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# Futuristic Technology and Innovation to Solve the Problems of Indian Rural Education

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***Abstract:*** ***A study has been carried out on improving literacy in rural areas, inspired by the Digital India initiative by the Hon. Prime Minister of India. India currently has the largest population of illiterate adults in the world with 287 million. Even the 73.98% we consider "literate" may not be sufficiently able to convert their literacy to any productive output. This may result in burden on the central and state governments of India in order to support such population, even though they are literate. The 'demographic dividend' of India is at the risk of becoming a demographic handicap that burdens the tax revenue and safety of the nation's future citizens. The problem is particularly serious in rural areas. The present study is an attempt to show that such educational problems can be addressed through technology by improving quality of literacy as well as teacher training. This is vitally tied to the topic of teacher training in rural India, as less than 20% of rural teachers are even able to pass basic eligibility tests. Students are getting unskilled, ineligible teachers to teach them. This study proposes an approach with many components that works with existing initiatives, to maximise the benefits and reach the solution to far corners in efficient, economical ways. The focus is on the use of mobile technology, with offline and online modes, to make high quality "syllabus content" available in places without good cell networks. The study considers both teachers and students, with capable city-teachers and trained NGO workers to help the adoption of new ways of learning among rural children. A mechanism of learning and assessment has been proposed to ensure that students cannot progress without attaining minimum proficiency levels, while still permitting children to be curious and explore higher topics. Further it uses innovative, but pragmatic ideas such as Software translators (Google) instead of multi-language courses, WhatsApp Video Call for support from real humans, AI-based topic recommendation, AR/VR Mobile Labs, and offline chatbots. Teachers are given readymade worksheets and can get help over Skype from graduate housewives and teachers in cities. This study is based on my own survey carried out with children studying in nearby municipal schools, as well as data from UNESCO and the Government of India's MHRD site.***

***Keywords:*** ***Rural education in India; mobile technology in education; demographic dividend; AI-based education.***

## I. INTRODUCTION

As per UNESCO [1], in terms of quality of education, India features in the 17 worst performing countries along with Sub-Saharan Africa, Morocco and Pakistan. The country will soon be asked to find ways to support, through social security schemes, large masses of capable people, who are unable to contribute due to lack of sufficient mental capacity. As far as education in rural India goes there are certain problems that can be dealt with using technology. These can be classified broadly as: (1) making the illiterate literate and ( 2) improving the quality of education among the already literate population. To improve basic
literacy levels, various efforts have been taken by every government in power. Exceptional work is also being done by education start-ups and NGOs. This paper focuses on the latter.

Technology is a powerful tool in addressing the twin problems of improving student learning quality and improving teacher quality [10]. Relying on good physical infrastructure of schools is not an option for rural India. Technology overcomes the problems of poor infrastructure and inadequate teacher availability. It impacts the learner directly, giving students themselves a chance to improve their own learning. Tamil Nadu has successfully used this approach. Technology solutions to rural problems can be effective if done along with the private sector and NGOs, as recommended by the government, and by repeating what already works well.

The solution uses inexpensive mobile phone and tablet technology to deliver NCERT content in Hindi and English languages, primarily, with the option to add more regional languages. Students may directly learn in two ways – through 1) free discovery and 2) mandatory assignment of syllabus content. A teacher-edition of the tablet provides teachers with readymade worksheets, tests answer keys and activity suggestions that are suitable and low-cost. NGO volunteers will support on the ground – to train teachers and support students with technology. City teachers (or graduate home-makers) can use their free time to support rural students as virtual teachers, using simple technology like WhatsApp Video Calls to clear their doubts and help them understand better. These keep costs low and help use the free time of already trained people for a social good.

A small local study tests the hypothesis of whether putting technology in the hands of the learner directly helps them take control of their own education and improve the quality of outcomes. The finding is that, if done thoughtfully, it can. A teacher-survey confirms that the proposed ideas are in the right direction, but may be constrained by ground realities like the worry of tablets being stolen or even sold by the families/schools themselves for basic needs.

This paper is organized as follows: We discuss: 1) the problem in detail, 2) the opportunities that exist to solve them, including several opportunities revealed by UNESCO [1] and Govt. of India reports, 3) the suggested solution and 4) the supporting field tests of the hypothesis.

## II. PROBLEM STATEMENT

### *A. The extent of Illiteracy*

Across India, the percentage of the population that is illiterate is 26.02%, double the world average illiteracy rate of 14%. 26% of the India is 340,000,000 people. If we imagined a country out of the illiterate Indians, it would be the 3rd most populous country in the world! (Figure 1)

All of India's illiterates

[WorldAtlas.com]

| # | Country (or dependency) | Population (2019) | Yearly Change | Net Change | Density (P/Km²) | Land Area (Km²) |
|---|---|---|---|---|---|---|
| 1 | China | 1,420,062,022 | 0.35 % | 5,016,094 | 151 | 9,388,21 |
| 2 | India | 1,368,737,513 | 1.08 % | 14,685,659 | 460 | 2,973,19 |
| 3 | United States | 329,093,110 | 0.71 % | 2,326,362 | 36 | 9,147,42 |
| 4 | Indonesia | 269,536,482 | 1.03 % | 2,741,502 | 149 | 1,811,57 |
| 5 | Brazil | 212,392,717 | 0.72 % | 1,524,763 | 25 | 8,358,14 |

Fig. 1 Extent of illiteracy world over

### *B. The state of the Quality of Literacy*

In terms of quality of literacy, one-fifth of the 18 year olds could not read a grade 2 book in their regional language. More than 40% of 18 year old children couldn't find 10% of a number and 57% of 14-18 year olds could not solve a class 4 maths problem. This means that a large number of young people will be unable to pay the correct price of items, negotiate a salary, read a job advertisement or perform transactions as business persons.

