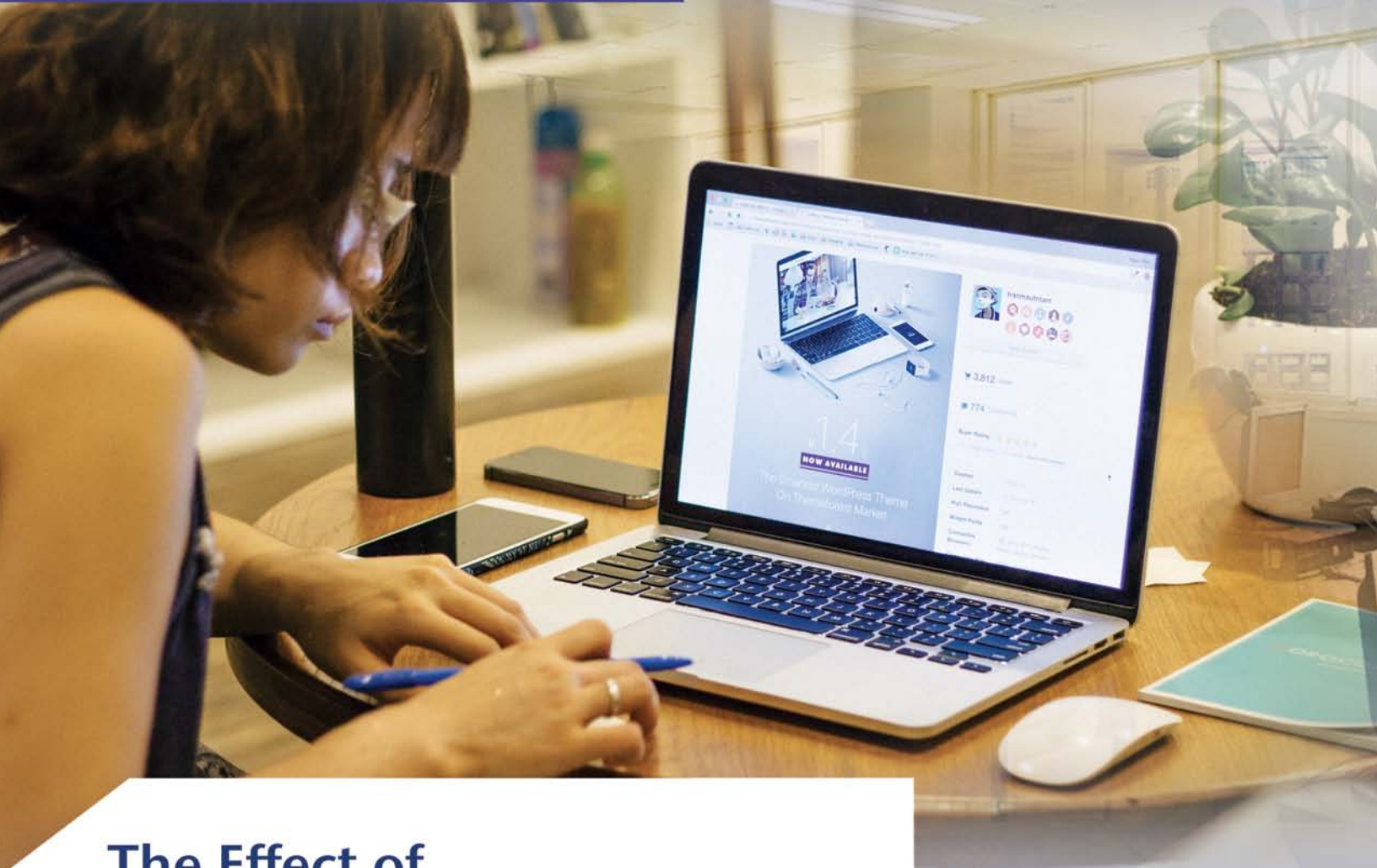




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The Effect of Technology-Enabled Learning on Student Achievement and the Perceived Experiences of Teachers and Students at SNDT Women's University



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COMMONWEALTH of LEARNING

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Abstract

Technology-enabled learning (TEL) implementation at SNDT Women's University (SNDTWU), supported by the Commonwealth of Learning (COL), started with the discussion and adoption of a TEL policy. This report presents the results of efforts to build capacity in the university's teachers so they could develop blended courses using the Moodle learning management system and offer these courses to learners in 2018. Over 600 students (over 1,000 if students registered in multiple courses are included) in 16 courses attended the blended learning courses. Comparison of the same courses offered in blended and non-blended modes previously had revealed

that blended courses integrating information and communication technologies (ICT) yielded no significant differences in ten courses, while there were increases in scores/grades in three courses and decreases in three other courses. However, the learners were broadly positive about TEL integration and considered the use of ICT in teaching and learning to be useful. Teachers who used TEL for developing their blended courses and taught these were eager to explore and adopt new active learning strategies. This presents an opportunity for SNDTWU to systematically scale up its TEL implementation.

1. Introduction

Indian higher education is growing in leaps and bounds in terms of educational institutions that offer programmes at various levels (certificate/diploma/degree); the country currently has 903 universities, 39,050 colleges and 10,011 standalone institutions. The gross enrolment ratio is expected to reach 30% by 2020 (in 2018, it was 25.8%). Today, 36.6 million young Indians are in higher education (MHRD, 2017, 2018).

Preparing them for global citizenship is a great challenge. Using technology to assist teachers in

transmitting information in the classroom is a traditional solution. But does it enable students to be more actively involved in the learning process? Does it help with “deep learning” rather than “surface learning”? Are technology-enabled and/or blended learning the probable solutions? To find answers, SNDTWU embarked on a project in which the Commonwealth of Learning (COL) became its partner: the integration of technology-enabled learning into higher education at SNDTWU.

2. TEL: Theoretical Framework

Technology-enabled learning (TEL) refers to the use of information and communication technologies (ICT) to facilitate the learning process. Kirk wood and Price (2016) state that TEL refers to the application of some form of digital technology to teaching and/or learning in an educational context. They use the term TEL to describe the use of technology to support students' learning (p. 2). The nature of ICT has been changing to a great extent. Film, radio and TV technologies, which traditionally are more for one-way communication and are called "mass media," have been transforming into individualised media. New media and technologies are becoming more user friendly and convergent. These developments are fruitful in several ways for the field of education.

2.1 Features of TEL

ICT tools and platforms are expected to provide more freedom for both teachers and students to plan classroom activities that better enable learning. The present TEL implementation study planned for and implemented extensive use of the Moodle learning management system (LMS), online databases from the university library, virtual laboratories, and learning community tools such as Google Drive.

COL's TEL initiative (2018) aims to increase access to quality teaching and learning by supporting (i) policy formulation and innovation in the application of ICT in education and (ii) the development of ICT skills. COL believes that for technology to have a transformative effect in teaching and learning, it is necessary to focus on policy–technology–capacity as a triangle and to base practice on research evidence. COL works with a range of technologies for teaching and learning: online learning, mobile devices, and low-cost technologies such as audio, video, radio and TV.

Technology trends in today's teaching–learning are changing the face of today's education.

Contact North (2016) has identified the following development trends in today's TEL:

1. Student expectations and requirements are changing
2. Flexibility is shaping new ways of delivering programs and courses
3. Competency-based and outcome-based learning are growing quickly
4. Technology is enabling new approaches to pedagogy
5. Moocs are offering expanded routes to the delivery and recognition of learning
6. Assessment for learning and assessment of learning are changing
7. Governments are re-thinking quality and accountability
8. Equity remains a challenge, despite massification
9. e-portfolios are emerging as critical resources for students
10. The role of the faculty member/instructor is changing

Developments in TEL and the use of blended learning are playing a major role in driving changes in India's higher education scene. The Government of India has taken steps to set up and promote a MOOC platform called Study Webs of Active Learning for Young Aspiring Minds (SWAYAM), has established a Repository of OER (NROER), and is encouraging the use of digital technologies in teaching and learning. Massive training programmes in new technologies, new pedagogies, new assessment strategies for teachers in higher education are being organised under the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMNMTT) (MHRD, 2015).

Kamat, Patil and Kadam (2017) suggest a taxonomy for TEL in which ICT are the media for:

1. accessing and studying learning materials
2. learning through inquiry
3. learning through communication and collaboration
4. learning through construction
5. student assessment
6. digital and multimedia literacy

The study of TEL implementation at SNDTWU leveraged the affordances of technology related to improving (i) access to learning materials, (ii) communication and collaboration, (iii) student assessment and (iv) digital and multimedia literacy.

Benefits of TEL

Today, many teachers are realising that the chalk-and-talk strategy is not at all useful for helping students “learn” in the real sense of the term. Some teachers use tools such as videos and PowerPoint presentations, but these only strengthen one-way communication. New ICT tools allow students to actively participate in the learning process and achieve higher-order objectives. TEL supports student learning, in part by addressing deep learning rather than surface learning.

Many research studies have highlighted several benefits of TEL (Lopez, 2015; Pearcy, 2009; Sykes, Oskoz & Thorne, 2008; Youssef & Dahmani, 2008). Some are listed below:

1. The ICT tools include an LMS, which offers a lot of flexibility in using the learning resources shared by the teacher. The students have access to those resources 24/7. Accessibility is a great benefit for students.
2. The learning resources to which the learner has access will mostly be open educational resources (OER), which also implies access to globally designed and developed OER.

3. Many ICT tools are used for communication among students. They can discuss, work on, add to, edit and co-create knowledge materials using these tools.
4. This implies very good-quality communication among students as well as teachers and students.
5. Numerous ICT tools assist with cooperative learning, so TEL provides many opportunities for students to collaborate, thereby reducing isolation. In the traditional face-to-face classroom, teacher-dominated strategies tend to isolate students both inside and outside the classroom.
6. Many technology tools, especially LMSs, help with individualising learning, including by allowing every learner to learn at their own pace.
7. Flexibility in the teaching and learning processes brings greater time/cost efficiency.
8. Many research studies have shown TEL to be more effective than traditional face-to-face teaching in terms of students achieving higher-order objectives through the learning process.
9. Teachers perceive TEL to be an important pedagogical approach that considerably facilitates student learning. But they need to be trained in how to shift from the traditional face-to-face classroom to TEL-based blended and/or flipped classrooms.
10. In blended learning (which implies TEL), the combination of synchronous and asynchronous learning events along with opportunities for collaborative and problem-based learning are likely to increase the quantity and quality of student–teacher and student–student interactions.

It must be kept in mind that not all TEL is blended learning; TEL can also be exclusively

online. But blended learning (the integration of face-to-face and online learning) is always TEL.

2.2 Blended Learning

Watson (2008) defines blended learning as the “online delivery of educational content with the best features of classroom interaction and live instruction to personalize learning, allow thoughtful reflection, and differentiate instruction from student to student across a diverse group of learners.”

Blended learning is a formal education programme in which a student learns in part through the online delivery of instruction and content, with some element of student control over time, place, path and/or pace (Clayton Christensen Institute, n.d.). It is a means to provide more engaging, quality-driven experiences by integrating or replacing portions of face-to-face with online or technology-enabled learning (Bourne, Harris & Mayadas, 2005; Clark, Kaw, Lou, Scott & Besterfield-Sacre, 2017; Dziuban, Hartman, Juge, Moskal & Sorg, 2006; Garrison & Vaughan, 2008).

This deliberate synthesis of online and face-to-face contact time between teaching staff and students has become particularly appealing to an increasing number of higher education institutions in recent years (Lim & Wang, 2016). Blended learning is generally regarded as learning that uses an appropriate mixture of face-to-face and online learning. The percentage share of each mode may differ from faculty to faculty, but there is a blend of both. Some teachers also look at the blend not only from the technology-integration angle but also in terms of the variety of teaching–learning strategies used (e.g., lectures, plus cooperative learning strategies). In addition, some employ a blended approach to assessment strategies.

2.3 Review of Research Related to TEL

TEL is a comparatively recent phenomenon, and blended learning emerged as an innovative

and effective alternative to traditional teaching–learning processes sometime after 2000; since then, many research studies have been undertaken to understand this phenomenon from various angles. The present study aimed to explore the phenomenon of TEL in an Indian university. Related studies were therefore reviewed. This section summarises some of them.

