Blended Mode of Teaching and Learning: Concept Note

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Index

Chapter I

Blended Learning

1.1 Defining Blended Learning

Blended Learning (BL) is a teaching-learning approach to be used by the teachers. Blended Learning is an approach in which a teacher thoughtfully plans a teaching-learning environment with some Online learning activities and Offline activities.

The term '**Offline**' refers to all activities within the classrooms/lab and/or on the field with **physical** presence of students and/or teacher including, ***but not limited to,*** experiences such as teacher's explanations, demonstrations, large group activities such as brainstorming, discussions; small group activities such as group-work, problem-solving, experiments, visits to workshops/offices in surroundings, etc.

The term '**Online learning**' refers to all activities outside the classrooms/labs with **non-physical** presence of students including, ***but not limited to,*** experiences such as accessing resources with or without digital devices (books, newspapers, journals, pdf, videos, audio files, web-pages, eBooks, eJournals, etc.) and getting involved in interactions with peers and community (online collaboration, web-based group-projects with classmates.

If a teacher/institute wishes to add **Online** learning, the weightage of time for such learner engagement in **Online** mode **should not exceed more than 40%** of the total session time. However, teachers/institutes using Blended Approach should plan **Offline** sessions with **at least 60% weightage of the total session time**.

Though students will remain engaged in online learning for such activities, teachers will be engaged in planning, identifying or generating resources, monitoring the activities, scaffolding and providing feedback resulting in **no change** in her/his teaching responsibilities. Planning such BL environments is, on-the-contrary, is more thoughtful, challenging and time-consuming process for a teacher.

1.2 Need of Blended Learning

Blended learning is the term given to the educational practice of combining different learning environments, physical and virtual. In blended learning environment, both the students and the teacher should meet in person for several activities, though not always. This approach, therefore, overcomes challenges and limitations of both, online and face-to-face modes. Several research findings are confirming limitations of using one single mode or learning experience. Every subject needs variety of experiences which get missed

out in fully online mode or else if teaching is fully confined to four walls of the classroom. Classroom interactions between teachers and students, student-student are much needed for holistic development as a human-being. Development of 21st century skills in Indian learners such as communication (face-to-face and online both), creativity, team-work, cooperation, critical thinking and problem solving is also crucial. BL approach tries to provide a meaningful blend of all experiences for which learning processes need to be planned thoughtfully and systematically. The blend demands consideration of several factors, mainly focussing on learning outcomes and the learner-centred instructional environment.

Given the emergence of digital technologies and the emerging importance of leveraging technology for teaching-learning at all levels from school to higher education, the NEP 2020 recommends for use of blended models of learning. The NEP-2020 states that "while promoting digital learning and education, the importance of face-to-face in-person learning is fully recognized. Accordingly, different effective models of blended learning will be identified for appropriate replication for different subjects. (NEP-24.4 (i), page – 62)". These guidelines will facilitate implementing the 'Blended Learning' approach proposed by NEP2020.

1.3 Benefits of Blended Learning

1.3.1 Effective Utilisation of Classroom Time

Face-to-face interactions, problem-resolution, eye-contact with teachers and peers can be achieved inside the classroom. Teachers can help learners solve problems, resolve issues, explain complex concepts (hard-spots) during face-to-face interactions.

A lot of classroom time, many-a-times, is consumed by one-way lecturing so as to explain, elaborate new concepts, theories. Though teachers try to achieve an average pace of explanation, many students get de-motivated either perceiving the pace of the teacher as very fast or else very slow. Attention span does not allow them to concentrate on the content of one-way lecturing beyond 20-30 minutes. If such elaboration is passed on to learners via digital media, learners can read, view and comprehend at their own pace.

Students are given several problems to solve at home when they are all alone and keep struggling for scaffolding. If the classroom time is utilised for solving such problems in teams and under guidance of teachers, learning and comprehension of such issues, problems will be more powerful in terms of understanding and retention.

1.3.2 Increased interaction

BL offers a platform to facilitate greater interactivity between students, as well as between students and teachers. If digital environment is used wherever possible, providing such experiences will be more feasible. e.g. teachers find it difficult to arrange small-group

discussions frequently during classroom sessions due to crunch of time. Such discussions can happen through online discussion forums or even through smartphone based social media groups.

1.3.3 Variety in Experiences

Resources such as video lectures, podcasts, recordings, digital infographics and articles would be provided in order to transfer the main bulk of the necessary knowledge from teacher to student before each class. This then frees up time in class for teachers to support students in activities, lead discussions and facilitate engagement.

Several topics demand multiple sensory experiences which get missed out inside classroom. Learner Engagement increases by introducing variety of learning experiences. Classroom time sometimes does not prove adequate for all such activities and experiences. If some of the activities are planned for Online mode, learners can be benefitted by such exposure as per their convenience of time.

1.3.4 Experiential learning

Fully classroom and fully online environment restricts the scope of experiential learning. Involvement in real-world or simulated world, community workshops, workplaces or virtual labs help in engaging learners and they will get experiential learning experiences. Real-life experiences such as viewing processes, performing procedures in real environment, or via digital resources such as animations, videos, simulations allow learners to get the real or real-like exposure. Wherever experiential learning is possible inside classroom, providing theoretical information through online resources leaves ample scope for teachers to engage students in experiential learning when they come to the class.

1.3.5 Digital Provide

If digital devices such as smart-phones, low-cost access devices are procured in remote areas with some central hubs with internet connectivity (e.g. at GramPanchayat) for downloading resources, more and more young higher education learners could be benefitted. Institutions, NGOs, alumni community can come forward to take education to masses, in remote areas by using low-cost technology ranging from audio-visual learning resources to multimedia and assistive technologies. Access to such digital environments will enable Higher Education students to develop their digital skills and help them cope up with the 21st century challenges.

1.3.6 Ownership of learning

Once the learner enters into higher education system, need for him/her to take responsibility of learning, develop ability to apply and transfer acquired knowledge and skills in a different situation, imbibe values of collaboration and cooperation increases.

Both face-to-face and online experiences can provide ample opportunities for the learner to take such responsibility of learning though active engagement. BL instills a sense of 'student ownership over learning' which can be a powerful force propelling the learning.

1.3.7 Time management and flexibility

Technology-enabled learning allows for learning anytime and anywhere, letting students learn without the barriers of time and location, but with the possible support of in-person engagement. Time management is another skill needed for a higher education learner before s/he enters into the real world of work. A blend of self-paced learning and activities with classroom sessions trains learners to manage time in a flexi-time environment. Since face-to-face sessions are inevitable, completing assigned tasks before coming to the class develops sense of responsibility.

1.3.8 Learning to be virtual citizens

Learners practice the ability to project themselves socially and academically in an online community of inquiry. Digital learning skills are proving essential to be a lifelong learner. BL approach helps learners acquire digital skills with the exposure of variety of technologies. Since freedom of selection of tools and assigning time lies with teachers, s/he can make decisions keeping in mind availability of infrastructure at the students' end as well as within the institutes (e.g. student IT cafe)

1.3.9 Repeatability and Reliability of Resources

Lack of quality resources and lack of connects between experts and students are the major issues of the day. If such experts and their knowledge reach to students spread across the country, more and more higher education students as well as teachers will benefit. Teachers can identify reliable resources for their students instead of students getting lost in the pool of authentic and unauthentic resources.

A blended learning approach provides ultimate flexibility in many aspects. And most of all, it can be applied to any program which holds on to the values of face-to-face learning and incorporates digital media with that. Students, academicians, policy makers etc. appreciate the needed flexibility. Only a well-designedd blended environments can provide ameaningful combinations of offline and online experiences. Appendix A presents hypothetical BL scenarios as illustrations.

1.4 Role of Teachers in BL Environment

BL shifts the teacher's role from knowledge provider to facilitator, coach and mentor. In BL, teachers can have an even more profound influence and effect on students' learning. It now becomes more learner-centric and customized, with differentiation as a main feature.

Role of a teacher in BL environment is not limited to the 'Sage on the stage' but s/he becomes 'creator', 'designer' and 'supporter' of teaching-learning environment to enable learners to interact.

Learning Designer:
Teacher's role is more creative and challenging as s/he needs to design new BL experiences combining online and offline class activities. Several resources, teaching-learning strategies, digital and non-digital learning material, digitalised and non-digitalised interactions of teacher-student. Even student-material and student-student interactions need to be planned.

Problem Designer:
BL environment demands that the learner should not remain a passive listener but should become a problem-solver. Teacher designs challenging but motivating problems for learners. The problems motivate and encourage learners to learn from the resources, discuss with peers and teacher and try to achieve the learning outcomes.