### *C. The Problem of Teacher Availability and Quality*

Simply put, India needs a million more teachers immediately. And they need to be further trained for better quality [3]. 76% of primary teachers are not proficient in grade 5 and 70% struggle with grade 8 competencies. 6.6 lakh teachers lack even the paper qualifications for the job as discussed in ASER [2]. In India, states cannot fill their quotas for recruitment of teachers unless teachers with lower levels of qualifications are hired as pointed out in UNESCO [1].

Most states train teachers for 7-10 days a year. It does not cover the basic content training that teachers seek. To properly train teachers, we need 100-200 hours of digital content, delivered through online platforms, since physical teaching is not viable in such a vast land.

### *D. Where is the Problem Primarily?*

As per the National Achievement Survey (NAS) [11] the poor-performing 15 states are largely located in North India and cover all of North India. (See the YELLOW area in the image.). This indicates that the solution can be just Hindi-based, rather than needing multiple regional languages. It brings down the cost and difficulty of managing good quality content. Figure 2 shows the average scores in languages in India.

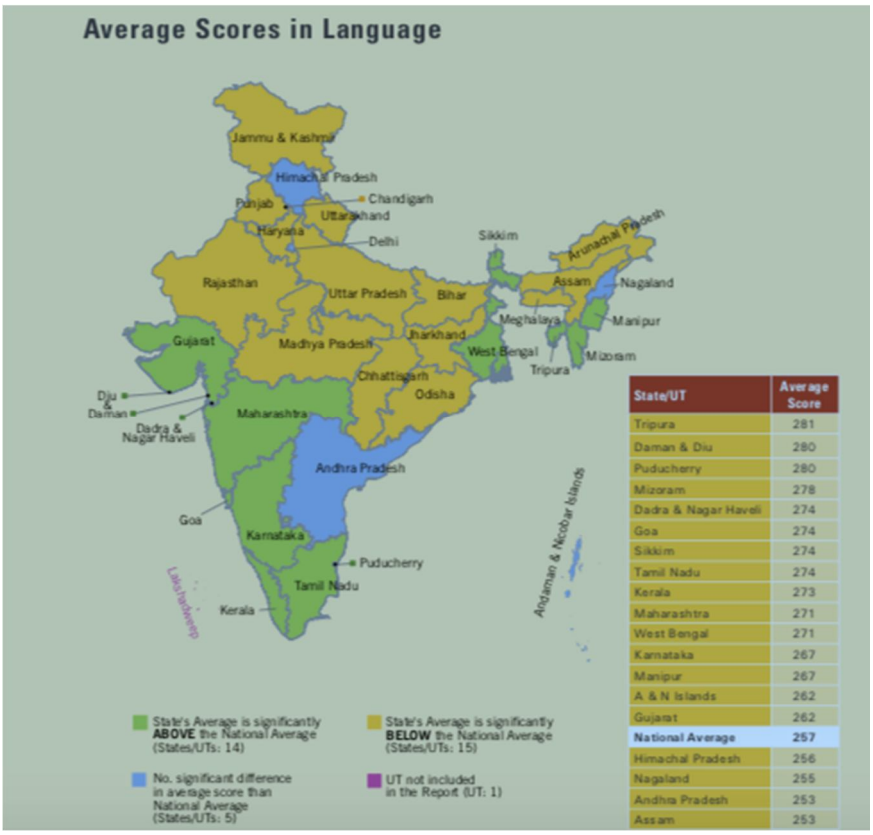


Fig. 2 Average Scores in Languages in India

## III. THE OPPORTUNITY IN DETAIL

While data reveals a dismal situation, it also reveals opportunities for where meaningful solutions can work. This author believes that the best solution can be found by: addressing realistic opportunities revealed by available data and working alongside existing initiatives, rather than starting from scratch.

### *A. Opportunities Identified by Major Reports*

The UNESCO report captures many data points that we see as statements of opportunity, as shown in Table 1.

Table 1: Opportunities Based on Unesco Report

| UNESCO REPORT FINDING | OPPORTUNITY |
|---|---|
| "Children who learn less (esp. in Mathematics) are more likely to leave school early." | Improving Mathematics before class 7 (age 12) will help. |
| "Teacher absenteeism varied from 15% to 42%. Absence of teachers harms learning. " | A system that doesn't expect teachers to always be present |
| "In Andhra Pradesh, 82% of teachers regularly corrected exercises given to children." | If we give students ready worksheets, the teachers are likely to correct them, using readymade answer keys as reference. |
| "Beyond primary school, pupils are unable to understand what is taught in later grades. India's curriculum is too ambitious, compared to what pupils can realistically learn in the given time." | Follow Vietnam's successful method to solve this problem [UNESCO recommendation]<br>Letting pupils learn at their own pace will help them cope. Going too fast will not help. |

### *B. Case studies of what has already worked well:*

*1)* "In Tamil Nadu, primary students learn at their own pace, using self-evaluation cards alone or with the help of another child; teachers pair more advanced learners with less advanced ones. Overall, children's learning achievement is high." [ASER]

*a)* *Opportunity:* Put learning in the hands of the students and their peers, with teachers and parents as 'support systems', rather than primary teachers.

