EFFECT OF JIGSAW AND TEAM PAIR-SOLO COOPERATIVE LEARNING STRATEGIES ON SELF-EFFICACY IN BASIC SCIENCE OF STUDENTS WITH BLINDNESS

Nnamani, Ogechi *PhD*
&
Onuigbo, Liziana N. *PhD*
&
Eze, Uchenna *Prof.*
Department of Educational Foundations
University of Nigeria, Nsukka

Abstract
This study sought to investigate the effect of Jigsaw and Team pair-solo Cooperative learning strategies on self-efficacy in Basic Science of junior secondary school students with blindness/visual impairment. Three research questions and three null hypotheses were generated to guide this study. The design of the study was quasi-experimental design. Specifically, the study employed the pre-test post-test control group design involving two experimental groups and one control group. The population of the study consisted of all 35 visually impaired Junior Secondary School two (JSS II) Students who were also used as sample. The instrument used for the study was Students' Self-efficacy Rating Scale (SSRS). Mean and Standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to analyze the hypotheses. The results of the study revealed that Jigsaw and Team Pair-Solo cooperative learning strategies improved the self-efficacy of students with visual impairment in Basic Science more than the conventional lecture strategy. Gender has no significant effect on the Self-efficacy of students with visual impairment in Basic Science. Based on the findings, recommendations were made; which among others include that teachers should give learners, especially the students with visual impairment, opportunity to participate effectively in teaching and learning activities in their schools. Learners should be encouraged to recognize, value and believe in the word self-efficacy so that it will help them in decision making that will pilot their survival in the society. The government should assist schools in provision of essential instructional facilities such as Braille, computer sets, good and friendly classrooms that will take care of visual impaired students' challenges.

Keywords: *Jigsaw, Team Pair-Solo, Cooperative learning, Visual Impairment, Self-efficacy, Basic Science.*

Introduction

It is widely and generally acknowledged that the gateway to the survival of a nation scientifically and technologically is through scientific literacy. Considering the importance of science in developed and underdeveloped countries, it then became necessary to have a balanced introduction to science, especially as it concerns Basic Science which is a solid foundation for upper and low Basic education. This according to Bukunola and Idowu (2012) helps to equip the students with skills and knowledge for successful science careers thereby directly or indirectly contributing to much needed scientific and technological advancement of the global community.

Basic Science which is the focus of this study is viewed by the Nigeria Educational Research and Development Council (NERDC, 2006) as that science subject in which science concepts and principles are presented so as to express the fundamental unity of scientific thoughts. According to NERDC (2007), Basic Science is a subject of study that draws its content and concepts from all the major disciplines in science such as life science (biology), physical sciences (chemistry and physics) and earth sciences (Geography and Agricultural science). The NERDC maintained that the general objective of Basic Science is to enable students observe and explore their environment using their senses. Basic Science formerly known as integrated science is the form of science a child encounters at the primary and secondary school level for the study of core science subjects at the senior secondary school level (Bukunola and Idowu 2012). To the researchers, Basic Science therefore, can be defined as a subject of learning that gives the fundamental knowledge and skills about the universe as a whole or in parts which drawn its content from Biology, Chemistry, Physics, Geography and Agricultural Science.

Basic Science represents the foundation stone for subsequent teaching and learning of science subjects (Ebeh, 2014). Ibe (2010) also posited that Basic Science prepares students at junior secondary school level for the study of core science subjects (physics, chemistry and biology) at the senior secondary school level. In view of the need for Basic Science among all the students and its importance to both physical, sensory, mental, psychological or emotional disabilities, it then becomes necessary that students with visual impairment who have been identified through some studies as well as interviews as having challenges will not be left out (Bukunola and Idowu 2012). According to the

authors, the visual impaired challenges ranges from vision problems, inability to explore and participate effectively in experimentation, inability to observe, copy notes, low self-efficacy, inferiority complex and among others.

Visual impairment refers to a functional loss of vision that can be corrected using corrective lenses or bold letters or vision problems that cannot be corrected by medication, surgical operation or ordinary optical lenses such as spectacles. (American Council of the Blind 2010). The council further explained visual impairment as a decreased visual acuity. World Health Organization (2021) also defined visual impairment as a state where a person's eyesight cannot be corrected to a "normal" level. WHO equally established that young children with early onset of severe vision impairment would experience delayed motor, language, emotional, social and cognitive development with lifelong consequences.

