

EFFECT OF DIGITAL PEDAGOGY INTERVENTIONS IN RURAL AREAS

Sona Ahuja and Diksha Yadav

The present study provides a description of the model of interactive digital pedagogy for remote areas and its impact on pedagogical satisfaction and academic achievement of students. This pedagogical intervention was designed to enrich and supplement the teaching-learning experience in remote and underprivileged schools through the use of technology. An interactive online teaching-learning system was set-up using a digital pedagogy. 150 school students and 80 prospective teachers from three higher secondary schools of Madhya Pradesh and Tamil Nadu participated in the study. Pedagogical satisfaction and academic achievement of the school students who studied in this set-up were examined. The results revealed that active learning, technological competence and learner autonomy were enhanced in an online environment when compared to an offline environment.

KEYWORDS: Interactive Digital Pedagogy, Remote Areas, Pedagogical Satisfaction, Academic Achievement

INTRODUCTION

It has been promised for a long time that technology will change education for better by making it more affordable and accessible. This promise of educational technology is of more significance in this era because of the changing environment, educational practices, societal structures, cultural diffusion and

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technological advancement. Also, there is a need to shift from the traditional classroom setting where students are seen as passive learners of educational knowledge to a classroom in which students are considered as active participants where, collaborative skills, information sharing, wide range of resources are given precedence. To advance this shift various new technological tools and techniques are introduced in the classroom (Melhuish & Falloon, 2010). The need of this era is to develop digital technological platform tailored around the students with enhanced pedagogical techniques. Access to good quality of teaching across different locations of the country covering educational institutes or schools in rural, remote rural and under privileged areas must be ensured. So, the key lies in using digital platforms and solutions to deliver secure and quality content and, more importantly, provide access to quality teachers (Kupathil, 2015). Ubiquitous digital access has been associated with opportunities for increased learning-focused time, with a corresponding increase in students' production (Jesson, Mcnaughton, Wilson, Zhu & Cockle, 2018). Digital platform can be helpful in achieving the desired level of quality education and reaching the last mile. In this approach two parallel processes take place in an online environment: Students become more active and reflective learners and students and teachers engage in learning through the use of technology and become more familiar with technology by using it (Gibson, 2001).

There is acute shortage of trained and motivated teachers in rural areas to impart education. Online teaching-learning is a powerful intervention for making learning more approachable and effective. It is also about creating contexts for authentic learning that use new technologies in integrated and meaningful ways to enhance the production of knowledge and dissemination of ideas (Montrieux, Vanderlinde, Schellens & Marez, 2015). Research on the effect of online teaching-learning indicates that this process helps learners by offering them a context in which they can construct and share knowledge in media-rich and stimulating environments. Digital environments offer chance to students by providing opportunities for increased engagement involving activities including interest and enjoyment (Bebell & O'Dwyer, 2010; Suhr, Hernandez, Warschauer, & Grimes, 2010). Results suggest that online teaching-learning has positive impact on student's motivation and promotes meaningful learning experiences (Twining, Evans, Cook, Ralston, Selwood, Jones, Underwood, Dillon, Scanlon, Heppell, Kukulka-Hulme, McAndrew, & Sheehy, 2005). Students are generally reported to be positive about their engagement in online courses, reporting the possibilities to motivate and engage them in learning, the possibility to make communication between peers and peers and peers and teachers easier and added the value for collaboration

(Clark & Luckin, 2013). Digital implementation is also thought to have positive potential impact on instructional interactions (Grimes & Warschauer, 2008; Lowther et al., 2012). The interaction construct is of utmost significance in both face-to-face and online learning modalities (Kuo, Walker, Belland & Schroder, 2013). In fact, many studies have found that both quantity and quality of student interactions are highly correlated with student satisfaction in almost any learning environment. The five elements of student satisfaction identified are; learner relevance, active learning, authentic learning, learner autonomy, and technological competence (Kuo et al., 2013). It was determined that learner-instructor interaction and learner-content interaction combined with technology are valid indicators of students' positive perceptions. It was reported that students' expectations influence instructor's design in online courses and act as key indicators to understand satisfaction level of students with digital pedagogical practices (Keengwe, Diteeyont & Lawson, 2012).

