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Blended learning to improve quality of primary education among underprivileged school children in India

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Abstract

Access to quality primary education is a major concern in India. Despite of having reasonable infrastructure, issues of teacher absenteeism, poor accountability of teachers, ineffective teaching learning materials and inadequate teaching procedures are still the prevailing causes for poor educational quality in lower tier schools. Though private schools with their high-end infrastructures have tried to establish their domination in imparting quality learning, the latter continue to remain a distant dream for the underprivileged students. Studies have revealed that Internet-enabled, Web 2.0 based blended learning environments can stimulate student engagement, motivation, and learning. However ICT-based supports in Indian schools are provided either mostly to those who can afford it, or as sporadic government experiments which are either discontinued or undervalued. In this context, the paper presents an Internet-enabled blended-learning platform, which combine traditional models of classroom interactions with synchronous e-learning, facilitated by expert online teachers with digital audio-visual contents. The pilot study conducted using proposed blended learning platform proves that it is possible to provide quality education to underprivileged school students. The findings indicate that blended learning platforms in classroom settings, along with quality digital content, expert online teachers and on-site teaching assistants as class coordinator creates a learning environment that can improve learning achievements and well-being of students drastically, irrespective of their socioeconomic status.

Keywords Quality education · Synchronous E-learning · Asynchronous E-learning · Web 2.0 technology · Wellbeing · Learning achievement

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1 Introduction

In India, the pattern of educational development is starkly dualistic in nature. The education spectrum witnesses excellent urban schools that are comparable to the best institutions in the world, but they are expensive and only a handful. On the other hand, there are low-end Government-aided public rural schools which are in deplorable state. Poor performances of these rural schools are "marked by teacher absenteeism, inadequately trained teachers, non-availability of teaching materials, inadequate supervision, and little support" (Kumar and Rustagi 2010). Children from rural schools often drop out due to factors like an "unattractive classroom environment, teacher absenteeism, teacher-centered teaching, and a stagnant daily routine" (Dreze 2003).

In this situation what seems to become pertinent is to actually understand the parameters of quality education and observe the role of ICT-driven blended learning framework as an important factor in imparting quality education in areas where there is dearth of it. Thus, the objective of this paper is to develop an Internet-enabled blended learning platform to improve learning achievements and well-being of rural underprivileged students. More specifically, the objectives of this paper are: (i) to propose indicators for benchmarking quality of education delivered by Indian school systems; (ii) to identify factors influencing quality of education; and, (iii) using the proposed benchmark, to demonstrate how ICT-driven blended learning framework can improve quality of education for underprivileged and low-performing primary school children.

2 Access to quality primary education: An Indian perspective

The highest number of school enrollments in India is still under government schools and the government has invested a lot in enhancing school infrastructures to facilitate free and compulsory primary education for all. However, investments to improve access and enrolment of poor students were not accompanied by investments in quality, resulting in high dropouts at various transition points in the school system (Dhawan 2014). This poor quality of education is starkly visible when a significant portion of the student population in rural secondary schools is incompetent in simple reading ability and nearly two thirds are not conversant with simple arithmetic (ASER 2014). Additionally, due to lack of proper benchmarking methods, the education standards were never mapped while the government continues to invest on education with no clarity on benchmarking (IANS 2018).

Teacher absenteeism, deplorable teaching quality especially in remote areas, non-availability of properly trained teachers, unattractive pedagogy, inadequate teaching-learning material can be identified as primary hindrances which make investment in traditional classrooms ineffective (Dreze and Sen 2013). Teaching methods predominantly include mindless rote learning, repetition without comprehension, and endless repetition of various tables (Dreze and Sen 2013). Teaching methods were often didactic, teacher centric and repetitive. Limited class time is devoted to activities involving discussion and participation of pupils (Sankar 2009).

In order to cope up with shortage of school teachers in Government and semi-Government public schools, there is a nation-wide practice of recruiting *para-teachers* with lower academic and no professional qualifications to serve in the formal public

school classrooms on a contract basis. The practice of recruiting professionally untrained and academically under-qualified teachers—referred as 'Para Teachers' or 'Contract Teachers'—to serve in the formal elementary schools of the country has been widespread since the 1990s as part of Universal Primary Education Program of Government of India. Several researchers have raised serious concerns about the capability of para /contract teachers to teach in elementary schools of the country and have warned against the de-professionalization of the teaching cadre (Atherton and Kingdon 2010).

Failures of the public education system in imparting quality education, coupled with a high propensity within India's middle class to spend on education, have resulted in the emergence of private schools. Education is not free in private schools and they are beyond the reach of majority of people. Moreover, good private schools are urban-centric and boast of high end infrastructure and ICT based support to enhance student learning. These schools are given preference because of their comprehensive curriculum, continuous evaluation, syllabi based on practical applications, interactive skill based assessments and fun based learning. These schools, in general, ensure better learning levels and better quality of school education compared to public schools in India (FICCI- Education Report 2014). They boast of higher learning achievement along with high overall development of students, thus proving to be more accountable towards provision of quality. The increase in private school enrolment in India has seemingly sown the seeds of inequality, as the fee they demand more often than not ends up being an exorbitant amount, unaffordable to a large segment of Indian population. Such stratification not only perpetuates inequality over generations, but also threatens the ideal of "public schooling" for all students (Muralidharan 2014).

Simultaneously another phenomenon has been observed: the rise of low-cost private institutions in semi-urban and rural India (Ohara 2012). However, studies indicate that there are concerns about content, quality and methods of teaching in both the government and low-cost private school segments and they are not adequate to provide access to quality educations (Sarangapani 2009). In this situation, there is a strong need to identify plausible and sustainable solutions to create educational quality for those underprivileged school students.

3 E-learning and blended learning in school education

3.1 Models of on-line and blended learning

E-Learning is learning with the help of computers (or other/newer electronic end-user devices) and the Internet (Laschewski 2011). Use of computers only to learn from offline digital content can also be termed as E-learning. However, *internet enabled on-line learning,* a combination of distance education and e-learning, can make e-learning truly effective, both in general terms and particularly in rural context (Laschewski 2011).

