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Research Article

Evaluating the Effectiveness of Enrichment Program in Improving the Learning Performance of Deaf-blind Students in an Achievement Test: A Single Group Experimental Study

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Abstract: This single group experimental study was conducted to evaluate the effectiveness of an Enrichment Program delivered to the deaf-blind students. It evaluated the improvement in the achievement test scores of the deaf-blind student before and after the Enrichment Program. Single group pretest and posttest experimental study design was adopted for this study. The sample size was small due to low number of students with multisensory impairment of deafblindness. The findings revealed that there is a statistically significant difference in the pre-enrichment program assessment test and post-enrichment program assessment test scores of the deaf-blind students at $p < 0.05$. However, no significant difference was seen in the post-enrichment program assessment test and follow-up assessment test. These findings suggest that the Enrichment Program delivered using multiple communication strategies such as Tactile Sign language and body schemas significantly improves the learning process in the deaf-blind students.

Keywords: Enrichment Program, deaf-blind students, students Tactile Sign language

INTRODUCTION

The students with multisensory impairments face complex challenges to develop their understanding of the world and learn the conceptual background. The multisensory impairment substantially reduces the learning abilities as well as limit communication and cognitive development (Ross *et al.*, 2011). The loss of critical senses such as hearing and vision in deaf-blind students impede their development (Anthony, 2016). The deaf-blind students are unable to receive the stimuli from the external environment. Besides that, these students are also unable to decode the information signals. Such a condition creates chaotic misinformation that results in a sense of fear among deaf-blind students (Caprino & Stucci, 2016).

Deaf-blind is a multisensory impairment in which people have issues in hearing and vision, these people are not completely deaf or blind (NHS, 2018). In deafblindness, a person has a certain degree of impairment in vision and hearing. There is no threshold level for a person to be labeled as deafblind (Bruce *et al.*, 2016). However, thresholds are established for legal purposes. The condition of deaf-blind complicates the disability and intensifies the impact on a person's ability to communicate properly. The needs of deafblindness are more complex as compared to those who have an exclusive disability of either deafness or blindness (Simcock, 2017).

Clinically the ambit of deafblindness is widened and those children are also included in the deafblind category who get benefit from educational programs for deafblind children. Therefore, sometimes children are referred to as deafblind who have one complete impairment and have an additional impairment (Preisler, 2005). Vision and hearing are the two most critical senses; these enable an individual to comprehend the information in the external environment (Jaiswal *et al.*, 2018). When a child lacks both senses in a condition of deafblindness, the problem of communication and information increases manifold (Brabyn *et al.*, 2007). However, the needs of deafblind people vary according to the age, type, and onset of deafblindness.

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Deafblind people are categorized into four different categories (Hersh, 2013). In the first category, people with early-onset deafblindness are included. These people have no loss of vision or hearing at the time of birth, but they lose either hearing or vision when they reach the age of 2. The underlying causes of such a situation include prematurity, prenatal insults or postnatal influence. It has been reported that the number of children in the first category has increased (Hersh, 2013).

The second category includes people with early-onset loss of hearing or vision. These children lose their sense of hearing before they become 3 years old and later on they also lose their vision. The major cause of blindness and deafness in these children is Usher's syndrome type 1 and 2 (Hersh, 2013). The people who have late-onset of visual or hearing impairment are categorized in the third category. The loss of vision and hearing in these children occurs after the age of 3 and the cause of multiple impairments includes metabolic conditions, head trauma, and Usher's Syndrome type 3 (Hersh, 2013).

The fourth category includes people who have early-onset of blindness and later on they also lose hearing. There are fewer people in the fourth category of deafblindness as compared to the previous three. The major causes of the fourth category deafblindness include postnatal infections, Alstrom syndrome, and birth trauma (Hersh, 2013).

