Blended Learning Strategies on Teaching Light Concepts for Underprivileged School Students

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ABSTRACT

Despite the growth in ICT applications in education, inequalities continue to exist. Students and teachers inadvertently suffer in underprivileged schools - facing isolation, neglect, coupled with inadequate pedagogic attention, poor infrastructure and insufficient resources. Science needs to be taught in the class room in a way that it stimulates the mind of the children to inquire and execute scientifically. A blended learning technique is employed for capacity building on light-based technologies. We have developed an innovative methodology of interlinking the concepts and activities prescribed in the science text books using hands-on minds-on intra-curricular experimental kits. The kits serve as essential alternative to the lack of any equipment in most of the schools and can be used in conjunction with textbooks. This new teaching-learning environment has been successfully tried and tested in different schools. All the stakeholders involved have responded positively and have expressed satisfaction of having understood the latent principles more clearly than when taught only through the traditional method of teaching.

KEYWORDS

Blended learning, Underprivileged, Teaching optics, altruistic, audio-visual room, Training

INTRODUCTION

Scientific learning cannot be confined within the four walls of the classroom. Understanding the physical principles involves a linkage of classwork with lab and field work followed by a project [1]. As envisaged in the National Curriculum Framework (NCF 2005), India [2], there is an imperative need for the learner to: understand and apply the basic concepts of science; learn scientific enquiry skills of gathering information; develop desirable attitudes and value appreciation for truth and objectivity; learn scientific method to apply it in solving problems and making decisions to improve everyday living environmental conditions and lastly learn scientific principles to promote development and use of technology. For achieving these objectives, it is necessary to shift emphasis from rote memory based, content oriented and teacher-centered method of teaching to hands-on minds-on learning approaches like: Problem solving-based; activity oriented; performance-based; and learner-centered approaches.

REPORT OF THE TELANGANA SCHOOL EDUCATION DEPARTMENT

The Telangana state government has revamped the high school syllabus in accordance with the national and state curriculum framework and the right to education act. However, If the class tenth board results are analyzed a massive drop in the pass percentage was observed with substantial drop in mathematics and science subjects. Even those who passed did so with mediocre marks. In a recent official report of the Telangana school education department [3], the government is worried and concerned about the performance of the state syllabus school students in mathematics and sciences and wants the teaching standards to improve. For this it feels that Continuous Comprehensive Evaluation (CCE) scheme be followed in letter and spirit. The government wants the teachers to be trained in application-based teaching to improve grades and pass percentages of students in the board exams. It has asked both the private and government schools to take corrective measures so that students are taught as per the application-based model rather the simple textbook teaching. It also expressed anguish that the school

Fifteenth Conference on Education and Training in Optics and Photonics: ETOP 2019, edited by Anne-Sophie Poulin-Girard, Joseph A. Shaw, Proc. of SPIE Vol. 11143, 111432U · © 2019 SPIE, ICO, IEEE, OSA · CCC code: 0277-786X/19/$18 · doi: 10.1117/12.2514653

education department has not been successful to change the teaching methodology in schools even though the changed exam pattern was bought in. Apparently, there has neither been teaching nor learning on applied knowledge. What was expected that this policy shift should have resulted in a change of pedagogy, which never materialized.

FACTORS AFFECTING THE CCE SCHEME

In our study we found that there is a marked shift and the prescribed CCE methodology is far from being implemented. It is mandatory on the part of the teachers to implement strategies like making the students to read the content of the textbook, discussion, analysis, lab activity, field trips, preparing project reports. Rote memorization of scientific information from guides and workbooks are still encouraged. Glaring inefficiencies were reported and a number of reasons such as lack of labs, basic amenities in the school, inexperienced staff, shortage of qualified teachers, corporate schools competition, lack of funds, lackadaisical attitude of the students, no focus on research, lack of proper teacher training programs, retention of students etc were attributed for the degradation of education standards. The magnitude of the problems increased manifold in the underprivileged private and government schools. Students have reported that most of the concepts of physical sciences are experiment based. Although the activity wise learning has been explained followed by laboratory exercises but they are unable to connect and comprehend with the concepts.