The Impact of TEL

Lee, Shen and Tsai (2008) as well as Felea, Dobrea and Albăstroi (2017) investigated the effectiveness of TEL. The first group studied interactions between TEL and pedagogies, whereas the second focused on student perceptions and attitudes toward TEL.

Lee and colleagues (2008) evaluated the impact of Web-enabled pedagogies on students, instructors and course design. The main goal was to improve students’ learning, explore Web-enabled learning effects, refine online courses and reinforce teachers’ professional development. Problem-based learning (PBL) and self-regulated learning (SRL) were the two methodologies used; PBL and non-PBL classes were divided into SRL and non-SRL groups, making four groups for comparison. Web-enabled pedagogies were used for PBL, and Web-enabled PBL was found to play a relatively positive role in enhancing students’ skills with software, in contrast to those students instructed without PBL. It was demonstrated that PBL via eLearning facilitated the development of students’ ability to apply computer software, particularly students in Taiwanese vocational schools.

Felea and colleagues (2017) conducted a study to explore three specific matters: (i) students’ perceptions of the quality of already delivered e-courses; (ii) the level of importance of specific elements of eLearning they encountered; and (iii) students’ general attitude towards eLearning, and their needs with respect to the quality of course materials, communication and support during the learning process. Additionally, students were asked to assess the technical aspects of LMS use. The research findings demonstrated that

students prefer course formats employing blended learning components. However, using these components implies an available technological infrastructure, ease of use and accessibility, and good-quality content. Hence, on the one hand, the quality of resources should be taken into account when implementing blended learning. On the other hand, effective teaching requires policy support from evaluation models for training as well as other types of support, all of which influence the implementation of blended learning programs in higher education.

Faculty Perceptions about TEL and Blended Learning

We reviewed three studies that looked at faculty perceptions about TEL: Myers, Bennett, Brown and Henderson (2004), Johnson, Meling, Andaverdi, Galindo, Madrigal and Kupczynski (2011) and Hamdan (2014). The first study examined blended learning environments whereas the second and third studies focused on the online mode.

Myers and colleagues (2004) studied teachers' perceptions about using educational technology and a blended learning approach for teaching and learning. Surprisingly, the teachers had favourable opinions about the learning experiences in online learning environments not because they were motivated to learn about new technologies per se but because they wanted to update their CVs and teaching skills. Secondly, the results suggested that it may be harder to convince older and more experienced faculty to use new technologies than younger and less experienced faculty. These results have practical implications for universities and support services in terms of recruiting and supporting faculty who will implement educational technologies.

Johnson and colleagues (2011) conducted a study to assess faculty members' current perceptions of online student learning. The researchers created an online survey instrument for data collection. Their results showed that tenured faculty, faculty who taught online courses, and faculty who had

taught online courses for five or more years had similar perceptions of student learning using online courses versus the traditional face-to-face environment. The researchers concluded that higher education institutions cannot assume online and face-to-face courses are the same, and that instructors need the specific skills, information and direction that face-to-face courses already demand.

Hamdan (2014) studied faculty members' perceptions of online learning in Saudi Arabia and found that study participants thought that through online learning, students were able to develop higher-order thinking skills. They also felt their teaching productivity had increased through teaching online courses. In their experience, the online and blended learning/teaching approaches offered a platform for students to be active rather than passive learners, and most faculty members preferred these methods. Faculty expressed a need for more professional development and support to enhance their technological proficiency and pedagogical tools.

Challenges to Implement Blended Learning

Al Gamdi and Samarji (2016) investigated the potential barriers faculty members experienced when trying to achieve effective implementation of eLearning in a Saudi university, as well as the types and patterns of such barriers. The top barriers revealed in their quantitative analysis were poor Internet access and networking in the university, lack of training on eLearning, lack of technical support in the university and inadequate availability of hardware and software.

Based on the implementation of blended learning in seven branches of Arab Open University for ten years, Sharafuddin and Allani (2012) examined how blended learning was used in that university. They found their university was using more of a traditional rather than an eLearning educational system: "Although we bear the name of Arab Open University, we are not really 'that open'!" (p. 414).

Tshabalala, Ndeya-Ndereya and Van der Merwe (2013) documented the perceptions of academic staff to study the challenges of introducing blended learning to a university in Southern Africa. The major challenges identified were the lack of an enabling environment, the lack of a blended learning policy, academic staff's lack of expertise in using blended learning, and limited student access to the computer laboratory. These challenges had resulted from a failure to plan properly for the implementation, monitoring and evaluation of blended learning.

Studies on TEL have consistently shown a positive impact on students' learning, and that students

are satisfied with TEL and blended learning. It is worth noting that Web-enabled PBL has proven to be an effective strategy. Higher education students prefer the use of blended learning environments. Teachers who employ TEL consider professional development more important than those who don't. Many accept that TEL improves their productivity as teachers. Challenges include lack of infrastructure and training.

Based on the benefits of TEL and the positive attitudes of teachers and students, it seemed advisable to study the effectiveness of TEL in an Indian university environment.

3. Research Context and Statement of Problem

The Department of Educational Technology at SNDTWU has been experimenting with TEL for the last 16 to 17 years. Under the guidance of then Vice Chancellor Professor Vasudha Kamat, the department conducted several training workshops for campus faculty from 2011 onwards. The training was mainly in free ICT tools and the Moodle LMS. A few of the campus teachers had attempted to get support for using the LMS, and some also developed online courses in 2014–15, receiving the then Vice Chancellor's assistance with planning and implementation. These were a few discrete efforts at the individual level.

It became essential to systematise the integration of ICT and apply the TEL approach on a larger scale. A baseline study was therefore planned in collaboration with COL to study the current status of TEL at the university. The study had the following objectives:

1. to study the accessing and use of ICT by the teachers and learners
2. to study the perceptions of learners and teachers about using TEL
3. to study the extent to which teachers use ICT in their teaching
4. to study the extent to which teachers use ICT for research and scholarship
5. to study students' perceptions of TEL

The survey was conducted on all three campuses of the university.

The results of the survey categorically demonstrated a demand amongst the university's students for ICT-enabled learning, automation of the student life-cycle (i.e., from admission to graduation) and an infrastructure for using ICT. Teachers also expressed positive attitudes towards ICT integration in teaching–learning and requested more training and support for these initiatives (Shinde, 2016).

The baseline survey conducted the previous year had revealed high student demand for TEL. Now, actual implementation was proposed. Those involved felt it was essential to gather teachers' and students' reactions after experiencing TEL first-hand, and to study the feasibility of and challenges to implementing TEL.

The baseline study indicated the need for the university to develop a TEL implementation policy, and with the involvement of about 25 faculty, such a policy was formulated and passed in May 2016 (SNDTWU, 2016). COL's contribution was significant even at this stage.

Implementation of this policy was the major project initiated in the 2017–18 academic year. This report outlines the findings on the impact of TEL implementation in select courses at SNDTWU through the lens of students' and teachers' experiences and by gauging TEL's effectiveness for student learning.

3.1 Operational Definitions

The following terms were defined operationally:

1. **Technology-enabled learning (TEL) approach:** planning and implementing face-to-face instruction with the help of eResources uploaded on the Moodle LMS and delivered through ICT tools such as Google Drive; activities conducted online through Moodle, such as discussion forums and other ICT platforms such (e.g., Padlet, blogs). Individual and group learning mediated through ICT are included in the TEL approach.
2. **Intervention:** teaching–learning processes conducted through TEL and small group activities in the classroom.

3. **Effectiveness:** comparison of students' end-of-semester scores for courses in which TEL was employed with those of the previous year, obtained from the university's centralised examination system.
4. **Attitude:** positive or negative opinions about TEL, and the level of acceptance of a TEL approach.
5. **Higher education:** post-graduate degree, undergraduate degree and diploma programmes offered by on-campus institutes of the university.
6. **Perceived experiences:** the opinions and perceptions of teachers and students about the TEL intervention. These were obtained through questionnaires consisting of rating scales, as well as individual student interviews and focused teacher interviews.

3.2 Objectives of the Study

This study was planned to determine the effects of an intervention based on blended TEL. The study also aimed to understand the reactions of participating teachers and students, for whom this was a new experience. The following study objectives were set:

1. to study the effectiveness of the TEL approach by comparing students' final scores in courses that were part of the intervention with final scores in the previous year for other students in the same course
2. to gather students' opinions regarding the use of eResources and TEL environments
3. to gather students' opinions regarding small group learning environments in the classroom

The following research questions were identified:

1. How did students and teachers perceive the whole intervention?

2. Did learners find TEL useful? Why?
3. Did learners find TEL feasible? What were various challenges for them when learning through TEL?
4. Did teachers find TEL useful? Why?
5. Did teachers find TEL feasible? What were various challenges for them in using TEL?

3.3 Hypotheses

With reference to objective 1, the following null hypothesis was set:

H0: There will be no significant difference between the students' final scores in courses that were part of the intervention and final scores in the previous year for other students in the same course.

The alternative hypothesis for the same set as:

H1: There will be significant differences between the students' final scores in courses that were part of the intervention and final scores in the previous year for other students in the same course.

3.4 Scope and Limitations

The scope of the study was limited to eight higher education institutes situated on the Juhu and Churchgate campuses of SNDTWU. The institutes consisted of six university departments offering programmes in library and information science, management, education, educational technology, and psychology, and two colleges offering undergraduate programmes in technology.

4. Research Methodology

The research methodology for the present study is discussed in the following subsections.

4.1 Research Method

Since the present study intended to determine the effects of a TEL intervention, a mixed-methods approach was used.

Analysis of the intervention was planned towards the completion of the intervention, so within the category of mixed methods, a sequential explanatory design was adopted (Creswell, Plano Clark, Gutmann & Hanson, 2003).

Since this was a study of a TEL intervention, it was appropriate to employ a quasi-experimental design for quantitative research. A two-group post-test only quasi-experimental design was employed.

Since the intervention occurred as a unique and innovative phenomenon in the university, the study looked only at participating teachers' and students' perceptions of the intervention. A phenomenological approach was used for qualitative analysis (Groenewald, 2004).

Variables

Dependent variable: Achievement as measured by the final scores in the courses taught with TEL was the dependent variable.

Independent variable: TEL was the independent variable.

Intervening variables: Heterogeneity in the nature and demographics of teachers and students, subjects, technology facilities and number of students in each class were major intervening variables that could not be controlled. The intervention occurred in natural settings without control or manipulation over anything except the independent variable and the Moodle LMS.

4.2 Sample

The present study had two categories of sample: teachers and students.

Teacher Sample

The project started with identifying teachers on the basis of basic ICT skills, prior experience with using Moodle, and willingness. Twenty teachers were identified.

The study wished to target about 1,000 students. Since in some cases, more than one faculty member implemented TEL with the same batch of students, even though the absolute number of students was less than 1,000, the total amounts to 1,024 (see Students below).

A few faculty members could not attend the orientation and capacity-building workshops and chose to drop out. Some did not update to the Moodle LMS and continued teaching without TEL. Two other faculty members who had not attended all of the workshop days but showed keen interest were included.

The final team of 15 faculty members (excluding the Project Investigator, who also implemented TEL) consisted of six males and 14 females. One of the teachers taught two courses through TEL, so a total of 16 courses were involved. The following programmes were selected for TEL intervention:

- Master of Computer Applications (MCA) 1 course
- MA Psychology 1 course
- MA eLearning 1 course
- Master of Education (MEd) 1 course
- Master of Management Studies (MMS) and Master of Business Administration (MBA) 4 courses

- Master of Library and Information Science (MLISc) 2 courses
- BTech (in IT, CST, EE and ENC) 4 courses
- Diploma in Electronics 2 courses

Student Sample

Once the sample teachers had been selected, the courses they planned to teach through TEL were identified (see the list immediately above). The students who enrolled in the courses served as the sample for the study.

Courses for all participating faculty were created

in Moodle. Resources were added by the respective faculty members to their courses created in Moodle starting in July 2018. TEL courses for the MEd, MBA, MMS and MCA programmes could not be started in July as admissions were open until August–September. Though the initial sample was about 650 students, some dropped out or did not attend for the final exam, so the final sample was 628 students.

The number of students enrolled in the same programmes in the previous year was 635 (Table 1). These students' scores were used for comparisons.

