

# **A UNIFIED APPROACH TO ENHANCING QUALITY OF EDUCATION THROUGH EDUCATION CLOUD AND TECHNOLOGY AUGMENTED LEARNING AND COURSE MANAGEMENT IN HIGHER EDUCATION**

K.R. Srivathsan<sup>1</sup>

## **ABSTRACT**

We propose in this paper the system of “Technology Augmented Learning and Course Management”, or TALCoM. It is well suited for integration of online, or e-Resources in to the Course Curriculum and its conduct. The system is evolved for the Indian scenario of Affiliating Universities and their colleges. It is centred on the development of ‘Pedagogically aligned Executable Lesson Plans’, or PELP over the course curriculum. Course PELP is developed by university assigned group of Subject Matter Experts (SME). The SME may choose the desirable pedagogy and method of course delivery for incorporating into the PELP. It is used to configure the delivery system – be it an LMS, MOOC or any custom platform – using which the course conduct is supported. We call the whole methodology as the ‘Technology Augmented Learning and Course Management’, or TALCoM. Both Formative and Summative assessments are integrated in to TALCoM. TALCoM methodology requires some IT support that is aligned with the course delivery model across colleges under each affiliating university. TALCoM has been shaped by the discussions with the Vice Chancellors of the state universities of Jharkhand in India. The approach presented in this paper is also of value in modernizing the system of course development and conduct in any collaborating group of colleges or stand-alone institutions as well. TALCoM is also well adapted into the ODL system of education under the Open Universities.

## **1. A BRIEF OVERVIEW OF INDIA’S HIGHER EDUCATION SCENARIO**

This paper is focused on how we reinvent and innovate the ways by which we enhance the quality of courses conduct and management in the colleges under the affiliating universities of India. The method is referred to as ‘Technology Augmented Learning and Course Management’, or TALCoM. This method is also applicable to any group of autonomous colleges collaborating at agreed course level, with one of them coordinating the same. As we bring out in this paper, TALCoM may be used for any chosen pedagogy and course delivery method. First, we shall bring out the issues with the system of affiliating universities and colleges of India.

The Ministry of Education, Govt. Of India recently released the ‘All India Survey of Higher Education – 2020’, or AISHE-2020 [1]. The survey brings out several remarkable aspects of India’s Higher Education (HE) System. It shows that among the 1043 universities, 307 of them are affiliating universities under the state (provincial) governments. These 307 universities have 42,343 affiliated colleges out of the total of 54,122 HE institutions. The rest, including the well known premier institutions of India are stand-alone institutions, and all the deemed-to-be-universities. Most of the colleges in the small towns and districts of India belong to the affiliated category. It is estimated that 38.5 million students (19.6 mn boys and 18.9 mn girls) are studying in the total Indian Higher Education (HE) system.

Amrut Bang writes [2] that, “The youth (18-29 years) constitute 22 per cent of India’s population, which is more than 261 million people — larger than the population of Pakistan.” The Gross Enrolment Ratio (GER) is about 27.1%. The National Education Policy – 2020 (NEP-2020) [3] aims to double the capacity of students in the colleges over the next 15 years. Generally the standard, or quality of education is higher in the well-to-do stand alone institutions than in most of these affiliated colleges. More than 75% of students study in the affiliated colleges. The problem of poor quality education is endemic in most of these affiliated

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<sup>1</sup> Prof. K.R. Srivathsan is Professor (Retired) of IIT Kanpur in India. He was the First Director of the Indian Institute of Information Technology and Management – Kerala, and Former Pro Vice Chancellor of IGNOU. Besides he was part of NPTEL from its inception as part of the founding group and Member Program Implementation Committee for 12 years. He proposed and coordinated the Kerala Education Grid, the Karshaka Information Systems, Services and Networking – Kerala (KISSAN-Kerala), KISSAN Krishi Deepam TV serial, founding member and Coordinator of ERNET India, besides being a member, chairman and coordinator of several other national and regional initiatives.

colleges. Hence we focus this paper on developing the proposed TALCoM system for enhancing the quality of education in these colleges. The University Grants Commission (UGC) summarized an approach [4] conforming to the NEP-2020, the salient points of relevance to this paper are given below.