Visual impairment are categorized into four, these includes; mild-visual acuity worse than 6/12 to 6/18, moderate-visual acuity worse than 6/18 to 6/60, severe-visual acuity6/60 to 3/60 and blindness-visual acuity worse than 3/60.(World Health Organization 2021). WHO saw mild sighted individuals as those who can read large characters and can identify shapes and colours. Mild sighted persons have visual acuity worse than 6/12 to 6/18 in Snellen test. Snellen test is the most commonly used method of measuring the performance of an eye or determining the condition of an eye. Snellen test uses a Snellen Chart which has letters of different sizes that are read, one eye at a time, from a distance of 20ft. People with normal vision are able to read the 20ft line at 20ft -20\20 vision. The mild impaired persons are those whose sight, though poor, is not as bad as to be regarded as blind. Moderate sighted individuals are those who can identify shapes and colours, distinguish between brightness and darkness, read characters with large size and broader strokes as well. However, moderate sighted individuals have limitations in seeing distant objects in their environment, poor night vision and blurry sight. These individuals see objects and materials in environment within a few inches or a few feet. Moderate vision individuals have visual acuity worse than 6/18-6/60 in Snellen Test. Another, category of vision acuity is severe vision; individuals in this category wear thick glasses or contact lenses that aid them to see. Individuals with severe vision have visual acuity worse than 6/60 to 3/60. On the other hand, persons with blindness are those that lack light perception and the ability to differentiate light from dark. This category of visual impaired individuals, have visual acuity of 3/60 in Snellen Test. Among these categories of students with visual impairments which include the mild sighted, moderate,

severe and blindness that made up visual impairment; this study is poised to investigate the situation of the blind students in the study of Basic Science.

Students with blindness use tactile and auditory channels for learning via Braille or other non-visual media (Kumar, Ramasamy and Stefanich 2000). Braille is the alphabet and numbers designed to be read with fingers rather than eyes by the blind students who cannot read or write printed materials (American Council of the Blind 2010). The Council further explained Braille as a code based on six dots used to represent all the letters of the alphabet, numbers, and punctuation marks that commonly occur in groups of letters. This category of students with blindness depends on auditory and tactile senses in order to understand their environment comprehensively (WHO 2021). They encounter a lot of challenges in learning Basic Science such as inability to observe, experiment, write down necessary information, inability to interact with other students, the students are emotionally traumatized and always fell inferior before their fellow students. Vermeji, (2004), also observed that students with blindness find it difficult to find out things in their environments through observation and experimentation which eventually results in their low self-efficacy in Basic Science.

Self-efficacy has been explained by different eminent scholars. Self-efficacy is defined as one's capabilities to succeed in specific tasks (Bandura 2001). According to Adedeji (2007), self-efficacy is one's judgments regarding one's capabilities to successfully perform specific task and behaviour. Students' self-efficacy in Basic Science is very vital because it is one of the determinants of students' achievement in Basic Science. To the researcher, self-efficacy means a person's belief in his or her own competence or having the confidence, ability, zeal, persistence, skill, courage and action to face a given task or challenge in school subjects including Basic Science. According to Schewarzer and Hallum (2008), self-efficacy can make a difference in people's way of thinking, feeling, and acting. Self-efficacy may be high or low (Bandura 2000). Bandura posits that when self-efficacy of people is high, the people are more likely to view difficult tasks as something to be mastered rather than something to be avoided while individuals with low self-efficacy saw difficult tasks as something that are not achievable and therefore avoid such tasks. This often results in their poor task planning and increase in stress that always results in their poor achievement in school subjects including Basic Science. Students with high self-efficacy have more interest and concentration to reach their set goals. Researches have shown that students with high self-efficacy have better achievement in school subjects including

Basic Science than the low self-efficacy students (Adelodun, 2015 and Ochieng, 2015).