Internet enabled e-learning environment or on-line learning can be divided into two categories: *synchronous* and *asynchronous* (Garrison 2011). **Asynchronous mode** promotes learning anytime, anywhere. People / organizations interested in imparting knowledge have the freedom to enrich the digital knowledge pool by providing various forms of e-content in the cyber-space (e.g. OER Commons, YouTube, Udemy, Khan

Academy, etc.). With the advent of MOOCs, various asynchronous learning platforms were introduced that changed the entire learning landscape to a virtual one. Examples are edX, Courseera, Udacity, FurtureLearn, Udemy etc. Any asynchronous, self-paced e-learning assumes that the learner has individualized access to a computer with internet. Additionally, the learner has to be proficient in English due to non-availability of e-learning materials in regional languages. Hence, this mode is not suitable for Indian rural / underprivileged students.

In **synchronous mode**, students and instructors are geographically separated but meet online at a scheduled time using video-conferencing tools in a virtual classroom. Several organization offer online synchronous learning for privileged children both locally and globally such as- My Big Campus, Learn It Live, TutorMing, Lessonface, Vedantu, etc. These synchronous e-learning initiatives connect privileged students and teachers dispersed geographically. The question arises whether such methodologies of dissemination of knowledge can be used for disseminating education for under-served school children.

When e-learning methods described above are being combined with traditional classroom methods, it can be termed as **Blended Learning.** Figure 1 shows e-learning as a continuum. It is to be noted that blended learning, which is a combination of face-to-face and e-learning, can be any one of the three "middle" modes (Bates and Poole 2003).

In "blended learning", the word *blended* signifies use of two or more distinct methods of learning. Ultimate objective of this *blending* is to ensure learners' knowledge acquisition process to improve their learning potentials. As indicated by Dziuban et al. (2004), "Blended learning should be viewed as a pedagogical approach that combines the effectiveness and socialization opportunities of the classroom with the technologically enhanced active learning possibilities of the online environment, rather than a ratio of delivery modalities".

3.2 E-learning and blended learning in Indian schools

The e-learning market is expanding rapidly in India with a large number of private players including start-ups entering this segment. According to Technopak's analysis, India's digital learning market is "currently estimated at US$ 2bn in 2016, growing at a CAGR of 30% and is expected to reach US$ 5.7 bn by 2020" (Technopak 2016). The increasing internet penetration, availability of low-cost smart phones, ease of learning in an e-learning environment and availability of online contents are the primary reasons behind popularity of e-learning initiatives.

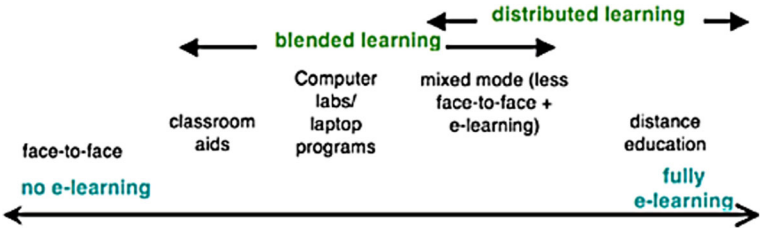

Fig. 1 Different forms of e-Learning (Bates and Poole 2003)

But unfortunately, in consonant with the elitist bias in our education system in India, these initiatives are primarily urban-focused. In spite of some Government initiatives, the rural populations are still far away to enjoy the benefits of these e-learning initiatives. Moreover, majority of e-learning initiatives, both Government and private, are focusing on either higher education or professional education with little emphasis given on school education. In this section, we will discuss some e-learning initiatives in school education of India.

E-learning in school education in India can be categorized as: Smart-Class solutions, Online Tutoring and Self-paced Learning using Digital Content.

Smart-class solutions This is a blended learning model using face-to-face driver mode where the teacher uses face-to-face instructional methods in classroom with computer-based digital teaching learning materials used in classroom or in separate computers labs. There are several expensive private initiatives like EduComp (http://www.educomp.com/) and start-ups like TeachNext (http://teachnext.com/), who offer a range of education services and products including multimedia contents and smart-classes for high-cost private schools. At the same time, there are some initiatives for rural children at government and government-aided schools also, like the Computer Aided Learning (CAL) programs and the ICT @ Schools scheme launched in 2004, which has provided technological and peripheral support to some of those schools. However, the success of such schemes is limited due to sporadic and ad hoc nature of these initiatives. Teachers are not adequately trained and motivated to use those teaching aids, leading to under-utilization of the computing facilities provided in public schools.

Online tutoring This is a synchronous mode of e-learning where students meet teachers at scheduled time slots through videoconferencing. There are several start-ups like Vedantu (www.vedantu.com), My-private-tutor (www.learnpick.in), The Center for eLearning and Training (C-eLT: www.c-elt.com), etc. operating in this space. However, their offerings are so expensive that it can only cater to the privileged section of Indian urban students.

Self-paced learning using digital content This is an asynchronous mode of e-learning that promotes learning anytime, anywhere through the digital contents available in the cyber-space. Some of the start-ups catering to privileged urban students in this domain are: *Ignitor* (ignitorlearning.com), *Classteacher Learning Systems* (www.classteacher.com), *Byjus* (www.byjus.com), etc. One of the social entrepreneurs operating in this domain is *EdJilla* (http://www.edzillasoftech.com/), which caters to rural/ semi-urban schools using the Textbook-on-Tablet solutions.

It is to be noted that pure synchronous and asynchronous e-learning models are not suitable for rural children, since these models assume that each student should have access to a computer or tablet on an individual basis. Smart-class solutions based on blended learning model are also not suitable in rural context, since they are dependent on local teachers at rural classrooms and do not address a major problem: non-availability / lack of accessibility of qualified local teachers at rural classrooms. So, we need to architect a classroom-oriented

blended learning model that uses internet to connect remote expert teachers in rural classrooms using video conferencing tools, thereby reducing dependency on local teachers at rural classrooms.