Table 1. Numbers of participating students, by programme

Sr. No.	Programme	Semester	No. of Students	No. of Students
			Year of intervention	Previous year
1.	MLISc	I	12	9
2.	MLISc	III	8	11
3.	MCA	III	68	57
4.	MA Psychology	III	18	11
5.	MEd	I	5	10
6.	MMS, MBA	I	89	83
7.	MMS, MBA	III	17	20
8.	MA eLearning	I	11	7
9.	BTech (IT, CST, EE and ENC)	I	162	144
10.	BTech (IT, CST, EE and ENC)	V	206	245
11.	Diploma in Electronics	VII	32	38
	Totals		628	635

Out of the 628 students in the intervention year, 375 received TEL from two different teachers. There were 68 MMS and 21 MBA students studying in Semester I. These 89 students received TEL from two teachers for two different subjects. Twenty-one

MBA students were taught one more course through TEL by a third teacher. If we consider courses and students receiving TEL in the respective courses, the student sample totals 1,024 (628+375+21; see Table 2).

Table 2. Participating classes

Sr. No.	Programme	Semester	No. of Students		
			Each class	Course II taught to the same batch of students	Course III taught to the same batch of students
1.	MLISc	I	12		
2.	MLISc	III	8		
3.	MCA	III	68		
4.	MA Psychology	III	18		
5.	MEd	I	5		
6.	MMS, MBA Course I	I	89		
7.	MMS, MBA Course II	I		89	
8.	MMS, MBA Course III	I			21
9.	MMS, MBA	III	17		
10.	MA eLearning	I	11		
11.	BTech (IT, CST, EE and ENC): Course I	I	162		
12.	BTech (IT, CST, EE and ENC): Course II	I		162	
13.	BTech (IT, CST, EE and ENC): Course I	V	206		
14.	BTech (IT, CST, EE and ENC): Course II	V		92	
15.	Diploma in Electronics	VII	32		
16.	Diploma in Electronics	VII		32	
			628	375	21
		Total	1,024		

Details of programmes and courses are given in Appendix D.

4.3 Tools and Techniques for Data Collection

Since a mixed-methods approach was used, a variety of tools and techniques were required.

Tools for Quantitative Data Collection

a. Scholastic Achievement Scores

Final scores were obtained for each course. Two types of scores were acquired from the

University Examination System: (i) end-of-semester external exams (50% weight for master's programmes and 75% weight for undergraduate and diploma programmes); (ii) total of internal and external scores declared as final results.

The effectiveness of TEL intervention was studied by comparing student achievement with TEL and student achievement in the same courses the previous year without TEL.

b. Student Questionnaire

A questionnaire was designed to collect students' demographic information as well as their opinions about instructional strategies and resources related to TEL environments. The objectives of the questionnaire were to:

1. collect demographic information: programme, institute, income group, possession of and accessibility to technology devices, availability of Internet, and academic background in terms of overall performance
2. collect opinions about the use of possible resources and activities by instructors
3. collect opinions about small group learning environments

Fifteen items each were constructed for collecting opinions related to objectives 2 and 3. Each item had a rating scale. The rating scale designed for objective 2 consisted of ten positive and five negative statements, whereas the rating scale designed for objective 3 consisted of eight positive and seven negative statements.

The questionnaire is included as Appendix A.

Techniques for Qualitative Data Collection

a. Interviews of Students and Teachers

Interviews were conducted with teachers and students. All 15 teachers were interviewed in detail using a semi-structured interview schedule, which is included as Appendix B. Three students from each teacher's class were selected to be interviewed, based on scholastic achievement: the highest- and lowest-scoring students, and one whose score was closest to the course average. Some students from the same institutes had received TEL teaching from more than one teacher and had the highest or lowest scores. A total of 26 students were interviewed.

b. Focus Group Interview

A focus group interview technique was used with some teachers. Their discussion helped with understanding collective perceptions, challenges, benefits and innovative teaching practices. A total of ten teachers participated in the focus group interview, which was monitored by Dr Sanjaya Mishra, COL's Education Specialist: eLearning.

4.4 Tools and Techniques for Data Analysis

Statistical Tool for Testing Null Hypotheses

The significance of the difference between two means was computed using the t -ratio.

Analysis of Questionnaire

Percentages were used for descriptive analysis of the data obtained from the questionnaire.

Qualitative Analysis of Teachers' and Students' Perceptions

Data obtained through interviews and focus group discussion were analysed by identifying codes and defining categories relevant to the intervention. A collective analysis — which included teachers' perceptions, students' perceptions and the views of teachers who participated in the focus group discussion — was synthesised.

5. Intervention

TEL was implemented as a systematic project from July to December 2017. The following sections describe the stages of the project.

5.1 Before the Intervention

Two-stage preparations were planned and implemented.

Training of Faculty Members in TEL and Instructional Design for TEL

A five-day capacity-building workshop spread over three sessions was organised, and the participants were oriented in blended learning, planning for ICT integration, and Moodle. Participants had time between sessions to complete tasks assigned during the workshop.

1. One-day workshop: May 5, 2017
2. Two-day workshop: June 29-30, 2017
3. Two-day workshop: July 11-12, 2017

Appendix C presents the schedules for this three-phase workshop.

The workshop mainly aimed to explore the needs and modalities of technology-enabled blended learning. Workshop participants were introduced to OER, skills for finding OER in their subject areas, flipped learning, ICT tools for collaborative activities, and Moodle.

All participants successfully OER, understood the significance of copyright issues, and identified materials for their selected course. A planning template was shared with all faculty members to help them keep track of resources they had found.

Faculty Members' Design and Development of Courses on Moodle

Courses for all participating faculty were created in Moodle. Faculty began adding eResources to their courses in July 2018. Having been oriented

in systematic planning for blended sessions, they chunked their four-credit courses into units and sub-units, designed learning objectives per unit, identified OER for all units and designed online activities. Online videos were major Web resources in their courses. Faculty also uploaded their own resources, such as presentations and PDF files. Some planned to record screencast videos. Once resources were identified, faculty started uploading all of their units to Moodle.

Launch of Moodle Classes

Moodle classes were created before the beginning of the semester. Students in the respective courses were added by the administrator. A few students subsequently withdrew from courses and were removed from the records. Conversely, new students were added when applicable.

5.2 Processes During the Intervention

The Teaching–Learning Process with Moodle

All the courses were worth four credits, which required 120 hours of study. The faculty participants had planned weekly interactions on Moodle. Classroom activities were also planned. Students were expected to access resources on Moodle outside of class time. Several resources were uploaded for their use. Many teachers also tried to provide adequate lab access for students to use the resources. A few online activities, either through Moodle or on other collaborative ICT platforms, were planned. It was, however, not possible for a few teachers to use the labs, particularly for courses with large enrolments and in non-laboratory subjects such as communication skills and mathematics. Mobile support with Moodle was integrated into the LMS, which enabled students to access it from their smartphones.

Mathematics teachers needed mathematical symbols to be incorporated into Moodle, after which they were able to upload many more resources and activities. Teachers also used other ICT tools, such as Padlet, blogs and Google apps.

The Teaching–Learning Process in the Classroom

Teachers had discussed learner-centred and group-centred classroom activities during faculty training. Although conducting such activities throughout the semester requires skills and practice, many teachers made a point of not then delivering in-class lectures on the same content. Discussions, group work, group presentations and a few cooperative strategies were implemented in classes.

Assessment and Feedback Using Moodle

Many teachers favoured the preparation of Moodle-based quizzes, particularly technology teachers. Those providing TEL to more than 100 students at a time perceived Moodle quizzes as a boon. Management teachers made extensive use of Moodle quizzes and also tried Padlet-based activities with feedback.

Online Technical Support and Trouble-Shooting for All Teachers

All teacher participants had ongoing access to technical support with Moodle. Some Moodle features were explored and added in response to teachers' suggestions. Online and on-campus trouble-shooting was provided by mentors and the technical team.

5.3 After the Intervention

Data on the predetermined variables were collected after the intervention.

Collation of Internal Assessment

The teaching of four-credit courses was completed according to the university's schedule, and

students were ready for their final exams. Internal assessment was conducted through various activities — project submissions, Moodle-based quizzes, etc. — as per university directives.

Assessment through Final Examination Results

Summative evaluation was conducted through final examinations. Exam schedules varied from institute to institute, depending on admissions dates and semester schedules.

Data Collection

Final exam scores were obtained for the TEL course students and the previous year's students who had taken those same courses. Data collection activities, such as administering questionnaires to and interviewing students and teachers, were done according to plan. The schedule varied by institute. Meeting students during exam periods and managing the schedules of all the institutes was a big challenge for the research team. Sometimes, the schedules of two campuses clashed, and it was difficult to meet students and teachers of both campuses in the same week. Meeting students whose exams were either over or going on was again a challenge. Some of the solutions to meet these challenges were being flexible about scheduling, involving teachers in getting students' participation after exams, and asking more research assistants to work on different campuses. A link to the questionnaire was uploaded to the Moodle courses, and faculty were also requested to send the link via cell phone.

Comparison of quantitative data was the most challenging part of the study. Examination data existed for the entire university student population on all campuses and in all affiliated colleges. Identifying the participating students and their scores, identifying the relevant previous year's students and their scores, omitting students who had dropped out of the course or not shown up for the final exam, and then comparing the scores were time-consuming tasks. All of the gathered data needed to be verified several times to confirm their accuracy.

6. Data Analysis for the Quantitative Study

Data analysis of the scholastic achievement scores and the tools that were used are presented in the following subsections.

6.1 Comparison of Participating Students' Final Evaluation Scores with Those of the Previous Year

Across all of the university's master's programmes, the external theory examination and internal assignments are weighted 50:50. This study considers students' results in the end-of-semester external theory papers separately from the total of the external and internal assessment results.

In undergraduate and diploma courses in technology, the ratio of external to internal assessments is 75:25. As dictated by limited availability, only the external scores of two diploma courses are considered for the study.

The Department of Educational Technology had been using a technology-enabled blended learning approach for the previous seven years. All other courses in the study were taught through TEL for the first time. Hence, students' scores in the course offered by the Department of Educational Technology were not considered for comparison.

Table 3 compares the results of the study year's students with those of the previous year's students. One undergraduate course in technology was excluded because the course had been replaced by a new one during the 2017–18 academic year. A summary of the results is presented in Table 4.

Table 3. Comparison of student achievements in TEL-taught courses and courses taught conventionally the previous year

	Programme & Semester	Course	N	Types of Scores	Mean of Summative Assessment of Course Under Intervention	N	Mean of Summative Assessment Scores from the Previous Year	Obtained <i>t</i> -ratio	Critical Value at 0.05	Critical Value at 0.01	Remarks
1	M 1 Sem I	C 1	12	External	19.917	9	26.440	1.833	2.093	2.861	Non-significant
1				External + Internal	49.833		63.440	2.410			Significant at 0.05 level; significantly lower mean for intervention group
2	M 1 Sem III	C 1	8	External	32.750	11	28.730	1.669	2.110	2.898	Non-significant
2				External + Internal	62.380		56.820	1.347			Non-significant
3	M 2 Sem III	C 1	68	External	24.765	57	32.890	5.418	1.960	2.576	Significant at 0.01 level; significantly lower mean for intervention group

	Programme & Semester	Course	N	Types of Scores	Mean of Summative Assessment of Course Under Intervention	N	Mean of Summative Assessment Scores from the Previous Year	Obtained <i>t</i> -ratio	Critical Value at 0.05	Critical Value at 0.01	Remarks
3				External + Internal	54.570		60.670	2.612			Significant at 0.01 level; significantly lower mean for intervention group
4	M 3 Sem III	C 1	18	External	28.406	11	27.640	0.286	2.052	2.771	Non-significant
4				External + Internal	61.670		66.910	1.734			Non-significant
5	M 4 Sem I	C 1	5	External	25.800	10	28.300	0.894	2.160	3.012	Non-significant
5				External + Internal	55.800		62.900	1.474			Non-significant
6	M 5 Sem I	C 1	89	External	26.380	83	27.100	0.9615	1.960	2.576	Non-significant
6				External + Internal	61.670		59.800	1.6754			Non-significant
7	M 5 Sem I	C 2	89	External	29.480	83	28.140	1.1846	1.960	2.576	Non-significant

