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New Approach for Providing Adaptable Curriculum Enrichment through Teaching-Learning and Evaluation

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***Abstract*— Post-pandemic, the perspective**

-pof the stakeholders of the education industry has changed considering online teaching learning and evaluation. Most of the stakeholders feel that a hybrid learning methodology can be adapted for multiple reasons. However, designing a framework for hybrid teaching-learning and evaluation is not easy. In this paper, an attempt is made to propose one such approach for implementing a hybrid teaching-learning and evaluation mechanism. First of all, a survey of the students was conducted to understand their opinion about the type of teaching-learning process. Then a strategy is suggested where theory sessions will be conducted online and lab sessions will be conducted in an offline (face-to-face) manner. Further, the implementation strategy, teaching-learning tools, feasibility, applicability, and challenges associated with this are discussed. The successful implantation of the suggested teaching-learning and evaluation method can be a promising solution for accommodating on-campus and off-campus learners.

***Keywords*— Hybrid learning; teaching-learning and evaluation; online learning; offline learning.**

I. INTRODUCTION

BEFORE the pandemic offline or conventional (Chalk and Board) teaching-learning process (TLP) with limited use of Information and Communication Tools (ICT) was well-accepted and considered ideal, at least in India. However, during the pandemic, a paradigm shift occurred, where the offline TLP is completely changed to online TLP. Although difficult, it was managed and implemented for almost one complete academic year. During this period, everyone, i.e. students, teachers, institutions, and universities faced several problems on all fronts including teaching, learning, assessment, and evaluation.

One of the biggest problems was to accommodate on-campus learners and remotely located learners, i.e. addressing issues in a hybrid model of education. To address issues in hybrid education, the following problem statements are proposed.

1. To develop a teaching methodology in hybrid mode with a systematic delivery mechanism for theory and laboratory courses, including courses involving field exposure.
2. To accommodate online and offline learners with comparable assessment and evaluation and ensure achievement of nearly equal learning outcomes for both types of learners.

With the advent of 21st-century technologies (21st-century skills, 2020) and National Education Policy 2020 (National Education Policy, 2020), the hybrid model of TLP is going to be popular very soon. Therefore, identifying the solutions for the above-mentioned problem statements is of utmost importance.

The various innovative hybrid instructional models and their advantages and disadvantages are very well documented in the literature. In (Tuckman, B. W. 2002), Active Discovery and Participation through Technology (ADAPT) is proposed to evaluate the effectiveness of the hybrid instructional model. This model combines the important features of traditional classroom instruction with those of computer-mediated instruction. This method is tested on a group of students and it was found that the proposed model provides students with both structure and opportunity for involvement in the learning process. In another study, the model for learning and teaching activities (MOLTA) is suggested (Delialioglu and Yildirim, 2008). The effectiveness of the model for students' achievement, knowledge retention, attitudes towards the subject, and course satisfaction is evaluated in comparison to traditional classroom instruction. The findings of the study indicated the attainment of equal learning outcomes for the hybrid course and classroom course. Recently in 2020, a study is presented (Raes et al., 2020) to propose a teaching-learning and evaluation framework for students who are physically present for face-to-face sessions and remotely present for online sessions. The results show that the framework provides flexibility in education as it gives students the choice of where to attend the course. Further, it is said that the performance of the remote students and their on-campus counterparts can be improved through continuously evolving the framework.

Prior pandemic, nobody has thought of online TLP. In the case of distance education also only the study material is provided and no online sessions are conducted. As a result, in the literature, very few references are available that propose a similar type of study. In this paper, a new approach is presented for the on-campus and remotely located learners. The new approach is about providing adaptable curriculum enrichment through teaching-learning and evaluation, which is abbreviated as PACE-TLE. In this, all the theory courses will be conducted online and the lab courses will be conducted offline. An option

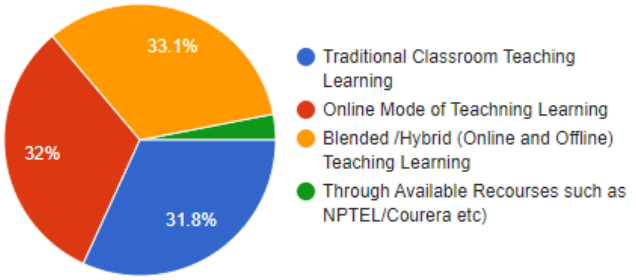

Figure 1: Response to the question 'What would be the most exciting or effective learning environment?'