*2)* "In rural India, an after-school programme for pupils from low income families used mobile phone games to help learn English. Pupils became much better at spelling common English nouns, particularly in higher grades with stronger foundation."

*a) Opportunity:* Use games and mobile technology to help older students.

*3)* Schools with trained female community volunteers helped improve Math outcomes.

*a) Opportunity*: Work with NGOs with existing trained volunteers.

*4)* "Digital classrooms can complement classes given by less qualified teachers. In India, the Digital Study Hall project shows DVD of video recordings of live classes taught by expert teachers, in rural and slum schools. An evaluation of four schools in Uttar Pradesh found that, after 8 months, 72% of pupils had improved scores."

*a) Opportunity*: Digital learning in classrooms that does not need the physical presence of qualified teachers. Use city-resources by recording them.

*C. Digital India (Government Initiatives)*

*1)* The Government of India, under PM Modi's direction has launched 33 new initiatives. The SWAYAM portal has been launched with 1,032 online courses by the best faculty and 17 million e-books. 32 lakh users are benefiting, accessing it for free.

*a) Opportunity*: Work in concert with the government's initiatives.

The context of the solution may be succinctly captured as shown in Figure 3.

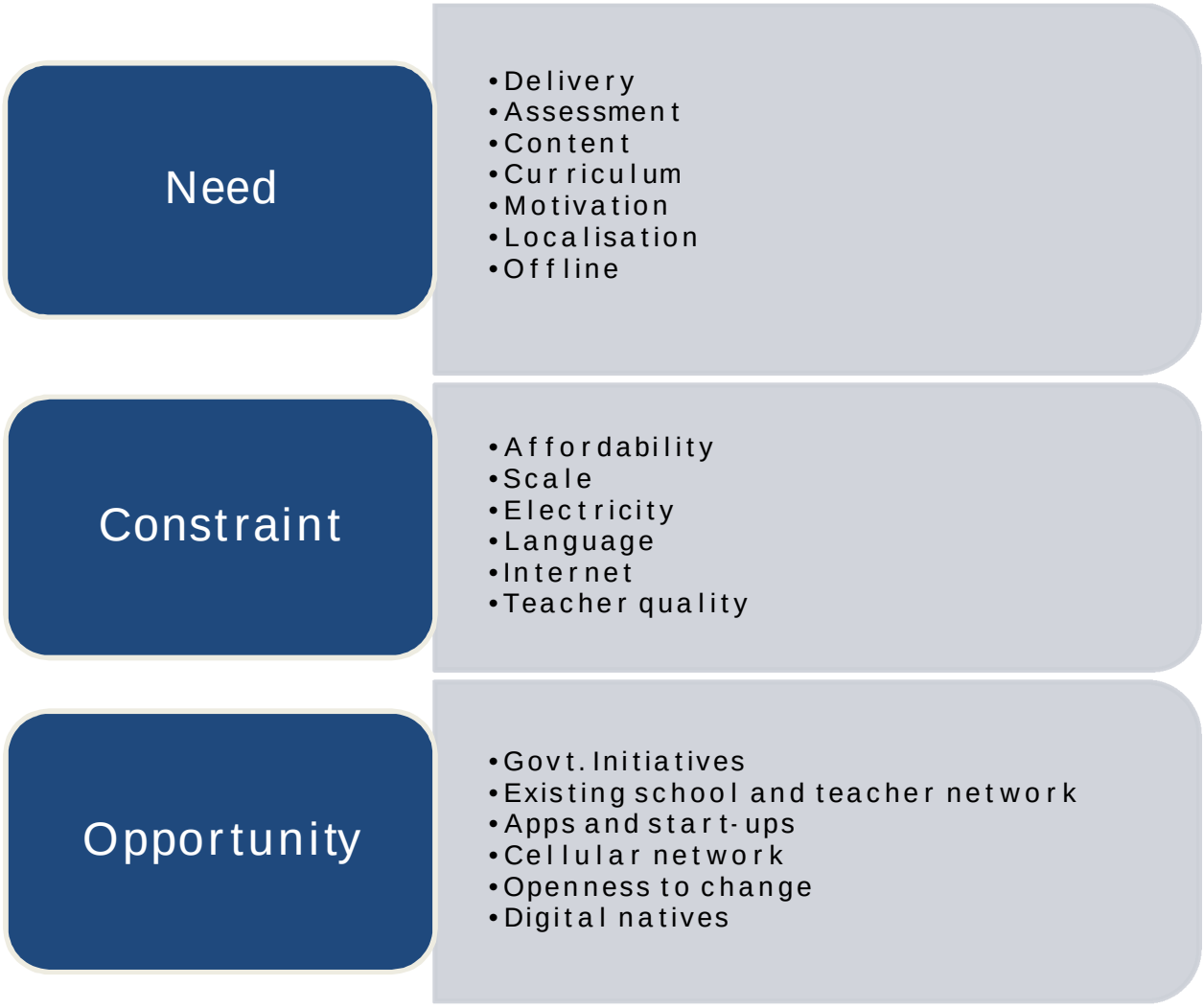


Fig 3 Context of Solution

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## IV. MIND-MAP OF KEY ASPECTS OF THE SOLUTION

The following mind-map (Figure 4) captures the key ideas of the solution succinctly.

