

Research Article:

Effectiveness of Academic Intervention on Learning of Environmental Science among Slow Learners

Archana Kumari^{1*} and Alka Kataria²

¹Department of Home Science, IIS (Deemed to be University), Gurukul Marg, SFS Manasarovar, Hans Vihar, Kalyanpura, Mansarovar, Jaipur, Rajasthan 302020, India

²Department of Environmental and Life Sciences, IIS (Deemed to be University), Gurukul Marg, SFS Manasarovar, Hans Vihar, Kalyanpura, Mansarovar, Jaipur, Rajasthan 302020, India

*Corresponding author: 19archana.kumari@gmail.com

ABSTRACT

The present study was conducted to find out the impact of teaching with intervention module on learning of the subject Environmental Science among slow learners, studying in the third class of Government Upper Primary Schools of Jaipur, Rajasthan. Out of total 53 slow learners identified from three schools of Jaipur, Rajasthan, slow learners of two schools were taught with intervention module in two different classroom settings: Remedial classes and Inclusive classrooms. The slow learners of the third school were taught with conventional methods by their subject teacher. The result showed significant improvement in the post-test score of slow learners in Environmental Science after being taught with an intervention module in both remedial classes and inclusive classroom settings. However, slow learners taught in inclusive classrooms scored higher in post-test as compared to those taught in remedial classes. No significant difference was found in the post-test score of normal students taught in remedial and inclusive classroom settings. Dealing with slow learners in the classroom is a universal matter of concern for all educators across the world so, the encouraging findings of this study can be an example for them. A simple change in the curriculum, pedagogy and classroom sitting arrangement that is pairing normal students with slow learners (peer tutoring) in regular classroom can bring a remarkable change in the achievement of not only slow learners but also of normal students. Besides this, there is a need for specific strategies and policies for making these students perform on par with normal students, such as allocation of more budget for training the workforce and establishing science and technology resource centers. The findings and limitations of the study suggest several possibilities for future empirical research in other subject at primary, secondary and higher level of education.

Keywords: History of science education, Japan, rika, science

Published: 30 December 2022

To cite this article: Archana Kumari, & Alka Kataria (2022). Effectiveness of academic intervention on learning of Environmental Science among slow learners. *Asia Pacific Journal of Educators and Education*, 37(2), 147–166. <https://doi.org/10.21315/apjee2022.37.2.7>

INTRODUCTION

Towards the fulfillment of the goals of the universalisation of elementary education, the Government of India has been putting in its effort by opening primary schools, providing scholarships, upgrading the quality of education, and so on. But the dropout rate at the primary level (Class I to V) in India is 1.5% and in Rajasthan, it is 3.6% (Ministry of Education India, 2022) which is a serious matter of concern. Children who are retained in a class are more likely to drop out (Bhatti et al., 2020). One of the factors responsible for high retention rate and leading slowly towards dropout at primary level of education is the unsatisfactory academic progress of the students. There are some students in the class who contributes to a remarkable extent in making the average academic progress of the class unsatisfactory. They are slow learners, who are neither mentally retarded nor learning disabled (Kaznowski, 2004). Educationists label the child slow learner if the child has learning difficulties which may be the result of widespread institutional phenomenon (Graham & Slee, 2008). They have the innate capacity to learn but they need individual attention from their teachers to achieve up to the mark of normal students in the class.

Although the performance of slow learners in almost all the subjects is below expectation but struggling with science is the most common among them due to the abstract nature and implication of this subject in real-life situations (Pujar & Gaonkar, 2008; Sharma & Sansanwal, 2002). Slow learners are poor in applying their knowledge in real-life situations so there is a need to redesign science activities so that they can apply knowledge to learn new knowledge (Al-Mutawah et al., 2022). In spite of being an interesting and enriching subject, slow learners encounter some difficulty in Environmental Science regardless of how the content is presented (Pujarr & Gaonkar, 2008). The difficulties of slow learners further increased due to the inability of teachers to pay individual attention to those children may be because of the big size of the class and lack of time for the conduction of innovative experiments (Mandima, 2015). Besides this, there are many other drawbacks at the institutional level as marked by National Focus Group (2006), such as lack of experienced teachers, ineffective pedagogy and prevalence of the rote learning method which further aggravates the difficulties in learning especially for slow learners. They do not get concrete experience and find it difficult to learn through textbook content which is generally teacher-centred. One of the basic assumptions underlying the planning of curriculum is that it should be need-based rather than knowledge-based (Common & Pratt, 1981). The purpose of science education is to help students develop the scientific attitudes, abilities, and information they require to comprehend their environment, to deal with challenges they may face, and to make wise judgements about scientific and socio-scientific topics (Ozdem-Yilmaz & Bilican, 2020) but, knowledge-based curriculum and academic outcome-based assessment which is mostly practiced in schools generally inculcate the habit of learning without understanding among students and further lead to their inability to apply that knowledge in further reasoning (Ezeanya, 2019).

The problems faced by slow learners in Environmental Science in a regular classroom can be dealt with, in two ways. First, they can be given remedial classes on a regular basis specially for the subject Environmental Science along with the regular classes with normal

children (Banerjee et al., 2007), and secondly, they can be taught the subject in the inclusive classroom along with the normal children but with little modification in curriculum and pedagogical strategies (Waldron & McLeskey, 1998). Remedial classes are extra classes that can be organised for slow learners, and they are taught Environmental Science regularly with special instructional methods and pacing, regular revision, remedial and constructive guidance, and reformed material (Sudhakar, 2021). Slow learners are usually benefited from guided instruction, individualised instruction, peer tutoring and organisation of the curriculum combined with audio-visual learning materials provided in the remedial classes (Vasudevan, 2017; Banerjee et al., 2007).

Another option is that instead of giving extra remedial classes they are taught Environmental Science in regular classes with normal children but, with a little modification of the curriculum and pedagogy. A number of studies have found that a simple change in pedagogy and learning materials can bring significant change in the learning outcome of these children in inclusive classroom (Yadav & Tiwari, 2017; H. Hamzeh, 2014).