Digital pedagogy does not only focus upon involving digital tools for the betterment of learning, but it is an approach based on collaboration, playfulness/tinkering, focus on process, and building (Stommel, 2012). The teachers should be trained in digital pedagogy from a critical perspective to reflect upon bringing out a pedagogical change for the success of this technological intervention. In order to provide exposure to prospective teachers and to reach to the underprivileged, the interactive online teaching-learning system was set-up using digital pedagogy which is one of several technology interventions at Dayalbagh Educational Institute (DEI).

DIGITAL PEDAGOGY INITIATIVE

In India, National Council of Teacher Education (NCTE) notified the revised Regulations 2014 under Government of India Gazette Notification No. 346 by following the Justice Verma Commission (JVC) appointed by the Government of India (NCTE Regulations, 2014). Extensive reforms were suggested in Teacher Education. As per the revised norms, the duration of graduate programme for prospective teachers (Bachelor of Education - B.Ed.) was increased from one-year programme to two-year programme. National Curriculum Framework of Teacher Education (NCFTE) provided the details of revised curriculum and course structure. One of the courses to enhance professional competencies was Critical Understanding of ICT. While other universities in India offered this course for developing the understanding of ICT among prospective teachers, the Faculty of Education, Dayalbagh Educational Institute (DEI) moved a step ahead. Besides the introduction of the course on 'ICT for teaching-learning in schools' based on the course structure of NCFTE, an internship programme enabling the practice and application of

digital pedagogy was also initiated. It served two-way benefit: (i) to provide exposure to prospective teachers to the practice of digital teaching, learning and evaluation bridging the gap between theory and practice and (ii) to connect the students of rural areas to the urban prospective teachers. This led to development of sensitivity among prospective pedagogues toward the rural school population in India.

The school students in these areas in turn got the opportunity to learn through interactive digital pedagogy. The objective was rural empowerment through digital education initiative. It is easier to reach the students even in the last mile through technology and meet the shortage of teachers especially for science and mathematics education. In the first phase, the online teaching-learning model was adopted and tested which is discussed in the present paper. In the second phase, the plan is to extend it to tablet teaching-learning wherein each student will have tablet to make teaching-learning more interactive. Figure 1 depicts the model in two phases. To begin with, this initiative was introduced in the DEI-board secondary schools in Rajaborari –a tribal cluster in Madhya Pradesh; Timarni, semi-urban area in Madhya Pradesh, Melathiruvencatpuram, remote area in Tamil Nadu and primary schools in Murar, rural area in Bihar and Chandigarh urban area in Punjab. The B.Ed. student-teachers visited some of these schools to understand the needs and entry behavior of the students in rural areas. A batch of 10 students each visited Timarni and Rajaborari. Each batch spent three weeks in these schools interacting with teachers and learners. Though the online internship was part of teacher education programme and students earned credit for it, the visit to remote areas was voluntary. A teacher-educator guided and supervised the activities during the visit. The interns designed the pedagogy for them with the help of the teacher educators. It was then implemented through Big Blue Button open source software customized at local server in DEI. The internet connection set-up and installation of solar power at the remote ends was done by the integrated efforts of various departments of DEI.

INTERACTIVE COMPONENTS OF THE MODEL

The components that make this digital pedagogy interactive include text chat, audio chat, survey poll, hand raise and whiteboard sharing. Using text chat, teacher can ask short answer questions viz. examples, definitions, enlisting types, etc. and questions with one-word answers. The benefit over physical classroom is that all students can respond simultaneously, and these responses can be viewed by all in no time. Some students are hesitant to ask their doubts in the class with the fear that if they use audio or text chat, the other students can view it and can make fun of them. The private chats enable students to interact

with teachers without qualms. A teacher can address the queries of a student without the other students viewing it. The audio and video chat enable explanation by teacher, questions by teacher, verbal response by students, raising doubts, etc. The different views enable students or teachers to shift from video-chat mode to focus on whiteboard to equally distributed focus on video, whiteboard and text chat. Thus, depending on the stage of lesson, a teacher can select the view i.e. during demonstration the teacher can opt for video-chat view and student can see the demonstration. (Figure 1). It also enables to monitor the participation of students in classroom activities. The feature also includes the use of virtual demonstration where the teacher can show the animated videos. White board sharing with students can allow them to participate in classroom activities by making them draw or label the diagram, draw shapes, underline the expected entities, etc. The teacher can read the non-verbal cues emitted by students through video and identify the inattentive spot.