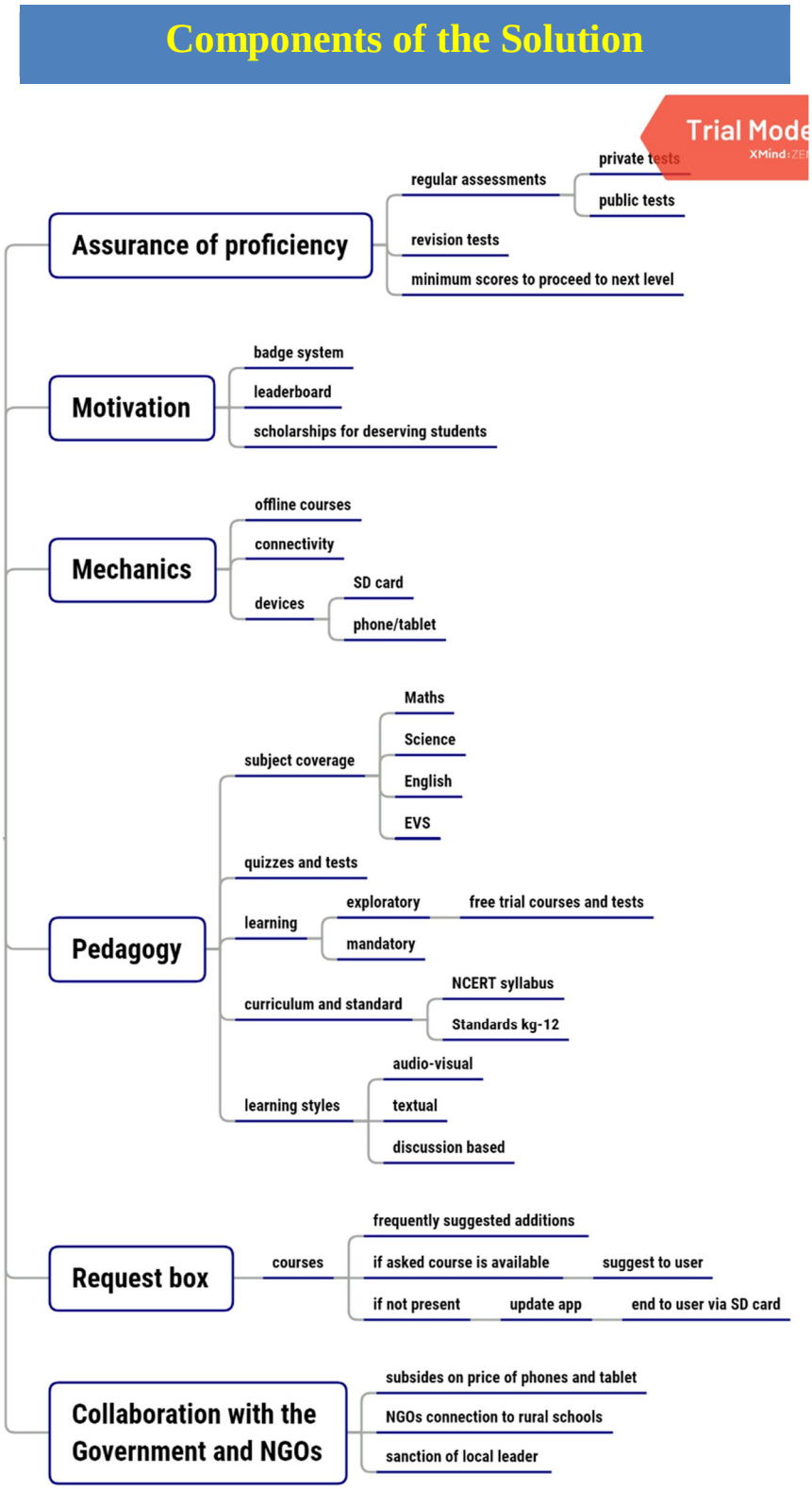


Figure 4: Components of the Solution

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## V. THE SOLUTION IN DETAIL

Analysing the opportunities noted above, from the reports, case studies and government initiatives, the author has proposed a solution, as shown in Figure 5, with the following parts:

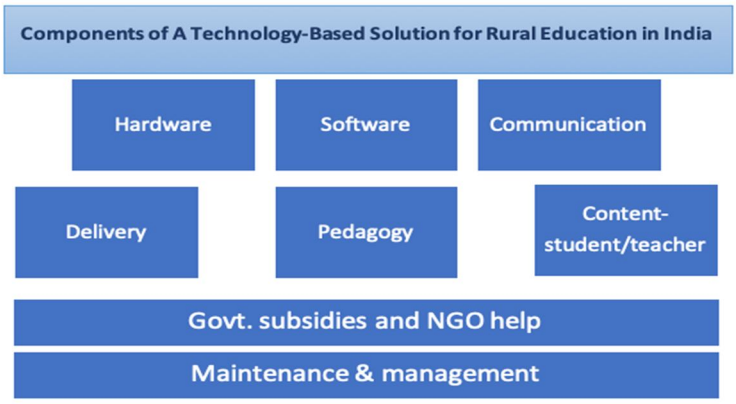


Fig. 5 Design of Proposed Solution

*A. Hardware, software, Delivery:* An Offline Mobile App

*a)* An offline app on a mobile phone and/or tablet is proposed, since rural schools don't have computer labs equipped with desktops. The tablet/phone with earphones, may be given to 'groups of learners' such as one per class, or even one per household.