The learning abilities of children depend on receiving and assimilating the input from the external world. Children assimilate sensory information and use it for communication as well as concept development (Baskale *et al.,* 2009). The loss of vision and hearing limits communication and render the children unable to learn. The deaf-blind children are also unable to perceive primary concepts such as body schema, space and time (Olayi & Ewa, 2014). The multisensory disability deprives deaf-blind children of skills to learn new information. These children do not perceive consistent information. The sensory potential of deaf-blind children is also limited and thus they lack the motivation to explore and learn from the environment (Zeza & Stavrou, 2015). These limitation put deaf-blind children at a disadvantage and adversely affects their learning process. The information does not convey a consistent and appropriate message to deaf-blind children thus the learning experience is poor. Therefore, deaf-blind children have limited attention in the learning environment and their learning performance is below par as compared to their peers.

Research Problem

The educational programs at the schools and colleges for special children cater to the needs of either deaf students, blind students or intellectual disabilities students. Children with multisensory disabilities have complex educational needs and require a specific approach to enable them to learn (Salleh *et al.,* 2018). There is not much empirical evidence on the educational program for deaf-blind children to enhance their attention in the classroom and improve their learning outcomes. Deaf and blind children are unable to process the information available in the normal learning environment (Salleh *et al.,* 2018). The only sense that enable learning among deaf and blind students is their sensory potential. These limitations deprive the deaf and blind students of equal opportunities to learn. According to a study, the information accumulated by deaf and blind is generally distorted and inadequate (Zeza & Stavrou, 2015). Therefor children with deaf-blind multisensory impairment need special communication techniques to acquire new information. Therefore, there is a grave need for developing an enrichment program specifically for children with deaf-blind multisensory impairment to cater to their complex needs.

Aims of the Study

The aim of this study is to evaluate the effectiveness of an Enrichment Program in developing selective attention and its impact on the academic performance of students with multisensory disabilities such as deaf-blind. Generally, this study determines the beneficial impact of the Enrichment Program using multiple communication approaches specifically designed for dual disability students with deaf-blind impairment.

Research Questions

The Research Questions That Are Addressed In This Study Include The Following:

1. Is there any statistically significant difference in the intermediate grades of deaf-blind students before the administration of enrichment programs and shortly after the administration of enrichment programs?
2. Is there any statistically significant difference in the intermediate grades of deaf-blind students in the post-enrichment program assessment test and follow up assessment test?
3. Does the deaf-blind students demonstrated significant improvement in the follow-up tests of Enrichment program?

LITERATURE REVIEW

Learning in Deaf-Blind Students

Educational assessment is the major pillar of ensuring that educational program has achieved its objectives. Assessment of deaf-blind students is a daunting task owing to the varying degree of hearing and visual impairment. These children with these disabilities cannot be assessed simply by adding the adverse impact of each disability. According to a research, the standardized tests are inadequate to

evaluate the learning outcomes in deaf-blind students (Nelson & Bruce, 2019). Therefore, the assessment of learning in deaf-blind students need to address their complex needs. Howley & Howely (2008) argued that the assessment of deaf-blind students should elucidate the impact of impairment on the educational needs.

Special Needs of Deaf-Blind Students

The deaf-blind students have complex special needs, limiting their activities due to structural and functional issues that may cause a problem in communication, autonomy, mobility, learning and social involvement (Walingo, 2017). The learning process of deaf-blind students is seen as their interaction with the external environment. Educators dealing with the deaf-blind students are not able to incorporate a specifically designed program in the classrooms. One of the studies has reported that individualized educational programs for children with multisensory disabilities are not appropriate (Nketsia, 2016). It shows that individualized educational programs are not adequate for deaf-blind students.

It has been reported that educators need to demonstrate specific skills and knowledge while delivering a lecture to deaf-blind students (Nelson & Bruce, 2019). It is imperative that educators evaluate and identify the special needs of deaf-blind students to effectively improve their learning process. One of the researchers has argued that educators need to view disabled learners in relation to their external environment (Oldfield, Humphrey & Hebron, 2017). Therefore, the complex needs of deaf-blind students should be considered before delivering any enrichment program. Deaf-blind students do not learn spontaneously and thus require a special learning environment (Nelson, 2019). For instance, it has been reported that deaf-blind students learn through physical contact and motor activities (Valente, Theurel & Gentaz, 2018). Moreover, the deaf-blind students do not effectively perceive the auditory stimulation as compared to their peers. Likewise, the deaf-blind students also develop self-awareness through structured locomotion and tactile stimulation. Such students require a special reactive and communicative environment to develop a learning connection with the teacher. Therefore, special attention is required to meet the educational needs of deaf-blind students.