The ability to rapidly analyze, review and give feedback to learners on their tasks, gives the teacher the ability to tailor his/her teaching-learning strategies.

Support system:
Teacher becomes a great support system throughout the BL environment. Learners are not thrown in any isolated environment, but BL yields more frequent and more personal teacher-student interactions, which may or may not be achieved in one-way lecturing. Teachers have the opportunity to deepen and strengthen student-teacher relationships. The trust that comes with close relationships can give teachers insights into students' personal struggles and needs insights which empower teachers to comfort and coach students through challenges that often serve as obstacles to learning. BL provides teachers with a fuller, more accurate picture of how each student is performing.

1.5 Role of Learners in the BL Environment

The role of a learner is more meaningful, engaging and active in BL environments.

Responsible Learner:
BL environment demand proactive learning on the part of the learner. S/he learns to take the responsibility of self and peer-learning out-of class as well as while in the class. Frequent interactions with peers and teacher develop the sense of responsibility. Students become self-driven and responsible, tracking their individual achievements**,** which helps develop the ability to find the resources or get the help they need, self-advocating so they can reach their goals.

Problem-solver:
The problem-solving experiences of BL environment changes role of a learner from a 'passive listener' to a problem-solver. Learner needs to understand the changed role and accept the challenges of new learning problems designed by the teacher.

Decision-maker:
BL environment, with its pool of resources, effective learning problems, and appropriate scaffolding of the teacher, demands learner's role as an efficient decision-maker. While exploring, solving every small step of the problem, learner gradually develop ability of taking appropriate decisions. This changed role of the learners helps them to be ready for the external real-world.

1.6 Role of Institutions in the BL Environment

Encouragement to faculty and Professional Development:
BL environment can succeed in the Institutions which believe in the BL approach and encourage their skilled faculty to experiment BL. Institutions also need to allow higher education faculty to participate in various Faculty Development Programmes (FDPs) for effective implementation of BL. Institutes themselves may come forward to organise such FDPs for their faculty.

Establishment and Maintenance of Infrastructure:
Digital and digitalized learning environments help in enriching online experiences. Establishing digital infrastructures on the campus such as computer labs, student cyber café, BYOD environments, wi-fi enabled campus, Learning Management Systems, etc. will help increasing access of more and more students to the digitalized environments who otherwise will be deprived of digital resources and digitalized learning environments. Institutions need to explore funding opportunities and strive towards achieving technology-enabled campuses. Though use of free software tools should be encouraged in the process, maintenance of the infrastructure and support for using various software and tools need to be continuously provided.

Apart from technology infrastructure, classroom furniture needs to be repurposed for an effective learner-centred learning environments. Wherever possible, flexible seating arrangements of learners can be provided. e.g. fixed long benches in a few classrooms may be replaced by flexible seating furniture. The institutions can also frame clear pathways for implementing such changes.

Chapter II

Implementation of BL

2.1 Introduction

Implementing BL requires a systematic, planned instructional process. An effective teaching learning process in a blended environment calls for understanding and skills of using appropriate pedagogies with suitable technologies. The following paragraphs provide guidelines for implementation of BL.

2.2 Pedagogies for Offline and Online Learning

Learner-centred teaching-learning activities include several cognitive processes which enable learners to be communicative, confident, creative and cooperative. Learners in BL environments are not visualised as passive learners, but active learners generating ideas, assimilating knowledge individually and in teams. Once learning resources are provided on an online platform, students sitting in the classroom need not again listen to the instructor. The time, then, can be used for engaging them in activities. Even their online time can be used innovatively for making online sessions more effective and interesting. A few learning processes are listed below:

a. Generating ideas
b. Brainstorming
c. Concept-mapping/Mind-mapping
d. Creative Presentations
e. Exposure to the real world
f. Case Study
g. Cooperative Learning Strategies (CLS)

Higher education teachers are suggested to refer to Appendix Bfor referring to these pedagogies in detail and experiment the same in their teaching-learning process.

2.3 Project Based Learning and Project Management Platforms

Blended Project-Based Learning tries to infuse advantages of project based-learning with traditional online lecturing. The students attain the conceptual learning through online resources such as recorded lectures or live classes. In addition, the students hone their practical skills by working on guided projects in a face-to-face setting. The artefacts produced during these projects are a part of the overall learning process and are directed towards supplementing the conceptual learning of the students.

Project Based Learning open avenues for learners even to work on live projects assigned by industries during their study period. Teachers collaborate with industries to bring such projects in the class and students collaboratively work on these projects under the guidance to the teachers to seek work-experience while learning even before they join workplace as interns or employees or later on as entrepreneurs.

There are three types of solutions which can aid this type of learning:

a. Platforms for delivering online lectures
b. Platforms for managing collaborative projects
c. Platforms for student assessment and feedback

Appendix C provides details regarding these types.

Significant ICT initiatives useful for the higher education teachers of our country while implementing BL are discussed in the following sections.

2.4 OER: NMEICT, NPTEL, ePG, NDL

Open Educational Resources (OER) are defined by the United Nations as any type of educational materials in the public domain or introduced with an open license. Critical to supporting open knowledge and open access, OER are learning materials supporting legal and free (a) copying, (b) usage, (c) adaptation and (d) sharing.

These resources can be anything from textbooks to syllabi, lecture notes, tests, videos or animations. While OER are not a necessity for successful BL, these two education innovations combine to make a powerful contribution to high-quality, accessible and affordable education. Using well-designed, available OER can free up resources that can then be used to design and deliver BL opportunities.

Creative Commons is a global, collaborative movement for the sharing of free, international, easy-to-use materials. The goal of this international community is to enable greater access and equality; it supports education for everyone. Those who created and now support and use Creative Commons believe in sharing and collaborating on materials such that the full potential of the Web will be realised; most importantly, this will also be true for the individuals who will use it. Creative Commons provides a set of licenses for anyone to use while releasing any teaching or learning resources as OER. The licences also provide a technical solution to tag the resources with a machine-readable language to identify them as OER. This allows potential users to filter their searches by "usage rights" in Google Advanced Search. There are many platforms through which we can find and share OER. List of a few Open Learning Resources and Open Access Repositories is provided in Appendix D.

2.5 MOOCs and SWAYAM

MOOCs

MOOC stands for Massive Open Online Course (MOOC) which is an online education system providing various courses, which aims at large-scale interactive participation and open access via web. MOOC aims to provide real time education online with the help of various features like videos, study materials, quizzes and online exams and also tries to make it more efficient than the real time education in class rooms by removing time constraints and location constraints. MOOCs also provide interactive discussion sessions for the user through interactive discussion forums that help to build a community for the students and professors.

SWAYAM

SWAYAM (Study Webs of Active Learning for Young Aspiring Minds) is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged.

2.6 Learning Platforms: LMS

Learning Management Systems (LMS) are web applications, meaning that they run on a server and are accessed by using a web browser. LMS gives educators a tool to create a course web site and provide access control so only enrolled students can view it. LMS also offers a wide variety of tools that can make your course more effective. They provide an easy way to upload and share materials, hold online discussions and chats, give quizzes and surveys, gather and review assignments, and record grades.

LMS can be installed in cloud & all faculty can upload to share all the particular class related documents, videos, audios, quizzes, etc. A few of the most used LMS are listed in Appendix E.

2.7 Innovative Technology-enabled Initiatives

A few effective technologies such as SimLab, Virtual Lab, Robotics, FOSSE etc. provide enriched real-like experiences to Science and Technology students. Virtual worlds are proving effective not only for Science students, but also for students of social sciences. Projects such FOSSE and eKalpa (Robotics) are free initiatives for Indian learners. A few of these projects are detailed out and illustrated in Appendix F.

2.8 ICT Tools for Collaboration and Knowledge Generation

It is evident that learner-centred pedagogy/ androgogy have always helped the learners achieve curricular outcomes and more than that adds to their skills to function effectively as the 21st Century learners. Collaboration, and not competition at individual level, needs to be encouraged for a teacher's contribution towards a productive society. Studies also emphasize that active participation of learners in the co-creation of knowledge leads to the increased level of learner satisfaction and motivation. At one hand, cooperative learning strategies, group-work, group-projects in the classroom environments help teachers in creation of conducive learning environments, whereas collaborative ICT tools prove a great aid to the teacher in co-creation of knowledge by learners.

BL may not turn into teacher-centred classroom scenarios in face-to-face and online mode. On the contrary, the learners can be engaged in creative and productive activities through several ICT tools.

