Project Report

Promoting Quality Education through Clean Energy Access

A Dual Approach to Rural Development

Submitted to

HT Parekh Foundation

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Background

Education is a critical building block of a sustainable and robust economy as quality education contributes to productive workforce which in turn contributes to greater productive potential for the economy. In India, while significant improvement has been made in improving school enrolment, however, quality education remains questionable. This is evident from a clear focus on quality by Ministry of Human Resource Development, Government of India and the recognition of the same by various State Governments.

The project titled "Promoting Quality Education through Clean Energy Access: A Dual Approach to Rural Development" aims to link clean energy access at schools with quality education access to students. In order to assess this linkage, five schools were selected in Chittorgarh district after a detailed technical assessment. The assessment took into account feasibility of the energy access, geographical location & status of power supply at the select schools. For operationalizing clean energy access at select schools, each school is installed with solar PV system connected to one Smart Board, in addition to fans & tube-lights in each classroom. The smart TV displays audio & visual learning materials meant to add value to the teaching pedagogy & learning outcomes of the students. It is through this infrastructure that the above-mentioned linkage is assessed in the select schools.

Table: List of Schools

S. No.	Name of School	No. of Teachers	No. of Students
1	Government Upper Primary School, Bilola	6	90
2	Government Upper Primary School, Aachoda	8	177
3	Government Secondary School, Gadhwada	13	178
4	Veer Shiromani Pratap Upper Primary School, Aawalheda	8	156
5	Government Upper Primary School, Pavatia	6	79

1. Introduction

Worldwide collectively, 188 million children attend primary schools which do not have access to electricity or any other form of alternate energy (UNDESA, 2014). It implies that almost one out of every three primary students go to a school without electricity (based on about 660 million children being enrolled in primary school worldwide) (UNDESA, 2014). According to Annual Status of Education Report (ASER) 2018, 81.6% schools in rural Rajasthan have electricity connection. However, despite such huge number of connections, quality of electricity supply during the school hours is highly inconsistent. Such situation has a huge impact on the realisation of Sustainable Development Goals (SDGs) in general & right to education in particular.

Amongst other UN SDGs, the Goal 4 meant to facilitate Access to Education is in the priority list of various states including India. However, despite substantial efforts by the Government of India both at the Central and State level, there still exist huge gaps between the educational outcome of rural and urban students. The reasons for such gaps are many including lack of quality teachers, poor teaching pedagogy, inadequate infrastructure & policy support, etc.

In India, energy access at household level has been on the priority of government, however, the energy infrastructure at schools is not dealt with such priority. The policy support for energy access and quality supply at schools is missing in the larger narrative. The infrastructure guideline for schools mandates electricity at premises but there is no rule to ensure the availability of quality supply of electricity and monitoring its impact.

2. Energy Access Status of schools in India

As per Unified District Information System for Education (UDISE) report, 2017-18, 63.14 per cent schools have energy supply in India; Assam has the least number of schools with access to energy at 24.28 per cent, followed by Meghalaya at 26.34 per cent. All the schools in Lakshadweep and Dadar & Nagar Haveli have access to energy while 99.93 per cent schools in Delhi have such access. Under the 'Deendayal Upadhyay Gram Jyoti Yojana', access to electricity is provided in villages and rural areas on priority basis. Accordingly, the schools that require electricity service connection may approach the state power utility which is governed as per the extant rules. Unfortunately, energy supply connection doesn't ensure access to energy as the energy supply is inconsistent in different districts of India including in Chittorgarh.

Energy in the form of electricity is an important component for last mile delivery of services at grass-root level. Lack of access to energy causes significant obstruction in delivery of different essential services required in the present time. The global discourse "Energy for All" needs to shift beyond household levels to essential infrastructure, such as schools, hospitals, etc.

According to Faith Birol, Chief Economist at the International Energy Agency (IEA), "lacking access to electricity affects health, well- being and income" (IEA 2011).

As mentioned above, electricity connection in rural areas of India does not guarantee energy access. Many of the schools which have electricity connections receive poor quality and inconsistent electricity supply during the school hours. The inconsistent supply of electricity substantially affects the learning outcome of students. Power supply is a crucial infrastructure requirement of a school. It assists in facilitating the interaction between teachers & students. It mitigates the effect of weather change & ensures a safe & learning space for students by providing light & air conditioning at schools. Therefore, any hindrance in power supply hinders the quality of safe & learning space of students. The hindrance in power supply affect learning outcome of the students & consequentially encourages absentism.

Electricity access in schools could facilitate better learning outcomes as it has the potential to increase enrolment of students in schools, provide convenient timings to teachers for conducting classes and enabling computer added learning in the classrooms. It will also contribute towards better staff retention and other co-benefits such as improved health and sanitation. (UNDESA 2014)

3. Energy Requirements of Schools

Understanding energy needs of schools is a first step towards measuring gaps within the parameters of quality education. During the engagement with teachers, students & district administration at the select five schools, following requirements were put forth by them:

- Availability of consistent power supply
- Availability of fans
- Availability of Indoor and Outdoor lighting
- Availability of plug points for charging mobile, radio and other teaching and learning materials.
- Availability of computer
- Availability of drinking water
- Availability of clean & hygienic toilets

4. Benefits of Solar Based Electrification/Clean Energy in Schools

Inadequate infrastructure in rural areas and inconsistent power supply prevent students from learning in most favourable conditions. It not only hinders their personal growth but also deprive them of their very basic right to education. Due to lack of access to energy, students lack access to information as well as communication technology.
Solar energy based intervention providing adequate electricity to rural disadvantaged community has the potential to improve living and education standard of such community.

Access to energy in the form of solar computer labs can be instrumental in enhancing skills & in facilitating digital literacy of teachers & students. It can also help them to explore avenues of self-learning through digital contents. The capacity building of teachers would have a direct impact on the learning outcomes of the students.

Solar energy in schools will not only save the cost of electricity bill but will also help to create modern learning opportunities in schools. It is very crucial that students, teachers and community members understand the modern environmental concerns. Access to solar energy can transform community members as sustainability agents thereby benefitting environment at local as well as global level. This benefit can be realised if such access is under the joint ownership of students, teachers, district administration & other community members. Moreover, the exposure to the clean energy access has the potential of creating a chain reaction of demand for clean energy access across the targeted area.