- i. Extensive use of Technology in Teaching and Learning.
- ii. Focus on regular formative assessment for learning rather than summative assessment that encourages today's 'coaching culture'.
- iii. Teachers and Faculty as the heart of the learning process: Their Continuous Professional Development.
- iv. Optimal Learning Environment and Support for students: Innovations in curriculum, pedagogy and assessment.
- v. Motivated, Energized and Capable Faculty, with freedom to design own curricular and pedagogical approaches under approved framework.

As we shall see, our TALCoM approach supports all the above aspects for the higher education system of India. The governments in the states (provinces), the Ministry of Education at the Centre and all the affiliating universities are yet to outline their strategies on how to achieve the above objectives. There are some positive developments in 'Technology Enhanced Learning', or TEL that are widely accepted in India and even across the world today. The major one is the development of the 'National Programme on Technology Enhanced Learning', or NPTEL [5]. NPTEL is led and coordinated by the seven older IITs and the Indian Institute of Science with IIT Madras serving as the central coordinator. NPTEL offers for free, hundreds of live online courses and also as e-content in the form of video lectures, web content and MOOCs. NPTEL courses cover subjects in sciences, technology and some areas of management and humanities. These courses, at both graduate and postgraduate levels, are popular and avidly used in the engineering colleges and institutions of India by their teachers and students. Working professionals in the industry and research organizations are regular users of NPTEL courses. Its online courses through MOOC, and concluded by proctored examinations and certifications attract large numbers of students. Its online certificates courses are valued in Industry for placement and promotion of those who complete it. NPTEL is also coordinating the SWAYAM online courses in non-engineering subjects and offered by teachers from the universities and colleges. NPTEL has now grown to be the world's largest repository and offering of curriculum oriented online courses.

A second set of developments has arisen during the last two pandemic years. Almost all institutions of HE are holding online classes and managed to continue some momentum with minimizing the deviations from their respective education calendar. The 4G smartphone network that is spread across much of the country has helped in this. However, we now have to understand issues of quality in these new technology augmented courses management.

## **2. THE AFFILIATE COLLEGES PROBLEM**

South Asia is possibly the only region where we see the affiliated colleges in large numbers. In India these colleges account for more than 75% of students enrolled in Higher Education. When Indian industry states that 75% or more engineering graduates are unemployable, they come from mostly these colleges. The poor quality of education is due to the emphasis being more on rote learning and poor access to cognitive and psychomotor skills training and capacity to work in real world situations. The assessment of students in the courses they study are conducted as university supervised written examinations. The colleges do more of coaching the students to score well in these examinations. How do we use the Internet, Education Cloud and online e-resources appropriately and effectively in the learning engagements of students in these colleges is a major challenge. Our TALCoM approach outlined in this paper shows how to address such issues and achieve better course outcomes.

In the present scenario, the affiliating university formally sets the course curriculum through its Board of Studies. There are inordinate delays of even 10 or 20 years in modernizing the curricula of approved courses in most affiliating universities. Though online classes are being held, the method continues to be coaching for the subject examinations. Hence the student records do not reflect their ability to address real world

problems, or capacity for higher order skills sets as outlined in the Bloom’s Taxonomy. In the following sections we show how we leverage the online e-resources and also necessary hands-on engagements of students in the colleges to be integrated in the teaching-learning-assessment scenarios of university courses.