Collaborative contribution of learners may be planned by teachers through free ICT tools. Blogging. Sticky-notes, Shareable cloud-based documents, Concept-mapping, Mindmapping, infographics, Comprehensive activities with tools such as Padlets, Miro, are some indicative ICT-based activities for collaborative knowledge-generation. Appendix G presents elaboration of these activities and supporting tools, though teachers are expected to explore many other tools for achieving learner collaboration.

2.9 Technology Infrastructure for Implementation

The section discusses the approaches of integrating technology infrastructure and infrastructure requirements. Approaches likely to be used in BL are as follows:

Video recordings of Face-to-face Lectures – Shared to the students for the entire course (Pen Drive / CD) - eTextbook experience but not dependent on broadband, offline mobile app could be planned as well.

Internet Based Learning (IBL) – Internet based projects (search & learn) to promote self-learning
Project Based Learning – integrating multiple peer group for the project, students to collaboratively generate ideas
TAB based remote learning / remote examination & evaluation/ touch screens and digital pens appeal to tactile learners / portable learning
Satellite based TV Channel/Radio including community radio – mass learning/ adult education / farmer education (different timings)
*Online Assessments – Quiz, Assignments, Test, Examinations – at regular intervals to measure learning outcome. Appendix H presents a few examples of proctored examination solutions.

A few more examples of technology based evaluation techniques can be:
Online Peer Interaction through webinar / Conference, Online Internships, Virtual Labs (Simulation based) for subjects with laboratory experiments, etc.

A few examples of Virtual labs can be referred from Appendix I.

Thought there is no limit to availing IT infrastructure for students, illustrative support IT infrastructure is presented in Appendix J. The nature and need of the infrastructure will vary from discipline to discipline and institution to institution.

2.10 Evaluation

Implementing BL is a new mode of teaching-learning in higher education and hence the area of evaluation needs to be explored again in the light of BL. The following paragraphs discuss effective trends in evaluation.

Continuous Comprehensive Evaluation should be encouraged in universities and colleges. Focus of National Education Policy-2020 is learner centred education systems. Only summative evaluation will not suffice the need of testing all levels of learning outcomes. Modular curriculum demands assessment at regular intervals during and after achievement of learning outcomes specified for every module leading to appropriate evaluation. Cognitive skills such as logical thinking, application of knowledge and skills, analysis and synthesis of concepts and rules demands evaluation strategies other than summative paper pencil tests. Innovative evaluation strategies are to be used by teachers during the semester. Increased weightage of internal evaluation should be encouraged by including innovative strategies. Out-of-box thinking about summative as well as formative evaluation is expected from the teacher implementing BL mode. The following paragraphs throw light on a few innovative strategies. The list is not exhaustive but mentions a few points with the expectation of continuous exploration of such strategies by the teachers.

2.11 Summative Evaluation Strategies

Open book examination
It is a right time to move away from the conventional approach of examination where remembering and reproducing is prime focus. In real functioning beyond formal education, life is all about open book examination. Hence in Higher Education system, we must prepare students for world of work by making them acquainted with open book examinations. It will also facilitate better understanding and application of the knowledge with a better potential for its positive impact.

Group examinations even for conventional theory papers

Such an approach is followed some time for project and also laboratory tests. But for theory type examinations it is generally not followed. The group examinations once introduced for theory papers can improve the average performance of a class as students would be encouraged to share their knowledge with each other and also help them improve their general understanding.

Spoken / Speaking examinations

These different approaches can be introduced now with the support of new generation of technologies. They can make examination faster and easier and also can be helpful to students with different abilities

On demand examinations

In most cases students are forced to write examination in a single go and collectively. However, with advent of new methods which are technology based and also blending of teaching-learning and examinations in new form, it would be a good approach to offer examination on demand so as to offer more flexibility and student centricity.

2.12 Formative Evaluation Strategies

ePortfolio

ePortfolio is not only a compilation of a few best assignments, activities of a learner throughout the programme, but his/her reflections about the assignments, experience and challenges faced during the process of working on these assignments, overall approach, attitude, philosophy towards life as a learner and also his/her academic resume. ePortfolio is a comprehensive tool which becomes a mirror to a learner for the world.

Creative Products

Innovative Pedagogies and relevant ICT tools enable learners to come out with creative products as an individual or group learning activities. These products are learning experiences in the beginning, but learners should always be given corrective feedback about their outputs. Once feedback is sought, learners need to be given chance to improve on their products and then can be considered for formative evaluation. e.g. preliminary concept-map can be revised after discussion of the topic, summarization and feedback. Revised concept-map can be assessed.

One creative/collaborative activity may then be led towards the another product which can be used towards evaluation. e.g. Group or individual presentations by self-learning would be a learning activity and not an evaluation activity. (Many teachers make mistake of giving marks to the first presentations made by learners after self-study). Once teacher provided corrective feedback during such presentations, learners can be expected to revise the same presentations, add a small write-up/infographic/video to it and submit as an assignment.

Creative assignments such as digital stories, Cartoon strips, drama scripts, eNewsletter, eMagazine, Recorded interviews of stakeholders, Case studies, etc. can be used for formative evauation.

Classroom/Online Quizzes

Through paper-pencil tests, over-use of question-answers may be discouraged for formative evaluation, a few ICT tools for quizzes and games can be used eventually for formative evaluation.

Use of AI tools for Proctoring as well as evaluation

During the COVID-19 pandemic time, many exams were forced to be conducted in an online mode. These were supported by variety of tools which came into being in recent times and were based on proctoring through Artificial Intelligence tools. However, AI as technology can be used for many more evaluation strategies including understanding attention levels, pace of learning, level of learning etc. Hence new tools should be experimented.

Chapter III

Suggestive Framework for BL Pedagogy

3.1 Background

'BL' is a meaningful blend of Offline (Face-to-face) and Online learning environments. Higher Education Institution (HEIs) teachers in India may attempt to create such BL environments for at least one of the courses at initial stage. Though such BL environments help Indian higher education teachers and institutes in the development of the twenty first century learners, it will demand rigorous planning and efforts on the part of institutes and teachers.

Theoretical background alongwith implementation-related guidelines are discussed in detail in the previous chapters and appendices. BL environments are elaborated in the previous two chapters.

This chapter discusses broad suggestive framework for BL environments in Indian HEIs. The chapter proposes the framework keeping in mind minimum expectations from non-technology subjects, but also proposes the high-end technology infrastructure and resources for Science and Technology programme implementations. The chapter nowhere prescribes the implementation guidelines, but presents a suggestive framework for the teachers and/or institutes who wish to experiment BL approach.

3.2 BL Learning Environments

Online mode of learning refers to several learning activities which can be done by learners individually or else with peers such as:

- accessing ebooks, ejournals, newspaper-cuttings, etc.,
- accessing eResources, mainly in the form of Open Educational Resources (consisting formats such as text, graphics, animations, simulations, gaming, interactive multimedia, etc.) uploaded on LMS by the instructor,
- accessing links, eResources, digital libraries suggested by the instructor as well as explored individually or in groups,
- studying MOOCs/ SMOOCs (Small MOOCs), etc. by the learner as per guidelines by the instructor (e.g. Instructor may connect students to a successful ongoing MOOC but plan several Face-to-face activities along with it.)
- performing individual or group activities using any ICT tool or platform
- participating in the workshops/ webinars in online mode as per suggested by the instructor related to the curriculum
- interacting with, interviewing experts, professionals, personnel on the field

- completing assignments and uploading on LMS / submitting to the instructor using other ICT platforms
- attempting tests/quizzes
- engaging into virtual labs, museums, virtual tours, etc.
- engaging in online internships/ projects, etc.
- any instructional activity directly related to the course curriculum for which learner is not needed to visit the teacher and the classmates physically but needs to get engaged into online learning experiences designed by the teacher. Online experiences include several digital and digitalised resources and learning environments.

Offline (Face-to-face: F2F) Mode refers to several activities to be performed by meeting in the classroom such as:

- attending instructor's short duration lecturettes for introducing or summarizing topics, understanding complex concepts
- resolving queries based on self-learning or group-learning
- participating in group activities in the classroom with peers, mainly for analyzing and applying information sought through eResources,
- collaborating and co-creating new knowledge
- borrowing and accessing books and periodicals from the library,
- face-to-face training, physical training, apprenticeships, internships, etc.
- participating in on-campus physical labs, hackathons, working in maker-spaces, etc.
- appearing for periodical quizzes, summative tests on-campus, etc.
- field-visit, understanding procedures, processes at the real work-place
- any instructional activity for which students and teachers physically in the class, in the lab or in the community in the light of learning outcomes

3.3 IPSIT: Indian Framework for BL

BL has been implemented across the world successfully. Several models are so far proposed and researched for BL implementation.