The access to solar energy at schools will familiarise students with the utility of solar energy thereby building a community of environmentally conscious citizens. Access to solar energy at schools will also help rural communities in co-opting sustainable development.

Access to solar energy at schools, especially in tribal and remotely located rural areas could prove to be a game changer. It can prove to be a catalyst in generating demand of energy access in the households. Moreover, it can also facilitate access to quality education, access to drinking water, education, communication and technology and develop model of sustainable development.

Further, it will translate into realisation of Sustainable Development Goal (SDG) 7 -"to ensure access to affordable, reliable, sustainable and modern energy for all." Energy access through clean energy has the potential to improve availability, reliability and quality of power supply which in turn would help towards the realisation of power sector reforms.

Clean energy also has its impact on the enrolment & dropout rate of students. If clean energy ensures consistent power supply & quality education, the enrolment rate of a school gets increased. (As observed at the select five schools)

5. Smart Classroom and its importance

Smart classroom is a technology-enhanced classroom that fosters opportunities for teaching and learning by integrating learning technology such as computers, specialized software, audience response technology, assistive listening devices, networking, and audio/visual capabilities.[1]

The traditional chalk and board method has lost its effectiveness in the present times. The technology based teaching and learning material is instrumental for ensuring high level growth and conceptual development of students.

The use of internet and different digital learning devices has the potential of revolutionizing learning and intellectual capacity of teachers and students. Moreover, students are generally receptive to new methods of teaching, if it allows them to think & express by inculcating their experiences & imagination.

6. Objectives of smart classroom

The following are some objectives of a Smart Class Room application:

- To facilitate access of teachers and students towards modern information, communication and technology. It enhances the teaching and learning ability of teachers & students respectively.
- To enable students in learning through pedagogically sound and visually rich curriculum.
- To simplify the concepts & facilitates learning through activities. i.e to make learning more student friendly.
- To enable students in contemplating & expressing their views on a given subject. It helps in gauging perspective of different students thereby enriching classroom discussion.
- To provide platform to students where they visualize the concepts & understand its practical utility.
- To provide opportunities to students for better understanding the concepts as opposed to the rote & knowledge cramming driven learning.

[1] Kuppusamy, P. (2019). Emerging Technologies and Applications in Data Processing and Management.

- To help in blending technology with traditional classroom methodology for educational development.
- To help in customizing contents as per the course curriculum and need of the students.

7. Advantages of Smart Classroom

- It allows teachers and students to use online database and information such as videos, knowledge database, etc, for strengthening their understanding on a given subject.
- It introduces pictorial method for enhancing conceptual understanding & encourages participation of students in classroom discussion.
- It bridges the rural/urban divide and creates opportunities for rural students to learn through the use of technology.
- With the help of apps, tools, and materials, it transforms learning into fun activity.
- Smart classroom running through clean energy introduces the utility of clean energy in the daily lives of those affected by it.
- It improves student engagement by encouraging discussion and surfacing out of the box ideas which further improve student teacher relationship.
- Interactive technology tools allow different forms of media like photos, maps, graphs and videos to be displayed. These tools provide flexibility to expand the nature of content that can be used in learning.
- As an educator, teachers learn more about how to effectively design and execute a class guided with technology.

8. Role of a teacher in a Smart Classroom

At the outset, it should be understood that the smart classroom is not an alternative to a teacher. It is a tool for enhancing understanding of the students where teacher is bound to play a role of the facilitator. "In classrooms today, the role of the teacher needs to change from the traditional role of prescriptor to that of orchestrator of learning which necessitates the designing of ICT integrated classrooms promoting higher order cognitive skills" (Fullan, 1991*)*. Following characteristics are essential to be possessed by teacher within a smart classroom.

- Facilitator and manager who encourages participation & different perspectives on a given subject.
- Smart, digitally literate and multi skilled teacher
- Simplifies the concepts & stress upon its practical utility.

9. Methodology and tools for Pedagogy Training to Teachers

The pedagogy training was provided to thirty five teachers across the select five schools.

9.1 Teachers Training

Following are the main components of a teacher training module:

1) Meaning of a smart classroom
2) Importance of smart classroom
3) Objectives of smart classroom
4) Role of a teacher
5) 5 E's Pedagogical Method of teaching
6) 4 Effective teaching Methods
7) Methodology to effectively teach Environment Science and Science
8) Methodology to effectively teach English through smart classroom
9) Methodology to effectively teach Maths through smart classroom
10) Steps & tools to operate a smart classroom
11) Trouble shooting mechanism in case of technical errors.
12) Demo class on the use of smart class room.

9.2 Teaching Pedagogy

The Pedagogical Model describes what effective teachers do in their classrooms to engage students in intellectually challenging work. It provides an overview of the learning cycle and breaks it down into five domains or phases of instruction:

9.2.1 Engage

Teachers shall know their students well and shall actively include them in building supportive, inclusive and simulating learning environment. Teachers shall motivate and empower students so as to facilitate development of their agency. They shall also treat students as participants in knowledge generation rather than as recipients of knowledge.

9.2.2 Explore

Teachers shall present challenging tasks before students in order to generate curiosity for acquisition of knowledge & development of ideas. They should facilitate students in expanding their perspectives and engage with multiple ideas around one concept.

9.2.3 Explain

Teachers shall explicitly impart relevant knowledge, concepts and skills in multiple ways to connect new and existing knowledge. They shall monitor student progress and provide structured opportunities for practising new skills and developing agency.

9.2.4 Elaborate

Teachers shall challenge students to move from surface to in-depth learning & facilitate development of students' ability to realise their learning. They shall facilitate students to be reflective and self-monitored learners.

9.2.5 Evaluate

Teachers shall use multiple forms of assessment and feedback to help students improve & develop their learning and agency respectively. They shall monitor students' progress and analyse data to map effectiveness of their teaching practices. They shall also identify focus areas and address individual needs of students.