	Programme & Semester	Course	N	Types of Scores	Mean of Summative Assessment of Course Under Intervention	N	Mean of Summative Assessment Scores from the Previous Year	Obtained <i>t</i> -ratio	Critical Value at 0.05	Critical Value at 0.01	Remarks
7				External + Internal	63.920		59.630	2.5650			Significant at 0.05 level; significantly higher mean for intervention group
8	M 5 Sem I	C 3	89	External	26.190	83	26.730	0.4733	1.960	2.576	Non-significant
8				External + Internal	54.440		55.430	0.5479			Non-significant
9	M 6 Sem I	C 1	21	External	22.190	20	24.350	0.8385	2.021	2.704	Non-significant
9				External + Internal	47.380		52.100	1.1946			Non-significant
10	M 7 Sem III	C 1	17	External	28.180	10	28.200	0.014	2.060	2.787	Non-significant
10				External + Internal	61.180		60.000	0.342			Non-significant

	Programme & Semester	Course	N	Types of Scores	Mean of Summative Assessment of Course Under Intervention	N	Mean of Summative Assessment Scores from the Previous Year	Obtained <i>t</i> -ratio	Critical Value at 0.05	Critical Value at 0.01	Remarks
11	UG I Sem I	C 1	162	External	42.53	144	57.0	14.895	1.970	2.595	Significant at 0.01 level; significantly lower mean for intervention group
11			162	External + Internal	42.530		57.03	10.4124			Significant at 0.01 level; significantly lower mean for intervention group
12	UG I Sem I	C 2	162	External	41.570	144	48.430	3.941	1.960	2.576	Significant at 0.01 level; significantly lower mean for intervention group
				External + Internal	59.430		65.700	3.058			Significant at 0.01 level; significantly lower mean for intervention group

	Programme & Semester	Course	N	Types of Scores	Mean of Summative Assessment of Course Under Intervention	N	Mean of Summative Assessment Scores from the Previous Year	Obtained <i>t</i> -ratio	Critical Value at 0.05	Critical Value at 0.01	Remarks
13	UG 2 Sem V	C 1	206	External	32.140	245	32.860	1.047	1.960	2.576	Non-significant
				External + Internal	49.390		49.270	0.143			Non-significant
14	UG 2 Sem V	C 2	92	(Newly introduced)							
15	Dip 1 Sem VII	C 1	32	External	37.190	38	28.530	6.549	2.024	2.684	Significant at 0.01 level; significantly higher mean for intervention group
16	Dip 1 Sem VII	C 2	32	External	36.880	38	31.420	3.0822	2.024	2.684	Significant at 0.01 level; significantly higher mean for intervention group

Table 4. Summary of testing level of significance

	Scores in External Evaluation		Scores in External–Internal Evaluations	
	No. of courses	%	No. of courses	%
Non-significant	10	67	8	62.5
Significant at 0.01 level; significantly higher mean for intervention group	2	13		
Significant at 0.05 level; significantly higher mean for intervention group	-	-	1	7.7
Significant at 0.05 level; significantly lower mean for intervention group	-	-	1	7.7
Significant at 0.01 level; significantly lower mean for intervention group	3	20	3	23.1
	15		13	100

Comparison of results with the previous year's proved useful for analysis, as it was revealed that the results were statistically similar for about 67% of the courses when considering only the external scores and 62.5% when considering external plus internal scores, even though the mode of instruction had changed. TEL intervention helped students in three courses achieve significantly higher scores as compared to the previous year, whereas students in three other courses gained significantly lower percentages after TEL implementation.

Teachers of the courses in which students scored lower were asked for possible reasons. All of the teachers mentioned that this particular batch of students had not performed well in other subjects either. One teacher mentioned that his assignments were application based and demanded extra effort from students. He evaluated them on all parameters, and they did not achieve high scores on the internal evaluations.

Students might have been used to listening to lectures and writing down notes, so when

eResources replaced much of the teacher's lecture, some students might have found it difficult to prepare for exams.

The multiplicity of resources, including Web links and videos, might have overloaded some students.

TEL also calls for different assessment strategies. Since the learning process becomes more learner centred and application based, recall and comprehension-level theory questions become difficult in terms of scoring. More application-oriented evaluation is required in a TEL approach.

Activities in a TEL environment may also be more application-based. Scoring more marks may be a challenge for some students in such a constructivist environment. In these cases, overall scores might be comparatively less than those in the previous year.

Almost all of the teachers continued using the TEL approach after the intervention ended.

6.2 Analysis of Questionnaire to Ascertain Students' Opinions

Since overall student development, the strengthening of team-building capacities, and exposure to ICT are a few of the significant advantages of TEL, it was essential to understand students' opinions about the TEL approach.

A questionnaire was designed to collect students' demographic information and opinions about the instructional strategies and resources related to the TEL environment. The objectives of the questionnaire were to:

1. collect demographic information: programme, institute, income group, possession of and accessibility to technology devices, availability of Internet, and academic background in terms of overall performance
2. collect opinions about the use of possible resources and activities by instructors
3. collect opinions about small group learning environments

Fifteen items each were constructed for collecting opinions related to objectives 2 and 3. Each item had a rating scale. The rating scale designed for objective 2 consisted of ten positive and five negative statements, whereas the rating scale designed for objective 3 consisted of eight positive and seven negative statements.

The questionnaire link was uploaded on Moodle, and all 628 student participants were asked to fill it in, but only 230 completed questionnaires were received. This sample size provided data with a 95% confidence level and a 5.25% margin of error.

Demographic Information

Demographic information was requested on:

- institute of study
- range of family income
- availability of digital access devices

- Internet access
- overall percentage in previous final exams

The responses helped with interpreting the data on students' opinions about TEL and small group learning. The following subsections present the demographic analysis.

Institute-wide sample distribution

Teachers in eight institutes situated on the Juhu and Churchgate campuses of SNDTWU participated in the intervention. A total of 36.6% of the participating students responded to the tool.

Annual family income

Figure 1 presents the range of family income of the questionnaire respondents.

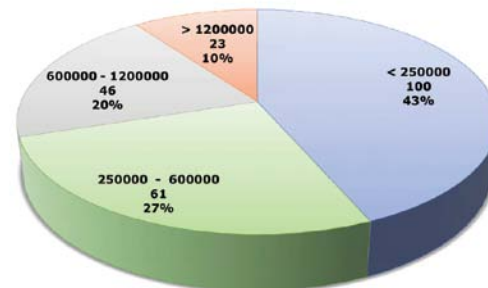


Figure 1. Family incomes of respondents
(Income figures are in INR)

About 43% of the sample students were from a relatively lower economic group, with annual family incomes of INR 250000 or less, while the family income of another 27% was between INR 250000 and 600000. These data were self-reported and not verified.

Availability and accessibility of digital devices

Table 5 presents the range of devices students used and their ease of accessibility. If desktops and laptops are shared with other family members, the devices may or may not be easily available to female students as and when needed. Several students had more than one device available and accessible.

Table 5. Availability and accessibility of digital devices

Statements	No. of students	%
1. Desktop system mostly being used only by me	4	1.74
2. Desktop system mostly being used only by me, with other options	57	24.78
3. Desktop system shared with other family members	4	1.74
4. Desktop system shared with other family members, with other options	37	16.09
5. Laptop mostly being used only by me	10	4.35
6. Laptop mostly being used only by me, with other options	54	23.48
7. Laptop shared with other family members	19	8.26
8. Laptop shared with other family members, with other options	55	23.91
9. My own tablet	3	1.30
10. Smartphone	185	80.43
11. I do not possess any of the above	0	0.00
Total	230	100.00

Four students had desktop computers available, while three possessed tablets and ten had their own laptops. Nearly 50% had desktops or laptops exclusively for them, along with other devices such as smartphones. Four had desktops and 19 had laptops available in the family for more than one member. Eighty percent claimed to possess smartphones. This number appears small in comparison with current trends in urban students. However, it establishes that 100% of the students

had at least one device available for them to participate in TEL, though many had to depend on smartphones for various activities.

Sources of Internet access

Web resources consisting of videos, web articles, teacher presentations and LMS tools were the main features of the TEL intervention. It was therefore essential to understand how students accessed the Internet. Table 6 presents these data.

Table 6. How students access the Internet

Statements	No. of students	%
My home has Wi-Fi.	138	60.00
My home system has broadband via cable.	14	6.09
My institute has Wi-Fi.	42	18.26
My institute lab has a cable network.	35	15.22
My smartphone has a data pack.	148	64.35
Only in cyber-café	1	0.43
Other...	0	

All student respondents but one had Wi-Fi or broadband access at home (66%), at the institute (33%) or through their smartphone data pack (64%). All of the institutes are connected to the Internet, but student access needs to be

significantly increased. Computer labs are generally not available for students in non-computer subjects. TEL implementation demands Wi-Fi-enabled campuses as well as labs that are better equipped and offer more Internet connectivity.

Students' Opinions of TEL

Students' opinions regarding the use of TEL and small group learning activities was elicited. The following subsections present an analysis of the relevant data obtained through the questionnaire.

Resources/materials shared by teachers

Students were asked, "What kind of resources/materials did your teacher share with you for learning/referencing and to what extent?" and presented with several response options. Table 7 presents the frequency with which such resources were uploaded.

Table 7. Availability of resources/materials shared by teachers

	Mean	SD	Always	Many times	Sometimes	Rarely	Never
Her/his own presentation slides used in the class	2.122	1.258	33 (14.4)	67 (29.1)	56 (24.4)	43 (18.0)	31 (13.5)
Her/his own notes (hard or soft copy)	2.478	1.132	42 (18.3)	87 (37.8)	55 (23.9)	31 (13.5)	15 (6.5)
Videos on the topic (e.g., links to YouTube, MIT/NPTEL programmes, etc.)	2.426	1.179	49 (21.3)	67 (29.1)	62 (27.0)	37 (16.1)	15 (6.5)
Web articles	1.757	1.197	18 (7.8)	47 (20.4)	68 (29.6)	55 (23.9)	42 (18.3)
Interactive multimedia (graphics, animation, etc.)	1.596	1.217	17 (7.4)	39 (17.0)	60 (26.1)	62 (27.0)	52 (22.6)
Web-based presentations (e.g., Slideshare)	1.878	1.286	26 (11.3)	54 (23.5)	61 (26.5)	44 (19.3)	45 (19.6)
eBooks	1.687	1.185	14 (6.1)	48 (20.9)	66 (28.7)	56 (24.4)	46 (20.0)
Articles/research papers from databases such as JSTOR, ProQuest, etc.	1.387	1.248	14 (6.1)	35 (15.2)	51 (22.2)	56 (24.4)	74 (32.2)

Note: Figures in parentheses are percentages.

Faculty preferred to provide their own notes, own presentations and links to videos. More than 60% of the students claimed that videos were provided frequently. Less frequent was the use of database articles and papers or interactive multimedia. This reflects the need to develop interactive e-content to support video formats. Since undergraduate students formed most of the respondents, the use of databases was minimal.

The data strongly reinforce that the teachers shared several resources frequently with their students.

Teachers' modes of sharing resources

Though all teachers shared resources with their students, their modes of sharing varied. Table 8 presents the results.

Table 8. Mode of sharing of resources/materials

Statement	No. of Learners	%
Gives us on pen-drive	22	9.57
Sends via email	154	66.96
Uploads on Google Drive	62	26.96
Uploads on class site or Moodle	173	75.22
Provides photocopies of slides/texts	76	33.04

Though 75% of the student respondents confirmed that most of the resources were uploaded on Moodle, surprisingly, resources were more frequently shared by email. This may have been due to the relative unavailability of labs to access the Moodle-based resources, as well as to teachers' doubts about whether students regularly used Moodle. The same reasons might even have compelled teachers to provide photocopies of the resources. Some of these photocopies might have been used in classroom discussions and activities.

That TEL nonetheless still significantly reduced paper use is worth recording.

Use of eResources

To understand students' patterns of interactions with the eResources, they were asked, "What was generally expected from you after the material was shared with you?" and were given five choices (from "always" to "never") to indicate frequency. Table 9 presents the results.

Table 9. Use of eResources

Statements	Mean	SD
Revision or extra reading at home after learning about the topic in class	3.178	0.86
Self-study followed by discussion in the class	2.965	0.98
Self-preparation and presentation in the class	2.530	1.22
Read and use in group study and group presentation in the class	2.500	1.26
Self-study at home, followed by group-work in the class	2.670	1.20

About 80% of the students claimed to use the resources mainly for revision of the topic after in-class teaching. This highlights the need to focus on flipped learning. Self-study followed by classroom discussion or group work seemed to be preferred. All activities gained a mean of more than 2.5 with low standard deviation (SD), which indicates that the use of eResources in lectures was minimal. This reinforces the blended mode of

teaching-learning. Only 6–8% of students claimed that their teachers never planned any in-class presentations or discussions but provided materials only for revision.