Communication is Vital in Enrichment Programs

The success of educational program for deaf-blind children depends on the communication and language used in that program. Likewise, the effectiveness of enrichment program for deaf-blind students depends on efficient communication. It has been reported that deaf-blind children have idiosyncratic style of communication which serves as a barrier in their learning process (Edwards, 2015). One of the key element of communication is developing trust and harmonious relationship between students and the teachers (Gablinske, 2014). One of the strategy identified to develop harmonious communication is through the use of symbolic language (Vallotton & Ayoub, 2010). It is essential for the instructor to recognize the way in which deaf-blind student perceive and learn new information to communicate effective. Besides that, a supportive communication partner is also vital to deaf-blind student's learning.

Curricula for Deafblind Children

Deafblind children require a specially designed curriculum to build their attention and improve their learning performance. It has been reported that the formal psychoeducational curricula are not well received by the deaf-blind children. Moreover, formal assessments are also problematic for deaf-blind children (Knoors & Vervloed, 2003). Therefore it is imperative to understand the strength and weaknesses of deaf-blind children and specially design a unique educational curriculum that meets their complex needs. One of the instruments that are designed to evaluate the development of deaf-blind children is the Callier Azusa Scales (Ayyildiz *et al.,* 2016). However, studies have reported that even this instrument is not reliable to evaluate the educational development of deaf-blind students. Therefore, it is critical for the teacher delivering education to the deaf-blind students to specially design a holistic program to cater to their complex needs.

The Body Schema

Body schema concept is vital for imparting education in the deaf-blind students. The body schema gives the perception of the unity of the body. It suggests that every individual has a body and that is unique. The body has a special point of reference that is used to interact with the social and natural environment (Morasso *et al.,* 2015). Body schema facilitates the personality development of a child. The gradual training enables the child to develop an awareness of body unity and learn to interact with the external environment (De Vignemont, 2011). The concept of body schema is not developed normally in the deaf-blind children. These children are provided special training to develop the concept of body schema and enable them to influence their environment. In this way, a deaf-blind child develops a sense of self-awareness. In the educational environment, the teachers can utilize the concept of body schemas in the interventional programs and enhance the learning performance of the deaf-blind students. During the programs, the teachers utilize different movements to establish a connection with the child's body part and in this way a connection is developed. This connection enables effective communication between the teacher and a deaf-blind student. The body serves as the main media of information exchange and tactual communication takes place of visual and auditory communication. The body

movements also enable a deaf-blind child to recognize the tactile cognitive signs and learn. In this way, body schemas offer a unique approach to improve the learning performance of deaf-blind students.

METHODOLOGY

Overview

Methodology section of this study are divided into the following subsections to reveal every step taken during the process of this study.

Participants

The study participants were recruited from the Computer Science Department at the Community College of Tabuk University. In this study, there were only 10 students with deaf-blind impairment and therefore all the students were selected, and prior to their selection an informed consent was taken from their parents. The visual acuity ranging from (40-59) from simple to moderate as well as the degree of visual acuity 24/60: 18/60 moderate degree of sight. There were a small number of students with deafblindness disability and therefore the sample size was kept small.

Material

A specially designed enrichment program was administered to the students. The content of enrichment program is provided in the Appendix (I). The assessment test taken to evaluate the effectiveness of the program is also provided in the Appendix (II).

Design

The quantitative experiment study design was adopted for this study. In this study, a single group was used due to the small number of deaf-blind students. A single group pretest-posttest study design is developed to determine the impact of any intervention. The two main features of this study design are that all the participants are recruited in a single group and similar intervention is administered to the participants. The second essential feature of the single-group study design is that it is carried out in a linear order in which the dependent variable is determined before and after the intervention (Allen, 2017). In this way, the researcher compares the results and identify any impact of the intervention on the dependent variable. The current study was also aimed at evaluating the impact of the Enrichment program and therefore single-group study design was the most relevant design.