Figure 1. Digital Pedagogy Model at Dayalbagh Educational Institute.

IMMEDIATE FEEDBACK IN THE DIGITAL PEDAGOGY MODEL

The teacher gets immediate feedback to teaching through student's response in text chat, audio chat and survey poll. Through survey poll, teacher can display the question and the alternatives on whiteboard and student can respond by selecting the alternative. Teacher gets instant feedback on screen as to how many students have responded correctly. This feedback can be used to decide whether the topic needs to be repeated or the next teaching point can be started. The intern gets feedback by recording the lesson and viewing later to evaluate for improvements. The teacher educator and peers of student can log in as observers. The peers give feedback to the intern teaching lesson by online

observation. The teacher educator can log in from his/her pace and give feedback to intern on various components of digital pedagogy.

CHALLENGES FACED AND SOLUTIONS IMPLEMENTED

Initially, while planning for this pedagogical intervention, some challenges were foreseen in implementation of this system such as low bandwidth, insufficient electricity, required infrastructure, medium of instruction of the learners. The initiatives of different departments of DEI already taken at ICT centers in selected remote areas addressed many of these challenges. The glimpse is shown in Figure 2. The solar power system installed in the school met the requirement of electricity. The issue of low bandwidth problem was resolved by upgrading the radios. The infrastructure like routers for network connectivity, public address system, webcam, LED TV, tablets at low cost were procured and installed at the schools in selected remote areas. The medium of instruction was as per the local requirements.

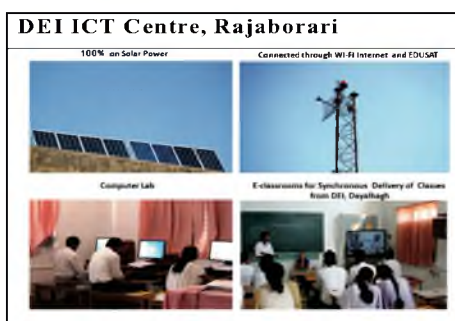


Figure 2. DEI Initiatives to E-Connect to Remote Areas.

DESIGNING CONTENT FOR DIGITAL PEDAGOGY: PARADIGM SHIFT FROM TEACHING TO LEARNING

Digitization of education unfolds various ways to expand educational opportunities to the masses. This demands a transition in pedagogical approaches where the focus should be on producing learning experiences rather than providing instruction. This change of approach is called as learning paradigm (Barr & Tagg, 1995). Digital pedagogy supports this idea of involving teachers and students as equal power sharers where learning experiences are designed according to the needs and demands of the learner. To follow this approach, the interns were oriented to the concept of lesson planning and resource planning to design the content based on digital pedagogy.

The planning begins with underlying the specific measurable objectives to be achieved by the end of the lesson. The success of the teaching can be measured by evaluating the extent to which stipulated objectives are achieved. The plan is developed on the entry behaviour of the students. The entire lesson plan is divided into teaching points. Each teaching point covers the teaching method and technique to be adopted, resources specific to that teaching point to be used. The next step is to mention the teacher's activity, students' activity and whiteboard work. All of these are cohesive. The whiteboard work is developed along with the development of lesson. The content is displayed on the whiteboard sequentially instead of presenting entire content at a time and then explaining the same. The teacher can change the sequence based on learning potential of students. The presentation of information in chunks enables the learner to assimilate the content developed. While planning for teacher's and students' activity, the intern ensures the maximum involvement of the student in the development of lesson. The teacher has to play the role of facilitator of content and the learner shares the majority of classroom interaction. This keeps the learner meaningfully active and engaged throughout the lesson. Thus, there is paradigm shift from teaching to learning and teacher is the facilitator of knowledge providing opportunity to learners to construct the knowledge. The prospective teachers practiced the lesson in simulated setting before teaching in the real classroom. The outline of the sample lesson plan is as in Table 1.