## 2.1. ENHANCING COURSE DEVELOPMENT PROCESS

Presently the university Board of Studies constitutes a group of Subject Matter Experts (SME) to develop or revise the curriculum of a course. The curriculum broadly states the course objectives, topics to be covered, who may take this course, recommended textbooks, breakup of summative assessments, course duration, number of lectures and number of credits it carries. This is not adequate to guide the teacher on how we use online resources and learning engagements both inside and outside of the class hours. So, we propose to augment the curriculum with a *table of Lesson Plans*. We call this as the *Pedagogically aligned Executable Lesson Plans, or PELP*. We show next how we develop the PELP. Our reasons, as given below, for developing the PELP over and above the Course Curriculum are several.

- i. Curriculum delineates the topics that are to be taught. A well designed curriculum may also delineate the learning objectives for each topic in the course.
- ii. Curriculum may state textbooks, relevant papers, refer to video lectures like those of NPTEL, SWAYAM, and others, yet incomplete by themselves in stating the learning engagements to be managed by the teacher and engaged in by the students.
- iii. Curriculum does not readily map to assessment of credit units for the course.
- iv. Curriculum does not guide the formative assessments and feedback to students as is necessary in Outcome Based Education.

It is necessary to state in some detail how the students will be engaged in the different learning activities and assist the teachers on how to manage such activities. PELP brings the necessary academic rigour into the course design and development.

## 3. DEVELOPING THE PELP

PELP is developed as a sequel to the course curriculum development. It is formulated as a table of Lesson Plans for the course by a Course Experts Group (CEG) duly constituted by the Board of Studies. An outline of PELP is given in Table-1. There are three columns in PELP for each lesson. Their functions are delineated below.

**TABLE - 1**  
**AN OUTLINE OF PELP FOR A COURSE**

<b>Calendered Lesson Plans</b>	<b>Activities and Related content</b>	<b>Supplementary Activities (SA) (Beyond the Lesson)</b>
<b>Week-1:</b> Lesson No. ; Lesson Title. Instructional Objectives * Recall of Prerequisite	i. A short description of the Instructional Objective. ii. Brief recall of <b>prerequisite knowledge</b> (through a link to lesson in an earlier course, relevant NPTEL or other OER content). Note: (i) and (ii) will help weak students to recall prior knowledge. iii. Link(s) to <b>Motivational content (optional for study)</b> . A <i>short online optional self-test (desirable) on the prerequisite knowledge in the LMS</i> .	SAs are not to be assessed as part of the course. These are to be posed as challenges to serious and curious students, as well as help them prepare for competitive exams like GATE, or an appreciation of its use in a real world problem. Include a summary of learning

knowledge with link (selected from OER, NPTEL, other online content)	<p><b>Part-1:</b> (i) Link(s) to study material (from text book, online, supplied class notes in the LMS), video lecture, NPTEL or other online content as deemed fit. (ii) Sample worked out problem(s). (iii) Sample problem set; (iv) <b>A short compulsory Online Self-Test posted in the LMS.</b> Necessary randomization and time interval in which to complete the test need to be adhered to. (Doing Part-1 in all lessons will give a pass to the student with minimum grade).</p> <p><b>Part-2:</b> (v) Post solved problems at stipulated Instructional Objective level. (ii) Homework that may be submitted. (iii) Solve essential part of a larger problem that will be developed further in other lessons of the course. (iv) Use of modelling, tools – related problems for practice. (v) Outline of a problem or concept that will be developed in the class. (vi) A weekly assessment provided to each student over the LMS (as per the Instructional Objectives and activities).</p>	<p>from the lesson and worked out examples. Add relevant GATE or NET question or some challenging problems for serious students. Links to online content of interest like case studies, and how the lesson learnt is applied in real world. Some SAs may help teacher to engage students in innovative ways.</p>
<p><b>Week-2</b> Lesson No.; Lesson Title. Instructional Objectives * Recall of Prerequisite knowledge with link (selected from OER, NPTEL other online content)</p>	-- do --	<p>-- do -- (May encourage students to do online blogging, and discussions in the LMS)</p>
<b>Week-3, 4</b>	-- do --	-- do --
...	...	...
<p><b>Week-5</b> ...</p>	Mid-term test	Solution to mid term test posted in LMS after the test date.
<p><b>Week-k</b> <b>Summative Lesson Title with Instructional Objectives</b></p>	<p>Show how the previous few lessons together combine to solve a larger problem in the subject. A mid-term test. We may get rid of the notion of internal test. As this is subsumed by the weekly online self-tests. Encourage group problem solving. Structure similar to Lesson-1. Have Mid-Term Test.</p>	<p>Show examples of design, Virtual Lab or other Online simulation wherever feasible. More GATE/Competitive tests questions and worked out problems.</p>
...	.....	...

