

Experiences in Online Teaching of Supply Chain Management course

S G Deshmukh

Professor, Mechanical Engineering Département, Indian Institute of Technology Delhi
New Delhi 110016, India
deshmukh@mech.iitd.ac.in

Prem Vrat

Pro-Chancellor, North Cap University, Gurugram
Gurugram, India
premvrat@ncuindia.edu

Abstract

Supply Chain Management (SCM) has assumed a significant interest both for academia and industry. The course on SCM attracts a wide interest from the student community, especially from institutes like IITs. Typical principles of quality management like customer focus, team working, involvement of all and continuous improvement were utilized in the design and implementation of a course on SCM at IIT Delhi. Typically, the course used to be offered in physical mode. However, with Covid-19, online teaching became the “new normal”. The SCM course is no exception to this. The present paper is an attempt to share experiences while teaching the SCM course in the online mode. Students responded to the challenge of self-managing teams and empowerment. Several improvements regarding the content and delivery were introduced for the course based on a PDCA philosophy of continuous improvement. Various editions of the course (like before the Covid-19 pandemic, and post Covid-19) offered various challenges as well as opportunities for the enhancing teaching-learning process. The paper concludes with a discussion of various implications for pedagogy.

Keywords

SCM, TQM, Customer focus, Improvement, Information flow, Teaching-learning process, Pedagogy

1. Introduction

The Coronavirus 2019 (COVID-19) pandemic has caused extraordinary challenges in the global education sector. Most countries temporarily closed educational institutions to contain the spread of the virus and reduce infections. In India, the move to online teaching and learning methods accelerated because of the physical closure of universities and university colleges in March 2020. IIT Delhi was no exception to this.

IIT Delhi is one of the leading institutes of technology in India. It has also been recognized as an Institute of Eminence by the Ministry of Education, Government of India. IIT Delhi offers various undergraduate and graduate programs through academic units such as departments and centres. The Mechanical Engineering Department (MED) of IIT Delhi is internationally renowned. In recent QS ratings, it stands at 64th rank globally and 2nd rank in India. MED offers various undergraduate and postgraduate programmes besides doctoral programmes. IIT Delhi follows a semester system. Typically, in a semester, about 55-60 courses are offered by MED under various academic programmes. Each course is codified. One such course is MCL756: Supply Chain Management.

This paper is a report on the author’s experiences in teaching this course, in online mode, especially during the pandemic period due to Covid-19. The course on SCM was introduced following an extensive curriculum revision exercise carried out in 2003-2004 at IIT Delhi. Accordingly, the course was offered for master’s students of Industrial engineering (MEE) in 2004. The course was a core course for the MEE. Students of other disciplines used to take this course as an elective.

Curriculum revision is a periodic exercise at IIT Delhi. The last revision was carried out in 2013-2014. The course on SCM was relabeled as MCL756. It was offered as an elective to various programmes of MED). Interestingly, the undergraduate students (generally their final year from various disciplines, not only Mechanical!) started opting for this course.

It was intended that the course seeks to utilize the philosophy and techniques of quality management in course design and pedagogy. To this end, students are invited to establish a partnership with their instructor for the achievement of course objectives. Students are expected to actively participate in the setting of goals and in creating the environment within which these goals can be achieved. A limited version of self-managed teams is also utilized. Finally, a continuous process evaluation and improvement mechanism are instituted which shall act as a feedback mechanism.

The objectives of the course are to enable students to:

- CO1: Understand the basic integrative philosophy of Supply chain
- CO2: Develop effective approaches for designing and managing supply chains
- CO3: Understand the impacts of inventory, transportation, and information on the management of SC
- CO4: Apply various quantitative /qualitative tools and techniques for successful management of SC
- CO5: Understand the role of risk in SC and various mitigation strategies
- CO6: Expose to good practices in the implementation of SCM

2. Literature

The principles around which the course was designed:

- Quality contents in line with contemporary developments.
- Team working and syndicate exercises
- Focus on softer aspects of SCM
- Continuous process evaluation and improvement.