4 Design and development of an integrated blended learning platform

4.1 The need for an integrated blended learning platform in rural context

Most of the ICT interventions in the context of rural transformation are exogenous in nature. They usually use a "push" approach and give less attention to the technology adoption capabilities of individual actors of the rural community. This approach assumes that rural development can be achieved through acquisition and implementation of technology (ITU 2011). This approach results in implementation failures of ICT interventions, since they fail to recognize the importance of the context and of users' practices (Giolo 2012).

The endogenous approach, on the other hand, is based on an understanding that the impact of ICT usages "are caused not by the technology, but by the new forms of informational behaviour they facilitate." (Mansell 2010). The endogenous model thus focuses more directly on resources and aspirations of users in the context of development.

In the context of improving rural education in developing countries, mere applications of education technology related tools and practices will not improve learning experiences and outcomes of rural children (Kalolo 2018). The design challenge is therefore about finding ways to appropriately integrate digital technologies in education systems that would help both teachers and learners to accept and adopt the digital technologies as new methods of learning systems.

Researchers have conceptualized the concept of *digital maturity* both in the context of individual and organization (Vardisio 2015). One of our major design challenges is that the digital maturity levels of our rural users in India are poor in the following three dimensions:

E-awareness: the aptitude to understand the opportunities of digital technology
Digital literacy: competencies to use digital technologies to fulfill personal and professional objectives
Informational literacy: the ability to retrieve, understand and interpret information coming from digital sources.

Thus, in this particular research, the concept and consequent design and development efforts need to be tuned according to the learning context and capacities of rural underprivileged students. Several models of blended learning have been tested both globally and locally (PERC 2014; British Council Report 2016). However, all models of blended learning usually assume face-to-face availability / accessibility of qualified teachers, enabling interactions in physical classroom settings as and when needed. However, as discussed in Section 2, non-availability / poor accessibility of qualified teachers at rural classrooms is one of the major problems in Indian education system.

Moreover, as discussed earlier, digital maturity of both rural students and class coordinators are poor and they are new to computer-based education systems. Additionally, poor economic condition of rural students inhibits them to possess and access any computing device (computer / laptop/ smartphone) freely, making them *digitally naïve* compared to the urban students and teachers, who are immersed into the usage of digital technologies throughout the day. Hence, we have to model a different kind of *blended learning practice* in order to improve quality of school education in rural India.

4.2 The design methodology

Design science research in Information Technology and Systems focuses on the development of IT artifacts with the objective of improving the performance of the artifact in users' context. Design science research methodology uses a build-and-evaluate cycle keeping the application perspectives in mind (Hevner et al. 2004). However, the exogenous approach of development described above is also prevalent in traditional Design Science Research (DSR) thinking in the context of Information Systems development. Existing DSR methods "value technological rigor at the cost of organizational relevance, and fail to recognize that the artifact emerges from interaction with the organizational context even when its initial design is guided by the researchers' intent" (Sein et al. 2011). In order to incorporate a user-centric approach in design, Sein et al. (2011) proposes the concept of "action design research (ADR)". ADR reflects the premise that "IT artifacts are ensembles shaped by the organizational context during development and use." ADR method focuses on the "building, intervention, and evaluation of an artifact" that not only captures the intent of the design but also the influence of it on users in context.

Our design methodology is motivated by ADR approach and uses the following four *interwoven activities*:

Problem Formulation: problem perceived in practice or anticipated by researchers.
Building, Intervention, and Evaluation (BIE): Testing the initial design of the IT artifact in the context of its usage. This phase "interweaves the *building* of the IT artifact, *intervention* in the organization, and *evaluation*".
Reflection and Learning: This is an iterative process to build and refine a solution to make it applicable to a broader class of problems.
Formalization of Learning: Finalizing a solution that addresses the problem

4.3 The Proposed Blended Learning Model

The model of blended learning proposed here is an outcome of our design methods discussed in previous section and it takes care of implementation failures that have been observed during the implementation of traditional model of blended learning, which assumed that the teachers and students are fully empowered to act as active agents in the process. And, it is to be noted that just providing access to technology through computer and internet was not enough to empower them as active agents.

We have architected an online blended learning platform where knowledgeable elderly or retired teachers in the city teach underprivileged children located in remote

rural classrooms through Internet. The online teachers use quality digital teaching learning materials that comprise of audio-visuals and graphical contents in regional language. An on-site teaching assistant/ class coordinator appointed at this rural classroom (e.g. para-teacher, as explained in Section 2) would schedule classes, coordinate the teaching process via this platform, correct homework with the online help of remote expert teachers, manages the classroom and interact with students and the online expert teachers during classroom sessions (Fig. 2).

The platform has an inbuilt video conferencing system that also has a provision to share digital content on the computer screen or to use in-built digital white board for diagrammatic explanations. The expert online teachers teach from their homes, where they have an ICT setup (laptop/desktop speakers, camera, and headphones) along with high speed internet connectivity. They use quality digital teaching learning materials that comprise of audio-visuals contents in regional language.

The students are located in remote classrooms, which are also equipped with a low cost ICT setup (desktop/laptop, large monitor/screen or projector, camera, speakers and microphone) and high speed internet connectivity. The classes are conducted at scheduled times, using the above platform with the help of an on-site teaching assistant/ class coordinator (Fig. 3).