Planning a few activities in Environmental Science based on the need and interests of slow learners, and changing pedagogical strategies used by the teachers such as giving them extra time to complete their work (Shaw, 2010; Muthiah, 2014), pairing them with normal students (Sabitu & Francis, 2016), regular revision of the content (Malik et al., 2012), use concrete materials such as charts and models (Pujarr & Gaonkar, 2008) and positive reinforcement either in a remedial or inclusive classroom setting may lead to improvement in the academic performance of slow learners because in the theory of cognitive constructivism, learning is an active process and the child should be an active agent in their learning (Bruner, 2006), and this could be possible when an activity-based curriculum and pedagogy will be provided to them. The purpose of introducing Environmental Science at the primary level is to expose, be aware of, connect and sensitize towards the prevailing environmental issues which cannot be fulfilled by memorising the concept. Learning without understanding and rote learning does not provide the opportunity to the child to explore his/her self, family, neighborhood, and the country and develops a sense of belongingness with his community and finally his country. They need a learning situation in which they can construct their own knowledge by exploring and experimenting with their surroundings and acquiring first-hand knowledge beyond the textbook. Against the backdrop of this, the present study was undertaken with the aim to find out the impact of the academic intervention on learning environmental studies among slow learners.

OBJECTIVES

1. To determine the pre-test knowledge of children of primary class in the subject, Environmental Science.
2. To find out the effectiveness of the Academic Intervention Module on knowledge of Environmental Science of slow learners of primary classes in remedial classes. To find out the effectiveness of the Academic Intervention Module on knowledge of Environmental Science of slow learners of primary class in an inclusive classroom setting.

3. To find out the difference in the pre-and post-test scores of slow learners in Environmental Science taught in traditional classrooms.

LITERATURE REVIEW

In spite of achieving significantly below average, slow learners are neither classified as learning disabled nor as mentally retarded as the IQ scores of these students are above the demarcated IQ level for considering a child mentally retarded (Kaznowski, 2004). Their IQ score ranges between 70 to 89 (Mumpuniarti, 2017). They constitute around 18% of the student population (Mangal, 2007). They stand on the lowest rung of the academic ladder and are unable to meet the minimum academic demands (Kaznowski, 2004), yada of inclusive classrooms because of average cognitive abilities (Canter & Carroll, 1997) and may lead to early dropouts (Sprague & Walker, 2000). The factors found responsible for their academic backwardness were lack of interest (Samaresh, 2017), physical and psychosocial status of the students and educational and socioeconomic status of the family (Selvarajan & Vasanthaguma, 2022), inability to study on their own (Kannan et al., 2015), lack of cooperation, guidance and facility from the family, uncondusive family environment (Thakur et al., 2016) and some institutional phenomena practiced in inclusive classroom setting such as the prevalence of rote learning method (National Focus Group, 2006), inadequate opportunities for learning, untrained teachers and large class size (Khan, 2008) inappropriate teaching strategies used by teachers and their absenteeism (Davies, 2022). They have problems in understanding, comprehension, and expression of concepts which poses problems in understanding the concepts, especially of science subject (Pujar & Gaonkar, 2008).

On the basis of guidelines given in the National Curriculum Framework (2005, p. 48), science and social science have been integrated as Environmental Studies and introduced in primary classes. There is a developing acknowledgement among our curriculum planners, academics, and educational administrators that our science education at the school level fails to fulfil its objectives. In spite of being such an important subject, many students have personal disliking and fear for science subjects (Lutfuzzaman et al., 2006). Moreover, in the absence of teachers' intervention children develops the habit of rote learning leading to their inability to connect conceptual knowledge with real-life situation.

Academic Intervention for Slow Learners in Environmental Science

The research evidence shows many methods and strategies for accelerating science learning among slow learners. They are Metacognitive Scaffolding (Chen et al., 2015), use of Constructivist approach over traditional method (Samaresh, 2017), multisensory learning approach (Shylika, 2015), Counselling with intervention such as group activities and games, role play, case studies and situational analysis, open-ended stories for brainstorming (Banu, 2015), Computer Assisted Instruction Programme (Arthur-Baidoo et al., 2022) classes and students for the study. One-hundred one (101, concept mapping and expository instructional strategies (Udeani & Okafor, 2012), "Authentic Integration" (Treacy &

O'Donoghue, 2013), and intervention through educational television programme (Meenu, 2006). Use of picture book, chart, models and individualised instruction (Pujarr & Gaonkar, 2008), ICT (Wettasinghe, & Hasan, 2007), and role-play to minimise language barriers (Cyparsade et al.), concrete materials, flashcards, demonstration, focus on a single concept at a time, presentation of content in small size, provision of extra time to complete the task, strategic intervention materials such as guide cards (Contreras, 2018). One of the very effective strategies to improve the academics of slow learners is peer tutoring suggested in many types of research (Sabitu & Francis, 2016; Pujarr & Gaonkar, 2008). Use of keyword methods used in mnemonics instructional strategies for slow learners are found extremely effective in facilitating high levels of memorisation and recall of unfamiliar and monster vocabulary and terminology (Scruggs et al., 1994).

Slow learners' academic performance may significantly be improved by implementing an individualised education plan (Pujarr & Gaonkar, 2008). A modified curriculum with a combination of pictures, models, and charts must be provided to the slow learners as an academic intervention for effective assimilation, modification, and better learning. Ramlakshmi (2013) suggested compensatory along with remedial teaching for teaching slow learners. Shaw (2010) described some classroom practices such as repetition and regular practice and hands-on activities of discrete skills to reinforce learning, breaking down lessons into short concepts, with concrete teaching, computer-assisted instruction, change in the assessment process and peer tutoring to increase the learning of slow learners. The practices which have to be avoided by the teachers are the use of jargon and monster words to make the comprehension of the content easy for slow learners (Ishaq et al., 2020).