The contents of the course were designed based on the literature, feedback from experts and interactions with industry. Various efforts available in the literature were also consulted.

In one of the pioneering efforts, Johnson, and Pyke (2000) established a framework for the teaching of SCM. Table 1 presents a summary of key contributions to teaching SCM.

Table 1. Key contributions to teaching SCM

Sn	Researcher (s)	Key contribution
1.	Johnson & Pyke (2000)	Developed a framework for courses in SCM. A good Initiation on the teaching of SCM
2.	Ozelkan, & Rajamani (2006)	Proposal for an effective process-based framework for teaching SCM
3.	Gravier and Farris (2008)	SC education must be based on strong ties with the industry
4.	Soni & Kodali (2013)	Need for an International perspective while teaching SCM
5.	Blanchard (2014)	Articulation of complex skill requirements for professionals in SCM
6.	Birou et al. (2016)	Guidelines for teaching purchasing & SC
7.	Mishra et al. (2020)	Online teaching-learning in higher educational institutes during the lockdown period
8.	Petra et al. (2020)	Categorizes the focal SCM/OM generic skills and pres3nts guidelines on how these skills can be adopted and implemented in SCM/OM study programs.
9.	Ferguson & Drake (2020)	The teaching of risk in pandemic driven SC and the use of classroom examples
10.	Folinas et al. (2020)	Highlighted use of simulation in Teaching Key Supply Chain Management Concepts
11.	Al-Shammari (2021)	An exploratory study on students' learning experience in a

		supply chain management course at a Bahrain university emphasizing cognitive, affective and interactive skills
12.	Birou et al. (2022)	Issues such as content, coverage, assessment, and gaps were analyzed regarding undergraduate courses on SCM
13.	Perrine & Curkovic (2022)	Proposed a Framework for Continuous Improvement in Supply Chain Management Education
14.	Lutz et al. (2022)	Surveyed graduates' courses on SCM for coverage, contents, and gaps. The aggregate number of topics covered in undergraduate courses totalled 95, while graduate courses covered 81 different topics. The primary evaluation techniques include traditional exams, projects, and homework.

It is a widely accepted view that a process view is needed while implementing SCM. The process view is also useful while adopting a framework for teaching the course on SCM. It is interesting to relate the process framework with industry standards, The Association for SCM's supply chain operations reference (SCOR) model was developed to demonstrate the need for integration across an organization's supply chain. The SCOR model has been adopted by several leading companies, including many of those in the Gartner Top 25 SCM (Intel, GE, Cisco, IBM Unilever etc.) The SCOR model is extensive and being practised by the industry as a de-facto standard used for the breadth of content coverage in the SCM syllabus.

Table 2. SCOR based content coverage of topics in SCM

Sn	Process	Content coverage
1.	Plan	Planning, Strategic issues, Inventory Planning, Forecasting, Demand Analysis, Supply Chain design, Network design, Risk pooling
2.	Source	Sourcing decision, Kraljick's portfolio, Various relationships for sourcing (Arm's Length, Collaborative, partnership etc.), Supplier selection/evaluation, Sustainability, JIT/ VMI, Green issues
3.	Make	Benchmarking, make-vs-buy, outsourcing
4.	Deliver	Transportation, Logistics, 3 PL, warehousing, location analysis
5.	Return	Reverse flow, Various Circular Economy models
6.	Enable	Systems, ERP, IT support, Blockchain, Information sharing, Human element, performance measurement

As seen in Table 2, the course encompasses the full range of SCM-related issues, including supply chain planning, design, and implementation. The SCOR based approach allows the contents to be woven around six fundamental processes in any supply chain, namely- Plan, Source, Make, Deliver, Return and Enable.