Study Duration

The Enrichment Program was conducted for one month. In this program, the deaf-blind students were delivered science concepts with the help of diverse techniques such as body schemas, tactile sign language, and American Sign Language. The duration of the Enrichment class was one and a half minutes. The use of diverse communication techniques enabled the teacher to keep the students motivated during the whole Enrichment Program.

Procedure

Data collection of this study was conducted in three phases. In the first phase, all the recruited participants were provided an assessment test and their scores complied. It was referred to as a pre-enrichment program assessment test. The second phase of data collection began right after the completion of the Enrichment Program. The deaf-blind students were provided with a similar assessment test and their scores complied. It was referred to as a post-enrichment program assessment test. The third and final phase of data collection began after a week of the second phase. In this phase, the students take a follow-up assessment test to evaluate any difference in the scores of deaf-blind students from the post-enrichment program assessment.

The results of the pretest, posttest and follow up test was complied. SPSS (version 20) was used to statically analyze the collected data and to evaluate the difference in the scores of pretest, posttest and follow up assessment tests. It was a Single group experimental study design and the objective of the study was to evaluate the effectiveness of Enrichment Program intervention in the deaf-blind students therefore Paired Sample T-test was the most appropriate test. It was applied to determine any significant difference in the mean scores of deaf-blind students in the pretest, posttest and follow up assessment tests.

Ethical Consideration

The study is conducted in consonance with the research and ethics principles of Helsinki Declaration. The researcher also ensured that the study participants were not harmed in any way during the whole process of administering enrichment program and assessments. A written approval of research was taken from the Research & Ethics Committee. The parents of deaf-blind students were consented before conducting this study.

RESULTS

The study aimed to evaluate the impact of the Enrichment program using various modes of communication on deaf-blind students learning performance. The study was a comparison between the pre-enrichment program assessment and post-enrichment program assessment. A Paired T-test was performed to evaluate any difference in the scores of students in the assessment test taken prior to the Enrichment program and after the Enrichment program. Table (1) below shows the paired sample statistics of the students' performance in the pre-post enrichment program assessment. There is a clear difference in the mean scores of deaf-blind students in pre-enrichment program assessment and post-enrichment program assessment.

Table.1 Paired Sample Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pre-Enrichment Program Assessment	8.50	10	0.850	0.269
Post-Enrichment Program Assessment	16.00	10	0.943	0.298

The difference in the mean scores of the deaf-blind students in the assessment test was evaluated to determine the significance of the difference in the scores at $p < 0.05$. It was found that the difference in the scores was statistically significant 0.00 at $p < 0.05$. The findings are presented in table (2) below.

Table 2. Statistical Significance of Paired Samples Test

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of difference		T	Df	Sig. (2-tailed)
				Lower	Upper			
Pre-Post Enrichment Program Assessment	-7.500	0.527	0.167	-7.877	-7.123	-45.00	9	**0.000**

Likewise, it was evaluated whether the scores of the deaf-blind students improved in the assessment test in the follow-up. The results revealed a slight variation in the mean scores of the deaf-blind students in the follow-up. The findings are presented in table (3) below.

Table 3. Paired Sample Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Post-Enrichment Program Assessment	16.00	10	0.943	0.298
Follow up Assessment	16.50	10	1.080	0.342

The slight difference in the scores of the deaf-blind students in the follow-up assessment is evaluated to determine statistical significance at $p < 0.05$. The findings revealed that the difference in the scores of deaf-blind students in the follow-up assessment was not statistically significant. It was found to be 0.052 at $p < 0.05$. The findings are presented in table (4) below.

Table 4. Statistical Significance of Paired Samples Test

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of difference		T	Df	Sig. (2-tailed)
				Lower	Upper			
Post Enrichment Assessment – Follow up Assessment	-0.500	0.707	0.224	-1.006	0.006	-2.236	9	0.052

DISCUSSION

A teaching deaf-blind student is a daunting task for the teacher due to their complex needs. The current study evaluated the impact of an enrichment program delivered to the deaf-blind students using different communication techniques such as American Sign Language; Tactile based language and Tactile Syntax. In this study, 10 deaf-blind students were selected and they were provided an assessment test prior to the intervention of Enrichment program and their scores were recorded for further use.