METHODOLOGY

Study Area and Participants

The study was carried out in Jaipur city of Rajasthan, the largest state situated in the northern part of India having 5.5% (6.85 crores) of the total population of the country)Jaipur is the capital of Rajasthan and the largest district in terms of population (66.26 Lakhs) with an average literacy rate of 75.51% (Ministry of Home Affairs, Government of India, 2022). The city of Jaipur is divided into 14 blocks. Out of 14 blocks of Jaipur city in Rajasthan, three blocks having Government Upper Primary schools were selected by purposive sampling techniques. From those three blocks, Sanganer block was selected randomly. Eight Upper Primary Government schools from Sanganer block were approached by the researcher, out of which four schools gave permission for conducting the intervention. To control the impact of socioeconomic factors on the learning of children, three Government Upper Primary schools from nearby wards were selected for the study. From these three upper primary government schools, the students of the 3rd class were included in the sample because any kind of intervention at an early stage often results in the best and effective outcome (Reynolds et al., 2001). The screening of slow learners was done on the basis of IQ scores of the students obtained in Standard Progressive Matrices (SPM) developed by Raven in 1938. In Raven's SPM, students are categorised on the basis of their IQ scores

into five groups, namely intellectually superior, above the average, intellectually average, slow learners, and intellectually defective. Students having IQ scores between the 25th percentile and the 5th percentile are categorised as slow learners. On the basis of this, out of total of 143 students in 3rd class, 53 students were identified as slow learners. The results are shown in Table 1.

Table 1. School wise students and slow learners identified in 3rd class

No.	School name	No. of students in 3rd class	No. of slow learners identified in 3rd class
1	Government Upper Primary School, Sumernagar	46	16
2	Government Upper Primary School, Haziyawala	57	23
3	Government Upper Primary School, Badmohanpura	40	14
Total		143	53

Instruments

Three tools were used for the present study.

1. For screening of slow learners, Raven’s Standard Progressive Matrices (2000 a) was administered to all students of the third class of selected government schools.
2. Self-structured questionnaire was used to examine the knowledge of slow learners in Environmental Science subjects before and after the administration of the instruction module. The questionnaire was prepared with the help of the subject teachers, and it included 25 questions from two selected chapters of the textbooks of Environmental Science by the Rajasthan State Education Board. The type of questions included in the pre-test was multiple-choice, fill-in-the-blanks, one-word answer, and true/false type. For example: “Where do we get fruits from?”, “Write the name of food items that can be eaten raw”, Write any one method, which you can practice at home for water purification”, “Which of the following is a waterborne disease?” The obtained score was summed up individually for all students. The same test was used for the post-test of all students.
3. Self-prepared academic intervention module for two selected chapters of Environment science. The Cognitive Constructivism Theory of Bruner (1957), Cognitive Load Theory of John Sweller (2011), Cognitivism by Gagne’s learning theory (1962) and Co-Constructivism Theory of Vygotsky were used in the development of the intervention module. For those two chapters, namely “Jal hi Jeevan Hai” and “Bhojan evam Khadhya Padarth”, 22 worksheets on topics such as sources of water and food, raw and cooked food, simple cooking methods and utensils used at home for cooking, sources of water contamination, simple water purification methods were prepared. Besides this, four activities, for example, “Food Basket”, “Dirty Bear”, two projects on “Balanced Thali” and “Show and Tell” for different sources of water, and a picture book named “Dadaji ka Khana Khazana” was prepared, taking into consideration the availability of resources in Government schools undertaken in the study. Once the module was prepared,

it was validated by a panel of eleven members, and the suggestions given by the experts were included in the intervention module.

Pilot Study

A pilot study was conducted on 50 students of class fourth of government upper primary schools assuming that they had already studied the chapters given in the module so they will understand and solve the module. During the pilot study, no changes were suggested in the pre- and post-test questionnaire may be because it was prepared with the help of subject teachers but, a few changes in the intervention module related to content and pictures were suggested by the students and teachers. They were- use of local names of cereals instead of common names, replacing or increasing the visibility of a few pictures, and providing more time for solving some worksheets. All the changes were included in the intervention module.

Procedure

The present study examined the impact of academic intervention on learning of Environmental Science by using a randomised pre-test/post-test design. The whole study was conducted in four phases namely: screening of slow learners, administration of pre-test, implementation of the academic intervention, and administration of post-test.

Phase I: Screening of slow learners

Screening of slow learners was done with Raven's STM (Raven, 1938) test which was administered to all students of the third class for identifying slow learners in all three schools. In the present study, students who scored between the 25th percentile and the percentile in Raven's SPM test were categorised as slow learners. Students with any kind of disability or illness were not included in the sample.

Phase II: Pre-test of students

Before conducting the intervention, a pre-test was conducted for slow learners as well as normal students of all the sampled schools. It was ensured that the selected chapters were already taught by their subject teacher before the conduction of pre-test in all the three schools taken into the sample. The scores obtained in pre-test by the students were tabulated and analysed.

Phase III: Intervention

The next phase was to teach the students with the intervention module. Since it was not practically possible to organise remedial or inclusive classes for slow learners of three schools at a common place as they were located at little distance from each other. So, three schools were randomly selected as experimental group I, experimental group II and control group. The slow learners of the experimental group I were taught the subject in the remedial classroom for two months (three days a week), which means apart from regular classes slow learners were segregated and given extra classes and in those extra classes, they

were taught the subject with an intervention module. The slow learners of Experimental group II were also taught with the intervention module but in an inclusive classroom setting, where normal students were also taught with slow learners in the same classroom for the same time period. However, the slow learners of the control group were not taught with the intervention module. They were taught with the conventional method by their regular subject teacher in the regular classroom.

Intervention in the remedial classroom: Approval from their parents and the principal of the school was taken for remedial classes after school hours. The schedule for eight weeks of intervention including time, topic, methods, and materials, was prepared. Revisions of previously covered topics were planned on a regular basis in the schedule prepared for remedial classes. Every new concept was first introduced to the students with the help of a concrete material either with real objects like cereals, pulses, or picture cards. Gradually it was shifted to the semi-concrete way of instruction and finally, it was taught in abstract form. Peer tutoring was also implemented where two slow learners were grouped together and asked to solve the problems and do the projects together with the help of each other.