9.3 Teaching Methods

There are four effective methods of teaching. These four methods shall provide tools to the teachers for effectively facilitating learning through smart classroom. The four teaching methods are as follows:

1. Activity Method
2. Discussion Method
3. Question-and-Answer Method
4. Demonstration Method.

Table 1: Teaching Methods

S. No.	Method	Smart Classroom Practices
1	Activity Method	• Teach students through available visuals on smart screen. • Start with conceptual videos; this will help students get clarity on a specific topic. • Encourage students to perform and to learn through different activity based videos.
2	Discussion Method	• During the presentation of videos, discuss difficult words and complex ideas with students. For instance, students will come across new words, concepts, ideas, facts etc. in the videos on which they will require further inputs. • Make them able to think about new word, fact, concept,

S. No.	Method	Smart Classroom Practices
		idea or any other information. • Discuss with students about the change/update in their perception towards a specific idea/concept. • Discuss with students about their self-evaluation.
3	Question-and-Answer Method	• Teachers shall pose questions before students during and after smart classroom. Teachers shall motivate each student to provide response based on one's learning. • Question and answer method brings clarity in the minds of students & brings different perspectives around an idea. • This method helps teacher in evaluating learning of the students as well as identify focus areas for improvement.
4	Demonstration Method	• The demonstration method has to be used after the usage of Question & Answer method. The demonstration is of practicality/utility/occurrence of any process or activity. • This demonstration can be field based exposure or classroom activity. • Demonstration helps students in relating theory & practice.

10. Good practices for teaching effectively through smart classroom

10.1 Pre Delivery Practices

- Effective use of Curriculum
- Selection of appropriate topic according to learning standards of students
- Selection of teaching and learning activities
- Preparation of lesson plan using books and smart classroom material

10.2 Delivery Activities

- Introduction to topic
- Pose different questions on the topic in order to simulate discussion among students.
- Encourage students to consider their surroundings as well as imagination in their responses.
- Use of Multimedia and activity videos for facilitating learning

10.3 Post Delivery Activities

- Engage students in activities where they could translate their acquired knowledge into practice.
- Evaluate learning of students through short writing or oral exercise.
- Identify focus areas for improvement based on the evaluation.

Table 2: List of Schools

S. No.	Name of School	No. of Teachers	No. of Students
1	Government Upper Primary School, Bilola	6	90
2	Government Upper Primary School, Aachoda	8	177
3	Government Secondary School, Gadhwada	13	178
4	Veer Shiromani Pratap Upper Primary School, Aawalheda	8	156
5	Government Upper Primary School, Pavatia	6	79

Table 3: Total Number of Beneficiaries

Sl. No.	Total number of direct beneficiaries (Students + Teachers)	Total number of indirect beneficiaries (Community members + District Administration)
1.	**721**	**14,000**

For the purpose of calculating direct number of beneficiaries, the total number of students & teachers is taken into consideration. The total number of indirect beneficiaries is arrived by adding the population of four villages around each school. The rationale behind considering population of four villages is the fact that on an average, each school is attended by the students from its adjoining four villages. The community members are the part of discourse around clean energy access & quality education. Furthermore, the ownership of this initiative lies with the community members, teachers, students & district administration. The average population of a village is taken as 700. Therefore, the total number of indirect beneficiaries stands at 14000.

11. School wise details

11.1 Government Upper Primary School, Bilola

11.1.1 Baseline

A baseline test was organised for students from class fourth & fifth. Before conducting the test, the students were taught chapters from "Environment Science Book" through customary classroom teaching methodology. The chapters were titled as कान खोले राज & जल में जीवन respectively. The test was based on these chapters where students were asked to respond to five select questions.

11.1.2 End line

Conceptual videos on the same chapters (as baseline) were shown to the same students of class fourth & fifth through the smart board. It was followed by an activity to translate conceptual understanding of students into practical utility. At last, students were asked to respond to the same (as baseline) five questions.

11.1.3 Rationale behind choosing class fourth and fifth

These classes were chosen as the students under primary classes are more open to new teaching methodologies. Moreover, class Sixth & Eighth had half yearly exams during the end line which could have not provided us with the objective results.

The improvement in the result of students is observed after the introduction of smart classroom pedagogy. The smart classroom pedagogy provides conceptual clarity to students through the use of audio & visuals. Simultaneously, the students learn practical utility of concepts through activity videos. Both these factors combined enhance overall understanding of students which is reflected in the end-line survey. The baseline survey is based on the traditional classroom teaching methodology whereas the endline survey is based on the smart classroom pedagogy. The effective tools used in smart classroom pedagogy attract the attention of students & enhance their comprehension skills. Following results are observed:

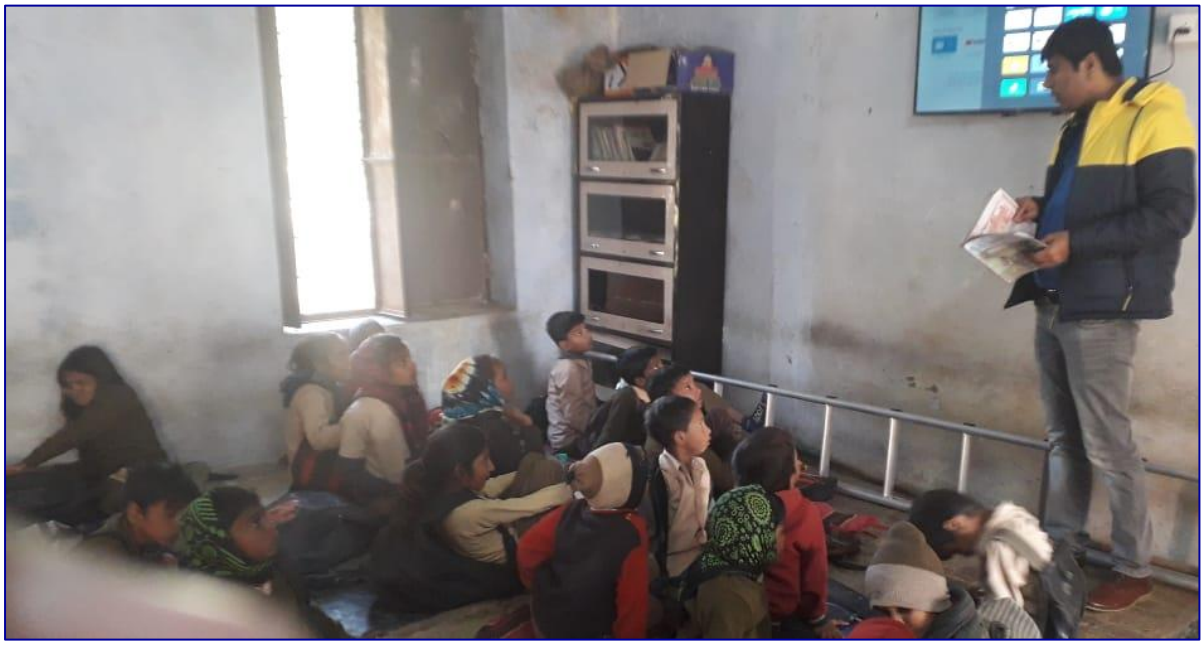
Table 4: Baseline and Endline results of Class IV (marks out of 10), Bilola