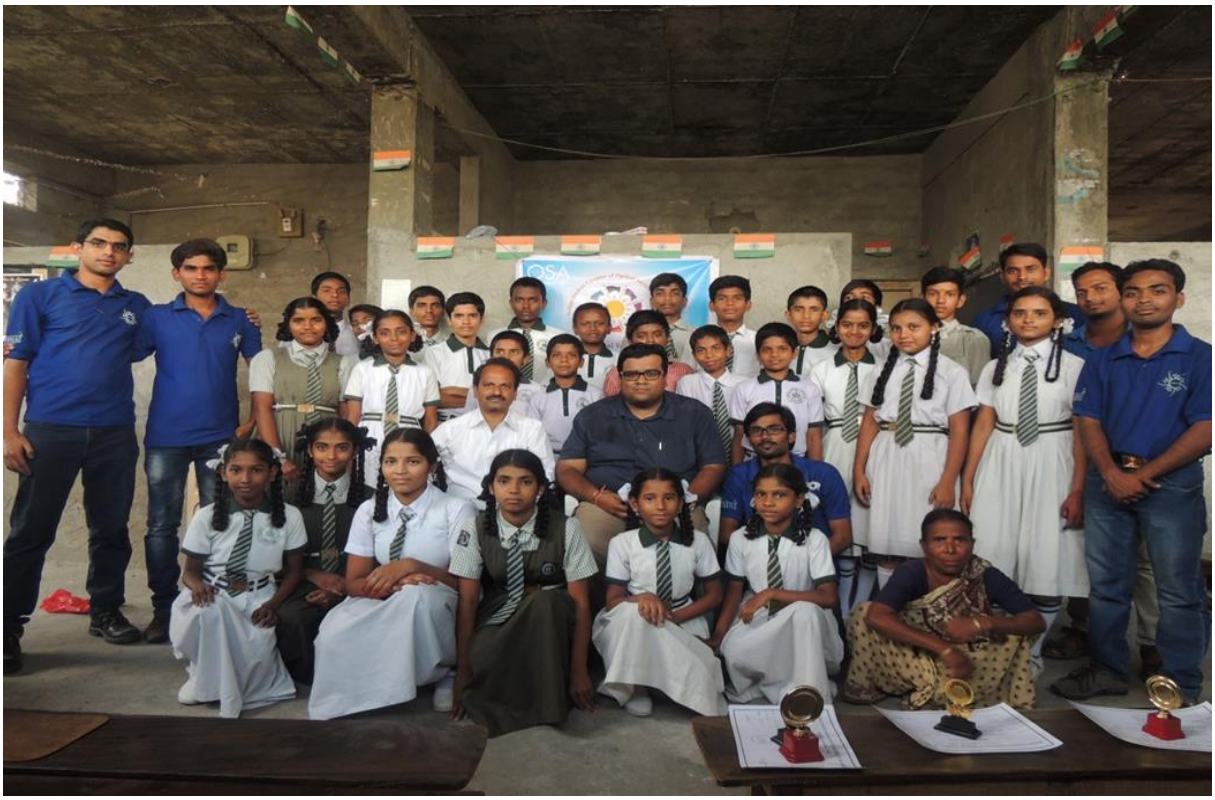

Figure1: Group photo of outreach program participants

METHODOLOGY

In our present society many crucial services like Laser, LEDs, Li-Fi etc., work on light techniques and it becomes imperative that students have a comprehensive knowledge of optics-based technologies. To realize these objectives, we have adopted a comprehensive and holistic capacity building mechanism which incorporates a