Researchers have shown that it is not only vision that can be a hindrance to the study of Basic Science but also inappropriate teaching strategy. In a study carried out by Ngwoke, Aneke and Ibiam (2020) on inclusive education and learning difficulties among special needs children in Nigeria; The case study of the visually impaired revealed that visually impaired students have unique educational need which are most effectively met by using a team approach of professionals, parents and children. Fatokun and Inti (2007) also attributed students' poor achievement in science to poor instructional approaches involving descriptive and excessive teacher-talk, copying notes, learning as encouraged by expository methods of instruction. In support of the above statement, Ali (2009) observed that the most important factor for learning to take place in science is the use of appropriate instructional approach. Generally, the instructional approach usually used for normal sighted students as well as blind students is Conventional–lecture learning strategy. Conventional-lecture learning strategy is a learning strategy where the teacher gives information, monopolizes every activity of teaching and learning (Scott 2012). This type of learning strategy usually results in an uninteresting teaching and learning activities in Basic Science which may lead to students' low self-efficacy. In an informal interview conducted by the researchers with the students with blindness, it was confirmed that the students feel reluctant in attending Basic Science lessons taught with lecture strategy. These students complained of being bored when teaching and learning processes are going on because of their inactive participation in teaching and learning activities. The students offer other subjects like, English language, Igbo, social-studies, Civic education to mention but a few. These blind students do fairly well in the above-mentioned subjects but due to the features of Basic Science and peculiarities of their vision challenges they could not observe, experiment or possess ability to write down notes, it then become a serious issue to the students with blindness. It is a situation like this, according to the students with blindness that makes it difficult for them to offer core science subjects like biology, chemistry and physics at their senior secondary school level.

Based on the interviews, it became evident and a source of worry to educational stakeholders, parents, schools and students with blindness who receive instructions in Basic Science through conventional lecture strategy. The situation therefore, calls for a search for appropriate teaching and learning strategies that will give students with blindness room for active participation,

exchange of ideas as well as opportunities to ask questions and work in teams and pairs. All these are expected to encourage students with blindness to learn maximally. Based on this premise, the researchers therefore, investigated on the effect of jigsaw and team pair-solo cooperative learning strategy as an activity-oriented strategy on the self-efficacy of students with blindness in Basic Science.

Jigsaw is a multifunctional structure of cooperative learning. Jigsaw can be used in a variety of ways for a variety of goals, but it is primarily used for acquisition and presentation of new material, review or informed debate. The use of this structure creates interdependence and status equalization (Kagan 2001). There are steps involved in carrying out Jigsaw cooperative learning strategy. These steps include: Firstly, materials are divided into sections and each of the expert groups is assigned a section to learn, explore and then report to their home groups. Secondly, the class shares common learning experiences and the expert groups take different approaches in analyzing or responding to these experiences. For instance, presenting an experiment or other scientific activities in Basic Science, posing a problem and presenting a possible solution for home group discussion. Finally, all the students will come together as a class to share ideas in their various tasks which will be followed by assessment of students' performance in the learning tasks (Kagan 2001).

Team pair solo is a type of cooperative learning strategy where students solve problems first as a team, then with a partner and finally on their own (individually). Team pair solo is designed to motivate the students or learners to tackle and succeed in solving problems which initially were beyond their ability (Ogunleye 2011). The choice of Jigsaw and Team pair-solo strategies were because the strategies are activity oriented, involving and increased higher level of reasoning; create new ideas and solutions in learning Basic Science tasks. Researchers have shown that when students are actively involved in teaching and learning process and necessary feedback received in their small groups, the students' self-efficacy will be promoted. Gillies (2004) observed that jigsaw and team pair-solo strategies help students to benefit academically and socially from small group learning. Colorado (2007) affirms that jigsaw and team pair-solo cooperative learning strategy promotes learning, fosters respect and friendship among diverse groups of students. Burcin and Leman (2007) indicated that cooperative learning strategies help students to develop their self-efficacy more academically and retain more information in science than the students taught using traditional strategy. Trends in research and evidence from literature tend to suggest that

cooperative learning strategies such as the above discussed strategies enhance self-efficacy in learning tasks (Ochieng, 2015).

Another controversial issue that has been of interest to the researchers is the issue of gender differences in self-efficacy Onwu (2015) defined gender as socially or culturally constructed characteristics, qualities, behaviours and roles which different societies ascribe to either male or female. Gender refers to different roles, rights, and responsibilities of men and women and relations between them (Bazilli 2010). Gender in the context of this study refers to the roles, responsibilities or attributes attached to males and females in a society depending on the culture of such society. This implies that the roles and expectations of males and females are defined by societies and cultures.