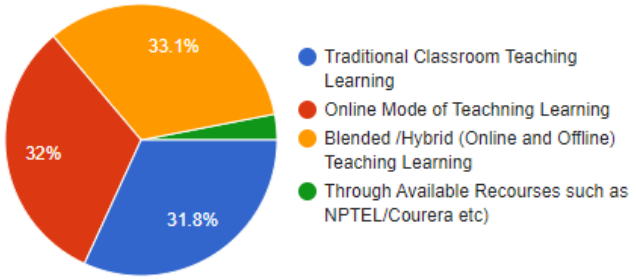

Figure 2: Response to the question 'Are you interested in implementing hybrid learning evaluation practices for the course?'

for the students, who wish to attend online lab courses is also provided. This paper also presents appropriate evaluation and assessment techniques for both online and offline learners. So that, learning outcomes will be comparable in the end.

The paper is organized as follows. In Section II, the motivation for the problem statement is stated. In Section III, the implementation strategy is elaborated with associated challenges. Key remarks and observations are given in Section IV. Finally, the paper is concluded in Section V.

II. Motivation for Problem Selection

For justifying the above-mentioned problem statement, an online survey of 500+ students (learners) is conducted. This survey has around eight questions. Out of the eight, the responses to the two questions are given below in Figures 1 and 2. The important observations are given below.

1) Figure 1 responds to the first question, i.e. 'What would be the most exciting or effective learning environment?' From Figure 1, it is found that around one-third of the learners wish to have the hybrid/blended TLP and out of the remaining two-thirds, almost half of the learners wish to have offline (traditional classroom teaching learning) and half wish to have online TLP. So those who wish to be offline can come on-campus and others can attend online sessions. Further, very few have shown interest in learning through NPTEL/Coursera, etc. Figure 2 shows the responses to the second question, i.e. 'Are you interested in implementing hybrid teaching-learning and evaluation practice for the course?' From Figure 2, it is quite clear that the majority of students would like to have a hybrid TLP.

2) Further, it is found that the hybrid model of TLP provides flexibility to the instructors (teachers) in using teaching tools during courses and flexibility to the learners in learning the course at their own pace. This facilitates an all-around better teaching and learning environment for instructors and learners.

The significance of the problem statement can be stated as follows.

1. The appropriate solution to the problem statement can result in better time management for the learners. With hybrid learning, learners can control their lectures and learn more efficiently. This will help to improve their grades and focus more on acquiring employability skills.

2. The introduction of the hybrid model of TLP can result in an improvement in enrolment for higher education, as it provides an opportunity for remote learning.

3. Hybrid learning helps students and instructors to use all the resources more efficiently and effectively.

A. Probable Solutions

The probable solutions can be as follows.

1. Online Theory Sessions + Offline Laboratory Sessions

2. Online Theory Sessions + Virtual Laboratory Sessions + Offline Laboratory Sessions (some courses)

3. Offline Theory Sessions + Online (Virtual) Laboratory Sessions

4. Live Streaming for Theory Sessions + Offline Laboratory Sessions

5. MOOCs + Offline Laboratory Sessions + Virtual Lab Sessions

The solutions mentioned above are received through a Google form circulated with students.

B. Recommended Solution

Out of the above-mentioned solutions, the 1st solution, i.e. Online Theory Sessions + Offline Laboratory Sessions is recommended for the reasons mentioned below.

1. Online theory sessions can be delivered in an effective way either in synchronous or asynchronous mode. Students can download the lectures and can listen to them at his/her convenience.

2. Online mode is not possible for all laboratory courses, so it can be conducted in offline mode.

III. Implementation Strategy

In the following, a systematic strategy is presented for the implementation of the PACE-TLE. First of all, the program development process is explained and then the course-specific development process is explained in a step-by-step way. After that use of andragogy, the use of technology, along with the feasibility and applicability of the proposed scheme are presented.