In this blended learning model, there is a blending of three components: (i) online synchronous learning, where actual teaching is imparted by online remote teachers

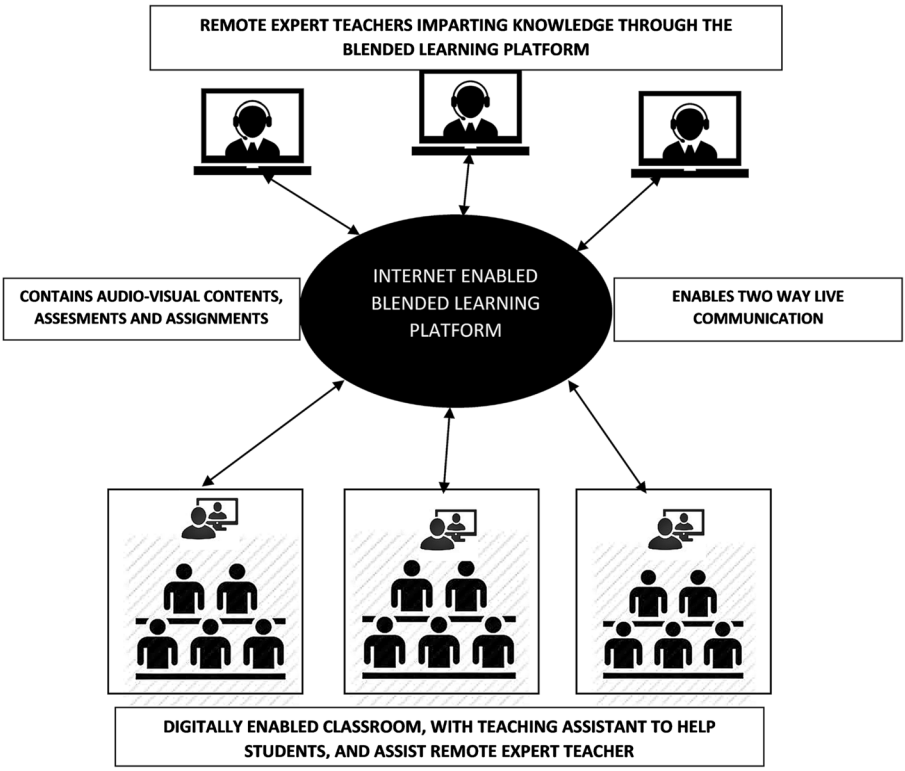

Fig. 2 The proposed blended learning model

Fig. 3 Students studying with remote teacher and local teaching assistant

through Internet using videoconferencing tools; (ii) online teaching-learning materials available digitally or created by expert teachers; and (iii) offline teaching assistant who manages the learning process physically in the classroom.

As indicated earlier, the concept of blended learning has been new in the rural context of India. In this particular research, the concept is modified according to the learning capacities of rural underprivileged students. The innovative components of our integrated blended learning platform are as follows- i) use of integrated video conferencing tool to remove the barrier of time and space so that rural students can obtain access to qualified teachers from urban areas, ii) supporting smooth delivery of audio-visual contents in regional language that can make learning enjoyable and engaging, iii) the method of dissemination of knowledge involves not only one way lecture but also promotes interactions in various forms, which is often lacking in the rural education, and iv) finally our blended learning platform provides an easy-to-use learning analytics app which is used by the online teachers and the in-class assistant teachers for easy assessment of students' performance.

Figure 4 depicts the technical architecture of the platform. The components are:

- **Online video-conferencing system** was integrated in the platform to connect teachers and students in a virtual classroom setting at scheduled day and time with a single click of a button.
- The platform had been integrated with **Digital Teaching-Learning-Materials (TLM) in regional language** to provide content support for the teacher and reference material for the students. Access to these audio-visual contents transformed the mundane text book experience to an enriching, interesting one. Students were able to concentrate on the lessons fasters due to the liveliness of the content.
- **The Online Expert Connect** is a forum where students can discuss various issues with a panel of mentors, teachers and counselors on-line. This serves as an integral part of online student support system.
- **Broadcast Sessions** are used to show edutainment videos in regional languages to make students familiarized with the idea of audio-visual content and instill in them knowledge/information that is beyond the classroom. It was observed that most of these children did not have any access to technology or the global knowledge; so, it became pertinent to augment students' knowledge with these edutainment videos.

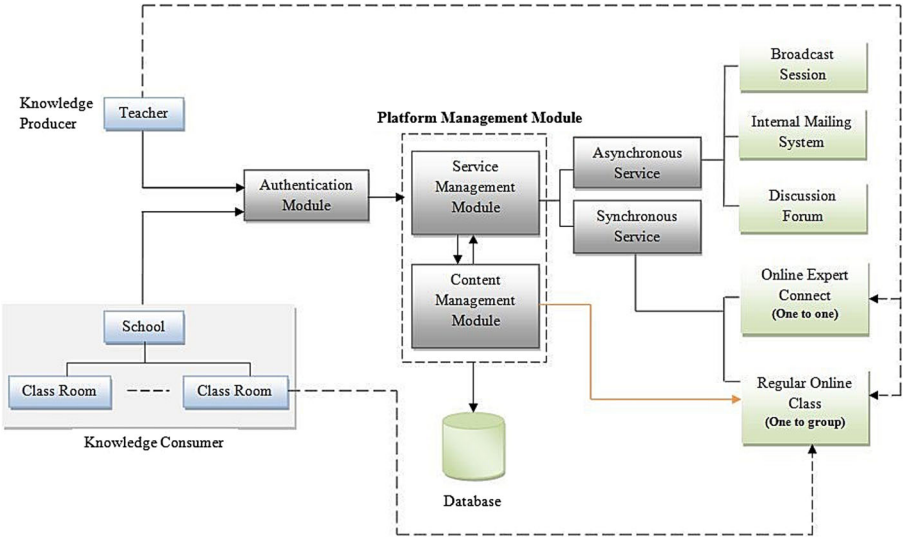

Fig. 4 Technical architecture of proposed blended learning platform

- **Learning Analytics** module is used to measure, collect, analyze and report data about learners and their contexts. The purpose is to create a continuous monitoring system for students and to monitor them at regular intervals to understand and optimize the effectiveness of learning process.
- **Internal Mailing System** was integrated in the platform to support local teaching assistant / class coordinator to interact with teachers and other coordinators on students' issues. It helps to form a group of learning communities.

4.4 Discussion

Several studies indicate that most of the underprivileged students are de-motivated and have no interest in current methods of teaching. To provide them with a learning experience that will create in them the zeal to study, one must create a learning environment that is engaging and allows free permeation of knowledge. In this situation, the proposed blended learning model serves multiple purposes. Firstly the student can freely interact with the online teachers without any fear or stress. In India, there is a strong caste difference that sometimes creates a bias in the teacher's attitude. Thus such unprecedented situations are avoided through video conferencing as the subject teacher is remotely interacting with the students. Hence, there is no fear of physical reprimand. Secondly, the audio-visual teaching learning materials are both interesting and explanatory. Thus students learn at a better pace without getting bored. Thirdly the presence of a teaching assistant not only helps maintain class discipline, but also provides the students with extra attention in their queries, home works, and assessments. This ensures a continuous support present with the students.