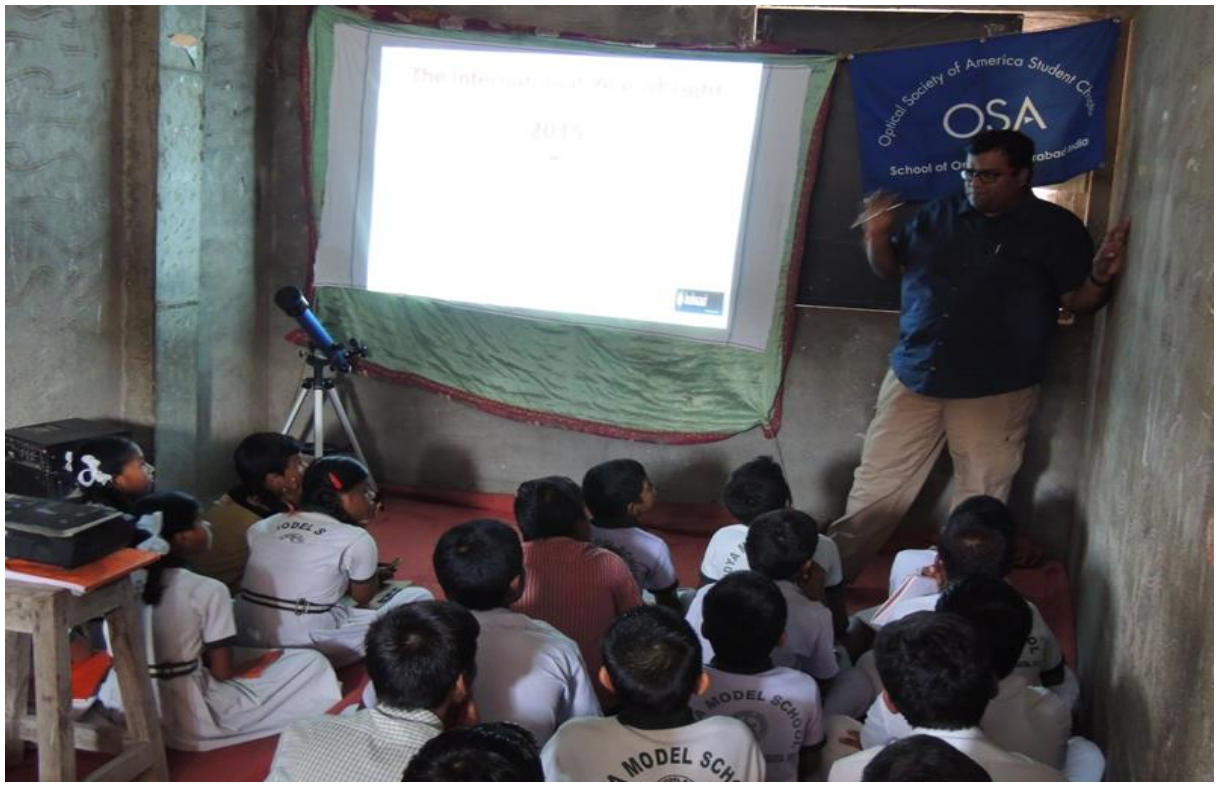

Figure2: PPT session on Light and Light-based Technologies

blended learning strategy on teaching light education to students in underprivileged schools. The blended learning approach has garnered significant attention in recent times, combining traditional classroom techniques and e-learning, creating an innovative, hybrid teaching methodology. To build conceptual understanding, the blended approach can provide balance between dissemination of content and interaction.

A state-of-the-art audio-visual room with LCD Projector for ICT mode of presentations of various light-based phenomenon has been installed funded by the Arati Memorial Foundation which has a seating capacity of 30-35 students is in place. We promote an active participatory environment to discuss, deliberate, understand and practice the concepts learnt. A laptop, printer and Wi-Fi connection exist. In addition, visual charts on various optical phenomena, inspirational portraits of important personalities who have contributed in this field are displayed.

The US National Academy of Sciences standards emphasize skills, practices and concepts common across areas of science and identify four Core Disciplinary Ideas of Physical Science [4] –

1. Have broad importance across multiple sciences disciplines or be a key organizing concept of a single discipline
2. Provide a key tool for understanding or investigating more complex ideas and solving problems
3. Relate to the interests and life experiences of students or be connected to societal or personal concerns that require scientific or technological knowledge
4. Be teachable and learnable over multiple grades at increasing levels of depth and sophistication

Figure3: Binoculars demonstration

Our new approach [5], for enhancing and enlivening classroom environment involves systematic hands-on minds-on investigation of the concepts that are taught in the class by supplementing intra-curricular experimental kits which are readymade, simple and ready to use equipment's by student-teacher participation. To use these kits in conjunction with a textbook program, a three-pronged strategy has been adopted. Firstly, materials are supplied to students after being introduced to the basic concepts of a new topic. Students were given the opportunity to explore freely activities and materials to generate interests and prompt questions related to topic. Secondly, hands-on activities are used to enable students to observe phenomena that are presented in their textbooks. Finally, students were given an opportunity to design new experiments based on the knowledge they have acquired. Preferably the activities can be performed individually or in small groups. These educational light-based experimental kits are designed to teach the students the power, properties and principles of optics through fun and investigation. It provides students with hands on activities that introduce them to the science of light.