Intervention in the inclusive classroom: The intervention in the inclusive classroom followed the same pattern as in the remedial classroom which is introducing the concept in concrete form with the help of real objects and picture cards followed by semi-concrete method in which they applied the learned concept in solving hypothetical problems from their real-life situation. Finally, the worksheets having problems in the abstract form was given to the students to solve. But, in this experimental group, the group formed for peer tutoring was different from the peer tutoring group formed in remedial classes. In the inclusive classroom settings, a normal student was paired with slow learners for peer tutoring and they were asked to sit together during intervention classes. The method adopted for revision was also different in the inclusive classroom setting. Before beginning the next concept, the normal student was asked to brief the previously taught topic to his/her peer partner. Assuming that very often slow learners would take a little longer to complete the given task, normal students grouped with those slow learners were asked to help their peer partner.

Phase IV: Post-test

The last phase was the administration of the post-test after two months of intervention. Post-test was administered to slow learners of experimental group I, taught in the remedial classrooms, and the control group. The same post-test was administered to slow learners as well as normal students of experimental group II taught in inclusive classroom settings.

Data Analysis

The obtained score from pre-test and post-test was analysed. Only quantitative analysis of the data obtained was not sufficient to achieve the objectives of the study so, qualitative analysis was also conducted. Statistical calculation such as descriptive statistics, *t*-test, one way ANOVA was done with SPSS version 25.

RESULTS

Table 2. Pre-test scores obtained by all students in Environmental Science

Schools	N	Mean	SD	Minimum	Maximum	Range
Experimental group I (Remedial)	46	10.60	5.24	1.00	20.00	19.00
Experimental group II (Inclusive)	57	10.52	5.87	0.00	19.00	19.00
Control Group	40	9.07	4.26	1.00	19.00	18.00

The mean score shown in Table 2, reveals that students of experimental group I (mean = 10.60) and experimental group II (mean = 10.52) scored similar marks in the pre-test. However, the score of students of the control group in Environmental Science was a little lower (mean = 9.07) than the scores obtained by the other two groups. The minimum marks obtained by students of all three schools range from zero to one and maximum marks range from 18.00 to 19.00. The mean pre-test scores show that the level of understanding of the subject of Environmental Science was more or less the same among students of all three schools.

Table 3. ANOVA for pre-test score in Environmental Science

	Sum of square	df	Mean square	F	Sig.
Between group	63.97	2	31.98	1.154	0.318
Within group	3881.942	140	27.72		(NS*)
Total	3945.916	142			

Note: *NS – Not Significant

An analysis of variance shown in Table 3 indicates that the pre-test score of students in all three schools in Environmental Science was not significant at 0.05 level of significance, $F = 1.154$, $p = 0.318$. It can be inferred that there is no significant difference in mean scores of pre-tests of students of experimental groups I, II and the control group in Environmental Science, and the level of understanding of the subject was more or less the same among students of all three schools. As discussed with the principals of schools, the probable reason for the low performance of students was the absenteeism of both the subject teacher and students and the almost negligible use of audio-visual aids or hands-on activities used by teachers while teaching.

Table 4. Comparing the pre- and post-test scores obtained by slow learners taught in remedial classes

Group	Test scores	Mean	N	SD	t-value	Sig (2-tailed)
Experimental group I (Remedial classes)	Pre-test scores	5.12	16	2.39	20.46	0.000**
	Post-test scores	15.81	16	1.97		

Note: **Significant at 0.01 level of significance

Table 4 shows a comparison between the pre- and post-test scores in Environmental Science obtained by slow learners taught in remedial classes. A significant difference at 0.01 level of significance was also found in pre- and post-test scores of slow learners taught with intervention module in remedial classes ($t = 20.46$). The mean values show a three times higher score in post-test as compared to pre-test score among slow learners. Initially when the slow learners were taught with concrete materials and given worksheets for revision and practicing the concept taught in remedial classes, many of them were not able to solve the problems given in worksheets but when they were taught the same concept with activities, and projects, they not only enjoyed the activity but also improved their ability to solve application-based problems given in the worksheets. Activities and projects provided them with an opportunity to apply their knowledge in real-life situations.

Table 5. Comparing the pre and post-test scores obtained by slow learners taught in inclusive classes

Group	Test scores	Mean	N	SD	t-value	Sig (2-tailed)
Experimental group II (Inclusive classes)	Pre-test scores	5.21	23	4.11	11.42	0.000**
	Post-test scores	18.69	23	3.69		

Note: **Significant at 0.01 level of significance

Table 5 shows a comparison between the pre- and post-test scores in Environmental Science obtained by slow learners taught in inclusive classes. When slow learners were taught with normal students with intervention module in inclusive classroom settings, a significant difference at 0.01 level of significance was also found in pre and post-test scores of slow learners ($t = 11.42$). The mean values show a three times higher score in post-test as compared to pre-test score among slow learners.

Table 6. Comparing the pre and post-test scores obtained by slow learners taught in control group

Group	Test score	Mean	N	SD	t-value	Sig (2-tailed)
Control group	Pre-test scores	5.00	14	2.54	0.540	0.598 (not significant)
	Post-test scores	4.71	14	2.58		

Table 6 shows a comparison between the pre- and post-test scores in Environmental Science obtained by slow learners taught in control group. The difference in pre and post-test scores of slow learners taught with the convention method in the control group was found non-significant ($t = 0.540$). In fact, the mean score of slow learners in the control group decreased slightly in the post-test. Many slow learners reported during the post-test that they have forgotten many topics as it was taught once and never got revised by the teachers. When asked to the subject teacher, she justified this saying that most of the time teachers are on some other duties given by the government so find very little time for planning activities and preparing concrete teaching-learning materials for students. They somehow try to complete the curriculum and left with no time for revision.

Table 7. The difference in post-test scores of slow learners in Environmental Science in the remedial and inclusive classroom setting

Experimental Group		Mean	N	SD	t -value	Sig (2-tailed)
Post-test scores in Environmental Science	Experimental group I (Remedial)	15.81	16	1.97	2.85	.007
	Experimental group II (Inclusive)	18.69	23	3.69		

Table 7 shows the difference in post-test scores of slow learners in Environmental Science in the remedial and inclusive classroom setting. The value of t is 2.84 which is significant at 0.01 level of significance. A post-test score of students taught in inclusive settings (mean = 18.69) is higher than the score achieved by slow learners taught in remedial classes (mean = 15.81). The difference in the achievement of slow learners in these two classroom settings may be contributed to peer tutoring because all the activities and worksheets used in the intervention were the same in the two groups, except for the pairing of students for peer tutoring. Slow learners were paired with another slow learner in the remedial classroom whereas, in the inclusive classroom, slow learners were paired with normal students for peer tutoring. It was observed during the intervention that before asking their doubts to the researcher, slow learners were discussing that with their peer partners and a sense of responsibility and willingness to help their slow learning partners was also observed.