A. Program Developmental Process

The program development process is shown in Figure 3. The

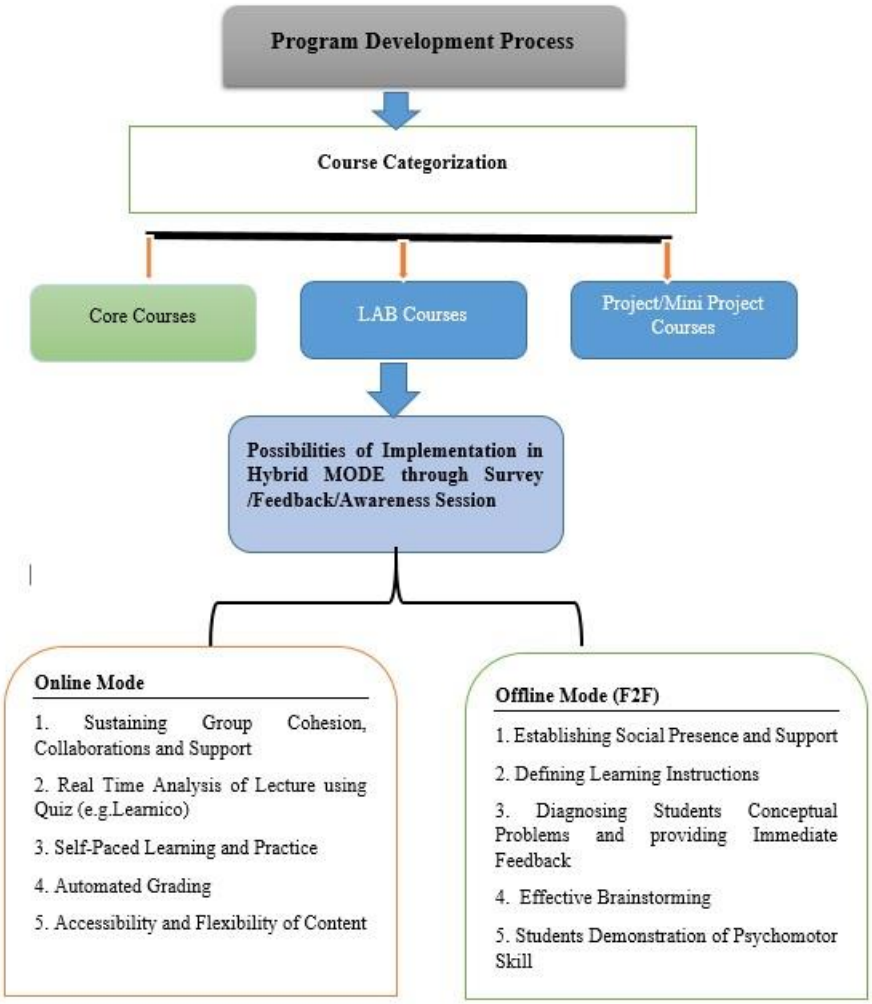

Figure 3: Flowchart for program specific development process

process is further explained with the points given below.

1) Understanding program development process: Initially, the program under which this framework is to be implemented is required to be understood for the number of theory courses, basic science courses, core courses, elective courses, humanities courses, courses involving field exposure (project, seminar, internship, etc.), courses involving lab assignments, etc. Further, it is necessary to consider the number of credits, and the number of teaching hours for each semester and academic year. Finally, an understanding of the program educational outcomes (PEO) prescribed by the specific program is also needed to implement a hybrid teaching-learning and evaluation framework. This can be done by conducting a meeting of faculty members and brainstorming on it.

2) Course categorization: In this, a general classification of the courses is given as lab courses, theory and core courses, and courses involving field exposure. This can be done to have a clear idea about the types of courses in the program with their teaching hours and credits.

3) Possibility of implementation of a course in hybrid mode: Whether to offer a course in online, offline, or blended mode can be decided by conducting a survey or collecting feedback from students. It can also be decided based on the previous experience of the teacher.

Features that can be included in the learning mode (i.e. online or offline mode) presented in Fig. 3, are given just for understanding. These are indicative features. Teachers, departments, or an institute can frame a common policy on what to be included and what not. Further, it can also be changed as per the need of a specific course. And, that feedback can be given to the teacher. Ultimately, it will evolve with time.