S. No.	Name	Class	Age	Gender	Caste	Baseline	End line
1	Anjali Jatiya	IV	10	F	SC	6	8
2	Aviraj Singh	IV	9	M	GEN	10	10
3	Aarti Nath	IV	9	F	OBC	10	10
4	Ganga Jatiya	IV	11	F	SC	5	6

S. No.	Name	Class	Age	Gender	Caste	Baseline	End line
5	Kanha Jatiya	IV	10	M	SC	6	8
6	Kaartik Jatiya	IV	9	M	SC	10	10
7	Kiran Kumhaar	IV	9	F	OBC	5	7
8	Narayan Nath	IV	9	M	OBC	6	8
9	Nilesh Jatiya	IV	8	M	SC	10	10
10	Suresh Jatiya	IV	14	M	SC	6	8

Table 5: Baseline and End line result of Class V (marks out of 10), Bilola

S. No.	Name	Class	Age	Gender	Caste	Baseline	End line
1	Anjali Meena	V	11	F	ST	4	6
2	Divya Kanwar	V	11	F	OBC	6	10
3	Kajal Bhat	V	11	F	SC	4	8
4	Rohit Jatiya	V	10	M	SC	4	8
5	Vijay Nath	V	10	M	OBC	4	8



11.1.4 Issues and Challenges

- Student-teacher relation needs improvement in Government Upper Primary School, Bilola. During the end-line test, students preferred the test to be conducted by the trainer instead of school teachers.

- The quality of teaching needs improvement in the school. It was observed that the performance of students attending tuition classes outside school is better than rest of the students.
- Additional responsibility/charge to the teachers reduces their teaching time in school. It was observed that two teachers were given additional charge of Booth Level Officer BLO, thus, they were not able to teach students on a regular basis.
- There is minimal infrastructure support from the government's side. It was observed that teachers collected donation from different sources for procuring essential commodities like blankets, water cooler, chairs, etc.
- The socio-economic condition of the parents/guardian of the students is not well off; hence they often engage students in farm fields during reaping & harvesting season.
- Students in this school don't have proper uniform; many of the students even don't have sweaters. As a result, students tend to leave before the official closing time of school i.e. 4 pm, so as to avoid the cold weather.
- Classrooms are clean, painted and have proper electricity fitting, however, there is no consistent electricity supply. On the day of training at school, there was no electricity supply through the grid but was available through the solar panels.
- School does not have enough funds for school development. School Management Committee is not functional either.
- Students are able to read & write in Hindi but have serious difficulty in the English subject.
- School gets mid-day meal food from Akshay Patra Foundation. The students are not satisfied with the taste & quality of roti.

11.2 Government Upper Primary School, Aacchora

11.2.1 Baseline

A baseline test was organised for students from class second & fourth. Before conducting the test, students were taught chapters from Mathematics & "Environment Science Book" respectively. (Through customary classroom teaching methodology). The chapters were titled as "कान खोले राज" & "Shapes & Figures" respectively. The test was based on these chapters where students from class fourth were asked to respond to five select questions whereas class second students were asked to identify numbers along with different shapes like triangle, square, rectangle and circle.

11.2.2 End line

Conceptual videos on the same chapters (as baseline) were shown to the same students of class second & fourth through smart board. It was followed by an activity to translate conceptual understanding of students into practical utility. At last, students were asked to respond to the same (as baseline) questions.

11.2.3 Rationale behind choosing class fourth and fifth

These classes were chosen as the students under primary classes are more open to new teaching methodologies. Moreover, class Sixth & Eighth had half yearly exams during the end line which could have not provided us with the objective results.

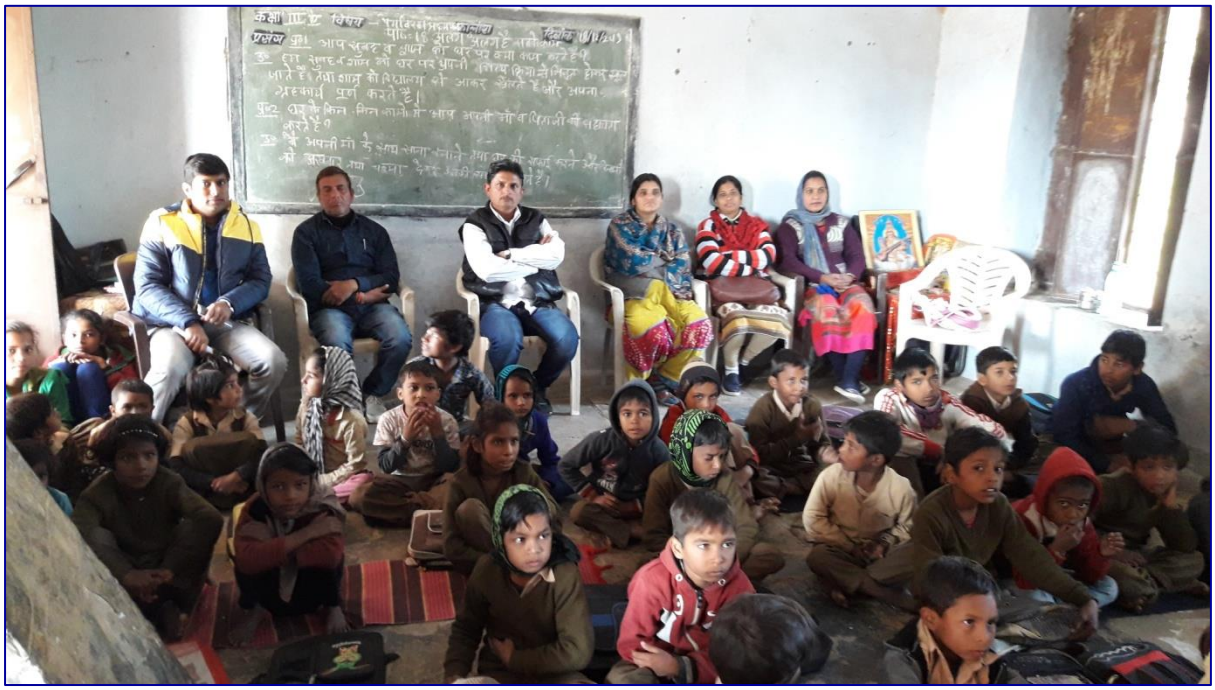
Following results are observed:

Table 6: Baseline and End line result of Class II (marks out of 10), Aacchora

S. No.	Name	Class	Age	Gender	Caste	Baseline	End line
1	Abhishek Regar	II	7	M	SC	4	6
2	Anjali Bhil	II	7	F	ST	4	7
3	Aasha Regar	II	7	F	SC	5	8
4	Bablu Bhil	II	7	M	ST	2	4
5	Gayatri Dholi	II	7	F	SC	7	8
6	Kanhaiya Lal Dangi	II	6	M	OBC	3	5
7	Krinha Kanjar	II	6	M	SC	4	5
8	Pawan Vaishnav	II	7	M	OBC	5	7
9	Pintu Dangi	II	8	M	OBC	4	7
10	Praveen Sen	II	6	M	OBC	6	8
11	Ramkanya Kanjar	II	7	F	SC	5	6
12	Vikas Regar	II	6	M	SC	7	8

Table 7: Baseline and End line result of Class IV (marks out of 10), Aacchora

S. No.	Name	Class	Age	Gender	Caste	Baseline	End line
1	Ankit Gurjar	IV	9	M	SBC	2	5
2	Anuradha Prajapat	IV	10	F	OBC	8	10
3	Bahadursingh Rajput	IV	9	M	GEN	6	8
4	Dilkhush Bairagi	IV	8	M	OBC	8	10
5	Dimple Regar	IV	9	F	SC	8	10
6	Dinesh Prajapat	IV	9	M	OBC	5	8
7	Khusbu Regar	IV	10	F	SC	8	10
8	Lalita Vaishnav	IV	9	F	OBC	2	8
9	Mohit Sain	IV	9	M	OBC	8	10
10	Raju Bhil	IV	9	M	ST	0	8
11	Shravan Sen	IV	9	M	OBC	6	9
12	Soniya Bhil	IV	9	F	ST	2	7
13	Suraj Bhil	IV	9	M	ST	4	8
14	Vishal Kanjar	IV	9	M	SC	0	7
15	Vishnu Regar	IV	9	F	SC	3	8



11.2.4 Issues and Challenges

- The students belonging to Scheduled Caste & Scheduled Tribe constitutes around 69% of the total student population in this school. Also, approx. 70% of the students belong to Below Poverty Line (BPL) family where their parents work as farm & non-farm labourers.

- Students often miss school as they either assist their parents during the work or take care of their younger siblings. Teachers regularly organize meetings with parents in order to sensitize them about the importance of school education.
- There is minimal infrastructure support from the government's side. It was observed that teachers collected donation from different sources for procuring essential commodities like chairs, sweaters, etc. For instance, Mahaveer International's Veer Darshna Group Chittaurgah donated eighty five sweaters to this school. It was observed that during winters, absenteeism of students got reduced after receiving sweaters.
- Additional responsibility/charge to the teachers reduces their teaching time in school. Students' understanding of English & Hindi language is below average and many students from class fourth & fifth are not able to read and write. Students from class fourth can hardly write their name. Trainer had to conduct oral exam for evaluating the performance of students.
- Students despite understanding a concept are not able to express their understanding due to lack of command on Hindi language.
- Classrooms are clean, painted and had proper electricity fitting, however with no consistent power supply.
- School has separate toilets for girls and boys. However, the toilet for boys is in unhygienic condition.
- Majority of the members of School Management Committee (SMC) are farm & non-farm labourers. Due to their busy schedule & low wages, they are neither able to devote time for meetings nor provide funds for the school development.
- School does not have adequate quality of durries for students to sit on them. Instead, thin pieces of mats are used during winter season. As a result, students leave early from the school in order to avoid cold.
- School gets mid-day meal food from Akshay Patra Foundation. The students are not satisfied with the taste & quality of roti.

11.3 Government Secondary School, Gadhwada

11.3.1 Baseline

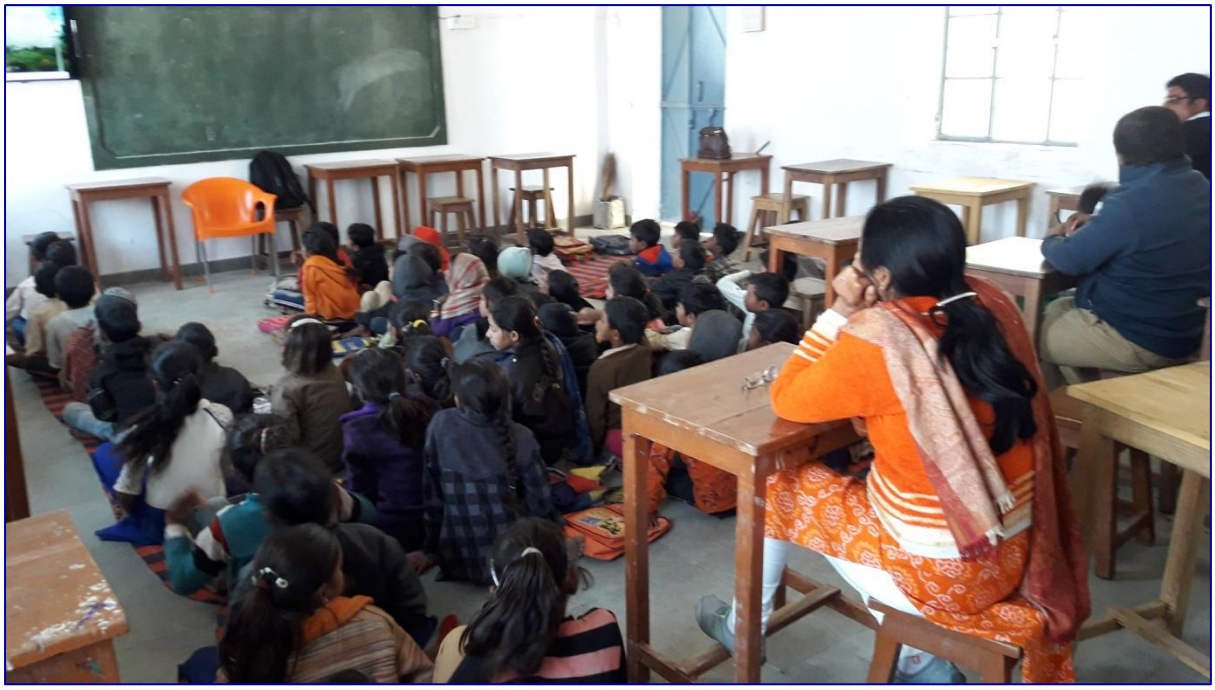
A baseline test was organised for students from class second & fourth. Before conducting the test, students were taught chapters from Mathematics & "Environment Science Book" respectively. (Through customary classroom teaching methodology). The chapters were titled as "कान खोले राज" & "Shapes & Figures" respectively. The test was based on these chapters where students from class fourth were asked to respond to five select questions whereas class second students were asked to identify numbers along with different shapes like triangle, square, rectangle and circle.