Online activities

Information on the perceived frequency of online activities is presented in Table 10.

Table 10. Frequency of online activities

Activity	Mean	SD
Online discussion forum	2.201	1.319
Uploading assignment on Moodle	3.184	0.981
Online concept mapping	2.518	1.224
Online slide preparation	2.120	1.329
ePortfolios	1.128	1.174
Blogging	1.407	1.253

The mean for Moodle use is high. All but two students claimed to use Moodle, out of which more than 80% claimed to use it frequently. All teachers continued to use Moodle in subsequent semesters, which indicates the success of using this LMS in teaching-learning. More than 77% of students mentioned using concept mapping, with a mean of 2.5, which confirms the generation of meta-cognitive knowledge in the class. Classroom discussions were mainly supported by online discussions, and even online slide preparation

activity seemed popular. ePortfolios and blogging seem little used. More input and support about these tools might change this.

Students' views about using ICT

It was essential to study students' views about using eResources and other ICT tools after one semester. Fifteen statements were provided, with responses on a four-point scale from "strongly disagree" to "strongly agree." Table 11 presents the results.

Table 11. Students' views about using eResources and ICT tools

Statements	Mean (range: 1-4)	SD
1. Online resources, books give us different perspectives about the same topic	3.00	0.71
2. Self-learning with the help of web-based articles and eBooks is not adequate to understand any topic. Teacher's explanation, instead, is useful.	2.13	0.75
3. Online learning materials apart from teacher's explanation make concepts clearer.	3.00	0.75
4. Going through videos on the topic before we study in the class is a waste of time.	2.94	0.83
5. It is always advantageous when the teacher gives students some links to online references, as they will be good-quality resources instead of just giving us a topic to explore.	3.16	0.66
6. eResources provide students with an opportunity to learn at their own pace (speed) and time.	3.14	0.64
7. Learning from resources and then going to class to discuss or work in groups creates in us a feeling of responsibility for learning.	3.08	0.67
8. When teachers provide learning resources to students instead of teaching the topic through lectures, they avoid their responsibility for teaching.	2.71	0.92
9. If the teacher had not provided the students with the opportunity to go through eResources, we would have been deprived of the huge wealth of information available.	2.75	0.74
10. Using the teacher's presentations by downloading them from the Moodle LMS helps with revision.	3.10	0.68

11. Downloading and viewing online resources is a time-consuming and boring task.	2.77	0.87
12. It is possible to refer to resources anytime throughout the day or throughout the semester if they are uploaded on the LMS.	3.08	0.68
13. Posting in online forums helps with developing confidence in students.	3.07	0.61
14. Logging in to the LMS every day proves to be an additional responsibility for students.	2.12	0.70
15. Self-expression and doing tasks ourselves on online platforms leads to better development of knowledge and social personality.	3.22	0.66

The data in Table 11 present a very high mean towards accepting TEL. Benefits such as self-expression, self-paced learning, quality resources, a feeling of responsibility, and different perspectives gained through online discussions had means of more than three out of four. Negative statements in Table 11 received low mean scores, indicating that students are positive about the use of eResources and ICTs. An average of four students chose not to respond to most of the statements.

Though students agreed about the benefits of online materials, about 70% felt the teacher's explanation was always needed. More use of cooperative learning strategies and teacher-made resources may reduce the extent of this need. Twenty-five percent of students found videos less useful than lectures. This points to a need for more studies on the use of videos in learning. According to feedback from teachers, most students did not prefer long videos. It is worth

noting that bandwidth issues can play a major role in student acceptance of long videos.

It can be concluded that most students perceived TEL intervention to be advantageous. Their positive attitudes toward TEL should be a motivating factor for teachers and the university as a whole.

Students' views about use of pair or small-group activities in the classroom

Learner-centred classrooms cannot be achieved merely through the use of technology; integration of technology in the classroom learning is essential. Pair learning and small-group learning help learners co-create knowledge and construct their own meaning. Teachers in this study used small group learning activities in their classrooms to achieve blended learning environments. Table 12 presents students' opinions on various aspects of these approaches.

Table 12. Students' views about pair or small-group activities

Statements	Mean	SD
1. Small-group learning gives students the opportunity to understand a topic in more detail.	3.04	0.64
2. Small-group activities prove to be hectic for students. We are exhausted by the end.	2.71	0.77
3. Friends' perspectives help us understand the topic better.	3.08	0.68
4. We get confused when everyone in the group starts discussing the assigned topic.	2.57	0.79
5. All subjects should be studied by using pair learning or small-group learning strategies, as they help with ineffective learning.	2.79	0.78
6. We cannot focus/concentrate fully when the teacher explains the entire topic for more than half an hour.	2.32	0.84

7. When we study any topic along with our friends, we feel ownership over our learning.	2.99	0.71
8. Group or pair learning provides us with an opportunity to learn at our own pace (speed) and in our own time.	2.95	0.71
9. We generally prefer to sit quietly and listen to the teacher's lecture instead of having discussions among ourselves.	2.56	0.82
10. Group learning requires more time than usual. Teachers won't be able to complete the entire course if they start using group-learning methods.	2.30	0.80
11. Many times, 2–3 students are more dominant in a group, and they do not allow others to express their thoughts.	2.27	0.81
12. We develop more confidence in presenting and expressing our views if we have more chances of group discussions and presentations.	3.12	0.63
13. Whenever teachers continue lecturing with more than 35–40 slides, we get tired and feel sleepy.	2.95	0.79
14. We feel enthusiastic when some activities are planned in the class.	3.11	0.65
15. The teacher should always lecture and then provide notes on her/his lecture for better results in exams.	1.95	0.82

Increased enthusiasm, deeper understanding, learning from peers' perspectives, feeling a sense of ownership in learning, alleviation from the boredom of passive listening, and developing confidence are the key benefits of group discussions and learner-centred activities as highlighted by the students' responses.

More than 85% of the students agreed with statements 5, 7, 12 and 13. This indicates that students understand the benefits of working with peers in small groups. Though in response to a previous question and rating scale, many students believed that the teacher's direct instruction was more useful, 83% of students here agreed that they understood better if they had discussions with peers; 78% of students even believed that their friends' perspectives helped them understand a topic better.

All statements yielded a mean above 2.5. About 36% of the students perceived the dominance of a few group members as a problem, which calls for

facilitators' attention. Only 26% of the students felt they got confused by various perspectives, which is a positive sign.

While students agree to a great extent about benefits of small-group learning, they disagree (mean = 1.95) that "teachers should always lecture and then provide notes of her/his lecture for better results in exams." This clearly indicates learners' preference for blended learning (i.e., a mix of lectures and small groups). Some students felt that small-group activities were hectic and time-consuming, and that they should not be deprived of the teacher's lectures and notes. Adjustments in assessment strategies may help change this opinion.

Frequent small-group learning strategies, constructivist environments, and innovative and learner-centred assessments would help change students' attitudes. Overall, though, students demonstrated positive opinions about small-group learning.

7. Data Analysis for the Qualitative Study

When an entirely new intervention is introduced, mere achievement scores generally are inadequate for gauging the success or failure of the intervention. Learner-centred or constructivist approaches aim not merely to increase achievement scores but also to develop students' abilities in other areas, such as finding information resources, gaining soft skills, co-creating, and generating knowledge. Since centralised assessments and teaching–learning strategies may not always be consonant in pedagogical interventions, it was equally important to determine students' reactions to the TEL intervention.

Interviews were used to gain further insights into students' and teachers' views about the experience of learning and teaching with TEL.

7.1 Student Interview Responses

Three students from each teacher's class were selected to be interviewed, based on scholastic achievement: the highest- and lowest-scoring students, and one whose score was closest to the course average. Some students from the same institutes had received TEL teaching from more than one teacher and had the highest or lowest scores. A total of 26 students were interviewed.

The students were asked about their overall experience, whether their expectations for the course had been met, and whether they had any suggestions for improvement. Their responses are organized into 11 areas:

1. Introduction to the course through TEL
2. Change in learning experience
3. Accessing resources
4. Challenges faced while accessing Moodle
5. Discussion forum
6. Assignment submission
7. Quizzes
8. Using other ICT tools
9. Classroom activities
10. Student participation
11. Overall experience

Introduction to the Course through TEL

Many teachers oriented their students in the use of Moodle at the beginning of the course. Some students still claimed to be a little nervous at the beginning, as it was their first experience with TEL. A few students mentioned being scared and worried by the unfamiliar pedagogy. They were not sure about the availability of infrastructural facilities, and many considered it additional work or even a burden. The examples below, as well as other student comments, are transcribed verbatim:

“Initially I was tensed as the platform was new and I got scared how would I continue my study through Moodle.”

“Initially I was tensed because I thought it would be extra work, but later found it easy and not waste of time.”

Students who had already participated in one or more online courses were excited about this experience. Irrespective of prior experience, students gradually started taking an interest in TEL.

Change in Learning Experience

Students, especially those from non-technology backgrounds, took time to adjust to this new pedagogical approach and were unsure whether they would be able to adjust to this new mode of teaching–learning. However, TEL exposed them to a variety of resources in the form of PDF files, videos, docs, etc. and it was welcomed by many. The majority considered Moodle a library where they could access all the uploaded resources at their convenience. One student said:

“All the notes were on Moodle, no books to carry in bags, everything at one place and it was easy and comfortable because it could be accessed from home.”

Some students liked the LMS concept, as it gave them freedom to express their views and opinions (on the discussion forum as well as the forum created for queries) and it made learning very interactive. Many felt it helped them avoid the potential monotony of learning.

Accessing Resources

As mentioned earlier, students appreciated the variety of the resources uploaded on Moodle by their respective teachers. They also liked the precise nature of the resources. Videos were widely appreciated. One student said:

“Teacher uploaded videos, word files, pdf files on Moodle. Videos were short and easy to understand.”

Many students preferred short videos over long videos. According to some students, animated or cartoon videos helped them understand a concept better. However, a few students liked videos of longer duration as well.

Though students appreciated the variety of resources uploaded, a few complained about feeling overwhelmed by the number of resources for certain topics. For example:

“Sometimes teacher use to upload many resources at a time, so I found it difficult to read all the resources.”

As a result, these students ran short on time and could not view all of the uploaded resources; they felt that a specific, limited number of resources should have been uploaded for each topic.

Challenges Faced while Accessing Moodle

During the initial phase, students had some problems, such as remembering their Moodle login details, encountering infrastructural limitations (e.g., no computer lab available or no

Internet access), and technology-related issues such as no access to Moodle because an Internet connection was unavailable. One student described a problem and its resolution:

“I faced problem while log in. I forgot the password and I approached teacher. She provided another password and issue was resolved.”

Teachers helped students with these difficulties. Many students tried to resolve issues either on their own or with the help of their peers. This helped students develop their independence and troubleshooting abilities.

Another issue was being notified by Moodle regarding assignment submission dates or the timing of quizzes. A few students did not receive notifications and hence missed deadlines or quizzes. However, this was an initial blip, and the teacher resolved the issues with the help of technical guidance from mentors.

Discussion Forum

The discussion forum was one of the major attractions for many students, and they posted their views, opinions, reflection, etc.

Discussion forum activities along with their benefits were described by two students as follows:

“After completing a topic in the class, a question on the topic was put up on discussion forum and everyone put up their opinions. We were able to read others opinions and share our opinions.”

“We can clear our doubts with our peers and also we get to know many things about the topic.”

Some students found the forum repetitive when they were asked to post the essence of a group/class discussion there.

Assignment Submission

Some students faced problems with submitting their assignments on Moodle due to file size constraints. They resolved these issues by raising

the concerns with their respective teachers. Some students who needed to solve mathematical sums used paper, then uploaded photographs of their work to Moodle.

However, many students liked the concept of submitting assignments online, as it granted them the freedom to send work from home. One student described the benefits she perceived:

“I would prefer Moodle for submitting my assignments rather than paper printouts because it’s easier. Also, it is environmental friendly. It saves unnecessary usage of paper. Isn’t that great?”

Other students also acknowledged this effort to save paper, indicating they were sensitised towards environmental awareness.