B. Course-Specific Development Process

The step-wise description of the course-specific development process is given in Figure 4 and is also explained in the following.

1) Mapping of CO-PO

First, the course outcomes (CO) of the course are defined and it is mapped with the program outcomes (PO).

2) Design of learning instructions for the course using course hand-out

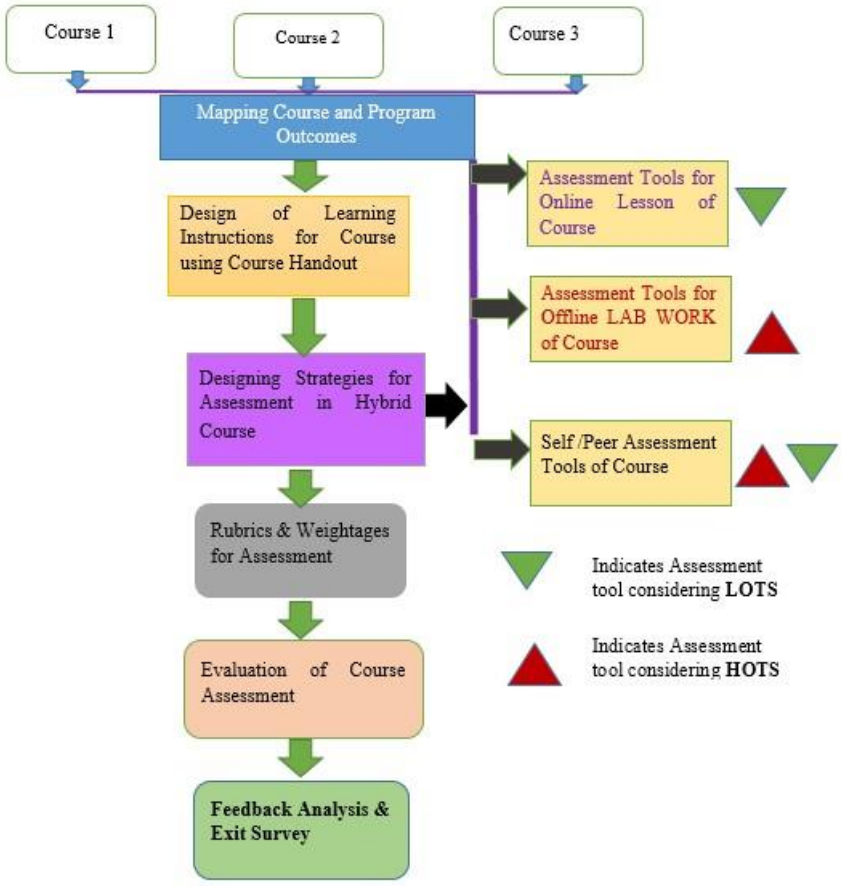

Figure 4: Flowchart for course specific development process

1. Course hand-out consists of details of hybrid instruction and the structure of the course including the teaching scheme
2. Hybrid instructions consist of online 3 Hrs./week lectures and offline 2 Hrs./ Batch laboratory session
3. Course hand-out also consist of CO-PO mapping of a particular course

Key Points: Flexibility in assessing curriculum, self-paced learning, doubt solving in face-to-face laboratory (practical) sessions, adequate exposure to a practical skill, etc.

3) Designing strategies/tools for assessment in a hybrid course. This process includes 3 parameters

1. Assessment tools for theory course:
1.1 Qualitative: Assessment of content delivered during each lecture using LearniCo (an MKCL tool) (50 minutes session will have 1 or 2 Quizzes in each 10 min). The quiz may consist of MCQ Based, Single MCQ, True or False, WORD CLOUD, etc.
1.2 If students have missed an online session then the same recorded lecture is provided and an assessment of the recorded lecture is done by the EDPUZZLE.
1.3 Unit-wise MCQ test, after completion of each unit, consists of 20 marks each (Continuous Internal Evaluation).
1.4 Fixed-hour mid-semester MCQ-based Test on Unit 1, Unit 2, and Unit 3 combining 30 marks
1.5 Fixed hour end-semester MCQ-based exam after completion of each course of 50 marks. The question paper is to be set by an academic/industrial expert.
1.6 Immediate feedback on the assessment to the learner for improvement in the course