Table 8. Comparing the pre and a post-test scores of normal students in an inclusive classroom in Environmental Science

Pre- and post-test	Mean	N	SD	t -value	Sig (2-tailed)
Pre-test scores in Environmental Science	14.11	34	3.79	5.74	0.000***
Post-test scores in Environmental Science	17.55	34	3.68		

Note: ** Significant at 0.01 level of significance

A significant difference was found in the pre and post-test scores of Environmental Science among normal students ($t = 5.74$), as shown in Table 8. The mean score reveals that the post-test score of normal students taught with slow learners in an inclusive setting

(mean = 17.55) is higher than their pre-test scores (mean = 14.11) in Environmental Science. It can be inferred from the above table that, the presence of slow learners in the inclusive classroom does not deteriorate the academic achievement of normal students in Environmental Science.

Table 9. ANOVA for a post-test score in Environmental Science

	Sum of square	df	Mean square	F	Sig.
Between group	108.02	2	54.011	4.605	0.012
Within group	1642.18	140	11.73		
Total	1750.21	142			

One-way ANOVA was conducted to compare the impact of the academic intervention on the achievement in Environmental Science. An analysis of variance shown in Table 9 indicates that the effect of the intervention on achievement of Environmental Science was significant at 0.05 level of significance, $F(2,140) = 11.73, p = 0.012$. It can be inferred that there is a difference in the mean post-test scores of students of experimental group I, II and control group in Environmental Science.

Table 10. ANOVA (Post Hoc Test) for post-test score in Environmental Science

	School	Mean difference	Std. Error	Sig.	95% confidence interval	
					Lower bound	Upper bound
Experimental group I (Segregated)	Experimental group II (Inclusive)	-1.582	0.678	0.055	-3.19	0.025
	Control group	-2.115	0.740	0.014	-3.86	-0.361
Experimental group II (Inclusive)	Experimental group I (Segregated)	1.582	0.678	0.055	-0.025	3.19
	Control group	-0.532	0.706	0.732	-2.20	1.14
Control group	Experimental group I (Segregated)	2.115	0.740	0.014	0.361	3.86
	Experimental group II (Inclusive)	0.532	0.706	0.732	-1.141	2.20

Table 10 shows the ANOVA Post Hoc Test for post-test score in Environmental Science. The mean of post-test score in Environmental Science for students of experimental group I and control group differ significantly at 0.05 level of significance. However, the other differences between experimental group II and the control group and between experimental group I and II is not significant.

DISCUSSION

In a heterogeneous classroom, all students do not learn at a similar pace. Some of them learn fast and some students learn at a slow rate. There are also few students, who have limited intellectual endowment (Shaw, 2010) by nature and cannot keep pace with their classmates (Khan, 2008), commonly termed as slow learners or dull students. The reason of a child becoming slow learner is not always their intellectual deficiency but the existing institutional phenomena like curriculum planned for keeping in mind the average students, ineffective pedagogy (Thakur et al., 2016), lack of joyful learning and rote memorisation (Kannan et al., 2015), score-based evaluation system and lack of adequate numbers and inefficiency of teachers (Zafira & Gunansyah, 2018) is responsible for making a child slow learner.

In the pre-test, students of all the three schools performed poorly as they all were taught with traditional methods by their subject teachers. A conventional teaching method is not enough to cater to the diverse need of the students of a classroom and especially of slow learners (Subban, 2006). In the absence of any special pedagogical strategies followed by the subject teachers for these learners (Mumpuniarti, 2017) and negligible use of teaching aids while teaching, many times slow learners lose interest and motivation for learning (Samaresh, 2017).

Academic improvement of slow learners can be improved, when teachers use concrete materials and multimodal strategies which means use of visual auditory and kinesthetic teaching learning materials for teaching (Ganvir & Ganvir, 2016). Activity based learning and provision of extra time to complete the task, helps them to a great extent in making academic progress (Shaw, 2010; Muthiah, 2014). In this study a significant improvement was found in the post-test score of slow learners taught in remedial Classes. The findings of this study is supported by Pujar and Gaonkar (2008), that when slow learners are taught with chart, pictures and peer tutoring method in remedial classes, they make significant improvement in academics. Engaging students as an active learner through planned activities and projects further contribute to enhancing the attention span of the child (Joseph & Abraham, 2019), and ultimately helps them to stand on the superior category of academic ladder (Muthiah, 2014).

In the inclusive classroom, slow learners were taught with normal students with the same intervention module consisted of worksheets, activities, projects and picture book and a significant improvement in their post-test score was found in this experimental group too. Teaching with concrete materials such as real objects, activities, and projects in remedial classes or even in the inclusive classroom provides the learners an opportunity to discover and construct their own knowledge and enables them to connect the concept with real-life situations (Pujar & Gaonkar, 2008). It facilitates learning with understanding, in-depth investigation and collaborative experiment rather than rote memorisation followed in conventional teaching (Hartini et al., 2017). The colorful pictures used in picture book and worksheets add further to their interest in learning (Epstein, 1994).

Slow learners have poor memory because of rigid and insufficient critical thinking, so revision plays a very important role in retaining the learned concept in memory (Malik et al., 2012), and in the intervention module, extra worksheets having problems based on their daily life and their surroundings were planned, which were given to students to practice at home which might contribute in increasing their working memory.

Waldron and McLeskey (1998) found in their study that students with special needs taught in inclusive school settings, made comparable progress as compared to the students taught in remedial classes. Kaznowski (2004) found the performance of slow learners are poor, irrespective of the classroom settings. So, rather than focusing more on educational settings suitable for slow learners, educational alternatives such as modification in curriculum, pedagogy, and assessment strategies are required to bring slow learners at par with the average students whether, it is remedial setting or inclusive classroom setting (Malik et al., 2012; Mumpuniarti, 2017).