<b>Week-n (Concluding week)</b>	Provide worked out examples of how the several concepts taught get applied in a larger problem. Show how this fulfils the courses objective(s). Concluding examination with sensible questions that tests essential comprehension and ability of what the course is intended to impart. We may reduce the weight of the course and add more weight to weekly online tests, class group activities and mid-term tests.	Add real world problems and applications of the concepts and skills taught in the course. Add links to online courses from NPTEL, Coursera, Open EdX, etc. where interested learners may add an online certificate of value over what they learnt in this course.
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\* **Instructional Objectives need to be focused and prescriptive towards assessable activities.**

- i. For each lesson, the first column states the lesson sequence number, title and *the Instructional Objective, or IO*. IO is stated prescriptively as the knowledge and skills that the student shall exhibit on completion of the lesson. It also provides link(s) to any prerequisite knowledge that the student needs to have for carrying out the stated lesson activities. It may add links to any optional motivational content to help the eager and weaker students.
- ii. The second column lists the sequence of learning and assessment engagements in the lesson that teachers and students broadly follow during the course progress. This may be shaped according to the chosen pedagogy. This column also determines the estimated student-hours put into the lesson activities and associated part of the credits estimate.
- iii. The 3<sup>rd</sup> column provides for supplementary activities and exercises that interested students perform. Teacher is more of a guide to the students while they carry out these activities. For assessment and grading purposes the activities pertaining to this column are not necessarily counted.

We may note that the PELP is like a ‘software program’, with the difference that, instead of a computer, it outlines the sequences of activities to be performed by the teacher and the students using LMS, classroom, lab, online resources and OERs. It includes activities done in the class, demos, practical, and done by students outside class hours as guided by the Course LMS. The lessons may include component activities that use visualization, virtual labs, Virtual and Augmented Realities, use of recent developments like Metaverse for study, illustrations and collaboration.

***The PELP will evolve over the semesters and we need to support it with version control.*** So we propose using any readily available document version control (DVC) system. We may use any one of the DVC available from Drop Box, GitHub, Git and many others. Further, the approved current PELP is also posted in an university/institute Wiki, or as open web publication with associated blog. Mediawiki that is used for Wikipedia and mounted in a university or college server is excellent for this purpose. Wiki has the advantage of keeping memory of past postings and edits. It may be edited by the instructor as and when necessary to correct errors. PELP will also help in setting up the Course LMS like Moodle that will be used in the colleges to conduct the course.

#### **4. THE TALCOM SETUP**

Given that the PELP is developed by a duly nominated group of Subject Matter Experts (SME), the first step is to configure the university’s Course LMS as the reference for the colleges. Each teacher assigned to teach the course in the respective colleges is registered as a ‘student’ in this LMS. The SME is assigned the role of ‘teacher’ in this LMS. The TALCoM setup for the course is illustrated in Fig. 1. It illustrates the three sets of processes required for each course as three ‘life cycles’ – to borrow the phrase from management. Each of these life cycles have its own suite of processes that are outlined in the PELP.