The following are the salient features of this course: a) Curriculum designed to sensitize about the integrative philosophy of SCM, b) Focus on process orientation as exemplified through the SCOR based coverage, and c) Emphasis on Learning-by-doing. The course must plan for the achievement of an "application-level" understanding of key SCM concepts. The following aspects were kept in mind to have an all-round course content:

- The course must contain small group activity, preferably incorporating self-managed learning, including at least one in-class group presentation followed by syndicate exercise.
- The course must contain a fair and valid mechanism for grading. At least 60 percent of the grade must be based on group or teamwork
- Tests/assignments must be evolved so that students get an opportunity to demonstrate achievement of course objectives.
- The course must have a substantial "real-world" component.
- The course must have a process evaluation/ continuous improvement mechanism.

3. Details of the course

3.1 Administration of the course

As described earlier, initially the course used to be taken by master’s students in Industrial Engineering (MEE). Later, looking at its relevance and importance from the placement point of view, the course was also taken by undergraduate students of the ME1 and ME2 programmes. The offerings are conveniently marked as Edition I to Edition V for further consideration. This means Edition I refer to the course offered in the period Dec 2019 to May 2020. The Covid -19 started during this period. About 75 % of the course coverage was done in physical (an offline mode). The national lockdown was declared on 22 March 2020. The remaining (25%) portion of the course was delivered online. This was in an asynchronous mode with powerpoint and other resource material made available through digital mode. Editions II to IV were completely online. MS Team was used a digital platform for administering the course. The examinations were also online. These were administered through a state-of-the-art Learning Management System (LMS) such as Moodle (table 3).

Table 3. Enrolment and mode of the course

Sn	Year (Semester)	Edition	Period	No of the students enrolled	Mode
1.	2019 (II Semester)	I	30 Dec 2019- May 2020	63	Offline (75%) -partly online (25 %)
2.	2020 (I Semester)	II	28 Sep 2020- 13 Jan 2021	56	Online (100%)
3.	2020 (II Semester)	III	3 Feb 2021- 16 May 2021	71	Online (100%)
4.	2021 (I Semester)	IV	9 Aug 2021- 24 Nov 2021	68	Online (100%)
5.	2021 (II Semester)	V	3 Jan 2022-14 Apr 2022	62	Contents Online (100%), - examination (30%) offline in physical mode
Total students				320	

3.2 Class process

In the offline mode (Edition I), the class was highly interactive. The instructor introduced the topic and gave a basic background. This was followed by general discussion and active participation by students. Since students have seen industry after their practical summer training, they were able to correlate practical experience with the SCM concepts taught in the class. The instructor provided several “individual”, “small group” and “whole class” exercise options (For example- “Bull-whip effect”) selected from a variety of sources. Small group exercises were generally preferred over whole class activities. Individual exercises were selected only once or twice; the class argued that there was no need to use class time for these and interested students could take the relevant handouts and do the exercise on their own. Similarly, longer exercises were selected less often than shorter ones. The class seemed to enjoy these exercises and reported them to be among the most educationally useful of all classroom activities. Most of the exercises generated considerable enthusiasm.

In the online mode, the challenges were different. Table 4 presents key attributes on which online and offline modes differ. Switching from offline mode (The pre-Covid-19) to online mode (during Covid-19 and after the third waw of Covid-19) was a big challenge for the instructor. It was a “Management of change”! Adjusting to the camera-driven platform, absence of real students, connectivity issues, non-observance of the body language etc. were some of the issues that the instructor must grapple with!

Table 4. Difference in online and offline teaching

Sn	Attribute	Online	Offline
1.	Location	Anywhere (digitally available)	Physical rooms. Students have to attend classes in a physical location (at IITD, Lecture Hall Complex)
2.	Type of content	Visual content is more valuable.	Contents from books, notes, copies etc.