Quizzes

Taking quizzes was another interesting activity for students. Many advocated the usability of this feature, as it allowed them to appear for tests without any restriction of place. In addition, they appreciated receiving instant feedback after the test:

“After attempting the quiz, we used to get the right answers there itself. It was like an instant feedback. It was useful.”

According to them, it helped them to identify areas where they needed to pay more attention. Some students faced technical problems, such as trouble logging in or accessing Moodle during the test time; this was subsequently resolved by their teachers.

Using Other ICT Tools

Apart from Moodle, students participated in various learning activities conducted using different ICT tools, such as Padlet, blogs, Google Drawings, etc.:

“We created a blog in WordPress. It was a group blog. In that blog, whatever we had learnt, we wrote. At first, we wrote introduction, then added our future plans. After checking by madam, we also updated our views.”

Many of them were given some orientation or a demo session in advance of using these tools. Almost all of the students liked and appreciated them.

Classroom Activities

Classroom activities helped students to raise questions, resolve doubts and learn in more meaningful ways. Many students also claimed to develop different life skills through these classroom activities. For example:

“I learned to tolerate others’ opinions. Shared views and opinions, learned to respect others’ perspectives.”

Some of the favourite activities were concept mapping, group discussions and group presentation. Many students mentioned developing communication, leadership, group-management and time-management skills. However, a significant number of students advocated a balance between group and individual learning activities.

Student Participation

Most of the students were happy and even enthusiastic about participating in various group activities. They were also comfortable sharing their views and opinions with fellow students. Positive reflections included:

“I was absolutely comfortable sharing my views, ideas and opinions on these platforms. There was no domination in group. Everyone considered everyone’s view.”

“It helped us to improve our soft skills like communication abilities, sharing knowledge, team work, etc.”

However, this was not everyone’s view. Some of the students mentioned that participation was a bit awkward and difficult for them in the beginning. Some were not sure whether other group members would welcome their opinion, some were scared of criticism, and some were too shy to open up.

In the beginning, some students also encountered other problems, such as idle group members, conflicts in the group, the language used in discussions and the dominance of certain group members. For example:

“Sometimes [a] few students dominate the group work but as we were friends, we talked over it and solved the doubts.”

Nevertheless, students worked through these issues either by discussing them with group members or with the teacher’s intervention. In the end, many called these collaborations a better way of learning.

Overall Experience

Almost all students liked this intervention to the core. Some were apprehensive about it due to their fear of technology. However, these students overcame their fear eventually, as they were curious, interested and constantly motivated by their teachers. One student stated:

“Given a chance, I would prefer to learn through Moodle again. I was not very comfortable in the beginning. But eventually I have got used to it. Thanks to constant support by my teachers.”

It was certainly an out-of-the-box experience for them. Students liked the flexibility they experienced in terms of submitting materials, accessing resources, appearing for a quiz and setting their own learning pace. They also felt responsible for their own learning.

Almost all of the students were very happy about the experience and even wished to participate in similar experiences in the next semester. Overall, it was a pleasant and interesting learning experience for them.

7.2 Teacher Interview Responses

The 15 teacher interviews and the focus group interview helped in understanding teachers’ views, challenges and experiences, and the overall impact of TEL for them. Their responses are categorised into nine areas:

1. Initial response to TEL (blended learning)
2. Factors leading (inspiring?) faculty members to participate in TEL implementation
3. Using Moodle
4. Using other ICT tools
5. Classroom activities and pedagogical approach
6. Results of the change in pedagogy
7. Learning outcomes and behavioural changes
8. Student assessment
9. Overall experience

Initial Response to TEL (Blended Learning)

The initial response of many teachers was welcoming. Several expressed satisfaction at having the opportunity to apply their technological knowledge in such a fruitful way and were very excited to use ICT in education. They were eager to learn about new ICT tools as well. Many teachers also appreciated the ICT support provided by the university’s Department of Educational Technology. One teacher stated:

“I have always been excited about use of ICT in education. Something that interested me lot has two reasons. First, I am always interested to learn new things related to technology. And the other is the motivation that I got from the university in terms of the getting pro as far as ICT is concerned.”

Teachers who had not used technology for teaching were a little nervous and even worried about whether they would manage. When asked why, they gave many reasons, including having no prior exposure, anticipating the need to do in-depth planning for such a gigantic task, and identifying relevant resources, especially videos. As one remarked:

“It was a huge task. I was unable to process that we had to make so much of material, videos especially... The contents in that video may not match with our video, which may happen with any online resources. This may not be exactly matching our syllabus.”

However, these inhibitions didn't prevent them from taking on the challenge. Many teachers appreciated the extensive workshop conducted by the project director, which helped boost their morale. Some teachers mentioned being helped by the workshops on blended course planning conducted by Professor Vasudha Kamat, who had been Vice Chancellor at the time. Gradually, they developed confidence and comfort with integrating technology in teaching-learning.

Some teachers considered this approach the best opportunity to connect with those students who needed more academic attention and support. They also felt that such interventions would help them to improve student-teacher relations.

Factors Inspiring Faculty Members to Participate in TEL Implementation

When asked about the factors that led them to participate in this intervention, teachers gave a variety of positive responses. Some expressed having an affinity with technology and hence being interested in TEL. They pointed out the advantages of a blended learning approach in terms of students' readiness to learn, the potential for personalised resources, and the variety of learning experiences, citing these as other reasons for participating. One teacher stated:

"I wanted to explore something new. I myself was getting bored with the blackboard teaching and thought I would give a try."

Some teachers did not have backgrounds in technology but had been motivated by the workshop conducted prior to the intervention, saying it had boosted their confidence to try new pedagogical approaches and break the monotony of regular classroom teaching.

TEL's "anytime, anywhere" approach inspired all of the teachers, including those without technological backgrounds, to take it up as a challenge irrespective of their subject and previous experiences. The workshop helped them plan a

four-credit course, design classroom activities that would use cooperative learning strategies, and explore new ICT tools such as blogs and Padlet. It also gave them insight into the reusability of the resources they had created or identified. The session on Creative Commons licences helped them choose learning resources with greater awareness. Some of the teachers also felt the necessity of such workshops for enriching and updating their knowledge base.

Using Moodle

All teachers tried to use Moodle optimally. They uploaded a variety of resources, such as OER related to their topics, or self-created screen-cast videos, notes and slide presentations. They organised quizzes for evaluation and tracked student contributions. Moodle also helped students to track their own progress, enabled teachers to create links for assignments, and provided discussion forums to allow students to express their views and to ensure equal participation. The majority of teachers opined that using Moodle helped them organise their learning materials, evaluate assignments, publish marks and give feedback in the most effective way. According to many teachers, "Paperless assignment submission" was the highlight of the implementation. One stated:

"I am someone who hates paperwork. Moodle gives you the window where I can tell students to upload the assignments and immediately give marks. This I really like. So, for assignments I prefer Moodle."

It helped teachers to evaluate assignments, publish marks and give feedback at their convenience (within the deadlines). This allowed students to understand their mistakes and improve further.

Moodle's capacity to send notifications about submission deadlines freed teachers from reminding students about their assignment submissions. This was a welcome change for many. SMS through Moodle was also appreciated by some teachers, helping them engage in rapid troubleshooting, and many

students preferred to communicate with their teachers through this service.

Since many teachers were first-timers with TEL, they faced a variety of challenges. Planning a course on Moodle was the major challenge, and they worked their way through by trial and error. Many teachers agreed that the workshop on Moodle was of great help to them. They also sought help from their mentors. For example, some of the teachers had trouble with creating quizzes on Moodle, but they managed to overcome this problem with a little support from mentors.

Apart from technical challenges, a few teachers also had trouble motivating students to use Moodle. Some students from non-technological backgrounds were reluctant about accessing Moodle on a regular basis unless the activity was going to be assessed and marked.

Some teachers planned for classroom activities using Moodle, but they found it difficult to implement. These teachers had poor infrastructural setups, such as too few available computers, low Internet connectivity and/or slow Internet speed. To overcome this challenge, teachers advised students to access Moodle on their mobile devices.

Another problem faced by teachers and students was a restriction on the size of the files they could upload. Teachers also found it difficult to upload videos on Moodle. As one teacher expressed:

“Uploading files was an issue. If the project was slightly lengthy, loading them was an issue. Then I tried to overcome them with Padlet. So Padlet did try to offer some flexibility to me in terms of submissions (i.e. MB).”

In addition, they received many complaints from students, as they could not upload files larger than 10 MB. Teachers used different ICT tools, such as Padlet and blogs, to resolve this issue.

Use of Other ICT Tools

In addition to Moodle, many teachers used Padlet to conduct various activities. Blogs, Google

Drawings and Google Docs were also used. One teacher remarked:

“As far as use of ICT tools is concerned, I tried to use Padlet and Google Drawings to some extent.”

Teachers maintained a balance between using synchronous and asynchronous tools for conducting classroom activities, ensuring their students would have flexibility in time and place. Some teachers felt the need to explore more ICT tools but didn't have the time:

“So far I have used LMS very effectively. I will explore other tools also.”

Classroom Activities and Pedagogical Approach

The majority of teachers preferred to conduct classroom discussions. They used group discussion methods and/or cooperative learning strategies such as Jigsaw, Think-Pair-Share, Four Corners, and Fishbowl. Apart from one or two exceptions, nobody felt the need to conduct lecture sessions in the classroom. In courses that required solving mathematical equations, teachers felt the need to repeat the procedure in the classroom for better understanding. Some students had prior exposure to certain topics whereas others were learning about them for the first time, and thus some teachers indicated that they made extra efforts to bridge the gap amongst the students in the class. Educational games, quizzes, student presentations, concept mapping, comparison charts, group projects, dramatisations, and role-playing, etc. were some of the methods and techniques used by teachers to conduct classroom activities. One teacher remarked:

“We used to have discussions in the classrooms, discussion forum, presentations, quiz. A lot of strategies we used.”

Teachers were satisfied to see student participation in the classroom activities, and some observed major changes in behaviour, such as students confidently contributing in group discussions because they had already gone through the

resources. Only one teacher complained about her students being unwilling to use the resources uploaded on Moodle. According to her, this behaviour was the outcome of students' initial hesitation about using technology for learning. Ultimately, their reluctance negatively affected classroom activities.

Time management was the major issue for teachers. Many required more time to identify appropriate and relevant resources than would have been needed for a traditionally taught course. Teachers spent significant time planning their courses. Many called it a time investment because they would be able to reuse the materials with little modification or upgrading. One teacher remarked:

"Identification of resources I wouldn't say was difficult but it was very time-consuming task in the initial phase.... But once initial phase is over, it will act as repository of selected resources. So actually, it's an investment of time."

All of the teachers were able to complete the materials in time. Some had been sceptical at the beginning, as they required more classroom hours. First-semester students also took more time to become attuned to the blended modality. Late admissions were another factor adding pressure on teachers and students. However, with constant encouragement along with variety in their learning experiences, students adjusted and enjoyed this new way of learning.

Results of the Change in Pedagogy

Pedagogical changes helped teachers to break the monotony often associated with classroom teaching-learning. Student engagement increased dramatically except for one or two exceptions, where students were not initially motivated to use technology for learning. Some faced problems with Internet connectivity and speed. Some hesitated to use technology, considering it additional work. Apart from these hiccups, teachers reported that the majority of students enjoyed classroom activities to the fullest.

According to some teachers, TEL helped certain students develop. Students who had initially been reluctant or apprehensive about this intervention embraced it wholeheartedly after receiving ongoing support and motivation. In addition, classroom activities helped students to grow not only academically but also socially and behaviourally. According to one teacher:

"Classroom activities like cooperative learning strategies, group discussion or role-play allowed students to interact with each other. It helped them to be a better team player."

Some teachers who were using technology for the first time took more time with planning and implementing the new pedagogy for their course. However, the experiences, both positive and negative, helped them grow as teachers and gave them the confidence that they could use technology more efficiently and effectively in future semesters. Techno-savvy teachers took things one step further and gave their students the freedom to explore various FOSS (free and open-source software) options and various social networking sites, such as Instagram, Facebook and WhatsApp, for discussion and assignment submission. Teachers reported that the majority of students welcomed this new approach. Student feedback about classroom activities also helped teachers introduce more variety into their teaching.