IPSIT Model is a similar model proposed for the higher education institutes in India. This suggestive and not prescriptive model is presented in the following sections.

IPSIT Stands for:

Identify Resources and Activities
Provide resources and announce activities
Support and provide scaffolding
Identify learning gaps and provide feedback (Formative Evaluation)
Test (Summative Evaluation)

3.3.1 Identify Resources and Activities

BL is an appropriate blend of Online and Offline, non-digitalised and digitalised teaching-learning environments. Need assessment and planning is inevitable for such meaningful blend of the environments. It should be ensured that required infrastructure for Offline, non-digitalised and digitalised environments are in place. e.g. if digital resources and LMS is to be used, then accessibility of internet, availability of hardware need to be considered. If group-activities are to be planned, flexible (and not fixed long benches) furniture in needed in the classrooms.

All Offline, lab-related and Online activities are to be planned in advance. Appropriate learning resources are to be explored by the teacher. BL should necessarily be active learning environments and not one-way lecturing by teachers. Learner collaboration and co-creation of knowledge should be attended carefully while planning learning environments. Sources of such learning resources, classroom strategies for learner-interactions and ICT tools for collaboration are presented in appendices. A suggestive generic template for planning BL learning environments of a course is presented in Appendix K.

3.3.2 Provide resources and announce activities

Once the BL teacher designs a comprehensive learner-centred plan, s/he is ready for the implementation. A digital platform such as Learning Management System helps in smooth dissemination of resources. Face-to-face (Offline) activities can be conducted under guidance of the teacher, whereas Online activities can be in a digital form through digitalised environments. Teacher can be a part of digitalised processes to support and guide. Detailed instructions can be provided through LMS. Syllabus, Learning Outcomes, reading/viewing/listening and interactive resources, announcements and instructions for individual as well as group activities, etc. can be uploaded on LMS in advance.

3.3.3 Support and provide scaffolding

Higher education teacher needs to shift his/her role from 'teacher' to 'facilitator' once starts implementing BL. Though the learner is accessing resources and getting engaged in various activities, continuous scaffolding will be required so as to achieve higher order outcomes. Even classroom environments will not remain teacher-centred. Classroom discussions will revolve around resolving queries; analysis and application of knowledge and creative outputs will be achieved under the supervision and guidance of the teacher.

There must be a support mechanism even for digital literacy of students and facilitators. Training should be provided to teachers as well as students to make the best use of various digital platforms and ICT tools used in BL.

3.3.4 Identify learning gaps and provide feedback (Formative Evaluation)

Awareness of the progress of every learner on the individual learning path is essential for any effective learning. Learners should be made aware about their achievements at the appropriate stages before the official completion of the course. Quizzes, presentations, assignments and projects help to identify if learner/s have gaps in the learning. Corrective Feedback on their work will enable learners to achieve learning outcomes successfully.

3.3.5 Test (Summative Evaluation)

Testing for summative evaluation ensures achievement of learning outcomes. Considering the innovative approaches higher education teachers are expected to adopt, nature of summative evaluation will also change to a great extent. 'Recall' level test items will not suffice the need of true evaluation. The evaluation strategies need to be innovative, comprehensive and outcome-based.

Though pedagogy of BL environments is discussed in the previous chapters and appendices in detail, considering diversity in the nature of institutional infrastructures, disciplines and pedagogy practices, suggestive framework components of IPSIT are proposed in the following sections. The framework suggests a few short-term consideration whereas also proposes long-term desirable standards for Indian HEIs. These desirable considerations will empower HEs to develop 21st century skills in the learners.

3.4 Technology and Resources for IPSIT

A framework for BL should take both the teaching and learning perspective into consideration. Infrastructure related considerations for the IPSIT are suggested below:

3.4.1 Infrastructure

Availability of infrastructure is fundamental to teaching and learning. HEIs need to strive hard to establish digital infrastructure such as internet with adequate bandwidth, hardware and space. Other infrastructure such as knowledge resource centres, workshops, activity and experience centres will enable smooth execution of blended teaching-learning process. Learners who cannot afford digital access devices at home should be able to use campus resources such as student cyber café even for Online activities.

The financial aid required to develop the infrastructure and resources need to be taken care of with the involvement of industries, alumni, funding agencies, etc. A few guidelines for digital infrastructure are suggested in Appendix L for the HEIs venturing in this area for the first time.

Infrastructural requirements will vary as per the student strength and nature of the institutes as well as the nature of subjects and learning outcomes.

3.4.2 Resources

The pedagogy in BL must revolve around the availability of resources. eResources enable learners to access the ocean of information and knowledge. In case of unavailability of existing eResources, new content can be created keeping in mind the needs of the students. Co-creation of contents by students will not only add to the pool of resources, but also develop higher order skills in learners. Teacher-training in the field of OERs, MOOCs, SMOOCs, ICT integration tools is needed on a large scale BL implementation.

3.5 Pedagogy for IPSIT

Pedagogy is the core of the entire BL environment. BL does not mean throwing learners in the ocean of resources or providing them hundreds of lecture-videos. The success of BL depends on how learning processes help learners to achieve higher order learning outcomes. BL implementation requires stage-wise plan of execution with innovative teaching-learning activities. Guidelines for such teaching-learning processes are provided in Appendix M**.**

3.5.1 Evaluation in BL

Continuous evaluation plays a major role in a learning process. Students can be informed about their performance in assignments and quizzes even through technology. They may be given constant access to their reports for them to monitor their growth over the time against their learning goals.

There should be good means to assess the performance of students. Well defined tools to assess the students' growth and accomplishments need to be used. Objectivity and standardization should gain significance. This will also encourage students to participate in self-evaluation and peer-evaluation activities, where judgement of learner himself/herself and about peers adds value. The minimum or suggestive standards for a University/College/Institution are indicated in Appendix N**.**

3.5.2 Effective Feedback

Continuous feedback and support are essential for effective learning. Apart from face-to-face feedback, different technologies can be used to provide feedback to support learning. Instructors can use audio and video inputs, written texts or in-text comments to provide feedback. Maximum feedback for all student work would help in encouraging learners to achieve learning outcomes.

Students can also engage in providing peer feedback by reviewing each other's work and commenting on blogs or discussion forums. Similarly, students can also give feedback to the instructors. The suggestive framework for Feedback is provided in Appendix O.

The HE teachers are encouraged to experiment with BL environments and HEIs are suggested to provide such opportunities to such skilled and willing faculty after considering availability of resources. Sharing of experiences of BL environments will help teacher community to learn from each other. Several Communities of Practice would support and enrich the teaching-learning systems across the country.

3.6 Widening the Concept of "Blended Learning"

Any teaching-learning-evaluation strategy or approach cannot be a one-point solution. The term 'Blended Learning' indicates a meaningful and effective blend of Online and Offline learning environments. The term can further be widened to accommodate meaningful combinations of different approaches, communication modes, pedagogies and learning environments towards effective learning. Such an environment will enable higher education learner of the nation to achieve 21st Century skills while developing himself/herself in a value-oriented responsible citizen with wisdom. Flexibility and appropriate selection of pedagogy choices on the part of every Higher Education Teacher would contribute to this aim significantly.

Suggested Readings

Bates, A. T. (2019). Building an effective learning environment. Teaching in a Digital Age-Second Edition. https://opentextbc.ca/teachinginadigitalage/

Bates, A.T. (2020). Developing Quality Blended Learning Courses. http://oasis.col.org/handle/11599/3739

Beaver, J. K., Hallar, B., &Westmaas, L. (2014). Blended learning: Defining models and examining conditions to support implementation. *PERC Research Brief*. http://8rri53pm0cs22jk3vvqna1ub-wpengine.netdna-ssl.com/wp-content/uploads/2015/11/Blended-Learning-PERC-Research-Brief-September-2014.pdf

Cleveland-Innes, M., & Wilton, D. (2018). Guide to blended learning http://oasis.col.org/bitstream/handle/11599/3095/2018_Cleveland-Innes-Wilton_Guide-to-Blended-Learning.pdf?sequence=1&isAllowed=y

Government of India Ministry of Education (2020). National Education Policy https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

Huang, R., Ma, D., & Zhang, H. (2008, August). Towards a design theory of blended learning curriculum. In *International Conference on Hybrid Learning and Education* (pp. 66-78). Springer, Berlin, Heidelberg.