		Online interaction through chat, WhatsApp/social media	The teacher interacts with students and social engagement both in and out of the classroom as a virtual support
3.	Teacher-student interaction	opportunities for understanding the body language of the students are missing. Similarly, a student also may not have opportunities to observe the body language of the teacher!	F2F (face-to-face) interaction helps to understand and interpret students' body language thereby providing an instant feedback mechanism!
4.	Peer-to-peer interaction	Limited, mostly online	Peers can interact in hostels, social meeting platforms like café/hostel/sports ground etc.
5.	Communication	Communication happens digitally/virtually	Communication happens physically F2F(face to Face)
6.	Focus	Facilitation and asynchronous	Instructional and synchronous (instant)
7.	Flexibility	Students can watch the recorded sessions anytime, anywhere	Less flexibility. Limited by space and time coordinates
8.	Examination	Online, Limitations on open-ended questions (which may be difficult), Proctoring is a challenge	Open-ended questions can be asked to test creativity, Proctoring is easy
9.	Practical hands-on	Not possible	Practical hands-on possible while being physically present in the classroom,
10.	Technological challenges	Connectivity is an issue in remote places, bandwidth	With well-equipped classrooms, technological challenges are minimal
11.	Miscellaneous	Online education may not offer opportunities for sound mental and physical health, feeling of isolation	Physical education offers opportunities and can contribute to mental and physical health, Social interaction promotes team spirit

Given the requirements of the course, the following initiatives were taken in the online mode:

- a) An extensive dossier was developed and made available to students at the beginning of the semester. This dossier contained the following: Introduction to the course, Focus of the course, The Course Objectives, Prerequisite skills, Course delivery platform, Expected outcome competencies, Outline of the contents, Free online resources, TedX/TED sessions, Recommended books, Evaluation mode, Contact details of teaching assistants etc.
The dossier was like a blueprint of the course. It was followed meticulously.
- b) In an online mode, one must accept the fact that students have multiple sources by which they can gain an understanding and appreciation of the course. A wide variety of online resources were catalogued and offered to students. The use of TED/TEDx can be a significant and engaging component of pedagogy.

3.3 Evaluation mode

A continuous evaluation scheme, typical of any course at IIT Delhi was followed. This comprises various components of evaluation: quizzes, Midterm test, Major-test, and assignments. The evaluation was at two levels: as an individual and as a team. The individuals were free to choose the team members. The teams were also required to identify themselves with innovative team names in line with the spirit of SCM. In practicing world, one must work in a team. The idea was to inculcate the spirit of team working and them to expose to the real world. The weightage of 65: 35 for the individual: the team component evolved after 2-3 iterations and feedback from the students.

In each assignment, the team members were required to explicitly write their contributions and learning as an individual and learning as the team. Each assignment was carefully designed to bring out the understanding of concepts and frameworks. There was a mix of both qualitative and quantitative elements in the assignments. For each question, the word limit was defined. In case, the word limit was exceeded, a penalty was imposed. The idea was to get pointed and sharp responses from students.

Students were required to do a mini project based on various themes learnt in the SCM course and with the philosophy of applying these ideas to a real-life situation. This was an action-based exercise where the team puts the knowledge gained in this course coupled with knowledge /experience gained elsewhere into practice with an implementation viewpoint. Students were required to demonstrate the use of various frameworks covered in the course (such as Push/Pull view, Fisher’s framework, Kraljick’s framework etc.). The report required a table indicating the specific contributions of each team member. The team was also required to send powerpoint presentation (not more than 10 slides) about the project. In addition, the team was also required to upload a video (not more than 4 minutes in duration) highlighting the outcome of the project. The link to the video must be given in the report. All the presentations were uploaded through Moodle for the consumption of the entire class.

3.4 Student evaluations of the course

Overall, the effort described here resulted in a positive experience, both for the instructor and the students. Student evaluations were very encouraging. Additionally, the instructor developed several questions focused on SCM concepts, which were administered to the classes. These results are consistent with remarks made informally by the students throughout the semester. While these data do not demonstrate long-term retention of SCM concepts and theories or lessons in SCM derived from the class process, they seemed indicative of a more positive experience for students than in a traditionally organized course.