The slow learners taught in inclusive classrooms performed better than those taught in remedial classrooms. All the activities and project conducted in both the classroom were same except the pairing of students for peer tutoring. In remedial setting peer group was made by collaborating two slow learners together whereas in inclusive classroom one normal student was paired with one slow learner during intervention. Teaching children with diverse abilities in inclusive classrooms may serve as a catalyst for improving the educational attainment of students with borderline intellectual functioning (Levine & Barringer, 2008). Peer tutoring was found one of the effective interventional strategies which can be practiced on a regular basis in the inclusive classroom setting by pairing an average or above-average student with a slow learner (Malik et al., 2012; Sabitu & Francis, 2016). In the method of peer tutoring based on the co-constructivism concept of Vygotsky both the peer involved in investigation and develop a shared understanding. They get opportunity to construct their own knowledge by connecting new experience with their existing experiences (Samaresh, 2017). Collaborative group learning strategy facilitated students in relating their learning to real world problems and provided opportunity to learn at his/her own pace (Samaresh, 2017).

Since slow learners were taught with normal students in inclusive classroom, the impact of intervention on normal students was also analysed in this study. The finding shows significant improvement in post-test scores in Environmental Science of not only the slow learners, but the normal students also improved significantly in terms of score in the subject and at the same time they developed a sense of confidence and built a good relationship with slow learning students during peer tutoring. The findings are crucial for the continued advancement of inclusive education. Szumski et al. (2022) found in their study that when normal students are taught with children with special needs, they neither lose nor gain in academics.

CONCLUSION

Though the study was limited to the intervention in only one subject that is Environmental Science on students of third classes of upper primary government schools, it brings forth the impact of this intervention on the academic achievement of slow learners taught in remedial and inclusive classroom settings. The academic intervention in addition to regular classroom teaching was found effective in improving the academic performance in Environmental Science of slow learners and normal students in both classroom settings. Problems related to dealing with slow learners in regular classrooms are not limited to the Indian context but it is a universal problem and has to be dealt with by the academician, policymakers, and curriculum planners of almost every country. The findings from this study are encouraging and can be exemplary not only for the educators of India or other countries of Asia Pacific region but also for the educators of other countries. There is a need for specific strategies and policies for making these students perform on par with normal students. The possible strategies could be:

1. Allocating more budget for preparing the skilled workforce who can prepare intervention strategies and use it as a part of their pedagogy to cater to the diverse need of the classroom.
2. Allocating more budget for establishing science and technology resource centers across the country so that teachers of government schools can have access to those resources. Most of the interventions involving technological methodologies such as smart classroom, and custom-designed software is very expensive and cannot be afforded by government schools as they have limited resources.
3. The methods used in the intervention of the present study like peer tutoring, picture book, and games can be used by the teachers as it does not put an extra burden in terms of resources.
4. A simple change in the classroom sitting arrangement that is pairing normal students with slow learners (peer tutoring) in regular classroom can bring a remarkable change in the achievement of not only slow learners but also of normal students.
5. Teaching slow learners in an inclusive classroom alongside their peers will not only save the extra effort, time, and resources required for teaching them in remedial classrooms but will also help in eliminating the feelings of getting discriminated among slow learners and boost their self-confidence.
6. There is an additional danger of failure and dropping out of school at the secondary level due to the current de facto procedure of promoting students to the next level of grades without improving their competencies at the primary level. Thus, including the intervention in regular instruction at the start of the session may help in achieving the desired results and avoid human resource waste.
7. Curriculum should be planned in such a way as to provide ample opportunities to students for exploration, investigation, and experimentation for making connections between a concrete concept in the subject and abstract thinking processes.

8. Instead of discriminating or labeling them as 'slow learners, if they are supported by teachers, parents, and peers, they can overcome the barriers in their performance and can achieve at par with the normal students.

In addition to putting into practice the aforementioned strategies, the government should direct empirical research on the impact of intervention in other subjects also at primary, secondary and higher education levels.

ACKNOWLEDGEMENTS

The authors are grateful to IIS (Deemed to be a University), Jaipur for providing the necessary infrastructure, academic environment, and continuous support to conduct research work. The author(s) received no financial support for the research, authorship and/or publication of this article.

REFERENCES

- Al-Mutawah, M., Mahmoud, E., Thomas, R., Preji, N., & Alghazo, Y. (2022). Math and science integrated curriculum: Pedagogical knowledge-based education framework. *Education Research International*, 2022, 1–10. <https://doi.org/10.31586/ojmr.2022.324>
- Arthur-Baidoo, F., Azumah, D. A., Osei-Manu, F., & Annan, M. K. (2022). Learners' perceptions of computer-assisted instruction approach teaching and learning of photosynthesis in biology lessons. *Trends Journal of Sciences Research*, 1(1), 8–16. <https://doi.org/10.31586/ojmr.2022.324>
- Banerjee, A. V., Cole, S., Duflo, E., & Linden, L. (2007). Remedying education: Evidence from two randomized experiments in India. *The Quarterly Journal of Economics*, 122(3), 1235–1264. <https://doi.org/10.1162/qjec.122.3.1235>
- Banu, N. (2015). Promoting resilience among academically backward children. *International Journal of Science and Research*, 6(2), 132–141.
- Bhatti, A. M., Parveen, S., & Ali, R. (2017). Integration of speaking and writing skills for better grades: perception of graduate students in Pakistani public sector colleges. *International Journal of Research and Development in Social Science*, 3(2), 1–14. <https://doi.org/10.5281/zenodo.3987812>
- Bruner, J. S. (2006). *In search of pedagogy volume I: The selected works of Jerome S. Bruner 1957–1978*. Taylor & Francis Ltd.
- Canter, A. S., & Carroll, S. A. (1997, 30 November). *Helping children at home and school: Handouts from your school psychologist*. ERIC. <https://eric.ed.gov/?id=ED420026>
- Chen, S., Huang, C.-C., & Chou, T.-L. (2015). The effect of metacognitive scaffolds on low achievers' laboratory learning. *International Journal of Science and Mathematics Education*, 14(2), 281–296. <https://doi.org/10.1007/s10763-015-9691-9>
- Common, D. L., & Pratt, D. (1981). Curriculum: Design and development. *Canadian Journal of Education/Revue Canadienne De L'éducation*, 6(4), 122. <https://doi.org/10.2307/1494364>