5 Experimentation, analysis and evaluation

5.1 Objectives

The primary goal of this paper is to understand the parameters of quality education and observe the impact of ICT-driven blended learning framework in imparting quality education in areas where there is dearth of it. More specifically, the objectives of this paper are: (i) to propose indicators for benchmarking quality of education delivered by Indian school system; (ii) to identify factors influencing quality of education; and, (iii) using the proposed benchmark, to demonstrate how ICT-driven blended learning framework can improve quality of education for underprivileged and low-performing primary school children.

5.2 Study design

5.2.1 Defining the variables: Quality of education

UNICEF defines quality education as "education that works for every child and enables all children to achieve their full potential" (UNICEF 2016). Although quality of education is traditionally measured by student learning achievements, relevance of what is taught and learned and how it associates with the continuous needs of the learner is important (Stephens 2003). Thus it becomes evident that quality of education is not just dependent on learning achievement of the student but several other factors. A large body of literature states that quality of educational attainments is strongly associated with wellbeing at school (Mukhopadhyay 2001). Based on these observations, we have tried to measure quality of education outcome with two variables: **Students' Wellbeing** and **Learning Achievement**. In this research, the notion of quality is viewed as a combination of the perception of students' wellbeing in the schools and their learning achievements or academic performances. The learning achievement of the students have been measured using competency based grade level questionnaire that have been formulated keeping in mind the heterogeneity of school boards and geographical locations.

Wellbeing Learning and wellbeing are closely intertwined, as students learn best when their wellbeing is at optimal level and eventually they develop a strong sense of wellbeing when they experience success in learning. In this context, it has been observed that students themselves identify schooling as significant influencer on their wellbeing:"be it the positive impact of a great teacher, an inspirational and engaging classroom lesson or that extra support provided at just the right time" (Student Learning and Wellbeing Framework 2018). It is stated that "more learning occurs in a joyous classroom where children feel safe, secure and accepted, and where they feel the teacher sees them for who they really are" (Diamond 2010). Thus wellbeing is a factor that is intrinsically associated with educational quality. A positive school environment augments motivation, increases academic aspirations and improves attentively and retention, thus fostering wellbeing and consequently quality of education (Frisco Report 2013).

The four **subcomponents of wellbeing** considered in this study are:

Teacher support in school: The role of teacher is to ensure a safe and conducive learning environment, thereby enabling students to achieve their potential. Several researchers explicitly bring out how interactive teaching can bring in decisive change in the academic and social development of students (Hamre and Pianta 2005).

***Teaching learning materials*:** Most of the time, the teachers focus on finishing the content of the curriculum and less attention is paid on how the content is taught to children. Effective teaching learning materials enhances the learning process of children, improving their feeling of wellbeing at classroom (Mayer and Ralph 2008).

Peer relations: In the early years of their life, children are inclined to associate and learn from children of the similar age (i.e. their peers). Peer relations are an important facet of human life that helps children grow not only socially but also emotionally (Alward 2005).

Happiness in learning: Happiness as an emotion has a very positive effect on learning. Evidences suggest that "periods of happiness are directly proportional to personal growth, health and development."Students who are happy are more receptive to outside stimuli than sad and depressed students (Scoffham and Barness 2011).

Learning achievement Learning achievement is the students' learning performance as reflected in their test scores on different subjects. The National Policy on Education (NPE 1986) emphasizes the importance of Minimum Levels of Learning (MLLs) along with progress measurement to ensure that "all children acquire at least the minimum levels of learning". Learning achievements assesses the "expected levels of learning that children should achieve for that class" (MHRD 2017).

5.2.2 Defining independent variables: Socioeconomic status, family support and school environment

Socioeconomic status The socio-economic status defines a family's capacity to afford the basic necessities and remain financially unburdened. Socioeconomic status also highlights the position of "individuals, families, or other units on one or more dimensions of stratification" (Fergusson et al. 2008). In India, students belonging to high socio-economic status can choose expensive private schools and are more likely to have more exposures that stimulate their intellectual development and wellbeing. Students from low socioeconomic background suffer from psycho-social problems that include cynicism with low self-esteem" (Blacksher 2002).

Family support Children's early well-being is primarily dependent on learning environment at home, which "focuses on parents' provision of learning opportunities in the home including both learning materials and their encouragement towards children's learning behavior". Parental involvement has a major impact on children's school

performance. Children whose parents are involved in school activities visibly show a higher performance rate both in curricular and extra-curricular activities (Khajehpour 2011).

School environment Once children are enrolled in school, the school environment represents a prominent community space that is likely to influence their well-being. Students spend a considerable amount of time in the classroom and their motivation levels are influenced by the physical learning conditions around them. Several Studies about student academic achievement and building condition conclude that the "quality of the physical environment significantly affects student achievement" (Tafani 2003:102).

5.2.3 Research instrument

The research undertakes a study on quality of education by interviewing 228 students hailing from 33 schools. The measurement of *quality of education* is a composite score of the measures of two components: *wellbeing* and *learning achievements*. The pre-intervention study tries of gauge the "as is" situation of the students through the level of perceived quality of education in school. The "as is" study observes the socio-economic background, the level of support they have from their parents, the environment of the schools they hail from, the perceived wellbeing level of the students in their schools and the learning achievement of the students, as explained in Section 5.2.1 and 5.2.2.

The **socio-economic status** of the students depicts their capacity to be able to spend on quality of education. The socio-economic status questionnaire has derived from the B.G Prasad scales and Udai Pareek scales (Singh et al. 2017). The **family support** questionnaire has been derived partially from Parental Support Scale (P.S.S.), developed by Nandwana and Asawa (2011). However for the need of the research the scale has been modified and tailored for open ended answers. The answers have been further coded based on the above scale. The questionnaire on **school environment** is derived from Wellbeing@School survey on primary students by New Zealand Council of Educational Research (Boyd and Barwic 2011).