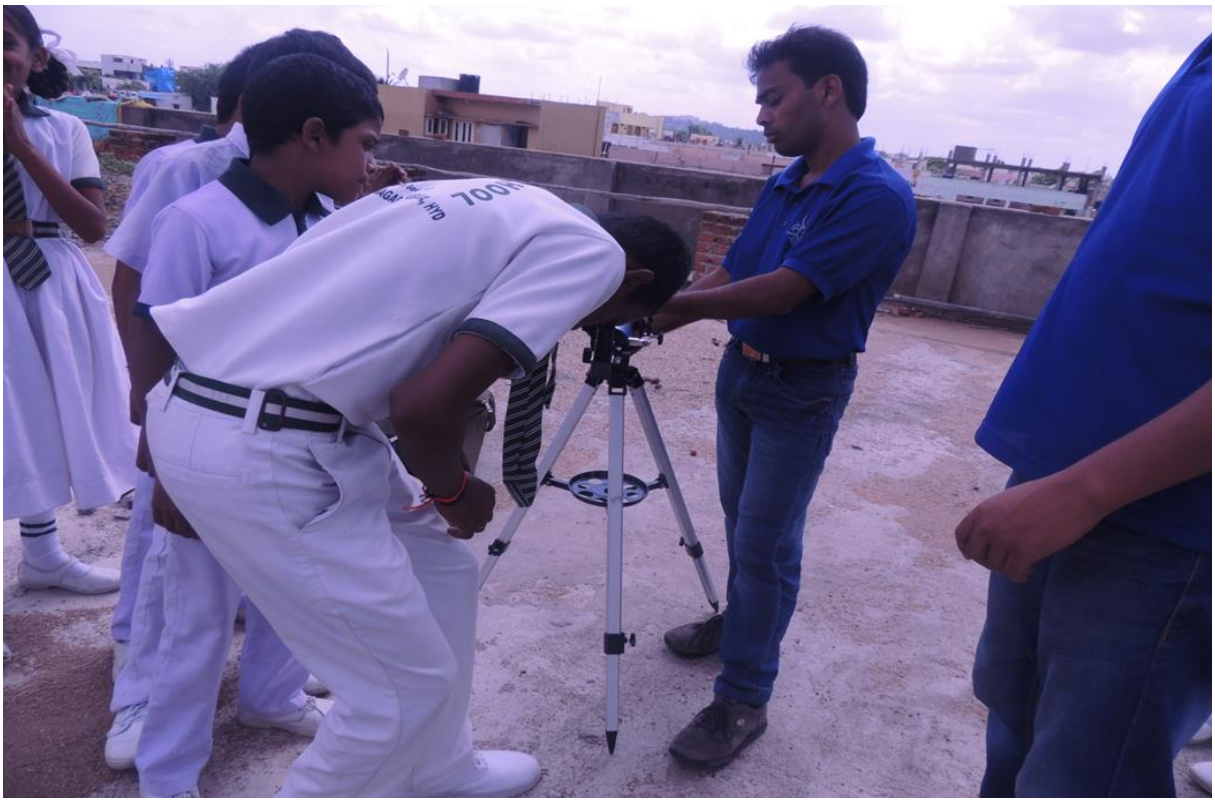

Figure4: Binoculars and telescope demonstration

RESULTS AND DISCUSSIONS

The study was empirical in nature where survey method was used to collect data. The population included all the high school students from three different schools. All the students as well as teachers were given full liberty to test the activities in curriculum and also expand their horizon of understanding by delving into multiple alternatives. A few students were able to express their own ideas and form parallel explanations. It was felt that such new teaching strategies can serve to go side by side in assisting the teaching- learning process. The responses were taken by a feedback questionnaire which was a Likert style scale, where 1 indicated strongly disagree and 5 indicated strongly agree, consisting of nine elements. The forms were distributed both to students and teachers.