*b)* Even one phone per household with installed educational apps that work offline can make a huge difference. In conditions like in rural India, where there is no constant supply of internet and data is expensive, offline learning is the best option.

*B. Content – Two editions:* Student and Teacher

*a)* The content can be in SD cards. It will be of two types- the student edition and the teacher edition. Teachers will be given ideas to explain a specific concept to the students, practical real-world experiments, worksheets, tests (with sample answers).

*b)* Updated content can be sent via post to the rural districts in the form of an SD card.

*c)* Content Division: Content will be available in *English and Hindi*, classified based on

*i)* *Level (Grades:* from KG to 12$^{th}$)

*ii)* *Type (Subjects:* Mathematics, Science, English, EVS)

*C. Pedagogy (Learning Path) – Part 1:* Syllabus, Language

*1)* The syllabus in both paths is NCERT, providing consistent coverage of concepts.

*2)* As noted in Section II, the largest problem is in the Hindi-speaking areas, so the primary content languages will be Hindi and English. However, regional languages need coverage too. To keep the cost of translation low, an innovative translator mechanism is suggested.

*a)* The phone should have Google translator pre-installed into it so that anyone can look the meaning of words or phrases they don't understand at any time.

*D. Pedagogy (Learning Path) – Part 2:* Balance between proficiency and curiosity

*1)* There will be TWO ways of learning – syllabus learning and exploratory learning.

*a)* *Syllabus Learning*

*i)* As aforesaid, 40% of 12$^{th}$ graders could not find 10% of a number. So, even someone who is classified into grade 12 by the school system, should have access to level 1 content on the software, to clarify earlier weak concepts.

*ii)* If you want to move to the next level, it is compulsory to score minimum 70% in your "private tests"(see below). This not only bolsters your elementary education, but also ensures that you are capable to handle the next level.

*b)* *Exploratory Learning*

*i)* Sometimes, children are curious to explore concepts that are above their levels. For such students, there are free trial courses and questions that give them a gist of the concept without having them unlock the concept.

*ii)* The system will suggest some similar or related concepts in their level that they can explore and go to the depths of.

*2) Method of Teaching*

*a)* Topics are explained using video to be easy to grasp. The modules provide visual and interactive parts, along with textual data. This keeps the user's attention on the module in an entertaining way, without being distracting.

*b)* To make sure the learner is not "skipping through" the video, there will be pauses to ask them questions, which they have to answer correctly to continue.

*c)* Artificial Reality is one way to provide a practical experience to children without physically using the apparatus. The tablet can be tilted and turned to simulate pouring, moving etc. and used to conduct experiments virtually.

*d)* Virtual Reality with Google Cardboard is a less expensive way to provide occasional experiences of stars, galaxies etc. A MOBILE LAB IN A VAN is suggested for this, which will move through various rural schools, providing children regular access to science lab experiments as well as VR experiences.

*3) Doubt Clearing*

Almost all students have doubts about a topic. The app will provide 2 ways to help:

*a)* *Doubt Bot:* This software provides a doubt-clearing space. The student types his/her question and mentions the keywords of the question. On entering the question, the system will scan the keywords and look for modules that include all or most of them. This module will further be recommended to the student. This uses the app's Artificial Intelligence ability to find matching content.

*b)* *Human Tutors:* In addition, city-based teachers or educated housewives with extra time will be available for phone conversations in their local language.

*E. Pedagogy – Part 3:* Testing

The tests in the software are of TWO types - private and public:

*1)* Private tests are frequent tests and quizzes that are available offline in order to check the knowledge of the child in each topic. They can be repeated any number of times till the child feels sure. 70% pass in this is required to go to the next level of syllabus-based topics, to ensure proper learning.

*2)* Public tests help compare his test scores with others and get recognition.

*F. Pedagogy – Part 4:* Motivation with Badges, games, leader boards, sponsorship

*1)* There is a concept of badges where the student collects different digital badges as and when he completes courses with good private test results. They show on the app.

*2)* Students also collect **badges** as they complete more and more concepts. Collecting 4 badges unlocks a fun game. This might encourage them to try out more topics.

*3)* If at any time, certain students get access to the internet, there can be a system of **leader boards** where they display the top scorers in the tests conducted. The spirit of competition may motivate some kids to do better and bring out the best in them.

*4)* Scholarships for those who show consistent effort and improve scores in a big way

*5)* One specific idea is "***Khud padho, apni behen ko padhao***" scheme where a child who scores well 'sponsors' a device for his/her sister. This encourages parents to push the boys to study and be "the pride of the family", who will then get the girls to study too.

*G. Connectivity, Delivery:* Public tests, live stream teacher training, support

*1)* There must be a minimum connectivity so that the student can endeavour to take the public tests too, when he/she feels ready [7]. The phone comes with pre-installed data.

*2)* Teacher training through live seminars they can join using Skype or WhatsApp video.

*H. Cost, Training,* Maintenance: Subsidised, maintained by volunteers [9], [10]:

*1)* The app must be free so that even the poorest houses can afford it. We need to work in concert with the government to get subsidies on digital devices and on content cost.

*2)* Local volunteers from NGOs can help train teachers to use the app and provide support either in person in a local language or through group calls on WhatsApp.