11.3.2 End line

Conceptual videos on the same chapters (as baseline) were shown to the same students of class second & fourth through the smart board. It was followed by an activity to translate conceptual understanding of students into practical utility. At last, students were asked to respond to the same (as baseline) questions.

11.3.3 Rationale behind choosing class fourth and fifth

These classes were chosen as the students under primary classes are more open to new teaching methodologies. Moreover, class Sixth & Eighth had half yearly exams during the end line which could have not provided us with the objective results.



Following results are observed:

Table 8: Baseline and End line result of Class II (marks out of 10), Gadhwada

S. No.	Name	Class	Age	Gender	Caste	Baseline	End line
1	Ankita Charan	II	6	F	OBC	7	9
2	Govind Bhambi	II	6	M	SC	5	8
3	Mahendra Bhil	II	7	M	ST	6	9
4	Mangi Bhil	II	7	F	ST	4	7
5	Maya Bhil	II	6	F	ST	5	8
6	Mukeshdan Charan	II	6	M	OBC	4	7
7	Priyanka Bhambi	II	7	F	SC	6	8
8	Pushkar Bhil	II	7	M	ST	5	6
9	Sandhya Charan	II	7	F	OBC	6	9
10	Vijaykaran Charan	II	6	M	OBC	6	8
11	Yogeshdan Charan	II	6	M	OBC	7	9

Table 9: Baseline and End line result of Class IV (marks out of 10), Gadhwada

S. No.	Name	Class	Age	Gender	Caste	Baseline	End line
1	Ajay Singh Charan	IV	7	M	OBC	10	10
2	Annu Kanwar Charan	IV	8	F	OBC	10	10
3	Arjun Daan Charan	IV	9	M	OBC	7	9
4	Aasha Bhambi	IV	11	F	SC	9	9

S. No.	Name	Class	Age	Gender	Caste	Baseline	End line
5	Mamta Charan	IV	8	F	OBC	4	8
6	Prakashdaan Charan	IV	8	M	OBC	10	10
7	Pooja Bhambi	IV	8	F	SC	7	9
8	Seema Bhambi	IV	8	F	SC	10	10
9	Vishnu Bhambi	IV	10	M	SC	10	10
10	Vishnudan Charan	IV	8	M	OBC	10	10
11	Vivekdan Charan	IV	8	M	OBC	9	10

11.3.4 Issues and Challenges

- This School is located on hilltop and there exists no facility of water during the absence of electricity supply. Also, the school campus does not have any kind of mobile network and internet connectivity. School has inverter but that is sufficient for one room only.
- Students often miss school as they either assist their parents during the work or babysit their younger siblings. Teachers regularly organize meetings with parents in order to sensitize them about the importance of school education.
- There is minimal infrastructure support from the government's side. It was observed that teachers collected donation from different sources for procuring essential commodities like chairs, sweaters etc. For instance, last year, entire school staff contributed 50,000 rupees & collected another 50,000 through donation for procuring furniture & shoes for the students. Through the donation, school administration was also able to construct gated toilets for students.
- Community members in this village do not prefer to send their girl child to school.
- Caste system is very prevalent in village. The community members don't prefer to inter dine or sit with different caste groups. It has a direct impact on the participation of students during classroom discussion.
- Classrooms are clean, painted and had proper electricity fitting, however with no consistent power supply.
- Majority of the members of School Management Committee (SMC) are farm & non-farm labourers. Due to their busy schedule & low wages, they are neither able to devote time for meetings nor provide funds for development of school.

11.4 Veer Shiromani Pratap Upper Primary School, Aawalheda

11.4.1 Baseline

A baseline test was organised for students from class second & fourth. Before conducting the test, students were taught chapters from Mathematics & "Environment Science Book" respectively. (Through customary classroom teaching methodology). The chapters were titled as "कान खोले राज" & "Shapes & Figures" respectively. The test was based on these chapters where students from class fourth were asked to respond to five select questions whereas class second students were asked to identify numbers along with different shapes like triangle, square, rectangle and circle.

11.4.2 End line

Conceptual videos on the same chapters (as baseline) were shown to the same students of class second & fourth through the smart board. It was followed by an activity to translate conceptual understanding of students into practical utility. At last, students were asked to respond to the same (as baseline) questions.

11.4.3 Rationale behind choosing class fourth and fifth

These classes were chosen as the students under primary classes are more open to new teaching methodologies. Moreover, class Sixth & Eighth had half yearly exams during the end line which could have not provided us with the objective results.