The notion of **wellbeing** is a derived understanding from pervious literature that has been refereed. The research undertakes its own understanding of the idea of wellbeing by measuring the following: a) teacher support in school, b) peer relations, c) teaching learning materials, d) happiness in learning. The section on **teacher support in school** is also derived from Wellbeing@School survey on primary students by New Zealand Council of Educational Research (Boyd and Barwic 2011). The section on **teaching learning materials, peer relation** and **happiness in learning** has been derived from the following scales - Multidimensional Students Life Satisfaction Scale (MSLSS) (Lani 2010). The **learning achievement** of the students have been measured using competency based grade level questionnaire that have been formulated keeping in mind the heterogeneity of school boards and geographical locations. Keeping in mind the research purview and its applications, the questions have been modified according to the geography and language barrier. All the questions have been marked using a five point Likert Scale.

5.2.4 Sample and data collection

An exploratory study has been conducted into the dimension of quality education through a quantitative survey of 228 students in 33 primary schools, randomly selected across 4 districts in West Bengal, India. These schools are both public and private schools from rural, semi urban and urban areas. The cost structures of those schools follow a wide spectrum from free schooling to high-cost private schooling. The study will help us to benchmark quality of education in schools and the pertinent factors of what may entail quality education.

After the "as is" study, 79 students from 3 bottom-most school in the "quality" ranking were chosen out of 33 sample schools to conduct a blended learning teaching intervention for a period of 90 days to study impact of this initiative on learning achievements and school wellbeing on those 79 students belonging to 3 bottom-most schools. After 90 days, an "after study" was conducted to see changes in the quality of educational outcomes.

5.3 Analysis

5.3.1 Analysis I: Benchmarking quality of education

Benchmarking is the practice of any organization comparing key metrics of their operations to other similar organizations. Benchmarking aims to answer the following questions (Kempner 1993): "How well are we doing compared to others? Who is doing it the best? How good do we want to be?"

In the context of quality of education in Indian schools, there is no standard metric to judge whether a school is offering quality education and to what extent. In this study, we have made an attempt to evolve a unique metric for the purpose of benchmarking quality of education. It is a composite metric, derived from Wellbeing score and Learning Achievement score (Section 5.2.3). Wellbeing is a score derived from students' perception of wellbeing in the context of their day-to-day life in their respective schools; and, Learning Achievement is their test scores obtained in a competency based grade level questionnaire that have been formulated keeping in mind the heterogeneity of school boards and geographical locations.

The Quality-of Education score (average of wellbeing and learning achievement scores of sample students for each school) is plotted at y-axis in Fig. 5 against 33 school-ids at x-axis. In other words, we translate the students' attribute to their schools attribute by averaging scores of sample students belonging to a particular school against each variable: *wellbeing* and *learning achievement*. As shown in this figure, school S-7 scores the highest in the quality-of education scale, and school S-33 score the lowest. This implies that, on the average, primary students of school S-7 are having a high Quality-of-Education Score (4.63) compared to those in school S-33 (1.24).

5.3.2 Analysis II: Factors determining quality educational outcomes

In order to understand the factors determining quality educational outcome of schools, we use three independent variables described earlier: *Socioeconomic Status* of the students, *Family Support* and the *School Environment* experienced by the students. The primary focus is to observe if these independent variables have any impact on two dependent variables: Wellbeing and Learning Achievement.

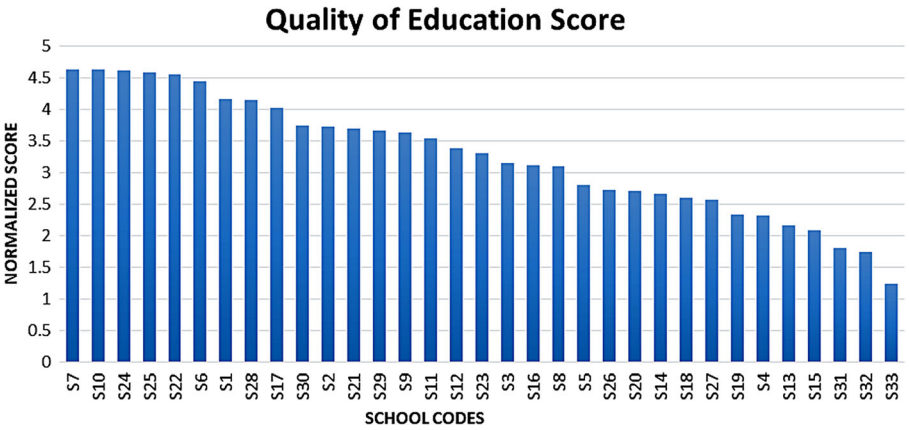

Fig. 5 Benchmarking quality of education: results from 33 schools

To do a correlation analysis, first we average the scores of sample students for each school against each variable. In other words, we translate the students' attribute to their schools attribute by averaging scores of sample students belonging to a particular school against each variable. We redefine the variables at school level as: *Socioeconomic Status* of the students of a school, *Family Support* enjoyed by the students of a school and the *School Environment* experienced by the students of a school. The correlation analysis between independent and dependent variables is presented in Fig. 6.

From the above observations, it can be deduced that quality of education, as captured in two dependent variables (Wellbeing and Learning Achievement) is heavily dependent on socioeconomic status of the students, the family support enjoyed by the students and the school environment experienced by the students. Hence, those schools where students have low scores on those independent variables are bound to suffer from lack of quality education. In some sense, this is quite intuitive to deduce that rich students who can afford high cost private schools having good school environment and who get family support towards their academic activities (in the form of encouragement, financing private tuitions etc.) will, in general, receive better quality of education.

As a consequence, the natural question we need to address is: how poor, underprivileged students, belonging to the bottom tier schools (Fig. 5) can get quality education? In the next section, we will address this issue by using blended learning technologies in bottom-tier schools.