*3)* If there are trusted locals or NGO workers whom the local 'sarpanch' or parents already know and trust, they are more likely to listen to them when a new solution is proposed. Otherwise, they may not be sure about enrolling.

*4)* Students can request for new content or new examples or suggest topics or even ask for their language content using a Request Box feature in the app, which records their requests and uploads it whenever internet is available.

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## VI. HYPOTHESIS TESTING

To find if this suggested solution is viable, two local tests were conducted. One, an activity was conducted with 30 slum children of class 4/5 who study in municipal schools in Mumbai; the second, a survey with local teachers. In order to test the technology based method of learning, the following session was conducted for 30 underprivileged students in the neighbourhood of my own school. These children were chosen mainly because we were able to organize this close to my residence, so that I can carry out the survey without affecting my normal day-to-day programs adversely. Besides, they represent the rural population and students who can speak primarily Hindi, but are from English medium. The method used was:

*1)* The students were shown a Hindi language video that teaches Solar System topic for Class 4. (Science - Solar system and its planets with animation - Hindi)
*2)* Then they were given a 6-question test. At first, they were not allowed to go back to the video or discuss.
*3)* Then the same test was given again, but allowing them to go back to the video and discuss with their peers.
*4)* Then they were given a questionnaire. The students were asked to answer: Yes, No, or Not Sure.
*5)* The assessment questions were mostly simple, except the first and fourth ones which were difficult (see Figure 6 below).

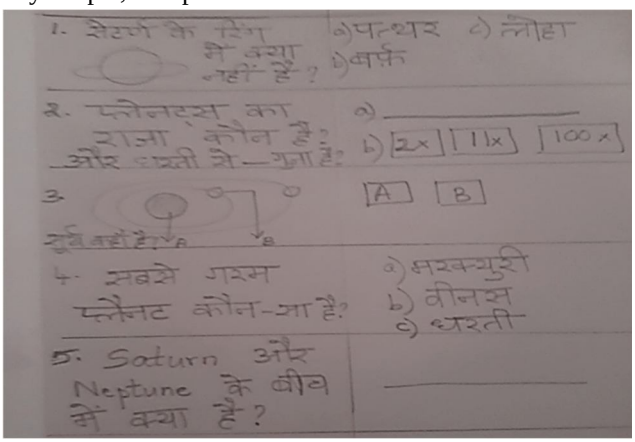


Fig. 6 Assessment Questions

The evaluation was done based on these answers. Note that student names were not taken to protect their identity. Teachers assisted them to mark the correct answer in English. . A separate Questionnaire was given to teachers also. Additionally, I discussed with the staff members and got their feedback to ascertain how useful the technology based education will be for the rural community. An appropriate set up was created, with children being provided digital devices, with earphones to listen to audio.

### *A. Hypothesis Testing – Results - Students*

The Assessment Results have been collected and are shown in bar graphs below (Table 2 and Table 3). The complete Assessment Data are shown in Table 4.

Table 2: Assessment Results With No Repeat

| | | | | | | |
|---|---|---|---|---|---|---|
| 26-30 | | | | | | |
| 21-25 | | | | | | |
| 16-20 | | | | | | |
| 11-15 | | | | | | |
| 6-10 | | | | | | |
| 1-5 | | | | | | |
| 0 | | | | | | |
| | Qn 1 | Qn 2a | Qn 2b | Qn 3 | Qn 4 | Qn 5 |
| No. of pupils with correct ans. | Results when children were shown the video once and were not allowed to go back or discuss with others. (This represents the traditional way – single lecture; no discussion.) | | | | | |

Table 3: Assessment Results With Repeat

| | | | | | | |
|---|---|---|---|---|---|---|
| 26-30 | | *Improved* | | *Improved* | *Improved* | |
| 21-25 | | | *Improved* | | | *Improved* |
| 16-20 | | | | | | |
| 11-15 | *Improved* | | | | | |
| 6-10 | | | | | | |
| 1-5 | | | | | | |
| 0 | | | | | | |
| No. of pupils with correct ans. | Qn 1 | Qn 2a | Qn 2b | Qn 3 | Qn 4 | Qn 5 |
| | Results when children were allowed to go back to the video and discuss to find the answer (Conclusion: Devices allow you to revisit lectures. Collaboration improves learning.) | | | | | |

The same test was conducted with students being allowed to revise the video. The complete assessment data has been captured below as shown in Table 4:

Table 4: Complete Assessment Data

| Students | Males: [19] Females: [11] | Age: 9yrs – 10yrs | TOTAL: 30 students participated | |
|---|---|---|---|---|
| Question Number | Question | Yes | No | Not Sure |
| 1 | Did you know this learning technology before? (Awareness) | 10<br>33.33% | 20<br>66.66% | 0 |
| 2 | Do you find this new learning method useful? (Usefulness) | 23<br>76.66% | 7<br>23.33% | 0 |
| 3 | Is this method better than the usual teaching-learning style? (Superiority) | 28<br>93.33% | 2<br>6.66% | 0 |
| 4 | Do you think you will be able to learn school concepts better now? (Effectiveness) | 28<br>93.33% | 2<br>6.66% | 0 |
| 5 | Would you like to learn more topics like this in future? (Continuation) | 30<br>100% | 0<br>0% | 0 |
| 6 | Do you prefer a combination of usual method and technology based method? (Combination) | 30<br>100% | 0<br>0% | 0 |
| 7 | Is this method fun to learn? (Happiness) | 30<br>100% | 0<br>0% | 0 |
| 8 | Would you attend all the classes if technology method is continued? (Regularity) | 26<br>86.6% | 4<br>13.3% | 0 |

The answers obtained from the Questionnaire were converted to percentage of students answering Yes. This is shown as bar-chart in Figure 7. It may be noted that no student has answered Not Sure for any question.