Following results are observed:

Table 10: Baseline and End line result of Class II (marks out of 10), Aawalheda

S. No.	Name	Class	Age	Gender	Caste	Baseline	End line
1	Ashok Kumawat	II	7	M	OBC	7	9
2	Banwari Lal Gurjar	II	8	M	OBC	4	7
3	Barkat Alee	II	8	M	GEN	7	9
4	Deendayal Kumawat	II	7	M	OBC	5	7
5	Dhanraj	II	7	M	GEN	6	8
6	Dharmendra Kumawat	II	8	M	OBC	5	8
7	Dheeraj Kumawat	II	8	M	OBC	5	9
8	Jasmin Salvi	II	8	F	SC	4	7
9	Kailash Kumawat	II	7	M	OBC	3	6
10	Kamlesh Kumawat	II	7	M	OBC	2	5
11	Khusbu Regar	II	7	F	SC	3	7
12	Komal Kumawat	II	7	F	OBC	5	8
13	Krishan Kanhaiya Kumawat	II	8	M	OBC	5	8
14	Lokesh Kumawat	II	8	M	OBC	5	8
15	Minakshi	II	8	F	OBC	7	9
16	Munna Gurjar	II	7	F	OBC	3	7
17	Munna Kumawat	II	8	F	OBC	2	5
18	Pooja Purbiya	II	8	F	OBC	4	7
19	Prince Gandharv	II	7	M	SC	6	9
20	Rechana Regar	II	7	F	SC	3	7
21	Rajal Gadilohar	II	7	F	OBC	3	6
22	Rajakaran Singh Chundawat	II	7	M	GEN	7	9
23	Ridhima Paliwal	II	7	F	GEN	6	8
24	Ritika Kumawat	II	7	F	OBC	8	9
25	Suraj Gurjar	II	7	M	OBC	5	7
26	Vikas Prajapat	II	7	M	OBC	6	9

Table 11: Baseline and End line result of Class IV (marks out of 10), Aawalheda

S. No.	Name	Class	Age	Gender	Caste	Baseline	End line
1	Anish Kumawat	IV	8	M	OBC	2	6
2	Anjali Teli	IV	8	F	OBC	6	8
3	Chandrakant Kumawat	IV	9	M	OBC	6	8
4	Dhan Singh Rathore	IV	11	M	GEN	4	8
5	Dolat Pathan	IV	10	M	GEN	5	8
6	Hitesh Giri Goswami	IV	10	M	OBC	8	8
7	Kamlesh Gurjar	IV	9	M	OBC	6	4
8	Kanhaiya Lal Jatiya	IV	10	M	SC	4	10
9	Kanhaiya Lal Purohit	IV	9	M	GEN	6	10
10	Khusbu Regar	IV	11	F	SC	7	10
11	Kuldeep Singh Chundawat	IV	10	M	GEN	8	6
12	Mahek Soni	IV	9	F	OBC	5	6
13	Naina Kumawat	IV	8	F	OBC	6	6
14	Payal Gurjar	IV	9	F	OBC	6	8
15	Piyush Dholi	IV	10	M	SC	6	4
16	Prahlad Jatiya	IV	10	M	SC	6	8
17	Prakash	IV	10	M	SBC	8	8
18	Ranu Salvi	IV	10	F	SC	6	8
19	Sangeeta Kumari Kumhar	IV	10	F	OBC	6	6
20	Satya Narayan Nayak	IV	10	M	SC	8	8
21	Sonu	IV	10	M	SBC	10	10
22	Sunil Kumawat	IV	8	M	OBC	8	8
23	Suraj Dhobi	IV	9	M	SC	6	10
24	Suraj Gurjar	IV	9	M	OBC	6	10

Veer Shiromani Pratap Upper Primary School, Aawalheda is a private budget school with adequate access to resources as compared to other four government schools. School has well- constructed rooms with marble flooring.

11.4.4 Issues and Challenges

- Availability of electricity is a major concern. Village hardly gets six hours of electricity supply in a day, moreover, time for the same is not fixed.
- Education of a girl child is not a priority in this village. Even though, all teachers of Aawalheda School are female, the academic performance of girls is lower than that of boys.

11.5 Government Upper Primary School, Pavatiya

11.5.1 Baseline

A baseline test was organised for students from class second & fourth. Before conducting the test, students were taught chapters from Mathematics & "Environment Science Book" respectively. (Through customary classroom teaching methodology). The chapters were titled as "कान खोले राज" & "Shapes & Figures" respectively. The test was based on these chapters where students from class fourth were asked to respond to five select questions whereas class second students were asked to identify numbers along with different shapes like triangle, square, rectangle and circle.

11.5.2 End line

Conceptual videos on the same chapters (as baseline) were shown to the same students of class second & fourth through the smart board. It was followed by an activity to translate conceptual understanding of students into practical utility. At last, students were asked to respond to the same (as baseline) questions.

11.5.3 Rationale behind choosing class fourth and fifth

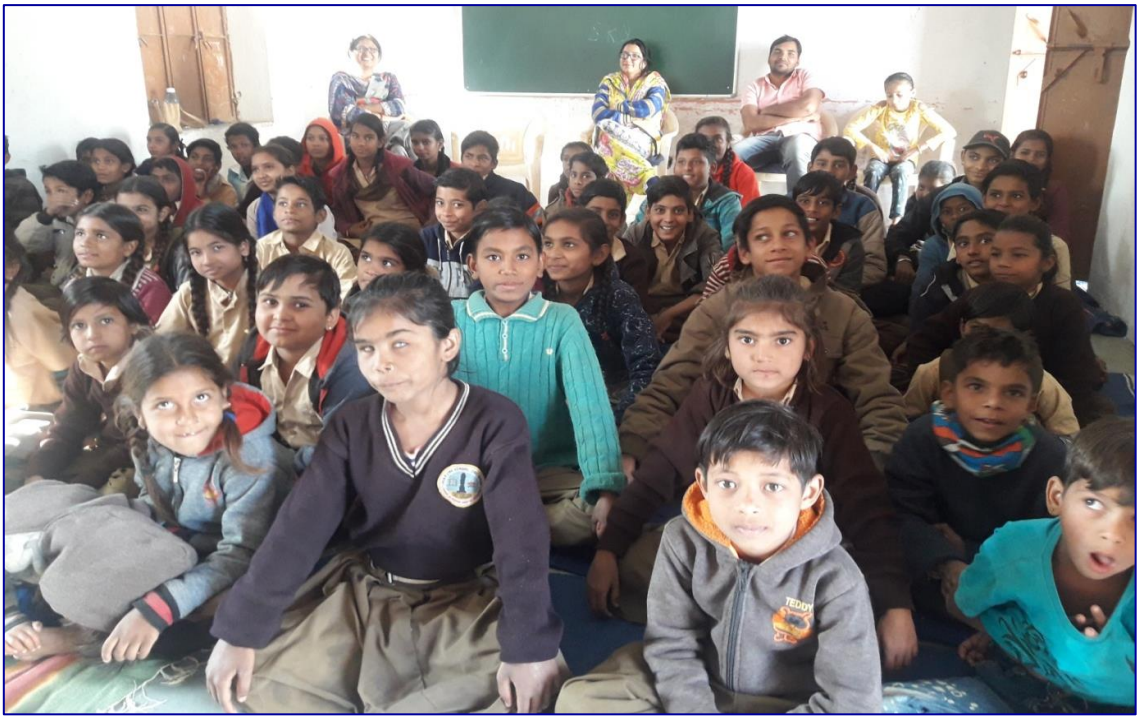
These classes were chosen as the students under primary classes are more open to new teaching methodologies. Moreover, class Sixth & Eighth had half yearly exams during the end line which could have not provided us with the objective results.