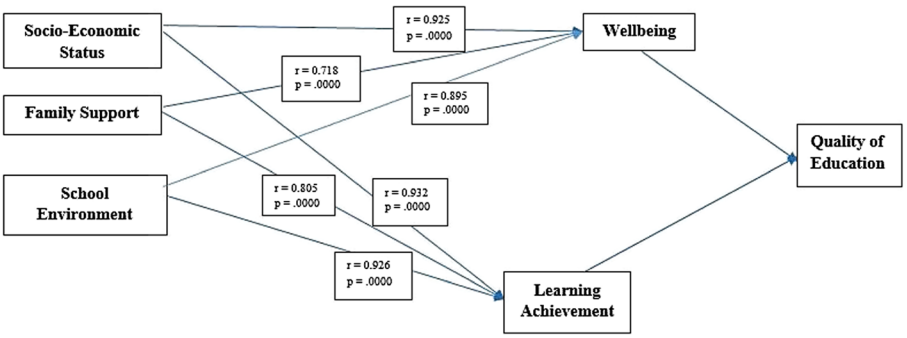

Fig. 6 Correlation between dependent and independent variables

5.3.3 Analysis III: Impact of blended learning on quality educational outcomes of underprivileged school children

Of the 33 schools that were examined in the "as is" study, quality scores of three schools were at the lowest (Fig. 5). These school students were chosen for the quasi experimental study to observe the effect of blended learning interventions for a period of 90 days. These three schools were also having very low scores in the independent variables of socio-economic backgrounds, family support and school environment.

A controlled intervention of remote live teaching by quality teachers using quality content and onsite teaching assistant or class coordinator (as explained in Section 4) was administered on the students for 90 days. After the end of the study, after-study assessments and observations were made to evaluate any change in Wellbeing and Learning Achievements of those children.

The first study was conducted in a rural school of Burdwan District of West Bengal, India, run by an NGO (School-id: 31). The children participating in the intervention are from class III, aged 8–10 years, hailed from extremely lower socioeconomic backgrounds. Through our blended learning intervention, 29 students have been taught English and Mathematics by an experienced teacher through the online remote learning platform for a period of 90 days.

The second study was conducted in a low-cost private school in South 24 Parganas district of West Bengal, India (School-id: 32). The children are from class III, aged 8–10 years and are from lower socioeconomic families. Through the blended learning initiative, 35 students were taught English, Mathematics via two experienced teachers remotely for a period of 90 days.

The third study was conducted in a NGO funded school in the outskirts of Kolkata for the orphan children. (School-id: 33). The children hailed from class 1, aged 6–8 years and supported by NGO. Through the online remote teaching initiative, 15 students were taught English, Mathematics via two experienced teachers remotely for a period of 90 days.

For the purpose of analysis, we have aggregated the students of all three schools. The descriptive statistical profile is given below in Table 1:

Thus, the after-study conducted on the students hailing from these three schools revealed that the students were gradually improving in their overall Quality score (well-being score and learning achievement score). This is depicted in Fig. 7.

To ascertain the actual improvement, a paired T-Test was administered on the dependent variables. Paired t-test is used to check statistical significance of the outcomes of a research on the same group or population before and after the research. A paired-sample t-test was conducted on the **Learning Achievement scores** of all the students in these three schools before and after the intervention. There was a significant difference in the scores pre-intervention study (M = 27.906, SD = 12.185) and post-intervention study (M = 57.094, SD = 11.338); $t = 21.239$, $p = 0.000$. There has been an increase of 104.5% of the Pre-intervention study score from 27.906 to 57.094.

To study the variations in the **Wellbeing score**, paired-samples t-test was conducted on wellbeing scores before and after the intervention. There was a significant difference in the scores pre study (M = 1.9559, SD = 0.25117) and post study (M = 3.2840, SD = .36290); $t = 23.904$, $p = 0.000$. There has been an increase of 67.90% of the Pre-study score from 1.995 to 3.2840.

Table 1 Descriptive statistical profile of selected underprivileged school children

Variables	Mean Score: Before-study		Mean Score: After study
	All 228 students from all 33 schools	79 underprivileged students from 3 bottom-most schools (before intervention)	79 underprivileged students from 3 bottom-most schools (after intervention)
Independent Variables			
Socio-Economic Level	3.59	1.96	–
Family Support	4.26	1.78	–
School Environment	3.35	1.88	–
Dependent Variable			
Wellbeing	3.26	1.93	3.28
Learning Achievement	3.27	1.40	2.85

To study the variations in the component of Wellbeing score before and after interventions, paired-samples t-tests were conducted as shown in Table 2.

It is to be noted that students have perceived a remarkable change in **Teacher Support in School** with 84.97% improvement. It must be stated that the online remote elderly teachers created a very positive impact on the students, with their teaching methods and teaching attitudes. There has been a remarkable increase in the perceived student attitude towards **Teaching Learning Material** (85.94% increase), indicating that the students were extremely receptive to the lesson-wise audio-visual digital content. There has been mentionable increase in student perception of **Happiness in Learning** at 61.35%, indicating that the students perceive such a mode of learning both educational and enjoyable.

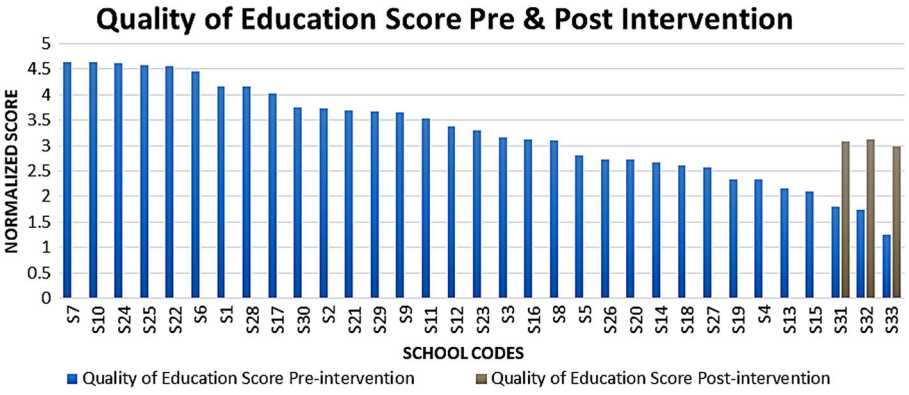

Fig. 7 Improvement of quality score of bottom-most schools after intervention

Table 2 T –Tests on components of Wellbeing on 79 underprivileged students

Component Of Wellbeing Score	Mean Score Before Intervention	Mean Score After Intervention	% Increase in Mean Scores	T Value	*P* Value
Happiness In Learning	2.06	3.32	61.35	14.55	0 .000
Peer Relations	2.15	3.11	44.63	11.95	0.000
Teacher Support In School	1.86	3.43	84.97	20.11	0.000
Teaching Learning Material	1.76	3.28	85.94	18.30	0.000