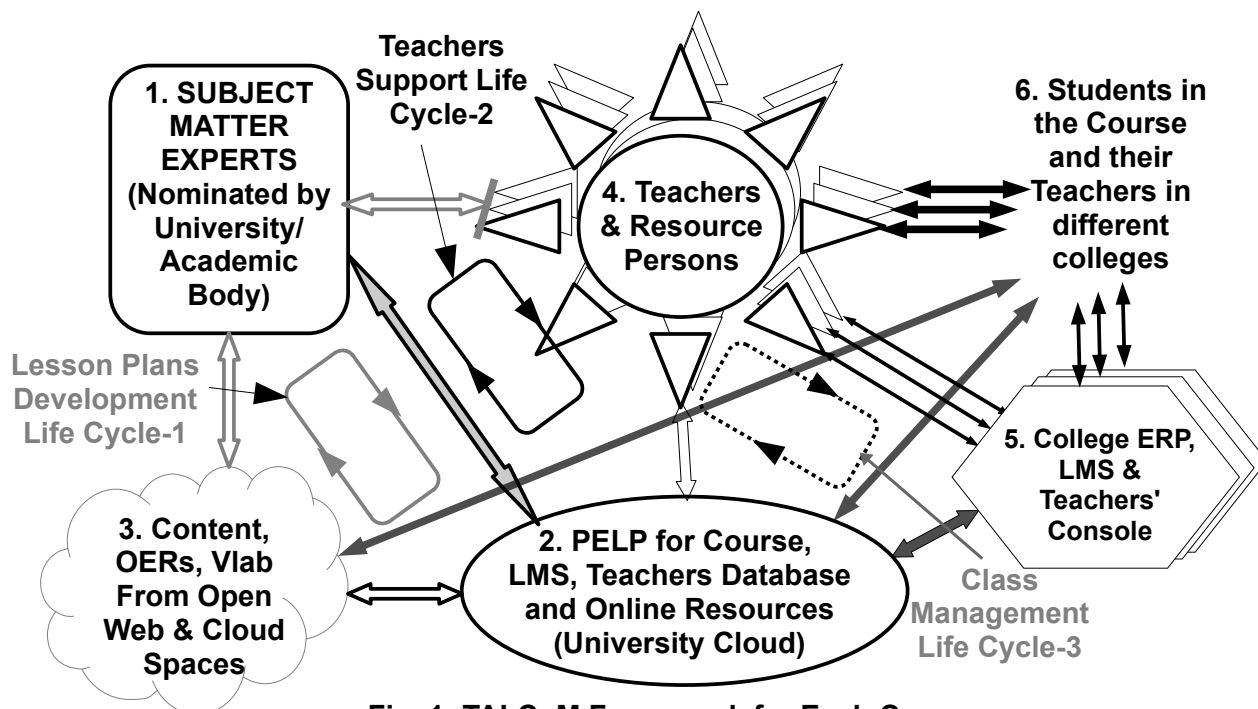


Fig. 1: TALCoM Framework for Each Course

- i. First is the *PELP Development and maintenance Life Cycle*. This is done, maintained and updated by the assigned group of concerned Board of Studies (BOS). The approved current version is posted in the PELP Wiki of the university for access by the college teachers. The version under development may be posted in GitHub, Dropbox, or similar version controlled documents management system (DMS). We recommend that the DMS is hosted in the university cloud.
- ii. Second is the '*Teachers Support Life Cycle*'. The SME will configure and set up an online LMS (we recommend MOODLE) set over the university cloud for the college teachers. They may conduct '*Proficiency Certification of Teachers*', or *PCT*. Further, this will also support the group of teachers in the colleges who are currently teaching the course. Such live support will add much to the confidence of the teachers and enhance the quality of students learning engagements.
- iii. *Third is the Class Management Life Cycle*: Here the teachers configure and set up the course as per the PELP in their respective college LMS. This is to be supported by the individual colleges for their respective assigned teachers and class students. Such LMS also support the mobile-learning environment for the students and teachers in the course.

The three life cycles of TALCoM together provide for a vastly improved education management system at each course level across all the colleges under an affiliating university. They provide for a vastly enhanced quality assuring university academics management across a network of its colleges. The same TALCoM model may adapted to skills education, and community education across clusters of collaborating institutions and organizations. The Commonwealth of Learning may adapt and adopt this TALCoM model for its courses and training programs in the Commonwealth Countries.