Table 12: Baseline and End line result of Class II (marks out of 10), Pavtiya

S. No.	Name	Class	Age	Gender	Caste	Baseline	End line
1	Gopal Vaishnav	II	7	M	OBC	4	6
2	Purnima Pareek	II	6	F	GEN	6	7
3	Rahul Banjara	II	7	M	OBC	3	7
4	Vinod Pareek	II	7	M	GEN	7	8
5	Komal Kumari Jat	II	6	F	OBC	5	7

Table 13: Baseline and End line result of Class IV (marks out of 10), Pavtiya

S. No.	Name	Class	Age	Gender	Caste	Baseline	End line
1	Jeevan Pareek	IV	10	M	GEN	3	8
2	Komal Gadri	IV	10	F	OBC	0	2
3	Pooja Gadri	IV	9	F	OBC	10	10
4	Priyanka Gadri	IV	9	F	OBC	0	2
5	Ratanlal Gadri	IV	10	M	OBC	0	4
6	Kartik Jat	IV	10	M	OBC	7	8
7	Pooja Kanwar	IV	10	F	GEN	9	10
8	Dilkhush Kanwar	IV	10	F	GEN	8	8



11.5.4 Issues & Challenges

- Boys and girls have separate toilets. Toilet for girls is hygienic & equipped with adequate infrastructure, however the toilet for boys is under pathetic condition.
- In last two years, overall students result has improved and some students from nearby private school have also taken admission in the school. The reason behind the enrolment of new students is the appointment of new teachers at school.
- Electricity supply during school hours is unreliable. The village receives three to four hours of electricity supply in a day which is generally not during the school hours. Majority of the members of School Management Committee (SMC) are farm & non-farm labourers. Due to their busy schedule & low wages, they are neither able to devote time for meetings nor provide funds for development.
- Education of girl child is not a priority for parents in this village. After 8th standard, hardly any girl from village gets the opportunity for further education.
- Due to the construction of Aanganwadi and a temple in school premise, there exists no playground facility at school in the present times.
- School gets mid-day meal food from Akshay Patra Foundation. The students are not satisfied with the taste & quality of roti.

12. Feedback from the Principals, Teachers & Students

The stakeholders including community members, students, principals, teachers & district administration have welcomed the initiative of linking clean energy access with quality education. These stakeholders are working in compact towards the realisation of its mandate. Teachers across the select five schools see it as a learning platform for themselves as well as the students. The initiative is also being looked as an instrument of skill building & catalyst for enhancing performance of students. The principals see this initiative as an opportunity to transform the select schools as the model learning schools in the entire Chittorgarh district. The students see this initiative as a makeover of education system. It not only attracts the attention of students during classroom activity but also engages them beyond it. The smart classroom has enabled the students to enthusiastically put forward their perspectives during class room discussion. It helps in localising the context thereby making the education more inclusive.

Access to energy through solar panel has transformed the stakeholders as agents of sustainability. There exists a fine understanding with the stakeholders on the impact of clean energy on the environment in general & reduction of carbon emission in particular. Moreover, the stakeholders also understand the influence it has on the learning outcome of students. Each stakeholder is celebrating this intervention for different reasons; teachers are celebrating as it would add value to their own digital literacy & improve the result of students. Students are celebrating as they have the access to new learning methodologies which helps them to realise theory into practice. Community is celebrating as it has been given equal ownership of this initiative. The district administration is celebrating because of the discourse this intervention has created around clean energy access & quality education. The discourse has reached across different blocks of Chittorgarh thereby raising demand for clean energy access & quality education.

Conclusion and Way Forward

When speaking of quality education, unfortunately the main focus is only accorded to learning outcomes whereas quality education is the combination of inputs, processes and outcomes. 'Inputs' may include attributes like infrastructure, teachers and classrooms; 'processes' may include attributes like school functioning, student teacher interaction, assessments, school environment, curriculum and 'outcomes' may include attributes like learning outcomes, retention rates, dropout rates, and age appropriate completion.

Therefore, while targeting 'quality', interventions on the ground must focus on each one of these elements. The initiative of linking access to clean energy with the students' access to quality education is a step in that direction. While on the one hand, it contributes to infrastructure development through provisioning of reliable energy supply, on the other hand it plugs in renewable energy solutions integrated with smart classrooms to address some of the other attributes aimed at quality education.

In other words, it contributes towards the welfare of children & simultaneously has the potential to mitigate climate change hazards, if such interventions are scaled up. In the long term, the overall effect of similar initiatives can be observed on the economy & environment. It calls for reiteration that this is possible only if such endeavours are scaled up.

In this regard, the present initiative serves as a 'demonstration' where joint ownership of the initiative lies with students, community members, teachers & district administration. The joint ownership serves two purposes, one that it ensures the sustainability of this initiative & second, it creates discourse around quality education & clean energy access.

The installation of Solar PV Systems & Smart Classroom is being viewed as an effort towards bridging the gap between rural & urban schools also. The community feedback suggests that there is wide acceptability of this initiative by different stakeholders. This is evident from the fact that the popularity of this initiative is gradually reaching beyond the vicinity of the targeted schools.

In other words, community awareness on accessing clean energy for educational, health and livelihood purposes seems to be gradually increasing. Speaking particularly in the context of education, the district administration & community of teachers have requested similar interventions in other schools of Chittorgarh district. In light of such encouraging feedback from the ground, this initiative has the potential of being scaled up across other schools in the region. To demonstrate, more diverse use cases of clean energy, even health and livelihood dimensions can also be thought of in addition to intervention on quality education.

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