Lim, C. P., Wang, T., & Graham, C. (2019). Driving, sustaining and scaling up blended learning practices in higher education institutions: A proposed framework. *Innovation and Education*, *1*(1), 1-12. https://innovationeducation.biomedcentral.com/articles/10.1186/s42862-019-0002-0

Lima, R. M., Da Silva, J. M., van Hattum-Janssen, N., Monteiro, S. B. S., & De Souza, J. C. F. (2012). Project-based learning course design: a service design approach. *International Journal of Services and Operations Management*, *11*(3), 292-313. https://www.inderscienceonline.com/doi/abs/10.1504/IJSOM.2012.045660

Monteiro, S. B. S., Reis, A. C. B., Silva, J. M. D., & Souza, J. C. F. (2017). A Project-based Learning curricular approach in a Production Engineering Program. *Production*, *27*(SPE). https://www.researchgate.net/profile/Ari_Mariano/publication/334726644_Best_practices_for_Active_Learning_a_literature_study_using_bibliometrics/links/5d3cdaf3a6fdcc370a6609ed/Best-practices-for-Active-Learning-a-literature-study-using-bibliometrics.pdf

Partridge, H., Ponting, D., &McCay, M. (2011). Good practice report: Blended learning. http://eprints.qut.edu.au/47566/1/47566.pdf

University of Central Florida (UCF) and the American Association of State Colleges and Universities (AASCU). Blended Learning Toolkit https://blended.online.ucf.edu/blendkit-course-diy-project-tasks/

University of NSW. (2020). Planning and Designing a Blended or Online Course https://teaching.unsw.edu.au/planning-and-designing-blended-or-online-course

Appendix A
Scenarios in BL

The curricula across the country are now credit-based. Total credits per Programme change as per UGC Guidelines and approvals to programmes by Academic Councils of the Universities. e.g. In a particular University, M.Com. programme may be offered of 80 credits whereas M.Sc. programme may be of 96 credits.

Considering a theoretical programme, where 15 hours classroom time is allotted per 1-credit (1-credit hour * 15 weeks), total classroom hours are 4 * 15 = 60 per course. If a teacher decides to offer a course in Blended Mode, instead of attending 60 hours of classroom sessions, his/her students will spend **upto 40%** of the allotted hours in Online interactions and will be present in the class (face-to-face) for the remaining hours as per directions of the teacher. Every teacher has a choice of deciding number of hours for Face-to-face (Offline) interactions and number of hours for Online interactions, but **minimum 60% of the total hours** should be used for the **classroom interactions**. Additional student work (self-study, revision, assignments, projects, preparations towards evaluation, etc.) are 60 hours which remain unchanged. Let us study a few hypothetical scenarios in BL in Indian Higher Education as illustrations.

Scenario I: BL Mode for 80-credit Master programme

A hypothetical structure of one semester of a Masters programme offered by a State University is provided in Table A.1. Course no. 205 is under CBCS, so students are allowed to skip the course and opt for SWAYAM or any other course offered by other departments under CBCS.

Table A.1
Sample Course Structure

Semester II: 5 courses	**Total Hours**	**Offline hours**	**Online hours**
Courses: (each course is 4-credit)			
201 Instructional Systems Design	60	39 (65%)	21 (35%)
202 Research Methodology	60	42 (70%)	18 (30%)
203 Educational Psychology	60 (Non-BL)	60 (100%)	
204 Web Applications*	120 (60)*	72 (60%)	48 (40%)
* Practical course, so double no of hours			

BL opportunity is being experimented in the following manners by each of the course teachers:

1. Teacher A is teaching course 201 'Instructional Systems Design' (ISD). There are 4 modules of 1 credit each demanding 15 classroom hours per module in non-BL mode.

Course 201 ISD	**Offline Session hours**	**Online resources and activities (Approx access hours)**
Module 1	3	12
Module 2	15	0
Module 3	11	4
Module 4	10	5
	(65% of 60) 39	**(35% of 60) 21**

   Teacher A has identified several resources and eBooks on 'ISD and planned collaborative activities. Resources and activities were made available on LMS from time to time. The students spent about 12 hours reading and viewing material on Module 1 and met their teacher for 3 sessions of 1 hour each. Teacher answered their queries, checked their understanding through small quizzes in every session. She then conducted classroom sessions of 15 hours for Module 2 and made them design ISD under her supervision and guidance. The remaining 2 modules were about the Stages of ISD. Four to 5 hours per module were spent in reading material and viewing videos of 8-10 min duration and interviewing an instructional designer. Stages of ISD are then discussed in the class briefly followed by group-work for all stages. It built confidence in the students for developing stages of ISD individually as assignments.

2. Teacher B teaching course 202 (Research Methodology) is teaching all 4modules in Blended Mode allowing students to access digital resources, books, complete activities in online mode for about 18 (30%) hours and be in the classroom for total 40 hours. These 42 (70%) classroom hours are being utilised for several activities, trouble-shooting, solving queries on the read or viewed contents, problem-solving, etc. Teacher prefers to allot less classroom time for theoretical aspect, but allots more classroom time for data analysis.

3. Teacher C teaching course 203 (Educational Psychology) is not comfortable in using BL Mode and hence all sessions are conducted inside the classroom.

4. Teacher D teaching course 204 (Web Applications) conducted 72 (60%) hours in the lab allowing students to explore and see demonstration by the teacher teaching web-application tools and platforms. The students also spent 48 (40%) hours at home or else in the Student Cyber Cafe of the campus. They explored tools, developed websites and sought guidance of the teacher on the tasks while in the lab. This allowed students to work at the own pace.

However, teachers A, B and D are allowed to use BL by their institute.

Scenario II: BL Mode for training used by a National Level Institute

A national level institute is involved in teacher-training at a massive scale. The approaches used by them are applicable even in case of thousands of students learning in higher education institutions (HEIs) or for common courses taught across disciplines and/or in all affiliated colleges.

The national level institute offers training in ICT using the following 3 approaches:

a. The Induction course of 'ICT in Education' Curriculum for teachers followed the flipped curriculum approach where the 18 sessions were conducted in face to face mode for 10 days followed up by reading materials online and doing activities like assignment submission, forum discussion and quiz online.

b. Refresher course on 'ICT Pedagogy Integration in Teaching Learning' followed the blended block model where a few modules were online and a few modules were completed in face-to face mode. There are 15 modules.
   - 8 modules were conducted in face-to-face mode.
   - 3 modules as completely through online only involving asynchronous communication
   - 4 modules were online having live online sessions through video conferencing followed by online submissions.

c. Refresher course in 'Research in ICT' uses maximum online modalities. The total number of hours planned are 120. LMS is being used alongwith synchronous sessions through virtual class. All resources are accessed through LMS. Synchronous classes are used for solving queries, conducting expert talks, online group activities. Participants attended face-to-face workshop only towards the end of the course and spent 30 hours in the institute (5-day workshop) and finalised research proposals. They also had a hands-on experience of SPSS in the institute's lab.

The scenarios discussed in this section provide a few ideas or implementing BL mode.

Appendix B
Pedagogies for BL

a. Generating ideas

Higher education learners are adult learners who come with their own world of experience, previous knowledge gained at schooling level and previous years of education, exposure to other sources of knowledge, etc. Even pre-session resources suggested by teachers help them some knowledge, information. Lecturing of teacher assuming the learners are empty boxes is no more a preferred pedagogy. Learners, instead, can contribute by sharing their knowledge, ideas, views, either in the classroom or else on online platforms.

BL mode may provide this opportunity to learners to a great extent. Resources can be uploaded and external links can be posted on Learning Management systems prior to classroom sessions. These Online resources prove useful at least for acquiring information. Once the students study through the resources, classroom time can be utilized fruitfully in discussions.