Finally, Figs. 8 and 9 shows the improvement on Wellbeing score and Learning Achievement score of those 79 underprivileged students **at an individual level**. It is to be noted that the improvement is noticeable for each individual students in their Wellbeing scores. It must be also stated that there has been a stark improvement in Learning Achievements among the students indicating a positive shift towards quality of education.

6 Discussions

Our after-study depicted remarkable improvement both in academics and in well-being of the underprivileged students. The findings proves our hypothesis that blended learning platforms in a classroom setting along with quality digital content, expert online remote teachers and on-site teaching assistants as class coordinator creates a learning environment that can improve learning outcomes and well-being of students drastically, irrespective of their socioeconomic status.

There are some common inferences that can be drawn from our study:

a. Steady academic improvement and wellbeing have been observed due to provision of quality teacher and content, even if it is delivered virtually using e-learning technologies. Remote teachers were readily accepted by the students.

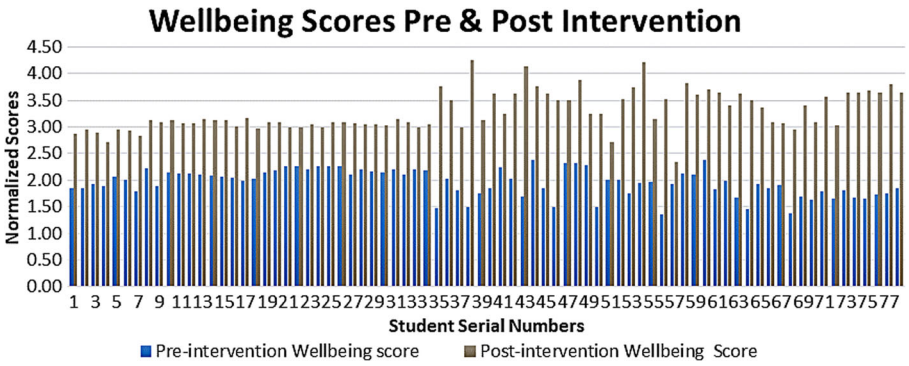

Fig. 8 Improvement of 79 students in wellbeing after intervention

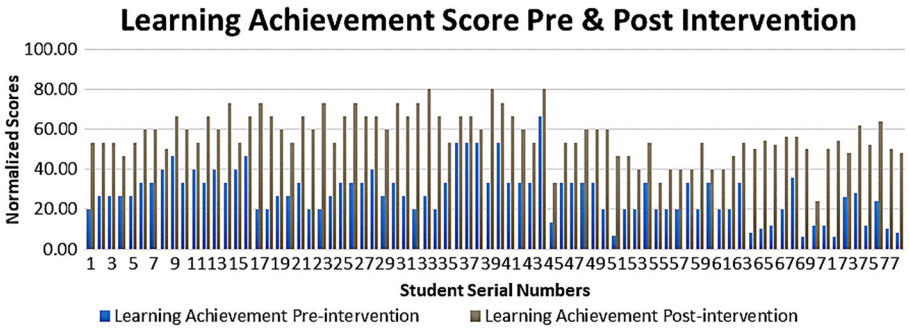

Fig. 9 Improvement of 79 students in learning achievement after intervention

b. Online teachers, with support from on-site teaching assistant, were able to maintain discipline despite physical absence, and online presence.
c. There were no dropouts and only 10% of absenteeism was noticed.
d. The students expressed that they were made aware of a lot of new ideas and notions that they did not know earlier.
e. Students were able to express their ideas and opinions more clearly than before.
f. General aspiration level of the children increased due to incorporation of global culture from online teachers from urban areas. It enhances the bridging social capital of rural students, as they are now connected to urban teachers.

7 Conclusion

There are various implications of what entails quality education, especially in the context of developing countries. Since quality education is essentially an expensive service in these nations, millions of students remain outside the purview of quality education because of their low affordability power. As a result, majority of the poor population of developing nations are compelled to avail the low quality affordable services provided by public schooling. Lack of necessary infrastructure along with lack of conducive learning environment coupled with a high rate of teacher absenteeism in these schools makes the education delivered ineffective. In this situation, the paper tries to create a benchmark of quality of education that is measurable and also observable and tries to figure out a solution to improve quality of education in poor schools using blended learning technologies.

In the first part of the study, the research has inferred that quality of education, as captured in two dependent variables (Wellbeing and Learning Achievement) is heavily dependent on socioeconomic status of the students, the family support enjoyed by the students and the school environment experienced by the students. Hence, an underprivileged rural school with low scores on these three independent variables would produce poor leaning outcomes and poor wellbeing scores for its students. In the second part of the study, a controlled intervention through the proposed blended learning technology model was conducted. The after-study reveals that our proposed blended learning model can create measurable difference in the students' scores on wellbeing and learning outcomes. In other words, students who have low socio-economic background, poor family support and bad school environment can still have higher scores in wellbeing and learning outcomes, if they use proposed blended learning methods.

With the growing use of ICT in everyday human lives, there is a chance that a large section of the Indian population will be digitally, socially and thus economically marginalized. It is hence mandatory for policy researchers to look at solution based models that utilize Internet and Web2.0 Technologies not only to create access to quality education among the rural masses, but also to help them to solve their life and livelihood issues in a digital way.

Publisher's Note

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