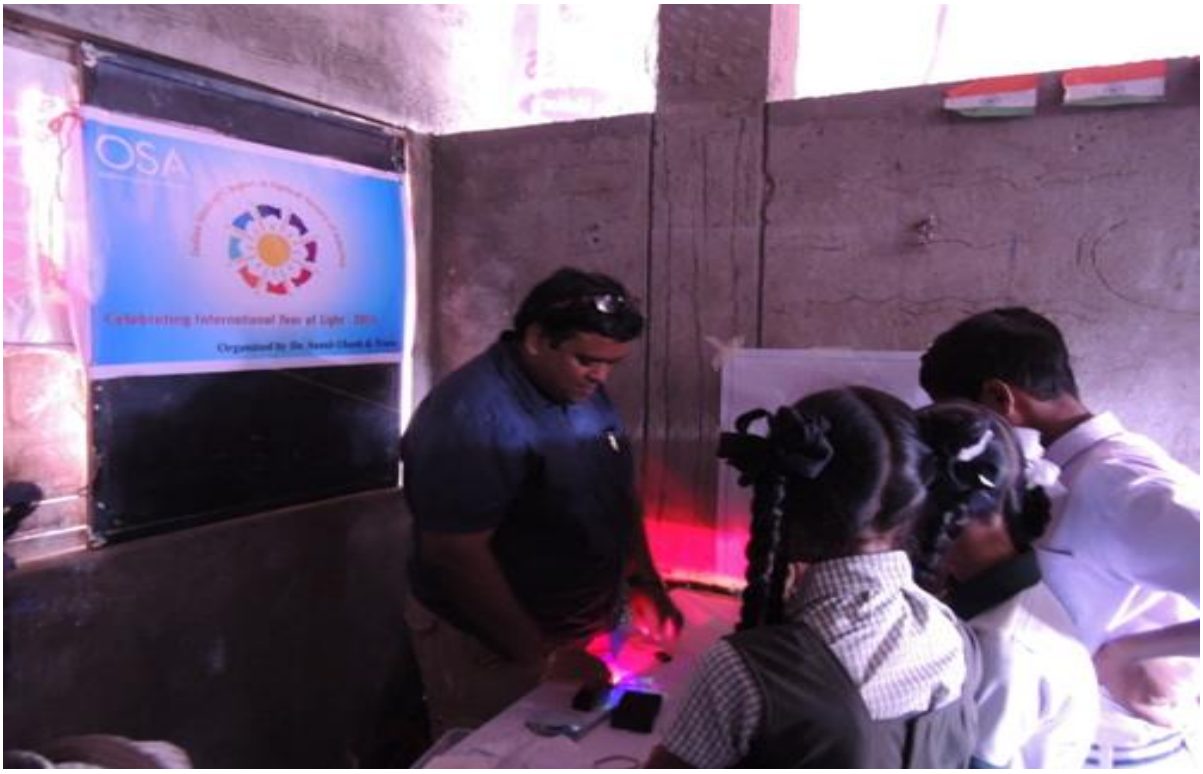

Figure5: Light blox demonstration

Figure6 Student Activity - Elocution Competition

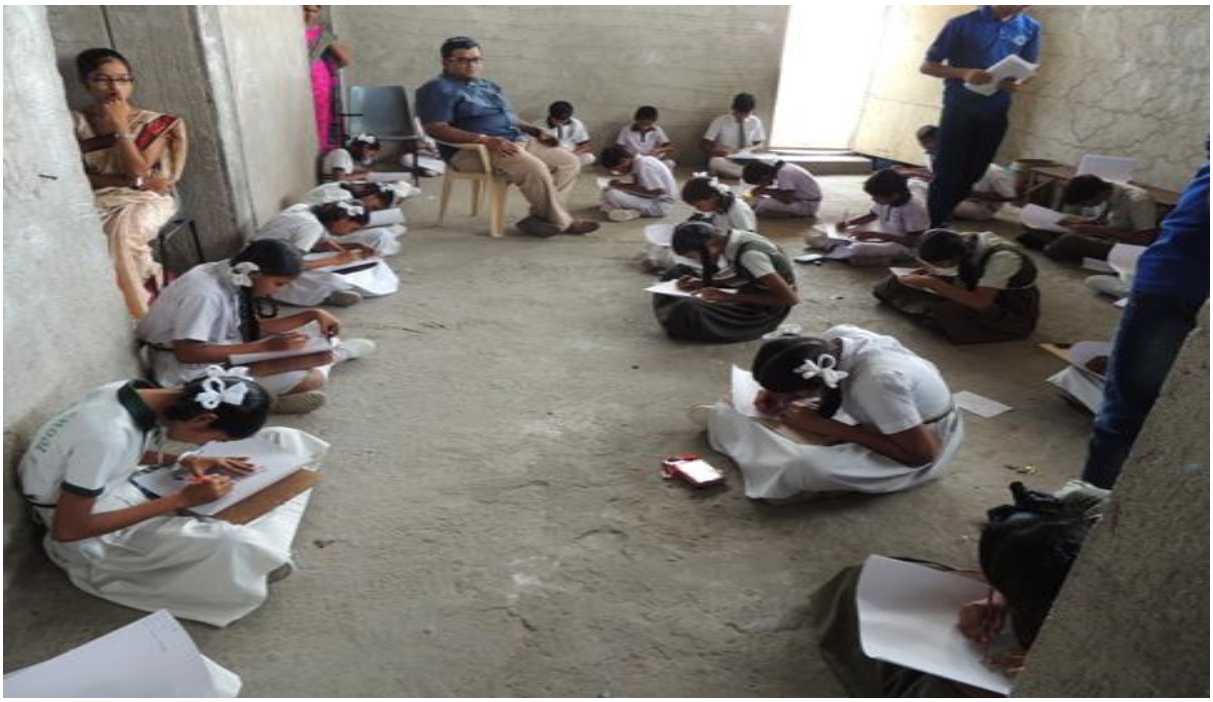

Figure7: Student Activity - Drawing competition

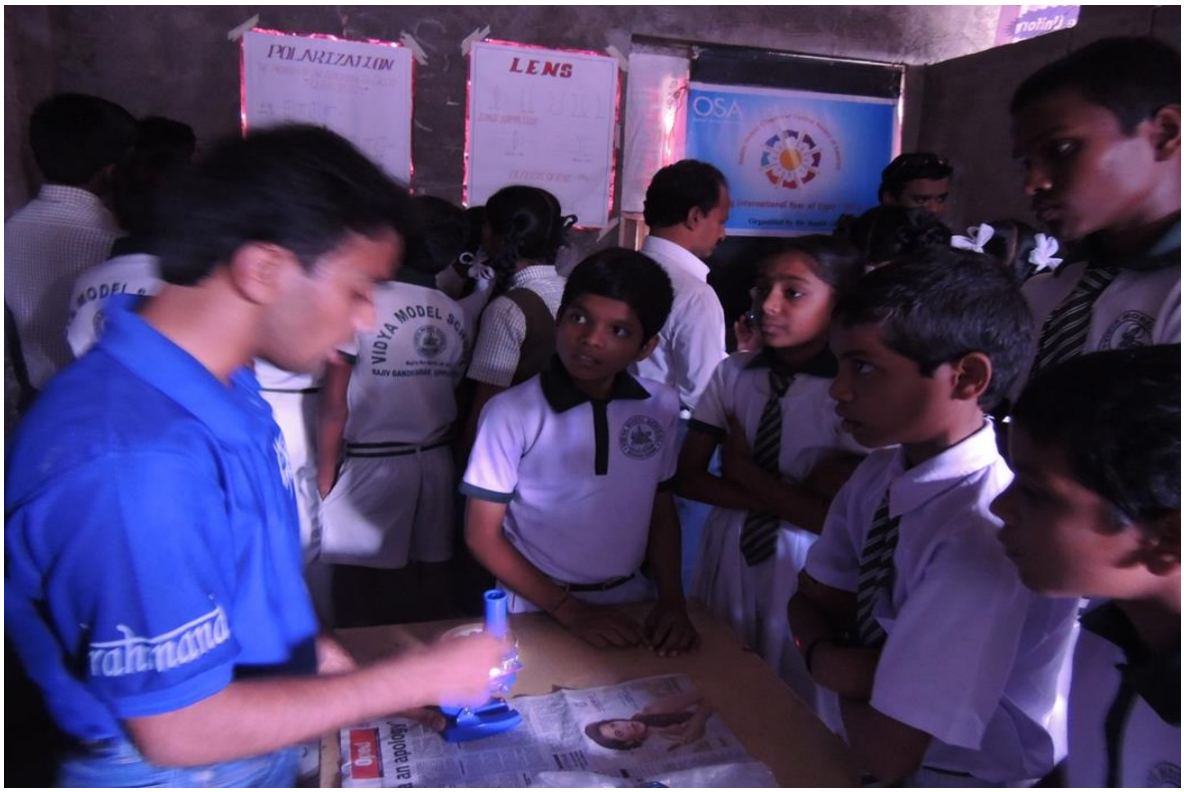

Figure8: Light concept Demonstration

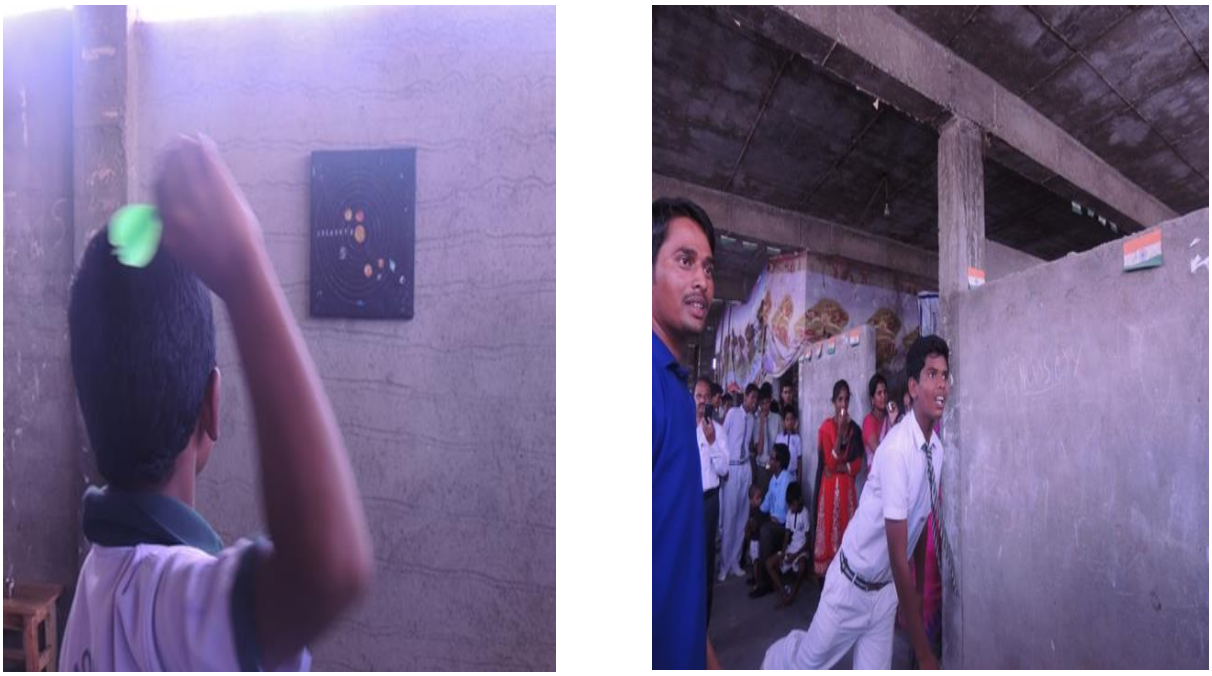

Figure9 Student Activity - Hit the Target

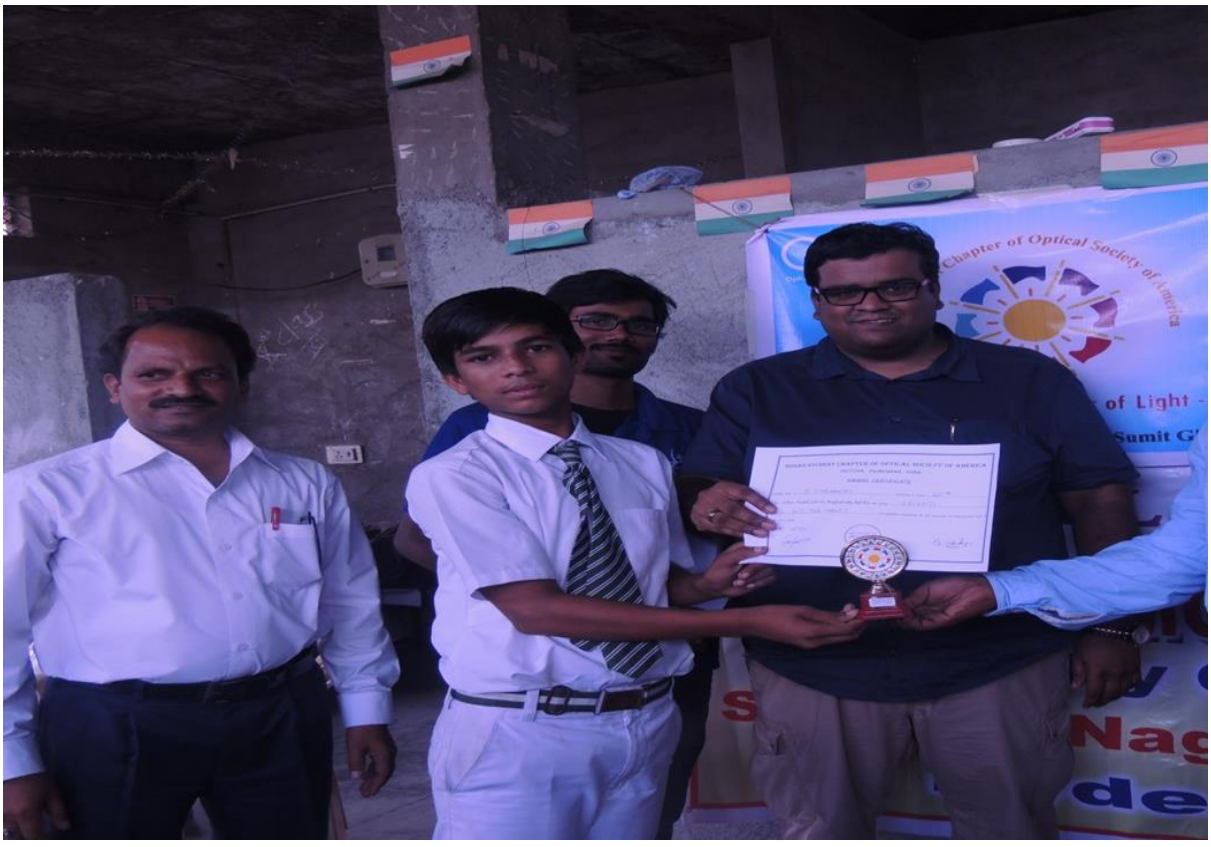

Figure10: Prize Distribution Ceremony

The use of these inter curricular kits have no doubt improved the teaching-learning experience of all students and teachers. This study was aimed to evaluate the perception of the students to the usage of these kits. The results revealed that although classroom teaching remains integral to the