2. Assessment tools for laboratory work:
2.1 Laboratory work consists of 10 practical sessions per course.
2.2 Each practical consists of 10 marks

3. Assessment tools for self /peer-review assignment:
3.1 The course will consist of a three-self/ peer-review assignments each of 30 marks (to be solved in lab sessions).
3.2 Assignments will be based on solving real-life problems, case studies, open-ended questions, capstone/ mini-project, project-based learning, etc.
3.3. Focus will be given to inculcating human values in students while performing assignments.
Key Points: Fair assessment of lecture, real-time doubt solving, and continuous monitoring of results, questions set by academic/industrial experts, improving psychomotor skills through lab work, learning through teaching

4) Rubrics and weights for assessment tools
1. Course is designed according to rubrics to be followed in the assessment of theory questions, lab work, and self/peer assignments according to Bloom's Taxonomy level.
2. Weights assigned to theory courses, lab work, and self/peer assignments are 40%, 40%, and 20% respectively.
3. Theory course MCQ questions are designed in such a way that simple, moderate questions address levels 1 to level 3 of Bloom's Taxonomy whereas difficult questions address levels 4 and level 5 of Bloom's Taxonomy.
4. Rubrics for lab work are designed in such a way that they address level 4 (Analyse) and level 5 (Evaluate) of Bloom's Taxonomy
5. Rubrics for self-peer review assignments are designed in such a way that they address the meta-cognitive skills and have a significant impact on Level 6 (Create) of Bloom's Taxonomy.
6. Additional 10 marks are given to one who follows safety norms and ethical practices in the lab and helps other students in finding out the solution
Key Points: Challenging assignments, learning through doing, learning through evaluation, the shift of the role of the teacher from moderator to observer

5) Evaluation of assessment methods
1. At the end of the course, a statement of marks for each assessment method will be generated
2. Evaluation of CO-PO mapping will be done based on the target/level set for the course, e.g. Level 3 = 60 % of students secure more than 80% of marks, Level 2 = 50 % of students secure more than 70% of marks, Level 1 = 40 % of students secure more than 60% of marks
3. Attainment will be ensured based on the achievement of the targets given above.
4. If the target is achieved, % of students is increased, and if the target is not achieved action plan is prepared for improvement and implemented.
Key Points: Ease of assessment for teachers, involvement of students in the assessment process, time-saving for teachers, continuous improvement in the course

6) Exit surveys and feedback
1. Exit surveys and feedback are taken at the end of each course
2. Based on the feedback, suggestions will be given to the learners, and also the professional needs of learners will be identified. This is then implemented in the next semester and monitoring will be done by the mentor. This will result in making learners ready for the professional world continuously.
Key Points: The philosophy of outcome-based education (OBE) is established by the assessment of the course and assessment of the program through the course exit survey, employer and alumni survey

C. End Product (Solution)
The end product or the solution proposed is, PACE T-L-E. This stands for Providing Adaptable Curriculum Enrichment through Teaching-Learning and Evaluation (PACE T-L-E). Through this, an attempt is made to accommodate on-campus and remotely located learners on a common platform with flexible learning and equivalent assessment for the overall development of the student.

D. Use of Andragogy
Some of the hybrid learning activities that make students interactive are as follows:
1. Picture Prompt – Show students an image with no explanation, and ask them to identify/explain it, and justify their answers (using Learnico) (Online).
2. Updating Notes (Google Classroom) – Take a break for 2-3 minutes to allow students to compare their class notes so far with other students, fill in gaps, and develop joint questions (Online).
3. Edpuzzle: The teacher sends video content from a passive to an interactive experience for students who miss class (Online).
4. Choral Response – Ask a one-word answer to the class at large; the volume of the answer will suggest a degree of comprehension. Very useful to "drill" new vocabulary words into students (Offline).
5. Word Cloud Guessing - Before you introduce a new concept to students, show them a word cloud on that topic, using an online generator (Wordle, Taxedo, or Tagul) to paste a paragraph or longer of related text, and challenge students to guess what the topic was (Online) / (Offline).
6. Instructor Storytelling – The instructor illustrates a concept, idea, or principle with a real-life application, model, or case study. (Online /Offline)
7. Grab a Volunteer – After a minute of paper (or better: think pair share) pick one student to stand up, cross the room, and read any other student's answer (Offline).