The deaf-blind students were delivered the Enrichment program in which the teacher used different techniques to impart knowledge. The major focus of the

teacher was to establish the concept of body schema in deaf-blind students. The Enrichment Program was also specially designed to meet the complex needs of deaf-blind students. It was expected that the intervention of the Enrichment Program substantially improves the learning process in deaf-blind students and their scores would improve after the intervention.

The teacher specifically designed activities in the program to encourage the deaf-blind students to use their body schemas and develop different concepts. In this study, the students were motivated with the help of various multimedia and other multisensory material such as sticky tapes, cloths, and clips. Besides that tactile sign language and tactile, touch cues were also effectively used to build the concepts of the deaf-blind students. It has been reported that the visual sign language movement is critical in communication with deaf-blind students (Dammeyer *et al.,* 2015). The message delivered through the acceleration, speed, and movement of body parts to the deaf-blind students. Furthermore, the teacher also utilized different approaches such as touching the hands with force as well as slowly to convey the core concept to the deaf-blind students.

One of the studies has reported that communication in tactile language takes place through the physical environment and the body (Dammeyer *et al.,* 2015). Thus, the teacher efficiently utilized these two spaces to deliver Enrichment Program to the deaf-blind students. In another study, it was found that the use of tactile communication with deaf-blind students in the classroom substantially improves their communication with the teacher (Grisham-Brown *et al.*, 2018). It shows that the use of diverse language modeling in the classroom is beneficial for deaf-blind students.

Communication is the key to establish robust attention in the classroom between teachers and students. It has been reported that when the teachers and students are able to communicate effectively the learning outcomes of the students improve (Lumpkin *et al.,* 2015). In the current study, the teacher integrated specially designed communication activities that motivate the deaf-blind students to communicate with the teacher and thus ultimately improved their attention in the classroom. The improved attention of the deaf-blind students in the classroom was evaluated through improvement in the post enrichment program assessment scores.

The Paired Samples Test revealed that deaf-blind students performed significantly better in the post-enrichment program assessment test as compared to the pre-enrichment program assessment test. These findings provide the basic framework for the teachers working with deaf-blind students to utilize diverse communication approaches in the classrooms to enhance their attention and improve their learning process. The findings of the current study are consistent with a recently conducted study that evaluated the impact of adjusted platforms on the learning performance of the students. It was found that the use of diverse tools and platforms significantly (87.5%) improved the learning performance of deaf-blind students (Batanero *et al.,* 2019). Similarly in the current study, the improvement in the scores was statistically significant at $p < 0.05$.

The current study also evaluated the long-term impact of the Enrichment program on deaf-blind students learning performance. In this study, a follow-up assessment was carried out and it was found that the scores of deaf-blind students had retained the scores of post-enrichment program assessment and there was no statistical difference in the scores of post-assessment and follow up. However, the follow-up assessment scores were greater than that of the pre-enrichment program assessment. These findings suggest that the Enrichment Program was beneficial in improving the learning performance of the deaf-blind students by enhancing their attention in the classroom. Moreover, the communication of the deaf-blind students with the teacher also improved with the help of diverse techniques such as tactile language. However, it is imperative to understand that the current findings are conducted on a small number of deaf-blind students and thus these findings cannot be generalized on a larger population size of deaf-blind people. Despite that, the findings of the current study provide a basic framework to implement specially designed education programs for the deaf-blind student in the classrooms to increase their attention and ultimately their learning performance. Moreover, it also highlights the integral role of a teacher who is pivotal in motivating the students with the help of diverse communication techniques such as tactile sign language and body schemas. Carefully planned and effectively delivered Enrichment program would be successful in improving the knowledge of deaf-blind students.

CONCLUSION

Deaf-blind students are disadvantaged due to their multisensory impairment. It is imperative that a specially designed educational program is delivered to the deaf-blind students. The Enrichment Program delivered in this study substantially improves the learning performances of deaf-blind students. The post-enrichment achievement test scores of the students were significantly higher than that of the pre-enrichment achievement test scores. However, no statistically significant difference was found between post-enrichment achievement test scores and follow-up assessment. It shows that the intervention of Enrichment Program using diverse communication

approaches improves the learning among deaf-blind students.

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