Some studies have found significant differences in self-efficacy of male and female students. Motani, Momanyi, Ogoma and Misigo (2012) found a significant difference in self-efficacy of male and female students in favour of male students. In another study by Webb (2014), female students had higher self-efficacy than their male counterparts. A study conducted by Mohammed, Atagana and Edawoke (2014) showed that male students had higher self-efficacy in Basic science. These differences in research reports indicate that the issues of gender in self-efficacy of students in school subjects are inconclusive. However, the above studies were conducted with students with normal vision. For the above reasons therefore, the researchers were motivated to carry out this study to investigate the effect of cooperative learning strategies on self-efficacy of students with visual impairment in Basic Science using gender as one of the independent variables.

The following three research questions guided this study:

1. What are the mean self-efficacy scores of students with Blindness in Basic science exposed to (Jigsaw and Team pair-solo cooperative learning strategies and those exposed to conventional-lecture strategy?
2. What are the mean self-efficacy scores of male and female students with blindness in Basic Science?
3. What is the interaction effect of treatment and gender on mean score self-efficacy scores of students with blindness in Basic science?

The following null hypotheses guided this study. They were tested at 0.05 level of significance.

1. There is no significant difference in the mean self-efficacy scores of students with blindness in Basic science exposed to Jigsaw and Team

pair-solo cooperative learning strategies and those exposed to conventional-lecture strategy as measured by the Students' Self-efficacy Rating Scale (SSRS).

2. There is no significant difference in the mean self-efficacy scores of male and female students with blindness in Basic science.
3. The interaction effect of treatment and gender on self-efficacy of students with blindness is not significant in Basic science.

Method

The study adopted quasi-experimental design. Quasi-experimental design according Nworgu (2015) is an experiment where random assignment of subjects to experimental and control group is not possible. Specifically, it employed the pre-test post- test control group design involving two experimental groups and one control group. The population of the study consisted of all 35 junior secondary school two (JSS II) of students with blindness (15 male and 20 females) who also were used as sample of the study. The instrument used for the study for data collection is Students' Self-efficacy Rating Scale (SSRS) in Basic science. SSRS is 10-item researchers made questionnaire which was used to elicit information from the respondents for the study. The instrument was validated by experts, two in Educational Psychology and one in Measurement and Evaluation all in the Faculty of Education in the University of Nigeria, Nsukka.

Students' Self-efficacy Rating Scale (SSRS) used four-point scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The instrument was administered by their Basic science teachers who were used as research assistants under the guidance of the researchers. The reliability of the instrument was determined using the Cronbach Alpha statistics. Students' Self-efficacy Rating Scale yielded 0.93 coefficient values. Data collected from tests administered were analyzed using Mean and standard deviation which were also used to answer research questions while Analysis of Covariance was used to test hypotheses formulated for this study at 0.05 level of significance.

The researchers visited the two schools that were used in this study with proposal letter from the Head of Department (HOD) explaining the purpose of the study and strategies that will be used as well as the expected benefits of the research. The principals introduced the researchers to the Basic Science teachers who liaised with the students and scheduled suitable time for the research and equally informed the researchers about it. The principals of the two schools equally signed an acceptance letters that were taken to the Zonal

Inspector of Education of Enugu South and Udi Education zone respectively for permission.

The students with blindness in the experimental (treatment) groups were exposed to pre-treatment session on Basic science skills and the use of Jigsaw and team-pair solo cooperative learning strategies for two weeks. The students were instructed on the concepts of Jigsaw and team-pair cooperative learning strategies, how they are used and the steps involved in using them. The main aim of this session was to prepare the students for the use of these strategies during class especially as the research assistants would integrate the strategies in their class instruction in Basic Science.

Before exposing the students to treatment, the researchers with the help of the research assistants administered pre-tests to all the students in the sampled classes to determine the levels of students' self-efficacy in Basic Science. The test was administered in such a way that the students saw it as their normal class tests. Thereafter, treatments were assigned to the treatment (experimental) groups as follow: Experimental group I in the two schools received treatment on Jigsaw cooperative learning strategy, experimental group 2 in the two schools received treatment on Team-pair solo cooperative learning strategy while group 3 in the two schools served as control group and used conventional-lecture strategy. The experimental groups received treatment session that lasted for 40 minutes three times in a week for four weeks while the control group used conventional-lecture strategy session that lasted for 40 minutes, three times in a week for four weeks. This was followed by post-test to all the students that were sampled in the two schools for the study. Here, the students used reshuffled instrument.