Even without formal feedback mechanisms, instructors can and do actively seek out feedback on their own. The time-honored approach is to evaluate quizzes, problems, and other assignments. Quizzes and problems, however, often tap only limited aspects of learning: in particular, it is often hard to tell from them how well students can make the connection between theoretical ideas and highly simplified examples to real-world applications.

However, mini-projects that require the real-world application of SCM tools, provided excellent feedback, especially on misunderstandings of concepts/ideas, in slightly difficult areas such as Bull-whip effect or ground level difficulties in handling Covid-19 challenges in SC. Appendix II presents an indicative list of projects undertaken by the students. Students liked the idea of working in group, preparing a report, preparing a powerpoint presentation and a video on the outcome of the project.

3.5 Application of PDCA cycle

The PDCA cycle, proposed by W.E. Deming, is a quality template to enhance the effectiveness of activities (Sangpikul, 2017). It was first used in the field of quality management. It was later applied in many areas of management and has achieved good results. The PDCA cycle is a well-established process framework which focuses on continuous improvement. The PDCA Cycle comprises four phases: Plan, Do, Check, and Act (or improve). Concerning teaching a course such as SCM, PLAN means to plan a course (its objectives, evaluation plan, organization of reading material etc.) while DO is to teach in sessions, assign work, or instruct students on how to do an activity; CHECK is to assess and make a mid-course correction (if required) and ACT is to make improvements. Improvements were necessary since we did not have much experience in the online teaching of the course. The prevailing Covid-19 environment also prompted to improve. Table 5 gives application of PDCA cycle to the course.

Table 5. PDCA cycle as applied to SCM course

Sn	Phase	Brief Description	Comments
1	Plan	Course plan shared with students at the beginning of the course	Gradually the Course dossier became the blueprint, students knew beforehand the content, pedagogy, evaluation scheme and the supporting resources
2	Do	Actual delivery of the content	Done through online platform MS Teams coupled with LMS like Moodle
3	Check	Mid-semester feedback and end-semester feedback	The midterm feedback was shared with students, mid-course corrections like introducing new topics, etc. were incorporated. End-semester feedback acted as a

			starting point for improvements
4	Act	Improvements	Adding new content, making content contemporary, increasing/decreasing of weightage of assignments/tests/mini-projects

Table 6 gives the improvements done over different editions of the course as an application of PDCA cycle.

Table 6. Improvements carried out

Sn	Edition	Improvement over the previous edition	Comment
1.	I (2019-II Sem)	-	Organized well Offline mode Intense interaction Taken as a baseline course
2.	II (2020- I Sem)	Asynchronous modes, sessions through MS Teams Attendance rule abolished Exams MCQ based	Organized in an ad-hoc manner, Environment full of negativity Examination questions were rudimentary
3.	III (2020-II Sem)	Examination through Moodle involving Small cases on Indian Organizations tackling the Covid challenge introduced Exam MCQ + Open-ended questions	Accepted the fact that online is going to be the way of teaching-learning
4.	IV (2021- I Sem)	Other online resources used (like NPTEL, Moocs courses) A few TED/TEDx talks introduced Focus on FMCG and cold SC Introduced Circular Economy models economy because of COP26	Organized well Developed question bank Making material contemporary and in tune with changing times
5.	V (2021- II Sem)	Expanded TED/TEDx talks as an additional resource Focus on resilient and tolerant SC Assignments with a focus on Covid response Introduced disaster SC in view of the Russia-Ukraine war Offline exams allowed the use of long descriptive questions	Extensive question bank Comfortable in handling online mode Developed a mature set of assignments and evaluation scheme Developed rubrics for every assignment

4. Competencies expected

One would expect to enhance his/her competencies in various domains after undergoing the course of SCM. At the end of the semester, what do we expect students to learn? Getting good grades (marks) is just one outcome. However, as an investment of about 36 hours, one would expect the students to gain the following competencies.