This intervention definitely created many avenues for enhancing the student-teacher relationship. It resulted in better communication and helped students work on student-student relationships as well. Some teachers observed better team building, group cohesion, problem-solving skills and communication skills in their students. Student-teacher relationships also became more transparent, with students exercising the freedom to raise doubts and bring their own analysis to answers and conclusions. One teacher stated:

"I was more approachable and with their doubts they were more vocal. The previous batches and this batch the improvement I see is they have become friendly."

Students became more independent, and the teacher's role shifted from information provider to facilitator. Initially, some students were shy or hesitant due to language barriers. Nevertheless, positive changes were gradually observed in these students as well.

Learning Outcomes and Behavioural Changes

Since the majority of the intervention was implemented with first-semester students, teachers found it difficult to comment on their academic performance in terms of academic achievement. However, all faculty observed behavioural changes and noted that students were more socialised. Classroom activities helped with developing students' interpersonal skills. Their openness greatly increased, and they developed as both team players and individual learners. One teacher claimed:

"Of course, the performance has improved, my students have become more open-minded, they are able to provide different perspectives and give justifications. They have learned to respect other's opinions. Now they can work alone as well as in the group. These acquired skills are outcome of this intervention."

In the beginning of the intervention, students expected more support from teachers in the form of face-to-face sessions or wished to continue with a traditional teaching modality. A few teachers felt that some of the students were not ready to leave their comfort zones. They were resistant, possibly due to shyness, language incompatibility and/or limited ICT awareness. Some students with non-technology backgrounds put in hard work to overcome these barriers and enjoyed the learning process.

None of the teachers felt there was any kind of connection between TEL and absenteeism. Indeed, some mentioned that students enjoyed their classroom discussions to a greater extent, which could have been an additional factor helping them to learn.

Assessment

Prior to the intervention, paper-based submission of assignments was the norm. The majority of the teachers involved in the TEL project supported online submissions over paper submissions, but a few remained in favour of the latter, while some used a blend of both modes.

The majority preferred online submissions because they were easier to organise, check and grade. They also found it easier to maintain and access student records this way. Some teachers mentioned that early in the project, they asked their students to email their assignments. One teacher remarked:

"I prefer online submissions. The records are with us and cannot be lost. I can also keep track of how many students have submitted assignments, which is difficult in face to face. I can also provide feedback which they can see any time."

The teachers who were in favour of paper-based submission pointed out that their students were complaining about infrastructural limitations at their end, so the teachers continued with paper.

Overall Experience

All teachers were positive about the overall experience of TEL implementation. Many were using a TEL approach for the first time and were amazed by its success. They recalled all the doubts they'd had before the intervention began, and now, they could track their process and growth as facilitators. They appreciated the help provided by mentors as well as by their colleagues, which helped them to complete this project productively.

Almost all of the teachers expressed the desire to continue with TEL:

"It was good and I want to continue this. When new batch comes, I will be using the same Moodle class plus I will improvise in that."

"I observed subtle changes in my students. They were not that evident in the beginning. But I think it's positive because they want to have this modality repeated for another semester."

7.3 Focus Group Interview with Teachers

A total of ten teachers participated in the focus group interview conducted by the researcher and Dr Sanjaya Mishra, COL's Education Specialist: eLearning. The discussion brought out many issues that were relevant to the whole team and that were either congruent with the data from individual interviews or provided additional input about the whole TEL experience.

The discussion started with the challenges at the initial stage, which included the following:

1. The university's infrastructure, such as computer labs as well as strong and continuous Internet bandwidth, were not adequate in the institutes with more students. Teachers consequently found it difficult to administer online tests requiring many concurrent logins. Uploading and accessing long videos also proved difficult. The solutions emerged from these challenges. Mobile Moodle was the major solution. The app helped students access material at their own pace and convenience and without the lab infrastructure. The LMS was shifted to a dedicated server, and more space was purchased. This was a boon to all.
2. The length of videos proved an issue of concern. Engineering students were reluctant to view videos, as these resources are generally longer. Faculty thereby realised the benefits of short videos, which helped to ease student access and to increase their level of acceptance of these resources.
3. Acceptance to ICT in general and Moodle in particular proved a challenge initially. Student reluctance to access it regularly was a challenge. Some faculty made quizzes mandatory so resources had to be accessed, but one teacher did not believe in imposing mandatory conditions; her students took a while to accept LMS-based resources.
4. Belief in the benefits of TEL and Moodle was shared by most of the faculty. The greater availability of resources to students was a major highlighted benefit. A teacher experienced less "crowding" when it came to troubleshooting problem-solving exercises, as all of the relevant materials had been uploaded to Moodle. A paperless semester was appreciated by a few faculty. One teacher even used ICT to take attendance.
5. Faculty explored and used several ICT tools other than Moodle — indeed, almost all of the tools discussed in the faculty training workshops. Padlet was extensively used by management faculty, whereas online tests were most preferred by engineering faculty. Google forms replaced the use of Moodle tests. Blogging was used for knowledge generation. Concept-mapping and mind-mapping tools were also preferred by teachers as well as students.
6. It can be safely concluded that TEL led to blended learning environments with several learner-centred pedagogical practices, which helped with developing cooperation and higher-order thinking in students.

8. Findings

The TEL initiative at SNDTWU can be considered a successful experiment. TEL initiatives, which are inclined towards constructivist approaches, run the risk of negatively affecting assessment scores in final examinations. Quantitative analysis showed that out of 15 courses, ten did not show any significant difference in mean examination scores compared to the same courses from the previous year, taught traditionally. For two courses, the means were significantly higher at the 0.01 level of confidence, which should motivate teachers. Three courses had lower mean values, but the teachers and students were still satisfied with the intervention.

Analysis of the student interviews is summarised in the following paragraphs:

1. **Introduction to the course through TEL:** Well before the intervention began, teachers oriented their students in using Moodle. Nonetheless, some of the students initially were nervous and lacked confidence. Some also perceived it as adding to the workload of their regular study regime. However, these students eventually worked their way around this new intervention.
2. **Change in learning experience:** Many students considered it a welcome change in their learning experience, as it helped them break the monotony of traditional learning. Students appreciated the various avenues for them to express their views and opinions. Some non-techno-savvy students experienced hesitation and took some time to adjust and adapt to the new modality, especially the technological part of it.
3. **Accessing resources:** The variety and preciseness of the uploaded resources contributed to eliciting positive responses amongst students. Many appreciated

shorter videos, but some preferred longer ones to better understand a topic.

4. **Challenges faced when using Moodle:** Students faced a few glitches, such as forgetting their password, or not receiving notifications about assignment submission deadlines or quiz dates. Some of the problems were resolved by students on their own or with the help of their peers. Other issues they took to their teachers. Many accepted that in the process, they developed troubleshooting abilities.
5. **Discussion forum:** Some students found classroom discussions repetitive, but for many it was a major attraction as it allowed them to develop higher-order thinking and express themselves. Hence, the discussions enabled them to go beyond just acquiring information and helped them construct their own knowledge.
6. **Assignment submission:** Many students liked the concept of online assignment submission, as it gave them the freedom to submit their work from anywhere. In addition, many found this mode to be environmentally friendly. Some students had problems related to file size or mathematical problems, but they figured out solutions and continued using the online modality.
7. **Quizzes:** Online quizzes brought an element of surprise and novelty. Many advocated online tests, as these allowed them to participate without any location restriction. In addition, instant feedback allowed them to rectify their mistakes immediately.
8. **Using other ICT tools:** Apart from Moodle, some of the other ICT tools

appreciated by students were Padlet, blogs and Google Drawings. Almost all of the students enjoyed this added variety in their learning experience.

9. **Classroom activities:** Classroom activities catered to students' scholastic and life skills, and they acknowledged the opportunity to develop many abilities.
10. **Student participation:** In the beginning, teachers received mixed reactions from students. Some were very comfortable about expressing their views, while others were hesitant. Some groups faced problems due to dominant students, and some faced the different problem of having idle group members. Eventually, many found a way to work collaboratively and appreciate the efforts of other group members.
11. **Overall experience:** It was an out-of-the-box experience for almost all the students. Though some were a little apprehensive in the beginning, due to various fears, they worked their way around this. Many enjoyed the experience to the core and wished to continue with the same modality.

Analysis of the teacher interviews is summarised in the following paragraphs:

1. **Initial response to TEL (blended learning):** Many teachers were excited to try their hand at a new pedagogical approach, to use the different ICT tools they had come across. Some were a bit worried about the time they would have to invest to identify and/or create specific resources. However, everyone claimed to have found it a wonderful opportunity to explore and expand their skills.
2. **Factors leading faculty members to participate in TEL implementation:** Enthusiasm about offering something new to learners was the major inspiration for many teachers, motivating them to participate in this intervention. Some acknowledged that their inclination towards technology helped them think more positively about the intervention. Some teachers from non-technology backgrounds were motivated to take a big leap of faith due to the workshop conducted prior to the intervention, saying it gave them the confidence to try something new.
3. **Using Moodle:** The teachers used Moodle optimally. The majority felt that using Moodle aided them in organising resources, evaluating assignments, publishing marks and giving feedback in the most effective way. The process was rapid compared to the traditional way and benefited students. Some teachers who were using Moodle for the first time and were not techno-savvy experienced blips, but they managed to overcome these hurdles by consulting mentors or by trial and error.
4. **Use of other ICT tools:** Apart from Moodle, many teachers used blogs, Google Drawings and Padlet to bring variation to the teaching-learning experience. They also maintained a balance between the use of synchronous and asynchronous tools while conducting various classroom activities. Some faced the problem of time shortages and hence could not explore more ICT tools.
5. **Classroom activities and pedagogical approach:** The majority of teachers preferred to conduct discussions in the classroom, either with the whole class or in groups. Many teachers also used cooperative learning activities in the classroom to facilitate better articulation of thoughts. Apart from this, many teachers conducted games, quizzes, student presentations, dramatisations, role-playing, and concept-mapping

activities to prevent monotony and facilitate learning. Time management was a major concern for a few teachers, as such activities demands more time.

6. **Results of the change in pedagogy:**

The change in pedagogy was reflected positively in the behaviour of the students. Class cohesiveness was increased. Students became more tolerant towards others' opinions and views. It also helped them to develop social skills. Overall, it resulted in a better learning experience. Apart from one or two exceptions, students appreciated this change in pedagogy. As a result of the change, students became more independent, and the teacher's role became more that of a facilitator rather than just a teacher.

7. **Learning outcomes and behavioural changes:**

Learners were found to be more socialised. Various classroom activities allowed them to develop their interpersonal skills. Many teachers noticed a remarkable change, with their students becoming team players and excelling individually. Since many teachers implemented the intervention with first-semester students, they could not comment on academic outcomes. However, they definitely noticed increased student participation in various activities.

8. **Assessment:** Many teachers advocated online submission of assignments, as this made it easier for them to evaluate, give feedback and keep track of students' progress. Due to infrastructural limitations, some of the teachers preferred to continue with paper-based submissions.

9. **Overall experience:** Teachers' overall response was positive throughout the intervention. Post intervention,

many noted remarkable changes in their students academically, socially and behaviourally. Non-techno-savvy teachers gained the confidence to try something new and break the monotony of traditional teaching-learning. They appreciated mentors for making them comfortable with the use of technology. Almost all of the teachers desired to continue exploring more ICT tools and using them to make the teaching-learning experience more enriching and meaningful.

Teachers' reflections as presented in the focus group discussion were as follows:

Although accepting ICT in general and accessing the LMS in particular proved challenging in the initial stages, the benefits of TEL and Moodle were widely discussed. The availability of resources on Moodle, the experience of a paperless semester, and the use of Moodle for marking attendance were some of the benefits highlighted by the faculty. Apart from Moodle, almost all of the tools discussed in the faculty training workshops were explored and used by the teachers. For example: Padlet was extensively used by the management faculty; online tests were mostly preferred by the engineering faculty; Google Forms were used in place of tests; blogs were used for knowledge generation; and concept-mapping and mind-mapping tools were preferred by both teachers and students.

Faculty also faced particular challenges. Institutes with more than a certain number of students could not use the computer laboratory and the Internet bandwidth to their full potential, as these proved inadequate for conducting online tests and for uploading and accessing videos with concurrent student logins. The length of videos proved to be a major concern, especially for engineering students. To facilitate easy access and increase student viewership of the videos, the benefits of shorter videos were discussed. Mobile Moodle and revising certain technical

components of the LMS emerged as feasible solutions. The Mobile Moodle app helped students access material without having to depend on the lab infrastructure. More space was purchased for the LMS, and it was shifted to a dedicated server.