Table 1

Basic Entries (Set-up: Simulated/Real - Centre: Name of School; Class; Duration; Period; Subject; Branch of Subject; Topic) Learning Objectives (specific and measurable) Entry Behaviour: Teaching Point: Teaching Method and Technique: Teaching resources specific to the teaching point:		
Teacher's Activity	Students' Activity	Whiteboard Work
<i>Activities of the teacher in the interactive digital pedagogical session include-</i> <i>Asking Introductory/Developmentary Questions; Constructing Knowledge; Demonstration; Providing Feedback; Addressing queries of learners; Encouraging student participation in e-classroom activities</i>	<i>Activities of the student in the interactive digital pedagogical session include-</i> <i>Participating in the development of lesson through the digital tools; observing demonstration; performing experiments; sketching/labelling diagram on whiteboard</i>	<i>Stepwise display of the content with images; display of questions/instructions; display of survey poll results</i>
Evaluation Questions Assignment		

LEARNING MANAGEMENT SYSTEM (LMS)

The teaching-learning experience is made more interactive through LMS. The prospective teachers uploaded the evaluation part of the lesson in the form of quizzes, fill in the blanks, multiple choice types of questions on LMS. As soon as students respond to the questions, instant report is generated enabling teacher to quickly assess the performance of each student. The prospective teachers also used LMS to upload the lesson plan, videos related to the lesson, question bank and assignments. Thus, after structuring this model for school level learners there comes a need to test its potency. In order to test the effectiveness of this model a study was conducted in DEI based on this approach so that various aspects regarding its implementation and functioning can be studied in detail.

RESEARCH METHODOLOGY

Twenty first century is known for its technological advancements. It has become an integral part of everyone's life. In today's era, teachers can't escape the growing trend of technology. Technology has paved the way for new and exciting teaching practices as a result the classroom is changing with new technologies dramatically altering the learning for both students and teachers. This objective can be fulfilled by online teaching-learning. Findings have revealed that 69% of students felt that online teaching-learning was motivating and that they worked better with it than without it (Walsh, 2012). It caters to the present educational needs. But there are some questions which need to be addressed. How does it change the role of the teacher? What is the level of satisfaction of students in terms of his learning needs? The present study examines effectiveness of online teaching-learning on students' achievement and their pedagogical satisfaction. In this view the objectives of this study are (i) To study the effectiveness of online teaching-learning on academic achievement of students. (ii) To study the effectiveness of online teaching-learning on pedagogical satisfaction of students. A descriptive survey method was employed to gather data from the selected sample. Single group pre-test-post-test design was used for the study.

SAMPLE FOR THE STUDY

The participants were students of class IX who were exposed to Digital Pedagogy in DEI board schools—(i) Radhasoami Adivasi Higher Secondary School at Rajaborari, M.P. (ii) Radhasoami Higher Secondary School at Timarni, M.P. (iii) Radhasoami Higher Secondary School at MTVpuram, Tamil Nadu where online teaching-learning was initiated. 150 secondary school

students participated in the study. 80 students were selected from first school (40males, 40females). 50 students were selected from the second school (25 males, 25 females). 20 students were selected from the third school (10 males, 10 females). The number of students in each school was decided based on the enrolment of students in that class for the selected school. The sample for the study also included 80 prospective teachers or B.Ed. (Bachelor of Education) interns who delivered lessons to remote areas in online teaching-learning setup.