4.1 Familiarity with various terms used

Typically, a course exposes students to about 90-100 concepts in a course (see Bouru (2022) mentions about 95-100 concepts in an undergraduate course). It is expected that students are thoroughly familiar with at least 50 % of the concepts in SCM.

4.2 Appreciation of various frameworks

The course exposes students to various frameworks (such as Push-pull, Kraljik's framework, Fisher's framework, SCOR framework etc.). It is expected that the students gain an appreciation of these frameworks in understanding the whole gamut of various processes as envisaged in the SCOR model.

4.3 Ability to articulate justification

It is expected that students will be able to justify various decisions in SCM. This decision could be based on sound articulation via a set of arguments and/or with some quantitative analysis. The following are indicative of such situations:

- i. Justification for Make-vs-Buy
- ii. Justification for use of selective inventory control (like ABC, FSN, VED etc.)
- iii. Justification for forecasting method (say exponential smoothing vs moving average vs liner/non-linear regression etc.)
- iv. Justification for cross-docking
- v. Justification for selection of transportation mode(s)

4.4 Able to relate to good cases

The students should be able to relate to best practices /leading examples of successful SCM. The students are exposed to the practices followed by Best 25 SC (such as Cisco, Amazon, P&G etc.) as published by the Gartner group. The students are also exposed to leading examples in Indian settings (like Amul, Patanjali, Parle, etc.)

4.5 Understand the complexity

It is the management practice that is relevant from the implementation point of view. Any implementation (whether it is the SCOR model, a typical transportation model etc.) requires an acute understanding of the context and culture where it is to be applied. The complexity in SC could be due to the following: Scale, Size, Scope, Speed, Skillset, Mindset etc.

Students were exposed to each of these.

4.6 Enhancement in skillset

The course is designed in a way that it acts as a launchpad for students who will be opting for a career in SC, Logistics etc. It is expected that students should also enhance their soft skillset. According to Bak et al. (2019), the changing competitive global environment indicated the increasing need for supply chain soft skills with emphasis placed on behavioral, decision making and management skills as critical in soft skills. Specifically, behavioral skills such as communication, planning, initiative, and negotiation were seen to be more important when compared to decision-making, negotiation, and management skills. The changing supply chain scope encourages the requisition and development of different supply chain soft skills with varying levels of emphasis on 15 soft skills identified in the literature. Table 7 presents these skills and the mechanism by which these are to be enhanced.

Table 7. Soft Skills Expected

Sn	Skill	Evidence through
1.	Problem-solving	Various numerical assignments, case studies, role-playing
2.	Planning skills	Planning for team, deadlines
3.	Flexibility	Accommodating team members
4.	Organizational skills	Organization of team, reports, presentations
5.	Communication skills	Short reports, ppt, Video presentations, assignments
6.	Time Management	Timely submission of term work,
7.	Motivation and Enthusiasm	Keeping the morale of team members
8.	Stress Management	Working with tight deadlines and managing submissions
9.	Initiative	Initiative in-class participation, the novelty of themes chosen
10	People Management	Keeping the team together, complementing each other,
11	Collaborative learning	Syndicate exercises, Mini Project,
12	Teamwork	Team submission of assignments, Mini Project
13	Leadership skills	Exhibition of leadership traits in class, teamwork, liaison with alumni
14	Management of complexity and change	Sensitization about the complexity due to size/scale/scope etc, VUCA environment, especially due to covid-19
15	Negotiation	Negotiate about the deadlines, interact with alumni etc.

5. Role of students

One dilemma comes up about identifying the student's role. This question is especially important in an online mode. Is the student the consumer or the producer?