From the faculty group discussion, it was clear that the use of TEL had led to blended learning environments with several learner-centred pedagogical practices, which helped in developing higher-order thinking and encouraging cooperation amongst students.

9. Conclusion

The TEL initiative at SNDTWU can be considered a major milestone in the university's systematic efforts towards offering a 21st-century education. Though discrete efforts towards TEL had been initiated in the previous few months, the involvement of 15-plus faculty with more than 600 students was a major accomplishment. Scholastic achievement was one variable indicating that integration of TEL alone does not influence students' scholastic achievement, as revealed in the performance of students in different courses. Students' performance in the tests was also associated with various other factors, as noted by the teachers in this study. Some of these included the level of effort put in by students and the nature of assignments.

Students in this study perceived the significant benefits of TEL to be online discussions, greater opportunity for self-expression, self-paced learning, quality resources, and an increased sense of responsibility for their learning. Despite the majority agreeing about the benefits, 70% of the students felt that the teacher's explanation was always needed, which further supports the use of a

blended approach to teaching and learning. About a quarter of the students found the videos less useful, which may have been due to their length or the nature of the videos provided.

Interview data revealed that the learners had very positive views about the use of TEL in teaching and learning, even though some had had reservations. Some of the negative perceptions were due to a lack of ICT skills; SNDTWU has subsequently developed a handbook to help students familiarise themselves with the technologies available at the university and how to access and optimise them.

A major outcome of this project has been the enthusiasm and commitment of the teachers about implementing TEL in their teaching. Teachers who used TEL demonstrated a positive approach to using active and interactive teaching-learning strategies. They were also willing to experiment with new approaches and new tools during the course of the project, presenting an opportunity for SNDTWU to scale up TEL implementation in more of its courses and programmes.

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Appendix A

Survey Tool: Learning Experience with TEL

Dear students,

Greetings from SNDT Women's University! We wish to understand your general opinion about various teaching-learning practices followed in your class.

We ask that you provide your honest opinion.

Please be careful, as you are not allowed to respond to the survey twice.

Your data will be strictly confidential and will be used only for the purpose of research. It will not be shared with anyone.

Email address:

Name of the College/Department/Institute:

1. UMIT
2. Department of Psychology, Mumbai
3. Department of Library and Information Science
4. Department of Computer Science
5. JDBIMS
6. PVP

Programme:

1. MCA
2. MLISc
3. MA Psychology
4. MEd
5. MMS
6. MBA
7. BTech
8. Diploma Electronics

Semester:

1. I
2. II
3. III
4. IV
5. V
6. VI
7. VII
8. VIII

Subject/Branch (e.g., ETC, Electronics, Finance, IT, etc.), if any:

Annual Family Income:

1. Less than 2.5 Lakh
2. 2.5 Lakh – less than 6 Lakh
3. 6 Lakh – less than 12 lakh
4. Above 12 lakh

Which device do you use? Click all applicable options:

1. Desktop system mostly being used only by me
2. Desktop system shared with other family members
3. Laptop mostly being used only by me
4. Laptop shared with other family members
5. My own tablet
6. Smartphone
7. I do not possess any of the above.

Where do you get access to internet?

1. My home has Wi-Fi.
2. My home system has broadband via cable.
3. My institute has Wi-Fi.
4. My institute's lab has a cable network.
5. My smartphone data-pack
6. Only in cyber-café's

What was your overall percentage in your most recent examination?

1. Above 80
2. 71–80
3. 61–70
4. 51–60
5. 41–50
6. 35–41

Section A

3. What kind of resources/materials does your teacher share with you for learning/ referencing and to what extent? (Rate the appropriate option(s) for your selections.)

	Always	Many times	Sometimes	Rarely	Never
a. Her/his own presentation slides used in the class					
b. Her/his own notes (hard or soft copy)					
c. Videos on the topic (e.g., links to YouTube, MIT/ NPTEL programmes, etc.)					
d. Web articles					
e. Interactive multimedia (graphics, animations, etc.)					
f. Web-based presentations (e.g., Slideshare)					
g. eBooks					
h. Articles/research papers from Databases such as JSTOR, ProQuest, etc.					
Any other? Please specify:					

4. How does your teacher share materials with you? (Please select all options that are applicable. More than one option is possible.)

- a. Gives us pen drive
- b. Sends via email
- c. Uploads on Google drive
- d. Uploads on class site or Moodle LMS
- e. Photocopy of slides/text
- f. Other (please specify):

5. What is generally expected from you after the material is shared with you? (Please select whichever are applicable.)

	Always	Many times	Sometimes	Rarely	Never
a. Revision or extra reading at home after learning about the topic in class					
b. Self-study followed by discussion in the class					
c. Self-preparation and presentation in the class					
d. Read and use in group study and group presentation in the class					
e. Self-study at home, followed by group work in the class					

Section B

6. What kind of online activities are planned by your teacher for time apart from the teacher's session time? (May be from home or from labs.)

	Always	Many times	Sometimes	Rarely	Never
a. Online discussion forum					
b. Uploading assignment on Moodle LMS					
c. Online concept mapping					
d. Online slide preparations					
e. ePortfolio					
f. Blogging					

7. Please express your opinion regarding the following:

	Strongly disagree	Disagree	Agree	Strongly agree
1. Online resources, books give us different perspectives about the same topic.				
2. Self-learning with the help of web-based articles and eBooks is not adequate to understand any topic. Teacher's explanation, instead, is useful.				
3. Online learning materials apart from teacher's explanation make concepts clearer.				
4. Going through videos on the topic before we study in the class is a waste of time.				
5. It is always advantageous when the teacher gives students some links to online references, as they will be good-quality resources instead of just giving us a topic to explore.				

6. eResources provide students with an opportunity to learn at their own pace (speed) and time.				
7. Learning from resources and then going to class to discuss or work in groups creates in us a feeling of responsibility for learning.				
8. When teachers provide learning resources to students instead of teaching the topic through lectures, they avoid their responsibility for teaching.				
9. If the teacher had not provided the students with the opportunity to go through eResources, we would have been deprived of the huge wealth of information available.				
10. Using the teacher's presentations by downloading them from the Moodle LMS helps with revision.				
11. Downloading and viewing online resources is a time-consuming and boring task.				
12. It is possible to refer to resources anytime throughout the day or throughout the semester if they are uploaded on the LMS.				
13. Posting in online forums helps with developing confidence in students.				
14. Logging in to the LMS every day proves to be an additional responsibility for students.				
15. Self-expression and doing tasks ourselves on online platforms leads to better development of knowledge and social personality.				

Appendix B

Interview Schedule for Students

(Questions are indicative, and the interviewer should treat them as guidelines only. Spontaneous questions are expected to make the interview more flexible.)

1. Which teacher or teachers used Moodle-based learning? What was your first reaction when your teacher used a different method than regular teaching method? (Amused / Scared / Excited / Curious / Confused, etc.)
2. How was this learning experience different from the usual classroom/learning experience?
3. Did it help in breaking the monotony? How?
4. Did you find it difficult to adjust to the new mode of learning?
5. Do you think the Moodle-based and activity-based way of teaching–learning was very time-consuming and the teacher(s) could (could not) complete the section?
6. Did your teacher use Moodle to upload various resources? If yes, which different types of resources and links were uploaded by your teacher?
7. Do you think the uploaded resources were adequate to understand the topic? If not, what were your expectations? Do you think those were too many to go through?
8. Did you have adequate infrastructure facilities? From where did you access Moodle? (Home, college, mobile.)
9. Did you face any problems while accessing resources, attempting a quiz, or uploading assignments? If yes, what problems did you face? How did you communicate these problems to your teacher? How did you solve these problems? (Did you solve the problems on your own or receive help from peers or teachers?)
10. Did your teacher help you solve your technical problems while using Moodle? Which teacher? Do you think special training in Moodle was needed?
11. Did your teacher use discussion forums? Which teacher? For what purposes or activities?
12. How did you submit your assignments to teachers? For which teacher? Paper print-outs or uploads on Moodle?
13. Which way would you prefer for assignment submissions?
14. Apart from Moodle, what different ICT tools have you used for learning? For example, Padlet, blogs or Google groups?
15. Do you think Moodle-based learning is beneficial? If yes, in what ways? If not, why?
16. If you were reading resources in Moodle, what did you do after coming to the classroom?

17. What was the nature of activities planned? Did you work in groups? Or were individual tasks assigned to you? (Presentation, group discussion, etc.)
18. Did you participate in any collaborative activities?
19. Were you comfortable sharing your views, ideas and opinions on these platforms?
20. Does it help you improve your soft skills? (Like social graces, communication abilities, cognitive or time management, teamwork and leadership traits, etc.)
21. Do you think group work helps you know your friends better? Do you think you will be able to work in teams in the future? What do you prefer, working alone or working with friends?
22. Were language skills a barrier for you while posting on forums or working in groups?
23. Did a few students dominate the group work, so you could not express your views due to your shy or introverted nature? Or were you over-burdened because of other, idle members?
24. Do you see any benefits of using learner-centred, activity-based learning in the class?
25. How will you summarise this learning experience? If given the opportunity, would you like to learn through this modality? Would you prefer Moodle-based learning or do you want to stop using Moodle?

Appendix C

Faculty Training Workshop for TEL Implementation

	Day 1 May 5, 2017	Day 2 June 29, 2017	Day 3 June 30, 2017	Day 4 July 11, 2017	Day 5 July 12, 2017
10:10 - 11:30	Introduction to workshop Objectives Agenda	Why TEL? Types of resources	Pedagogy in TEL In-class activities Tools for collaboration	Moodle LMS: Adding resources: demonstration	Moodle LMS: Adding Quizzes: demonstration
11:30 - 1:00	Concept of Blended Learning and Flipped learning	Exploration of resources	Co-operative Learning strategies	Moodle LMS: Adding resources: tasks	Moodle LMS: Adding Quizzes: task
1:00 - 2:00	Lunch	Lunch	Lunch	Lunch	Lunch
2:00 - 3:30	Out-of-class resources and In-class activities: Meaning and examples	Identifying online tools for content generation, e.g. Blendspace, Google drawing, blogs, Padlet	Planning in-class activities	Moodle LMS: Adding activities: demonstration	Creative Commons Licenses: Online session by Dr Madhulika Kaushik
3:30 - 5:00	Demonstration and discussion of planning templates Challenges in TEL implementation and discussion on modalities	Working in planning template	Working in planning template	Moodle LMS: Adding activities: task	Closure: Chair: Prof Shashikala Wanjari, Vice Chancellor, SNDTWU

Appendix D

Faculty and Courses for TEL Implementation (July–December 2017)

Sr. No.	Department/Institute	Programme	Sem	Course for Intervention
1.	Department of Computer Science	MCA	III	Computer-Oriented Quantitative Techniques
2.	Department of Educational Technology	MA eLearning	I	Educational Technology and Instructional Technology
3.	Department of Educational Technology	MA eLearning	I	Open and Distance Learning
4.	Department of Psychology	MA Psychology	III	Human Resource Management
5.	Department of Education	MEd	I	Psychology of Learning and Development
6.	J.D. Bajaj Institute Management Studies	MMS, MBA	I	Perspectives of Management
7.	J.D. Bajaj Institute of Management Studies	MMS, MBA	I	Business Economics
8.	J.D. Bajaj Institute of Management Studies	MMS, MBA	I	Accounting for Management
9.	J.D. Bajaj Institute of Management Studies	MMS, MBA	III	Services Marketing
10.	P.V. Polytechnic	Diploma in Electronics	III	Basic Electronics and Circuit Design
11.	P.V. Polytechnic	Diploma in Electronics	VII	Telematics
12.	P.V. Polytechnic	Diploma in Electronics	VII	Industrial Organisation and Management
13.	SHPT School of Library Science	MLISc	III	Digital Librarianship
14.	SHPT School of Library Science	MLISc	I	Fundamentals of LIS
15.	Usha Mittal Institute of Technology	BTech IT, CST, EE and ENC	I	Applied Chemistry
16.	Usha Mittal Institute of Technology	BTech IT, CST, EE and ENC	I	Engineering Mathematics
17.	Usha Mittal Institute of Technology	BTech ENC	V	Microprocessor I
18.	Usha Mittal Institute of Technology	BTech IT, CST, EE and ENC	V	Communication Skills

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