introduction of the subject, these kits when used in conjunction have helped to absorb the actual underlying essence and principle of the concepts. Consequently, we could enhance the analytical, investigation, reasoning, observation and communication skills and provide a meaningful, quality, joyful, enthusiastic, motivated and sustainable student learning environment. The hands-on minds-on inter-curricular kits thus assisted the children in becoming self-reliant researchers capable of thinking intensely in scientific terms. Thus, we could cultivate a new generation with scientific thinking. The students found it more interesting when PPT model using videos, pictures, charts, were presented using ICT method. They particularly appreciated the engaged discussions in which they actively participated. The standards reflect a conceptual shift away from disciplinary content, discreet facts and lectures, and toward an interdisciplinary, applications-based focus.

CONCLUSIONS

Till date we have carried out more than twenty-five altruistic programs as well as important practical events for all the stake holders. The education kit does a marvelous job at introducing the properties of light to children in addition to igniting their interest in science overall. We were delighted to have introduced our Telangana state students to the science of light, with hands-on, engaging activities and lessons that develop their intellectual curiosity and understanding of the scientific method. We believe that every child should be given the opportunity to reach their full academic potential. The students feel inspired to explore, learn new things and imagine themselves as the next leaders in the scientific world. Not only we have been successful in enhancing the knowledge and skills of the deprived students but also elicited how future development of society has an intricate connection to the effective utilization of light. Our endeavor has rekindled the student's interest for science; particularly optics so much so that, they have volunteered to take up science-based courses for their future higher education programs.

ACKNOWLEDGMENTS

We wholeheartedly thank the Optical Society-USA and Arati Foundation for sponsoring this program.

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