- Contreras, S. J. (2018,). *Utilization of manipulative and interactive strategic intervention material (MI-SIM) in chemistry 9*. Asian Society of Teachers for Research, Inc. Retrieved from https://www.academia.edu/43092083/Utilization_of_Manipulative_and_Interactive_Strategic_Intervention_Material_MI_SIM_in_Chemistry_9
- Cyparsade, M., Auckloo, P., Belath, I., Dookhee, H., & Hureeram, N. (2013). Beating the language barrier in science education: In-service educators' coping with slow learners in Mauritius. *Science Education International*, 24(4), 402–415.
- Davies, E. (2022, 25 April). *Absence: Electoral cycles and teacher absenteeism in India*. Paper presented at the 2022 annual meeting of the American Educational Research Association. Retrieved from the AERA Online Paper Repository. <https://doi.org/10.3102/18883949>
- Epstein, J. N. (1994). *Accelerating the literacy development of disadvantaged preschool children: An experimental evaluation of a Head Start emergent literacy curriculum*. [Doctoral dissertation, State University of New York at Stony Brook]. ProQuest Dissertations and Theses Global.
- Ezeanya, C. A. (2019). *Indigenous Knowledge and education in Africa*. Springer Singapore.
- Gagne, R. M. (1962). Military training and principles of learning. *American Psychologist*, 17(2), 83–91. <https://psycnet.apa.org/doi/10.1037/h0048613>
- Ganvir, S., & Ganvir, S. (2016). Strengthening learning styles may improve the academic performance of slow learners. *Journal of Education Technology in Health Sciences*, 3(2), 61–64. <https://doi.org/10.5958/2393-8005.2016.00006.1>
- Graham, L. J., & Slee, R. (2008). An illusory interiority: Interrogating the discourse/s of inclusion. *Educational Philosophy and Theory*, 40(2), 277–293. <https://doi.org/10.1111/j.1469-5812.2007.00331.x>
- H. Hamzeh, M. A. (2014). Teaching strategies used by mathematics teachers in the Jordan public schools and their relationship with some variables. *American Journal of Educational Research*, 2(6), 331–340. <https://doi.org/10.12691/education-2-6-1>
- Hartini, A., Widyaningtyas, D., & Mashluhah, M. I. (2017). Learning strategies for slow learners using the project-based learning model in primary school. *Journal Pendidikan Inklusi*, 1(1), 29–39. <https://doi.org/10.26740/inklusi.v1n1.p29-39>
- Ishaq, K., Mat Zin, N. A., Rosdi, F., Abid, A., & Ijaz, M. (2020). The impact of ICT on students' academic performance in Public Private Sector Universities of Pakistan. *International Journal of Innovative Technology and Exploring Engineering*, 9(3), 1117–1121. <https://doi.org/10.35940/ijitee.c8093.019320>
- Jeba Shylika, J. (2015, 1 April). *A study to evaluate the effectiveness of multisensory learning approach on academic performance of slow learners among school age children in a selected school at Kulasekharam*. EPrints@Tamil Nadu Dr MGR Medical University. Retrieved from <http://repository-tnmgrmu.ac.in/11758/>
- Joseph, L., & Abraham, S. (2019). Adaptive e-learning system for slow learners based on Felder-Silverman learning style model. In A. Luhach, D. Jat, K. Hawari, X. Z. Gao, & P. Lingras (Eds.), *Advanced informatics for computing research, ICAICR 2019. Communications in Computer and Information Science* (vol. 1075). Singapore: Springer. https://doi.org/10.1007/978-981-15-0108-1_13

- Kannan, L., Vijayaragavan, P. V, Shah, P. B., Suganathan, S., & Praveena, P. (2015). Factors contributing decreased performance of slow learners. *International Journal of Scientific & Technology Research*, 4(3), 58-61.
- Kaznowski, K. (2004). Slow learners: Are educators leaving them behind? *NASSP Bulletin*, 88(641), 31-45. <https://doi.org/10.1177/019263650408864103>
- Khan, S. M. (2008, 15 August). Education of slow learner. *Education Blog*. Retrieved from <https://research-education-edu.blogspot.com/2008/08/education-of-slow-learner.html>
- Levine, M., & Barringer, M-D. (2008, 30 April). *Brain-based research helps to identify and treat slow learners*. Education Digest: Essential Readings Condensed for Quick Review. Retrieved from <https://eric.ed.gov/?id=EJ799025>
- Lutfuzzaman, A. A. K. M., Muhammad, N. M., & Hasan, A. S. M. T. (2006). Developing a quality mathematics education culture in Bangladesh. *Bangladesh Education Journal*, 5(2), 25-34.
- Malik, N. I., Rehman, G., & Hanif, R. (2012). Effect of academic interventions on the developmental skills of slow learners. *Pakistan Journal of Psychological Research*, 27(1), 135-151.
- Mandima, A. (2015). *The teaching and learning of slow learners in mathematics at Secondary School level in Gweru Zimbabwe*. [Doctoral dissertation, Midlands State University].
- Mangal, S. K. (2007). *Educating exceptional children: An introduction to special education*. PHI Learning Pvt. Ltd.
- Meenu. (2006). Utilisation and effectiveness of educational television programs at primary school level. *Indian Educational Review*, 41(1), 79-89.
- Ministry of Education India. (2022). *Unified District Information System for Education Plus (UDISE+) 2021-22*. Department of School Education and Literacy, Government of India. Retrieved from https://www.education.gov.in/sites/upload_files/mhrd/files/statistics-new/udise_21_22.pdf
- Ministry of Home Affairs, Government of India. (2022, 15 June). *PCA OTH: Primary census abstract data for others, India & States/UTS-2011*. Retrieved from <https://censusindia.gov.in/nada/index.php/catalog/43477>
- Mumpuniarti, M. (2017). Challenges faced by teachers in teaching literacy and numeracy for slow learners. *Journal of Sustainable Development*, 10(3), 243. <https://doi.org/10.5539/jsd.v10n3p243>
- Muthiah, R. (2014). A study on the remediation of disorders in the speaking ability of the slow learners in VI standard taught under activity centered teaching of English. *IOSR Journal of Research & Method in Education*, 4(6), 1-9. <https://doi.org/10.9790/7388-04640109>
- National Curriculum Framework. (2005). *National Curriculum Framework 2005*. National Council of Educational Research and Training, New Delhi, India. Retrieved from <https://ncert.nic.in/pdf/nc-framework/nf2005-english.pdf>
- National Focus Group. (2006). *National focus group position paper on teaching of mathematics*. New Delhi: NCERT. Retrieved from <https://ncert.nic.in/pdf/focus-group/math.pdf>
- Ozdem-Yilmaz, Y., & Bilican, K. (2020). Discovery learning-Jerome Bruner. In B. Akpan, & T.J. Kennedy (Eds), *Science education in theory and practice* (pp. 177-190). Springer.