Results

Table 1: Mean and standard deviation of self-efficacy scores of students with blindness in Basic Science exposed to Jigsaw strategy, Team pair-solo cooperative learning strategy and those exposed to conventional-lecture strategy

Treatment	Pre-self-test			Post-test		
	N	Mean	SD	Mean	SD	Mean Gain
Jigsaw	14	24.35	3.02	60.85	6.78	36.50
Team pair-solo	14	25.85	4.11	56.50	10.43	30.65
Conventional – lecture Strategy	7	24.42	3.20	44.42	11.67	20.00

Table 1 shows that the students with blindness who were exposed to Jigsaw cooperative learning strategy had mean posttest self-efficacy score of 60.85 with a standard deviation of 6.78 in Basic Science against their mean pre-test self-efficacy score of 24.35 and standard deviation of 3.02, students with blindness who were exposed to Team pair-solo cooperative learning strategy had mean posttest self-efficacy score of 56.50 with a standard deviation of 10.43 in Basic Science against their mean pretest self-efficacy score of 25.85 with standard deviation of 4.11 in Basic Science while those who were exposed to conventional-lecture strategy had mean posttest self-efficacy score of 44.42 with a standard deviation of 11.67 against their mean pretest self-efficacy score of 24.42 and standard deviation of 3.20 in Basic Science. Mean gain scores of 36.50, 30.65 and 20.00 for the three groups imply that the students with blindness who were exposed to Jigsaw cooperative learning strategy had higher mean posttest self-efficacy score in Basic Science than those exposed to Team pair-solo cooperative strategy who equally had higher mean posttest self-efficacy score in Basic Science than those exposed to conventional-lecture strategy.

Table 2: Mean and standard deviation of self-efficacy scores of male and female students with blindness in basic science

Gender		Pre-test		Post-test		
	N	**Mean**	**SD**	**Mean**	**SD**	**Mean Gain**
Male	15	28.00	2.82	59.06	5.98	31.06
Female	20	22.70	1.86	53.40	13.22	30.70

Table 2 shows that male students with blindness had mean post-test self-efficacy score of 59.06 with a standard deviation of 5.98 in Basic Science against mean pre-test self-efficacy score of 28.00 with a standard deviation of 2.82 in Basic Science. The female students with blindness had mean post-test self-efficacy score of 53.40 with a standard deviation of 13.22 in Basic Science against a pre-test self-efficacy score of 22.70 with a standard deviation of 1.86. Mean gain scores of 31.06 and 30.70 for the male and female students with blindness respectively imply that the male students with blindness had slightly higher mean post-test self-efficacy score than their female counterpart in Basic Science.

Table 3: Mean and standard deviation of self-efficacy scores of students with blindness in Basic Science for the interaction effect of treatment and gender

			Pre-test		Post-test	
Treatment	**Gender**	**N**	**Mean**	**SD**	**Mean**	**SD**
Jigsaw	Male	6	27.16	1.60	60.83	3.60
	Female	8	22.25	1.83	60.87	8.72
Team pair-solo	Male	6	30.00	1.54	62.33	2.65
	Female	8	22.75	1.98	52.12	12.08
Conventional Strategy	Male	3	25.66	4.61	49.00	2.64
	Female	4	23.50	1.91	41.00	15.20

Table 3 revealed that male students with blindness who were exposed to Jigsaw cooperative learning strategy had mean post-test self-efficacy belief score of 60.83 with a standard deviation of 3.60, male students with blindness who were exposed to Team pair-solo cooperative learning strategy had mean post-test self-efficacy belief score of 62.33 with a standard deviation of 2.65 while the male students with blindness who were exposed to conventional strategy had mean post-test self-efficacy belief score of 49.00 with a standard deviation of 2.64 in Basic Science, Female students with blindness who were exposed to standard deviation of 8.72, female students with blindness who were exposed to Team pair-solo with a standard deviation of 12.08 while the female students with blindness who were exposed to conventional strategy had a mean post-test Basic Science self-efficacy belief score of 41.00 with a standard deviation of 15.20. This may imply that male students with blindness who were exposed to Team pair-solo cooperative learning strategy had higher mean post-test Basic Science self-efficacy belief score than the male students with blindness who were exposed to Jigsaw and conventional strategies while the female counterpart who were exposed to Jigsaw cooperative strategy had higher mean post-test Basic Science self-efficacy score than the female students with blindness exposed to Team pair-solo and conventional-lecture strategy.