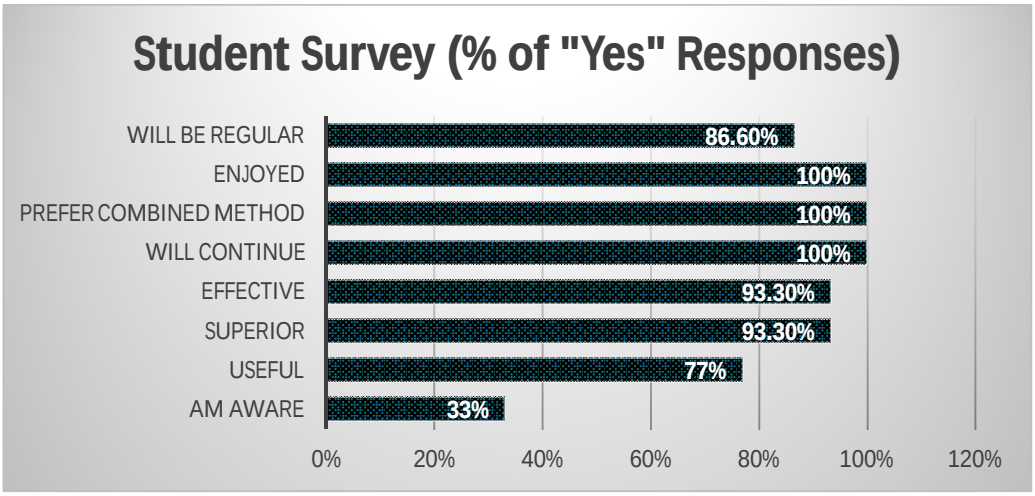


Figure 7: Percentage of Yes Responses

*B. Other Observations during This Project*

*1)* These are young children and they get excited easily and were ready to dive into the technology world. But we don't know about their parents.

*2)* One child had difficulty using the tablet, navigating it and seemed to have formed a negative view of it even before starting. He was restless the whole time.

*3)* Children were quite engrossed in the content itself. They were reluctant to discuss to understand, but eased up, when nudged.

*4)* Children tried to touch and play with the video player. It would have been good if there was animation in the content, but they understood how to use the tablet fast.

*C. Teacher Survey*

Teachers were asked whether they found this method useful or not. A questionnaire was used to gauge teacher-acceptance of these new methods. A sample table of our survey with data of three teachers is shown in Table 5.

| Hypothesis Testing: Tablet given to primary teachers of municipal school on: Solar System | | | | |
|---|---|---|---|---|
| Qn. No | Question | Teacher 1 (Female) | Teacher2 (Female) | Teacher 3(Female) |
| 1 | Did you learn anything new? | N | Y | N |
| 2 | Have you taught this topic? | Y | Y | Y |
| 3 | How well did you fare on test? (no discussion; no replay) | 6/6 | 6/6 | 6/6 |
| 4 | Is it useful or fun or both to you? | F | B | B |
| 5 | (Given worksheets) Would you use these? | Maybe | Y | Y |
| 6 | Do you think it will be fun for children in rural areas? | Y | Maybe | Y |
| 7 | Do you think it will be useful to improve rural learning levels? | Y | Y | Y |
| 8 | Is this a viable solution for rural children? | Maybe(+) | Maybe (+) | Y (+) |
| 9 | Is this best used as a primary tool for learning or supplementary? | S (*) | P (*) | P (*) |
| 10 | To what extent will teachers adopt this? | Medium (**) | Medium(**) | Low(**) |

NOTES:

(+) All teachers had questions on viability – electricity, charging point availability, theft of devices, misuse, what if the devices are never given to children and used instead by corrupt officials and teachers? They felt that some school headmasters will never take the tablet out of the shelf!

(*) All teachers felt that children need the human touch and that technology can only supplement; but they know that qualified teachers are rare in rural areas. So they sadly approve "tablet as teacher" and hoped that children themselves are able to teach each other using this content, to escape illiteracy.

(**) All teachers agreed that there is a negative bias and superstition about technology in rural areas; changing their mindset will take time. The survey participants worried about the rural teacher's pride that they don't know how to use technology, but the children do. The participants also noted that teachers are still teachers and will overcome their pride, if the children genuinely get to learn better.

Table 5: Teacher Survey Data

## VII. CONCLUSION

The proposed solution consists of two parts: Futuristic technology and Innovative Ideas for improving education of rural students and teachers.