- https://doi.org/10.1007/978-3-030-43620-9_13
- Pujarr, L. L., & Gaonkar, V. (2008). Instructional strategies to accelerate science learning among slow learners. *Karnataka Journal of Agricultural Science*, 21(4), 553--556.
- Ramlakshmi, T. B. (2013). Slow learner: Role of teachers in developing the language skills. *Shanlax International Journal of English*, 2(1), 21–28.
- Raven, J. C. (1938). *Appendix: G, Raven's progressive matrices along with the manual*. StuDocu. Retrieved from <https://www.studocu.com/en-us/document/studocu-university/social-psychology/ravens-standard-progressive-matrices/10824641>
- Reynolds, A. J., Temple, J. A., Robertson, D. L., & Mann, E. A. (2001). Long-term effects of an early childhood intervention on educational achievement and juvenile arrest. *JAMA*, 285(18), 2339. <https://doi.org/10.1001/jama.285.18.2339>
- Sabitu, A. M., & Francis, T. T. (2016). Impact of class-wide peer-tutoring strategy on secondary school slow learners' performance in redox reactions in Funtua, Katsina State Nigeria. *Issues and Ideas in Education*, 4(2), 83–97. <https://doi.org/10.15415/iie.2016.42007>
- Samaresh, A. (2017). Effectiveness of constructivist approach on academic achievement in science at secondary level. *Educational Research and Reviews*, 12(22), 1074–1079. <https://doi.org/10.5897/err2017.3298>
- Scruggs, T. E., Mastropieri, M. A., & Sullivan, G. S. (1994). Promoting relational thinking: Elaborative interrogation for students with mild disabilities. *Exceptional Children*, 60(5), 450–457. <https://doi.org/10.1177/001440299406000507>
- Selvarajan, P., & Vasanthagumar, T. (2022). The impact of remedial teaching on improving the competencies of low achievers. *International Journal of Social Science & Interdisciplinary Research (IJSSIR)*, 11(1), 283–287.
- Shaw, S. R. (2010). Rescuing students from the slow learner trap. *Principal Leadership*, 10(6), 12–16.
- Sharma, A., & Sansanwal, D. N. (2002). Comparison among video-based instructional strategies for teaching science at class IX level in terms of achievement. *Indian Educational Abstracts*, 3(1), 31–32.
- Sprague, J., & Walker, H. (2000). Early identification and intervention for youth with antisocial and violent behavior. *Exceptional Children*, 66(3), 367–379. <https://doi.org/10.1177/001440290006600307>
- Subban, P. (2006). Differentiated instruction: A research basis. *International Education Journal*, 7(7), 935–947.
- Sudhakar, D. J. (2021, 4 February). *Remedial classes enables the child to gain positive impact by filling his cognitive gaps!!!!* LinkedIn. Retrieved from <https://www.linkedin.com/pulse/remedial-classes-enables-child-gain-positive-impact-filling-sudhakar/>
- Sweller, J. (2011). Cognitive load theory. *Psychology of Learning and Motivation*, 55, 37–76. <https://doi.org/10.1016/b978-0-12-387691-1.00002-8>
- Szumski, G., Smogorzewska, J., & Grygiel, P. (2022). Academic achievement of students without special educational needs and disabilities in inclusive education—does the type of inclusion matter? *PLOS ONE*, 17(7), e0270124. <https://doi.org/10.1371/journal.pone.0270124>

- Thakur, S., Agrawal, N., Singh, R. (2016). Prevalence and causes of academic backwardness among school children of Udham Singh Nagar and Nainital District. *Progressive Research: An International Journal Society for Scientific Development*, 11(3), 373–375
- Treacy, P., & O'Donoghue, J. (2013). Authentic integration: A model for integrating mathematics and science in the classroom. *International Journal of Mathematical Education in Science and Technology*, 45(5), 703–718. <https://doi.org/10.1080/0020739x.2013.868543>
- Udeani, U., & Okafor, P. N. (2012). The effect of concept mapping instructional strategy on the Biology achievement of senior secondary school slow learners. *Journal of Emerging Trends in Educational Research and Policy Studies*, 3(2), 137–142.
- Vasudevan, A. (2017). Slow learners: Causes, problems and educational programs. *International Journal of Applied Research*, 3(12), 308–313.
- Waldron, N. L., & McLeskey, J. (1998). The effects of an inclusive school program on students with mild and severe learning disabilities. *Exceptional Children*, 64(3), 395–405. <https://doi.org/10.1177/001440299806400308>
- Wettasinghe, M., & Hasan, M. (2007). *Investigating the efficacy of the use of ICT for slow learners: Case studies in Singapore Primary Schools*. Paper presented at The ICL2007 Conference, 26–28 September, Villach, Austria. <https://telearn.archives-ouvertes.fr/hal-00197252/document>
- Yadav, B., & Tiwari, R. K. (2017). Effect of skill based training on slow learner's science and mathematics ability. *International Inventive Multidisciplinary Journal*, V(IX), 52–64.
- Zafira, R., & Gunansyah, G. (2018). Teacher pedagogical competencies in inclusive elementary school. *International Journal of Educational Science and Research*, 8(3), 95–106. <https://doi.org/10.24247/ijesrjun201813>