Online platforms such as discussion forums, shared documents, blogs, etc. may be used to help them share their ideas and knowledge on a common platform.

b. Brainstorming

Brainstorming exercise always helps learners to think spontaneously; derive solutions, ideas; appreciate others' ideas and enjoy generation of several ideas by the whole group instead of listening to only teachers' ideas and views. It develops a sense of responsibility to think and learn ourselves. Brainstorming

c. Concept-mapping/Mind-mapping

Creating cognitive structure/schema of any topic in the mind is the best cognitive exercise for learners. These help learners understand the topic from all perspectives and also help learners establish relationships of concepts on their own. Features such as inserting images, sticky-notes, sketches in such tools makes the exercise interesting and learners get engrossed in the process of meaningful learning.

d. Creative Presentations

Education, at any level, and of any subject, should develop creative thinking abilities of the learners. Microbiology or Sociology learners can present their concepts through creating cartoon-strips. Story-creation tools are helping learners of higher education for presenting their knowledge of a subject instead of merely making presentations in the class. Infographics, short videos, podcasts provide them opportunity to give a creative form to their knowledge of any topic. This will develop their expression skill and help them present their ideas creatively even after in the field of work after education.

e. Exposure to the real world

Higher education students are just a few steps behind the field of work, i.e. the real world. Exposure to this real world while studying in colleges/universities will help them get ready for this real world. Field visits to understand the processes, interviews of stakeholders, case studies, small surveys, etc. will help them interact with the real world closely. Instead of explaining every process, let learners visit the organisation to understand the processes or else acquire information from websites, portals. e.g. Elaborating rules and regulations of any organisation in the classroom by yourselves, let the learners visit the organisation physically or else study the rules and regulations from the website of the organisation.

f. Case Study

Though learners cannot be exposed to every real world scenario, teachers can use case studies to bring such real world examples to the classroom. Case studies with though provoking questions, exercises can be shared with them in classroom or else in online mode. Giving exercise of preparing case studies is one of the best exercises for learners to apply their understanding of the topic. e.g. Assignment of writing case studies of one type of Experimental Design or Sampling Techniques help teachers understand how well the learners have understood these Research Methodology topics.

Teachers are expected to generate many such ideas to engage learners in the classrooms as well as in online mode. Since several eResources are available and even teachers can develop Open Educational Resources for their teaching-learning, lecturing can be minimised and BLmode can be made truly meaningful and effective by using such learner-centred pedagogies.

g. Cooperative Learning Strategies (CLS)

Cooperative Learning Strategies such as Jigsaw, Team-Pair-Share, Team-Pair-Solo, Fishbowl, Corners, One-stray, PQP, etc. (there are many more, which can be explored by teachers) have proven effective in face-to-face modes. These strategies help in developing sense of responsibility of learning, interdependence, team-work, logical and analytical thinking and teacher can ensure participation of all learners in the meaningful learning process. Synchronous and asynchronous online learning environments and some of the ICT tools for collaboration providing facility to discuss, chat, work together can be exploited to use CLS in online mode.

Appendix C
Platforms for Project Based earning

Platforms for delivering online lectures

MOOC Management Platforms can be useful in providing the essential knowledge to the students in the form of Online Lectures, Lectures Notes, and Live Tutoring sessions for clarifications. Platforms such as SWAYAM, NPTEL and MOOKIT can be helpful in the process.

Platforms for managing collaborative projects

Another part of such a learning process is creation, mentoring and evaluation of projects in a collaborative setting. Students can either meet periodically with a guide, or project-based learning platforms such as Project Pals, Headrush and Student Corner can be used for a fine-tuned project-based learning experience.

Platforms for student evaluation and feedback

Traditional solutions that are often categorised as Learning Management System can be useful in continuous evaluation of students. Google Classroom and Canvas are two common examples of such systems. They can be helpful for a teacher in designing an evaluation-oriented learning experience. Some solutions, such as Microsoft Flipgrid, provide a feedback mechanism to students to share their experiences with the teacher as well as their peers.

Appendix D
Open Learning Resources and Open Access Repositories

1. National Digital Library of India (NDL)*	https://www.ndl.gov.in/
2. SWAYAM	https://www.swayam.gov.in
3. Directory of Open Access Journals (DOAJ)*	https://doaj.org/
4. Directory of Open Access Books*	https://www.doabooks.org/
5. National Programme on Technology Enhanced Learning (NPTEL)*	https://nptel.ac.in/
6. Shodhganga-a reservoir of Indian Theses*	https://shodhganga.inflibnet.ac.in/
7. e-PG Pathshala	https://epgp.inflibnet.ac.in/
8. Open Access Thesis & Dissertations*	https://oatd.org/
9. Open Knowledge Repository-World Bank*	https://openknowledge.worldbank.org/
10. The OAPEN Foundation*	http://www.oapen.org/content/
11. PubMed Central (PMC)*	https://www.ncbi.nlm.nih.gov/pmc/?cmd=search&term
12. Project Gutenberg*	https://dev.gutenberg.org/
13. HighWire	https://www.highwirepress.com/
14. Southern Connecticut State University	https://libguides.southernct.edu/openaccess
15. AGRIS	http://agris.fao.org/agris-search/index.do
16. ScienceDirect Open Access Content	https://www.sciencedirect.com/#open-access
17. AidData	https://www.aiddata.org/
18. ILOSTAT	https://ilostat.ilo.org/
19. Oxford Open	https://academic.oup.com/journals/pages/open_access
20. Project Euclid	https://www.projecteuclid.org/librarians/lib_oa
21. SpringerOpen Journals	https://www.springeropen.com/journals
22. Taylor & Francis Open Access	https://www.tandfonline.com/openaccess/openjournals
23. Cambridge University Press	https://www.cambridge.org/core/what-we-publish/open-access
24. Free Open Access Books	https://www.freetechbooks.com/
25. SWAYAM Online Courses	http://storage.googleapis.com/uniquecourses/online.html
26. UG/PG UGC-MOOCs	http://ugcmoocs.inflibnet.ac.in/ugcmoocs/moocs_courses.php

Appendix E
Learning Management Systems (LMS)

Title	Licensed/OpenSource	Link
Moodle (Australia)	OpenSource	www.moodle.org
Google Class Rooms (USA)	Licensed/Free (For Limited Users)	http://classroom.google.com
ILIAS (Clogne)	OpenSource	https://www.ilias.de/en/
NEO (India)	OpenSource	https://www.neolms.com/india
ProProfs LMS (USA)	OpenSource	https://www.proprofs.com/c/category/lms/
Eduwave	OpenSource	https://www.capterra.com/p/133877/EduWave/
Eliademy	OpenSource	https:// www.eliademy.com
Zoom Learn	OpenSource	https://zoomlearn.com
Canvas(Australia)	Licensed/Free (For Single Users)	https://www.instructure.com
D2L (Australia, Brazil, Europe)	Licensed	https://www.d2l.com
TVS (India)	Licensed	www.tvslms.com
BlackBoard (USA)	Licensed	https://www.blackboard.com
Totara Learn (New Zealand)	Licensed	https://www.totaralearning.com/
CLANED (Finland)	Licensed	https://claned.com/
Matrix (Europe)	Licensed	https://www.matrixlms.com/india
CALF (USA)	Licensed	https://nuvedalearning.com/calf/
SYNAP	Licensed	https://synap.ac/
Adobe Captivate Prime (USA)	Licensed	https://www.adobe.com
SPOT(France)	Licensed	https://www.spotlms.us

Appendix F
Innovative Technology-enabled Initiatives

A few effective technologies are suggested in the following paragraphs.

SimLab+

www.simlab-soft.com: Licensed Tool

SimLab is a process-oriented multidisciplinary simulation environment to accurately analyze the performance of complex assemblies. SimLab is designed as a powerful 3D visualization and communication platform with a rich set of built-in workbenches. As general multi-purpose 3D software Solution it helps users to simplify complex work-flow through simple GUI and easy-to-figure tools.

Sim lab provides AR/VR headset and its supports android/win/ios. SimLab's VR Viewer is a stand-alone application that can view, edit and share interactive VR experiences.

Virtual Lab

www.vlab.co.in : Open Source / Support

Virtual labs provide remote-access to Labs in all major disciplines of Science and Engineering. These Virtual Labs can cater to students at the UG & PG levels as well as to research scholars. Use of these labs can cut down the effective cost by 24x7uses and providing better reliability, repeatability and access.

Allows us to share costly equipment and resources, which are otherwise would be available to limited number of users due to constraints of cost (including the initial cost, maintainability and the ROI)

It helps student to conduct experiments by arousing their curiosity and learning basic and advanced concepts through remote experimentation but with more safety, security.

Can be considered as a part of Learning Management System where the students can avail the various tools for learning, including additional web-resources, video-lectures, animated demonstrations and self-evaluation.

Robotics

https://www.e-yantra.org/ : NMEICT Project

https://www.sc.iitb.ac.in/robotics/index.html

Robotics is a branch of engineering and science that includes electronics engineering, mechanical engineering and computer science and so on. This branch deals with the design, construction, and use to control robots, sensory feedback and information processing.