*A. The Futuristic Technology includes [7], [8]*

*1)* Offline mobile app on a device with pre-paid data, with content provided in SD cards
*2)* Artificial Intelligence (AI) Bots to suggest concepts related to doubts and FAQs
*3)* Artificial Reality(AR) to simulate lab environment and virtually conduct tests
*4)* Virtual Reality (VR) devices like Google Cardboard shared among many villages
*5)* WhatsApp video calls and Skype for teachers to interact with students in remote areas
*6)* Google Translator to translate courses in Hindi or English to other regional languages

*B. Innovative Ideas Like*

*1)* '*Khud padho, apni behen ko padhao*' (learn yourself; educate your sister)
*2)* Mobile Lab in a Van and
*3)* Using the free time of city residents to train teachers and help students

These are suggested as ways to overcome the psychological, cost and practical difficulties in such projects. Technology solutions, when pragmatically built, can make a real difference. All this is but a starting point for upcoming solutions as it too has some shortcomings. The hypothesis was tested on a very small sample group, as I was constrained as a student and not able to get approval for bigger groups. Besides, the learning activity was video-based. Ideally it should have been a learning app on a tablet (such as what companies like Byju's provide). I would have liked to speak to NGOs in education to understand more about ground-level problems they face every day. However, I was limited by my meagre means and the given time. A subsequent study may focus on these areas of improvement. As we have seen, there will always be students who are uncomfortable with change, teachers who think it is not pragmatic due to scarcity of primary implements like charging points, and parents who are reluctant to use technology. For this solution to work, the pre-set thinking of rural residents needs to evolve to accept change and use of technology. To ease people into accepting it, we need to hide the power of technology behind simple, easy to use interfaces. Simultaneously, we also need to use the influence of existing ground-level NGO workers and government initiatives and put the power of learning in the hands of children, while helping eager teachers to better support them. When all forces come together, learning will improve. The future of India depends solely on the minds of young thinkers who can, now, using educational platforms, transform the buds of curiosity in their minds to flourishing trees of success. This will be the end of the third most populous nation in world- Illiterate India.

## VIII. ACKNOWLEDGMENT

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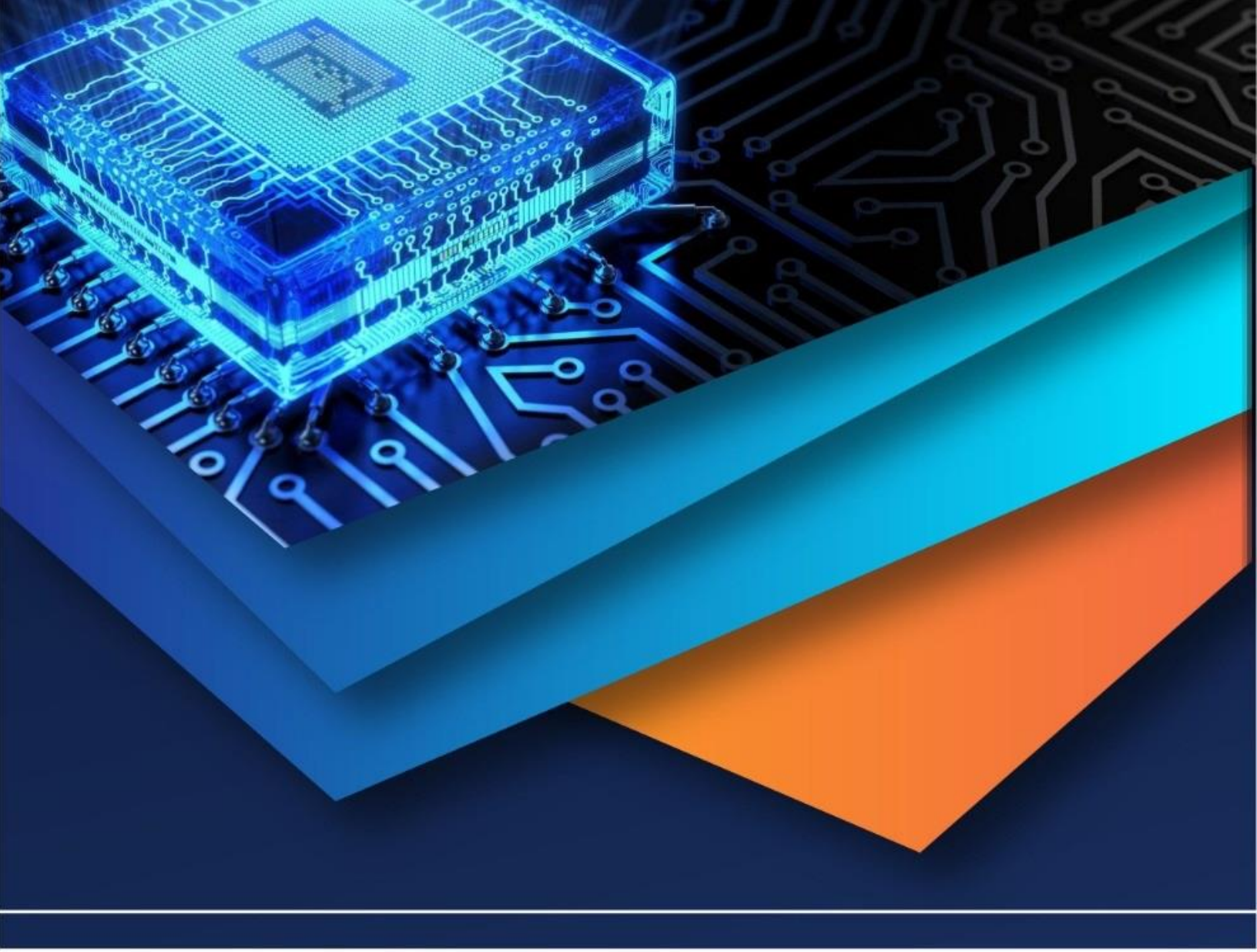

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