<---	ENVIRONMENTAL FACTORS	-.147	.264	-.555	.579	

The table below shows the summary of the results generated by the SEM software, it resulted to Psychological Factors which obtained the highest estimate of 0.058, Environmental Factors which resulted to 0.006, and lastly which is Methods of Teaching which obtained 0.011. The following factors are significant for which it can be applied for the development of a system.

	Estimate
PSYCHOLOGICALFACTORS	.058
ENVIRONMENTALFACTORS	.006
METHODS	.011

Table 5. Squared Multiple Correlations

5. Conclusion

In this study, researchers applied ergonomic approach/principle in order to develop a system that is suitable for children with autism spectrum disorder. Assessing factors significant in the existing learning system of the children is considered to be a starting point in the development of Learning Management System in order to eliminate negative behaviors which became part of their learning process. This approach gives an advantage in the relationship between teachers and students since it will enhance both teaching and learning process. It opens up opportunities for the future research that may be done in accordance with this area. Based on the statistical tools applied by the proponents, the gathered data is a normal since the data obtains a p-value of 0.190 which is greater than 0.05 alpha level. The highest estimates lie at Psychological Factors (0.058), then Methods of Teaching (0.011) while the lowest lies at Environmental Factors (0.006). In order to enhance the learnability the following significant factors are needed, first, adaptability should be the focused of the system; it should be designed for children with autism to adapt easily. Next are videos and films as part of instructional materials, given that they easily learn through this aid, it is significant to use these tools. Lastly, sounds should be relaxing, given that they are irritated to disturbing ones; therefore it is relevant to use calming and relaxing sounds.

6. Recommendation

After a keen observation and data gathering from learning preference checklist which were deployed with parents and teachers of autism diagnosed students, the students are mostly like to learn through visuals and video models mode of instruction and communication. Proponents strongly recommend an ergonomically designed Learning management system through an aid of technology to eliminate uncontrollable physical behaviors which takes part upon the learning process of autism diagnosed students. The system has an aim to reduce teacher assistance by making the lessons accessible and can be easily understand by the future end users. Basically, good interaction between teachers and parents is relevant; the system will promote interaction since the system is notification based wherein parents can be notified about the current status of their children yielding to a higher percentage that communication will be much easier. Teachers can test certain student learnability through different type of assessment tools such as home works, seat works and assignments. In terms of mode of instruction, video models and visuals based will be applied given that autism diagnosed students are most likely communicate and learn through this kind of communication. All users can benefit the system, since the system is not just for students but also for parents since the latter can get updates and articles (e.g, how to handle tantrums and news about autism spectrum disorder).

The tabulated chart below shows the proposed flow chart of system wherein it subdivided into three (3) categories wherein it offers different features in those categories. In terms of student, School and Home are their options wherein it is location based.

Table 7. Proposed Flow Chart of System

FLOW PROCESS	PROCESS DESCRIPTION
	- Start of the process. - The users will select options for them to login. There are three variations of options namely Parents, Teachers, and Student. - Users will then choose to an option to log in in order to access the system fully. - The home page will then appear. - If the user is Student it consists of two (2) options, "HOME" or "SCHOOL". If the student chooses the school category it shows educational subjects while in home, there includes life lessons and good traits. - If the user is Parents the account includes articles about autism and notification about the performance of their child. - If the user is Teacher the accounts includes schedule, grading system and learning progress of the children with autism.

The figure below shows the proposed learning management system which is subdivided into three (3) aspects of logging in, Teacher, Parent and Student accounts namely. The sign-in page includes the name of the system, and sign-in box. If in case a user has no account yet, it has sign-up button which includes user's name, email address and password. The student account has two (2) options where it is based on their location, Home and School. These two options will cater different lectures based on the selected location of the user. The chosen theme and color of the system is based on the users' preference which is light colors and a clickable icon based which helps the users to understand and easily adapt the proposed system.

Figure 4. Proposed System

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