The use of robots is rapidly growing and becoming more common across workplaces, homes, and educational institutions. Institutions have also started using teaching robots,

to impart knowledge to their students. These robots can help in delivering lessons in Science, Technology, Engineering, and Mathematics concepts that are essential in the educational curriculum.

The use of robotics in learning is ideal for interaction in classrooms as it can improve and encourages collaboration among students. Playing (and learning) with robots also offer additional benefits for students with disabilities. Students can undertake challenging tasks by designing, creating and programming their own robots.

FOSSEE

www.fossee.in : Open Source

FOSSEE (Free/Libre and Open Source Software for Education) project promotes the use of educational tools in academia and research. The FOSSEE project is part of the National Mission on Education through Information and Communication Technology (NMEICT), Ministry of Education, Government of India. Below is the list of some of the projects which are promoted by FOSSEE.

E-sim: eSim is an open source EDA tool for circuit design, simulation, analysis and PCB design.
Osadag: Osdag is a cross-platform open-source software for the design of steel structures, using the Indian Standard.
DWSIM: DWSIM allows chemical engineering students and practicing engineers to model process plants by using rigorous thermodynamic and unit operations models.
PLC: Provides training and skilling for PLCs.
SBHS: The single board heater system (SBHS) is a lab-in-a-box setup useful for teaching and learning control systems.
R: R is a language and environment for statistical computing and graphics.
QGIS: QGIS (Quantum GIS) is a desktop Geographic Information System (GIS) application.
PYTHON: Easy to read and learn, useful for scientific computing.

Appendix G
ICT Tools for Collaboration and Knowledge Generation

Blogging

A blog can be created by the teacher, and then students can be added as contributors to the blog. A problem, theme, issue may be provided with a few resources and learners' views, ideas, opinions, examples, scenarios, etc. can be invited as contribution to the blog. Blogging can be given as an asynchronous activity and the teacher can be facilitator to guide them throughout the posting process.

Stickynotes

Stickynote tools such as IdeaFlip, Lino.it, Jamboard, etc. can be used for online brainstorming. Brainstorming activity can be done as a synchronous activity in live online class or else an assignment of such idea generation can be given as asynchronous activity.

Shared documents

Students can be told to come out with a product after working in small groups of 2 to 5 students. Tools such as Google Doc, Google slides, etherpad, ScatterSpoke, ideaboardz, etc. can be introduced to them. Most of these tools are free and students get chance of being online at their own convenience and internet availability.

Concept-mapping, Mindmapping, infographic tools

Collaborative Concept-mapping and Mindmapping ICT tools such as Miro, Google Drawing, Conceptboard, Coggle, Bubble.us, etc. help learners come together online, discuss and establish relationships of concepts related to a topic/theme. Online tools avail features of adding videos, images, sketches, links to other files, hyperlinks, etc.

Comprehensive activity tools

Comprehensive activity platforms such as Padlet, Miro, Whimsical, etc. may prove effective virtual workspaces. Features such as wireframe will enable learners to develop project management, team-work abilities needed in 21st Century learners.

Many more ICT tools and platforms can be explored, experimented by teachers and students. Use of Free and Open Source tools may be encouraged. Mobile Apps of many tools will be useful for easy access and availability to students. Computer labs on the campus may be made available for needy students to perform online activities. The next chapter describes different ways of using these tools.

Appendix H

Proctored Examination solutions

MERCER METTL	www.mercer.com
MERRI TRAC (INDIA)	www.merittrac.com
JUPSOFT (INDIA)	www.jupsoft.com
DIGI PROCTOR	www.digiproctor.com
CAMPUS.TECHNOLOGY	www.campus.technology
MICROSOFT PARTNER SOLUTIONS(WHEE BOX)	www.wheebox.com
CAMPUSLAB(USA)	www.campuslabs.com
CHALK AND WIRE	www.chalkandwire.com
QUESTION MARK	www.questionmark.com
TEST MOZ	www.testmoz.com
CLASS MARKER	www.classmarker.com
M UNI PARIKSHA	www.municampus.com

Appendix I
Virtual Labs

Title	Licensed/OpenSource	Link
MERLOT(USA)	Licensed	https://virtuallabs.merlot.org/
NASA Biolab(USA)	Licensed /Free(For Limited Users)	https://www.nasa.gov/offices/education/centers/kennedy/technology/Virtual_Lab.html
PhetLabs(USA)	Licensed	https://phet.colorado.edu/en/accessibilit
Shakshat(India)		https://www.vlab.co.in/
MacMillian Learning Lab Solution(UK)	Licensed	https://www.macmillanlearning.com/college/us/solutions/lab-solutions/lab-simulations
Siemens(USA)	Licensed	https://new.siemens.com/global/en/products/automation/industry-software/automation-software/tia-portal/highlights/virtual-commissioning.html

Appendix J
Suggestive IT infrastructure requirements

A. User Computing Devices – following are the user devices primarily required

a. Personal Devices - Mobile Phones / TABs / Laptops / Desktops – are required for supporting end user computing needs
b. Lab Devices – Desktops – are required for Laboratory
c. Audio / Visual Devices – Projector, Smartboard, Conference Solution, Voice Recorder required to support the classroom
d. Graphics Board Tablet with Stylus – are required for do digital illustration work or photo retouching
e. TAB Based remote learning / remote examination
f. Satellite Based TV Channel – Mass Learning
g. Low Cost IOT devices – Raspberry PI – convert TV to a smart TV
h. Remote VPN – faculty / student can access school computers & work from home

B. Core Network to be placed at Data-centre

a. Router – one router for each Inter link, suggested to take redundant link to optimize load & reduce downtime
b. Link Load Balancer – To optimize / balance between dual ILL connection
c. Firewall – is required to keep the internal organization safe from external threats
d. Wireless Controller – is required to control campus wide all access points
e. Campus Core Switch - the primary witches to connect all campus connections.
f. IP CCTV – is required to connect each observation location
g. Storage (SAN for hosting application & NAS for Backup) – Storage is required for storing servers /data & NAS required to keep the daily backups.

C. Distribution Network for each building

a. Distribution Switches / Access Switches – to be placed in each building to support local LAN Connectivity to all required locations
b. Access Points – for Wi-Fi deployment
c. IP CCTV - for physical security

D. Servers – Servers can be taken on campus or on cloud

a. On Campus

- Microsoft Active Directory Server for Authentication
- Library Management Server
- Video Management System (VMS) for CCTV – recording hosting
- LMS – Learning Management Server
- Simulation based Virtual Labs on Cloud (i.e. AWS / Microsoft / Google)

b. On Cloud

- Opex Model / Pay As you Go / Anytime Scalability
- Backup Server – for disaster recovery
- Cloud server Parameters
    1. Compute Power – Amount of CPU core required to do the work
    2. Memory – Amount of RAM needed to run the Applications
    3. Savings – Power, Maintenance, ROI

c. Internet Link
    a. Internet Leased Link (ILL) – approx. 1GBPS for 1000 students
    b. ISDN – Internet on copper connection
    c. RF link – Internet on Radio Link
    d. MPLS – Link for multiple campus connect
    e. Connectivity through different ISPs for redundancy

d. Studio Setup for Lecture Recording
    a. HD Camera
    b. Lighting
    c. Backdrop
    d. Microphone
    e. Video Editing Software (Adobe Photoshop / 3D studio max / Movie Maker / Coral Draw

e. Other Software
    a. Antivirus
    b. Microsoft Windows Server
    c. Network Monitoring Software
    d. Office tools (e.g. MS Office/Libre Office)
    e. Remote Support tools

f. Other Support Infrastructure
    a. UPS
    b. Biometric
    c. Generators

Appendix K

Template for Detailed Course Planning in Blended Learning Mode

Faculty/Instructor:
Institute (Dept/College/Institute):
Programme:
Course: Sem:
Credits: Marks: Class size:

Prerequisites:

Objectives of the course:
1. ….
2. …

Course Structure

(Please add columns and rows as per the course structure)

	Module 1 (Credit: 1)		Module 2 (Credit:)
1.1		2.1	
1.2		2.2	
	Module 3 (Credit:)		Module 4 (Credit:)
3.1		4.1	
3.2			

Detailed Plan

- Mention whether Resources/ Communication/ Collaboration/ Co-operative strategy, etc.
- Type of Resource (OER /URL/IM/CP: OER/ Reference URL/ Instructor-made / Copyrighted with permission)
- Describe nature of IM, i.e. instructor-made resources (PPT/ Screen-cast/ Video/Interactive module/ PDF, etc.)
- Describe activities in detail