PROCEDURE

There are two key classroom processes that can work as catalyst in order to bring out educational change in digitally enabled environment. One is to understand new configurations, resources, and functions of the tools associated with activities. The other is to understand altered interaction patterns associated with new features of that environment (Jesson, McNaughton, Wilson, Zhu & Cockle, 2018). In order to gain better understanding, the prospective teachers were first oriented about generation of e-content, lesson planning for digital pedagogy, teaching-learning in digital environment & integration of learning management system with online teaching-learning. An e-mail was sent to the respective heads of the school to seek their consent to participate in the study. School students were introduced to use of online teaching-learning platform for classroom learning in ICT class. This was done for conditioning of school students to the environment before actually implementing this model in real classroom. In order to analyse academic achievement, scores of examinations conducted before intervention were collected as pre-test scores. Pedagogical satisfaction scale was used to measure satisfaction of students.

Prospective teachers or B.Ed. interns practiced this pedagogy in simulated setting for a month before connecting to students in rural areas. They were then exposed to online teaching-learning environment. B.Ed. interns of experimental group used digital pedagogy to teach students in rural areas for thirty days. After this intervention, an academic achievement test was conducted and scores of this test were collected as post-test scores. The mean and SD values were calculated by using these scores. Finally, the pre-test and post-test scores were compared, and paired sample t-test value was calculated to analyse the difference in the academic achievement before and after online teaching-learning process.

MEASURES

To assess pedagogical satisfaction, a questionnaire was developed which was based on five dimensions related to pedagogical satisfaction of students. The dimensions of the tool included learner relevance, active learning, authentic learning, learner autonomy and technology competence. The response was on a four-point scale (strongly agree, agree, disagree, strongly disagree) related to the dimensions of pedagogical satisfaction. The tool was in both English and Hindi language for the ease of students. The reliability of the tool was calculated using Spearman Brown prophecy. The validity and reliability of this tool was 0.75 and 0.65 respectively. Finally, after gathering the data from all sources, dimension wise percentage analysis was done.

RESULTS AND DISCUSSION

The results are presented in Table 2, Figure 3 and Figure 4. These reveal the academic achievement and pedagogical satisfaction of students post digital pedagogy intervention.

Table 2
Mean and Standard Deviation (SD) of Academic Achievement Scores at Pre and Post-Test.

	N	Mean (SD)	t
Pre-test	150	20.39 (7.41)	4.61*
Posttest	150	27.81 (5.27)	

**Significant at 0.01 level*

The mean value of the students before and after online teaching-learning is 20.39 and 27.81 respectively. The calculated t- value (4.61, $p<0.01$) reflects that the group differs significantly before and after online teaching-learning. It reveals that students in rural areas performed better when exposed to interactive digital pedagogy as compared to traditional pedagogy. The continuous interaction with the learner, active participation of learner in the development of lesson and application-based evaluation at the end of each teaching point must have influenced the way students learn. The interaction patterns enabled students to think deeply.

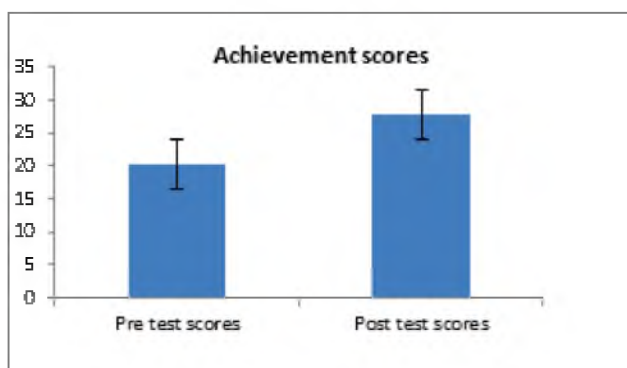


Figure 3. Academic Achievement Scores of Students (Bars represent standard error).

Second part of the study was aimed at examining pedagogical satisfaction of students with interactive online teaching-learning. The distribution of pedagogical satisfaction scores was studied on the basis of responses obtained on four-point rating scale along the various dimensions of pedagogical satisfaction which are Active learning, Learner relevance, Authentic learning, Learner autonomy and Technology competence. Figure 4 reveals that pedagogical satisfaction varies for various dimensions. It was found through the results that students were actively engaged and enthusiastic for learning through interactive digital pedagogy as they got opportunities to interact with the new educational world outside the walls of their classroom. The students reported major improvement in the technological competence of students. The learning was reported to be authentic and had learner relevance in this model. Most of the students reported learner autonomy and active learning experience. The students could participate actively in digital environment due to interactive features like- polling system for giving response to objective type questions, sharing of white board for student participation and response of students to short answer questions through chat box.