With TALCoM, the university's Quality Assurance Cell (QAC), Board of Studies and roles of the Teachers Training provided under its Academic Staff College – all get much more enhanced. With some disciplined management of TALCoM for each course that is taught across the many colleges facilitates Outcome Based Education. The advantages of the TALCoM method of running a course are several as given below.

- i. The PELP development helps the university to revise and modernize its course curriculum. This overcomes the situation at present wherein most of the affiliating universities in India have not done this for many years.
- ii. PELP, being the central template for delineating the sequence of lessons, and how each lesson is conducted, is readily aligned with the chosen pedagogy.
- iii. Teachers in colleges are trained and certified as a part of the course launch process under the TALCoM. This will be a big relief to most colleges in the small towns and districts where they do not get enough experienced teachers.
- iv. Online OERs and other relevant OERs as relevant to the course get well integrated into the activities of each lesson. Advanced resources like uses of simulation, data visualization, relevant computation, new modes of learning engagements using VR, AR, relevant data analytics may be introduced over time.
- v. TALCoM may be adapted to drive any mode of course delivery: Conventional classroom and testing, MOOC mode, Flip Class, Blended learning, for lab and field work types of courses, and those involving programming, data sciences and analytics.
- vi. TALCoM brings the much needed academic rigour and discipline in the ways we manage a course delivered through a network of colleges.

The key to the unified approach of TALCoM is the PELP. PELP may be adapted to any mix of pedagogy and the course delivery that is compliant with it. Whether it is the traditional classroom, homework and tests type, it is online classes with problem solving class hours (i.e. the flip class model), the MOOC method, different blended models, or lab courses, etc., by developing the appropriate PELP, we shall be able to conduct the course using the TALCoM approach.

#### **4.1. IT REQUIREMENTS FOR TALCoM**

The university needs to establish and manage its own Education Cloud. It may take the cloud space from providers like IBM Red Hat, Amazon Web Services, Google Cloud, Microsoft Azure and such others. Or it may choose to set up its own Linux Servers, Kubernetes and containers as may be needed for the cloud. The key IT requirements for the university as well as the colleges are: (i) A university Database of Teachers of the chosen courses across its colleges; (ii) An LMS – Moodle is well suited for hosting the course details, and primed with course relevant database of teachers of colleges under the university, and those of registered students of the course in each college; and (iii) Online open access web and blog pages for publishing course related details, the PELP, relevant blogs, etc.

### **5. PROGRESS IN TALCOM DEVELOPMENT**

The TALCoM initiative was first proposed by the author in the annual meeting of Vice Chancellors under the Association of Indian Universities [6] in Feb. 2019 that was held in Bhubaneswar, India. Subsequently a paper on how to do this was circulated to the participants. This itself is a sequel to the author's report to the IT@Colleges committee under the Kerala State Higher Education Council submitted in 2025 [7]. This was followed by a meeting of the Vice Chancellors and Directors of universities and institutions in the State of Jharkhand in India held in Oct. 2019. All present in the meeting agreed on the need for such an initiative. A project proposal titled the 'Jharkhand Education Grid' was submitted to the Government of Jharkhand. This

is being discussed and the modus operandi being worked out with the seven state affiliating universities of Jharkhand. Following the developments in Jharkhand, an adapted proposal is being submitted to the Ministry of Education, Govt. Of India to commence a pilot implementation for two courses each across 4 state affiliating universities. To ensure effective implementation of the Education Cloud in the universities, the services of ERNET India under the Ministry of Electronics and IT (MEITY) are being solicited.

Interested academicians and management of colleges in the countries associated with Commonwealth of Learning may contact the author for TALCoM like developments through email: [srivathsan.kr@gmail.com](mailto:srivathsan.kr@gmail.com)

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