Sr No of Module	Number of related Learning Objective	Week/ Dates	Online Mode		ICT Tool/ Platform/ LMS	Face-to-face Mode		Duration in Minutes
			Resource (OER /URL/IM/CP)	Activity (Describe activity in detail)		Resource (OER /URL/IM/CP)	Activity	
Module 1 1.1								
1.2								
1.3								
1.4								
Module 2 2.1								

Appendix L
Guidelines for digital infrastructure

Aspects	Minimum Standards	Desirable Standards* (Long term plan)
1. LMS	LMS at least on a shared server for maximum 500 students and on dedicated server for maximum 1000 students	Cloud-based LMS with institutional domain name is recommended
2. ERP	Automation of student life cycle should be initiated	Fully Integrated (Admission to Placement) ERP should be in place. LMS should also be integrated in the ERP.
3. Bandwidth	1 Gbps	5 – 10 Gbps
4. WiFi& Campus Intranet	Wifi should be available for classes involved in BL. Necessary firewalls should be in place not restricting student access to ICT tools and Social media being used by teachers.	The entire campus should be fully Connected. All teachers and students alongwith the admin staff should be able to use Wifi. Necessary firewalls should be in place not restricting student access to ICT tools and Social media being used by teachers.
5. Electronic Devices (Computer)	Devices (desktops/laptops) in the ratio of 1:2 for technology/professional programmes and 1:4 for non-technology programmes under BL Low-cost access devices and N-computing solutions may be used for institutes with financial challenges	Fully Functional, Networked & Internet enabled Computer Labs with 1:1 ratio Integration of personalised devices should be provided. Classrooms/ labs equipped with desktops/laptops/tablets are recommended for BL environments where integration of ICT can be possible during classroom sessions

6. Data Centre Services	Shared / Dedicated Secured Server withadequate Storage Space	Dedicate, SecuredCloud based Data Centre to support BL and storage of ePortfolios
7. Smart Class Room	One shared infrastructure per 1000 students to start with is recommended. All BL classes should have at least a projection facilitywith internet connectivity. Virtual classroom software with recording facility for teachers involved in BL is recommended	Every Class room under BL Connected with the Smart class
8. Studio Facility	One Studio with Pre & Post Production facilities for Cluster of minimum 10 neighbourhood HEIs on time & resource sharing basis Video and screencast content development software such as Camtasia, OBS and training to use the same for teachers involved in BL	Each HEI may strive to have own studio with Pre & Post Production facilities for Development & launching of professional courses
9. Software Support i) Plagiarism Check Software ii) Domain Specific Software for CAD, CAL etc.	At least one set Anti-Plagiarism Check Software [e.g. Urkund, Turn-it-in] domain-specific software for specific subjects (ARC, SPSS, CAD etc.) are suggested for launching BL in that subject. FOSS are recommended in all possible cases.	Institutes should be equipped with all necessary FOSS or a few Licensed versions (if FOSS is not adequate) related to the subjects being taught in that institute.

Infrastructural requirements will vary as per the size and nature of the institutes as well as the nature of subjects and learning outcomes.

* Desirable standards are ideal infrastructure to be achieved in a long run for effective and well-equipped state-of-the art HEIs. HEIs interested in initiating BL may strive to achieve minimum standard of infrastructure for successive BL practices.

Appendix M
Pedagogy for BL

Aspects	Minimum Standards	Desirable Standards (Long Term plan)
1. Ratio of Offline and Online class activity	At least 60% Offline sessions are mandatory. Maximum 40% Online activities are suggested. Teacher implementing BL may aim at minimum 20% Out-of-class activities for a successful initiative	Maximum 70% Online mode for a programme per semester (Less than 30% Offline sessions be disallowed for a BL programme)
2. Approval to offer BL	Approval of Academic Council or equivalent committee Approval to one single course or a single teacher should also be encouraged. Number of courses or teachers is not important for the initiative.	All programmes of a particular institutes can be granted the approval if minimum infrastructure conditions are fulfilled and teachers are competent to offer BL approach. Minimum access devices need to be available to students, at least on campus for Online activities.
3. Nature of digitalised/ Online Mode	Combination of synchronous-asynchronous modes will help learners study, collaborate and seek guidance from the instructor Though non-digital environments can also be blended with the classroom sessions, digital resources and both synchronous as well asynchronous activities should be encouraged in online learning. One-way teacher-talk should be minimized for	Teachers should create interactive collaborative environments in online mode. Both synchronous and asynchronous activities should be planned and be offered on LMS. One-way lectures over online mode should be avoided if not a necessity. Such instructions can be provided by teacher's own videos of 8-10 min duration. Use of animations, interactive

	successful learner-centred active learning.	multimedia and other learning resources. Passive listening or viewing of resources should not consume more than 50% of the total Online learning time.
4. Offline (Face-to-face) environment	At least 30% of the total face-to-face (classroom) time should be utilized for learner-centred activities rather than lecture method. Offline sessions should be utilized for trouble-shooting, guidance, query-solving, demonstrations, learner presentations, etc. Cooperative and collaborative activities need to be planned. The percentage of such learner-centred activities could be increased gradually with proper planning.	Instructor's lecture 'talk' through should not exceed beyond 30% of the total Face-to-face time. Lecturing may be replaced by pre-recorded videos of the teachers and other resources. Since resources are to be uploaded on LMS, classroom time to be used for learner-centred activities.
5. Use of LMS	Maximum possible resources for the topics should be uploaded on LMS. Instructions for Online as well as even some Offline activities can be posted on LMS. Free LMS can be explored an used by teachers using BL. Institutes are encouraged to install free LMS such as Moodle.	All learning resources and activities would be reflected through LMS (direct uploads or else links to the processes and/or outputs. LMS would not only facilitate all teaching-learning activities but also prove as a face-sheet of the BL mode.

Appendix N
Guidelines for Evaluation

Aspects	Minimum Standards	Desirable Standards
1. Product and process evaluation	Analysis, Application and Create level learning outcomes should be defined for all subjects under BL. These higher level outcomes should be evaluated through internal evaluation. Process and product evaluation should be encouraged. At least 2 rubrics should be designed for subjects under BL Process evaluation through grading of synchronous group-chats, discussion forum posts, collaborative infographics, etc. can be achieved. Grading of concept-maps, mind-maps, stories, infographics, etc. created by students can be used for product evaluation.	Rubrics should be developed for all courses. All possible cognitive learning processes and creative products to be evaluated.
2. Continuous Comprehensive Evaluation (CCE)	Modes of CCE should be innovative, learner-centred and competency-based.	Necessary evaluation systems should be in place and all evidences of internal evaluations to be maintained. Paper-pencil tests, unit-end exams to be completely discouraged for CCE. Instead, other modes of evaluation should be used.
3. Open Book/Closed Book	Both models to be followed selectively for courses under BL.	Both models to be followed selectively for all courses under BL.

4. Group Examinations and Evaluation	At least one group-work activity should be evaluated per course under BL.	Group-work evaluation and Group Examinations should be encouraged for all subjects
5. Viva Voce	Viva-voce for at least 70% experiments, group-projects should be used.	Viva-voce for all experiments, research projects, group-projects should be mandatory
6. Project Presentations	Presentations to be planned against evaluation of projects and dissertations at least 2 times per course.	Presentations to be planned for evaluation of projects and dissertations at least 3-4 times per course. Evaluation Rubrics to be developed for such presentations.
7. ePortfolio	ePortfolio in any easiest form should be encouraged for at least one subject, preferably for the professional subject.	ePortfolio should be encouraged for all students.
8. Online evaluation	Online evaluation strategies should be introduced at least to some extent.	Online evaluation strategies should be used at least partially for all subjects.

Appendix O
Guidelines for Feedback

Aspects	Minimum Standards	Desirable Standards
1. Self-Feedback	Course related feedback on monthly basis or unit-wise, primarily for teaching-learning plans and efficacy of classroom activities	Course related feedback on weekly basis
2. Peer Group Feedback	At least once in a Semester (preferably within the given department/ institute in the middle of the semester) Feedback from different levels of operations need to be planned at least once in a year	360 Degree Feedback at least once in a semester
3. Teaching-Learning Process, Learning Resources and Instructor	Student Feedback regarding T-L processes, Learning Resources and the Instructor at least once a semester for every course under BL.	Student Feedback regarding T-L processes, Learning Resources and the Instructor at least 2-3 times a semester for every course under BL.
4. Learner activities/ outcomes	corrective feedback on at least 50% of the learner activities and assignments	Feedback on at least 75% learner work