Though some students felt the need of better interaction if offered with opportunities where each student can participate using these features. For this, the present model will be extended to teaching through tablet model in next phase wherein each student will have tablet for individual interaction. Private chat-box to clarify doubts with the teacher enabled those students who were shy to interact with the teacher without any interference of other students. This will increase learner participation and autonomy. Though

there were some glitches due to lack of infrastructure & electricity related facilities but on asked about preferences they preferred studying through online teaching-learning set up as it supports learner centered approach and allows every individual to participate equally in every activity.

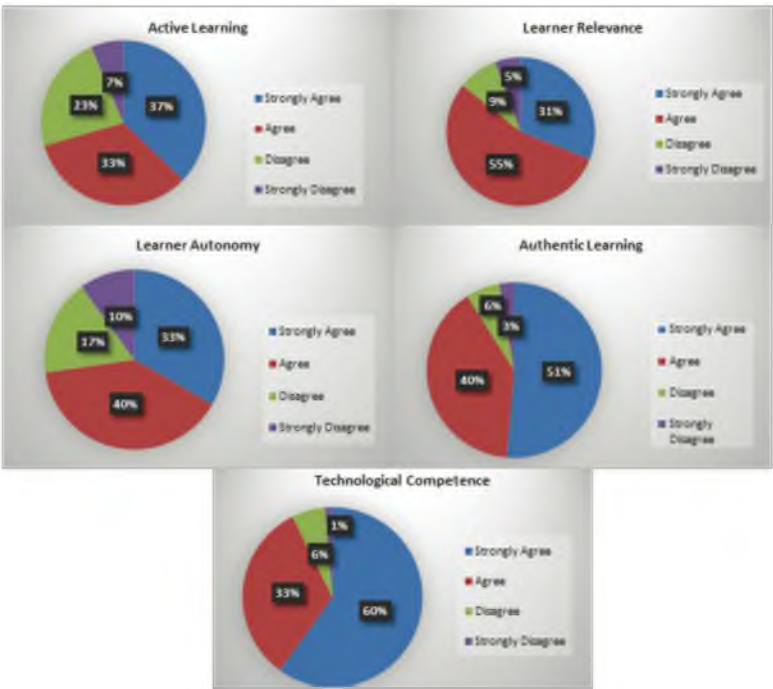


Figure 4. Pedagogical Satisfaction of Students.

CONCLUSION

The focus of the study was to examine the effect of interactive digital pedagogy in rural set-up. Hence, the study is limited to schools in rural areas. The study can be extended to semi-urban and urban set-up to gain insight into the effect of digital pedagogy irrespective of set-up. Further, the teacher satisfaction can be studied to identify the problems faced by teachers in implementing this pedagogy. Since this was the first phase, online teaching-learning system was introduced and one student at a time could participate in classroom activities as in offline classroom. In the next phase, efforts will be made to extend this to tablet based teaching learning where each student will get tablet for classroom participation enabling involvement of all students simultaneously in classroom activities.

The present study has documented the impact of digital pedagogical interventions for students studying in rural areas. The effects were largely focused on pedagogical satisfaction and academic achievement on the part of students. The results indicate that the academic performance of students engaged through interactive digital pedagogy is better than the traditional classroom. The interaction is the key component of success in teaching-learning situation. In traditional classroom, one student can respond at a time among many who raise hands to answer question raised by a teacher. On an interactive digital pedagogy platform, each student gets opportunity to participate in class in the same time. This enables teacher to know about the performance of each student and gives direction for adopting the required pedagogical strategies. The cognizance of performance in class also enables the learner to improve himself and choose the required learning path. By optimizing the student participation, interactive digital pedagogy can improve the quality of education. Thus, interactive digital interventions can be of utmost importance in order to support behaviour change

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