E. Use of Technology
Some of the ICT tools in teaching-learning and assessment are given below.

1) Online learning tools:
1. Google Classroom: It is an easy-to-use and secure tool that helps educators manage, measure, and enrich learning experiences.
2. LerniCo (MKCL): It bridges the gap between teacher delivery and student learning.
3. Flipped Learning: It offers a personalized learning experience.
4. Canvas: It is designed as a virtual classroom, allowing students and educators access to all course-related materials.
5. Edmodo: It is an application for academic communication
6. Udemy: It is a leading destination for learning and teaching online
7. BrainPop: It is a learning resource supporting core and supplemental subjects
8. NPTEL/Coursera (MOOCs): It provides E-learning through online web and video courses in various streams

2) Online teaching and assessment tools:
1. Virtual labs: The virtual labs address this issue of lack of good lab facilities, as well as trained teachers, by providing

remote access to simulation-based Labs in various disciplines of science and engineering
2. Go Formative: Teachers can view students' responses in real-time and provide timely feedback.
3. Labster: Virtual version of the lab practical to use beforehand, teaching them the techniques, skills, processes, protocols, and underlying theory.
4. Edpuzzle: It is a program that allows teachers to transform video content from a passive to an interactive experience for students
5. ZOOM: It is a classroom instruction platform.
6. Google Meet: Online teaching tool for teachers.
7. GoToWebinar: It is a classroom instruction platform.
8. Jplag: JPlag is a web-based plagiarism detection system.
9. WebAssign: WebAssign is an American educational company that provides online homework applications for faculty and students.
10. Code Similarity: Web Check is a test for plagiarism that compares code to over 100 million sources of code from major public and private repositories.
11. Assignments by Google: A collaborative power of Google workspace for education.

3) Offline Teaching and Assessment Tools:
Some of the offline teaching and assessment tools are given below. But these are indicative. Teachers can go for a variety of tools.
1. Group Forum
2. Flipped Learning
3. Peer Assessment
4. Students Profiling using Continuous Assessment

F) Feasibility of the Proposed Solution
1. The feasibility of the solution is checked by conducting the survey using Google Forms. Students are more inclined to the suggested solution.
2. It involves or promotes the use of open-source tools, cost-wise also it can be feasible.
Applicability of the Solution: Further the applicability of the proposed solution is justified for the following points.
1. There may be some challenges to the application of the proposed solution, e.g. not applicable for all types of courses, not applicable for some learners, change of pattern or curriculum, etc.
2. These challenges may appear at the 1st time of implementation. However, all these issues can be overcome over the period. For that, the system should evolve continuously. Also, there can be a mechanism where learners and instructors can share their issues on a common forum.

IV. Remarks and Comments

The following points support innovation and creativity in the intervention.
1. It offers the effective use of teaching-learning tools, technologies, and strategies for the implementation of hybrid models. This includes meta-cognition (self-assessment), peer assessment, continuous assessment, use of LearniCo (a tool by MKCL), etc.
2. Course-wise and semester-wise continuous assessment and suggestions on it by the instructor when carried out over four years in a systematic way will help to develop the profile of the students. So that students can be trained as per the requirements of the industry.
3. If this is implemented, it will result in the saving of resources and cost-cutting in several ways.
However, there are some challenges associated with this. These are listed below.
1. The whole approach is presented based on the assumption that the institute has the flexibility to conduct a specific course in online or offline mode.
2. Faculty members are trained to use online and offline teaching-learning and evaluation tools.
3. Institute ensures the availability of all the required resources to implement this approach.
4. Feedback mechanism should be implemented effectively time-to-time and the system should be updated so that better results will be obtained every year.

V. Conclusion

In this paper, a novel solution is provided for accommodating online and offline learners. In this, there will be online theory sessions and offline lab sessions. Those who face difficulty with offline lab sessions can opt for virtual labs, lab recordings, and live lab sessions. Assessment is designed fairly for both online and offline learners. This will help in enriching the quality of TLP, making learners ready for the competitive world, and self-sustaining development.

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