Discussion

The findings of this study indicated that students with blindness exposed to Jigsaw and Team Pair-Solo cooperative learning strategies had higher self-efficacy in Basic Science than those exposed to conventional lecture strategy with Jigsaw having an edge over team pair-solo and conventional lecture strategies. This implies that Jigsaw cooperative learning strategy promotes

self-efficacy better than Team Pair-Solo and conventional lecture strategy. The findings further revealed a significant difference in self-efficacy of students with blindness exposed to Jigsaw and Team pair- solo cooperative learning strategies and those exposed to conventional- lecture strategy in favour of those exposed to jigsaw and team pair solo cooperative learning strategies. This finding is in consonance with the findings of Hung, Huang and Hwang (2014) who in their study on the effect of game-based learning strategy on students' self-efficacy, motivation, anxiety and achievement in learning Mathematics established that game-based learning strategy enhanced students' self-efficacy more than the conventional lecture and traditional instructional model. The implication therefore, is that any teaching strategy that involves students' active participation in learning tasks is expected to promote self-efficacy. In support of the above claim, Ochieng (2015) established that teaching strategies used in classroom can and do make a difference in students' self-efficacy in handling difficult tasks in learning activities.

The findings of the study revealed that male students with blindness exposed to cooperative learning strategies (jigsaw and team pair-solo) exhibited higher self-efficacy than their female counterparts and those exposed to conventional-lecture strategy. By implication, jigsaw strategy had the highest influence in the promotion of self-efficacy of students with blindness in Basic Science. However, this study established that the two strategies promote self-efficacy of students with blindness in Basic Science better than the conventional-lecture strategy. This study further found out a significant difference in self-efficacy of male and female students in Basic Science in favour of males. The finding of this study is in agreement with the finding of Atagana and Edawoke (2014) who in their study on the difference between male and female students' self-efficacy, academic engagement and academic achievement in Biology found a significant difference in self-efficacy of male and female students in favour of male students. Similarly, Motani, Momanyi, Ogoma and Misigo (2012) conducted a study on the gender differences in self-efficacy and academic performance in science subjects among class three secondary school student in Lugari District, Kenya and found out a significant difference in self-efficacy of male and female students in Science subjects. The difference is in favour of male students.

The result of this study indicated that the interaction effect of treatment and gender on self-efficacy of students with blindness is not significant. By implication, it means that the two strategies Jigsaw and Team Pair-Solo were

effective and consistent in treatment of gender and as a result, male and female students with blindness benefited from the two strategies used in this study.

Conclusion

In conclusion, it was established that Jigsaw and Team pair-solo cooperative learning strategies produced higher self-efficacy of students with blindness in Basic Science than conventional lecture strategy. There is need therefore, to encourage teachers, curriculum developers to see Jigsaw and Team pair-solo as strategies that will boost students with blindness self- efficacy. The two strategies could also be useful to students without vision challenges. Finally, teaching and learning activities should be focused on group, team and pairs thereby waving away gender disparity among our students. Jigsaw and Team pair-solo will equally help male and female students with blindness to benefit maximally in their self-efficacy development, their gender differences notwithstanding.

Recommendations

The following recommendations are made based on the findings of this study.

1. Teachers should give learners, especially the students with blindness, opportunity to participate effectively in teaching and learning activities in their schools by engaging them in team tasks or studying in pairs.

2. Learners should be encouraged to recognize value and believe in the word self-efficacy so that it will help them in decision making that will pilot their survival in the society. This can be achieved through involving them in challenging tasks as well as stories of some important personalities in the society.

3. The students should also be encouraged to cooperate and interact among themselves for it will help to sustain the students' self-efficacy in learning activities. This can be possible by working together, showing love to each other, their individual challenges notwithstanding.

4. Emphasis should be on the provision of appropriate and adequate teaching aids such as Braille, computer sets and creation of an enabling environment by the government and non-governmental organizations.

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