Student-as-a-consumer: The perception of "consumer" is a buyer of a product or service. Students take classes, consume meals, buy books, and use many services for which they pay tuition and fees. The student certainly fits this definition of the word "consumer". The student is buying a professor's course and has the unmistakable right to expect, certain things for his/her money: Relevant course content, fairness, access, expertise, and a reasonable learning situation. Most frequently, external consumers have the freedom to choose their supplier, and in fact, they do so. This is not true for internal customers in an educational institute like IIT Delhi.

According to McCulloch (2009), the 'student as consumer alone' is inadequate because it:

- i. overemphasizes one aspect of the student's role and of the university's mission.
- ii. suggests undue distance between the student and the educational process, thereby de-emphasizing the student's role in learning.
- iii. encourages passivity on the part of the student.
- iv. fails to encourage deep learning.
- v. implies in the student a level of knowledge and information, and the possession of tools to use them, that are unlikely to be present.
- vi. compartmentalizes the educational experience as 'product' rather than 'process'; and

As rightly observed by Gupta et al. (2021), student-teacher duality implies that the overall quality of teaching-learning is dependent on both -the teacher and student quality.

Students are both the consumer and the co-producer: Clearly, the teachers' most important customer is the student. A student does not only consume the final product (therefore, are customers), but also participates in its production (therefore, is a co-producer or employee). It becomes evident that the student is not the product. The real product is the learning of the students (Sytsma, 1996). Learning is a team effort between the teacher and the student. Jointly, they produce a product, that is the learning for the student. Both parties are responsible participants in that process. Broadly speaking, it is a multi-faceted effort on the part of all constituencies -- students, parents, alumnae, the community, and the faculty.

Table 8 depicts a variety of co-production activities (both in the classroom and out-of-the classroom). It may be seen that out-of-the-classroom co-production activities assume predominance in the online mode.

Table 8. Student co-production activities related to learning/teaching*

Type		Activity
Out-of-class co-production	Individual activities	Studying for tests/quizzes
		Reviewing class notes/presentations
		Consulting Teaching assistants
	Group based activities	Participating in group assignments
		Participating in group mini-projects- preparing reports, preparing presentations, preparing videos
In-class co-production		Class attendance Notes taking Asking questions and participating in discussion Behavior towards other students in the class

*Adapted from Kotze and Plessis (2003)

This fact coupled with the following points, tempts us to take a view that students are also co-producers.

- i. Continuing advances in digital technologies, social media, and mobile devices such as smartphones/tablets give the student much more control over access to and the creation and sharing of knowledge. This empowers students and helps to increase their motivation and engagement. Digital media, YouTube videos such as TED talks and,

increasingly, open educational resources in the form of animations, simulations (for example Bull-Whip effect), virtual labs enable instructors and students to access and apply knowledge in a wide variety of ways.

- ii. The Online mode provided flexibility and wide access to resources (such as NPTEL quizzes, Tedx, YouTube videos etc.) and experts (Not only IIT Delhi, but NPTEL courses offered by IIT Roorkee, IISC Bangalore etc.).
- iii. In the online mode, the instructor is no longer responsible for delivering all of the contents or even providing all of the sources for learning. He/she may be perceived as facilitator and assessor of the learning.

The teacher based on his/her experience and expertise as a producer is the one who develops the plan for learning and the course content. The student, as a co-producer and consumer, will focus on the teaching & learning process.

If a teacher views the student as a consumer, he/she will be more tolerant, more interested in implementing ways to improve the learning process, more accessible, and more student friendly. A teacher needs to empathize with students, especially during Covid-19 time.

We feel that all the above perspectives, student-as-a-consumer, and student-as-a-co-producer are valid in online teaching mode.

6. Observations and Insights

- a) In a typical offline course, there is a discipline (due to attendance requirements, regular physical interaction with teacher/teaching assistants etc.) in the teaching-learning process. This discipline guarantees that learning takes place regularly. However, this type of discipline is difficult to visualize in an online mode. However, if the teacher engages the students in interesting activities, a learning efficiency that is like that of the offline mode may be obtained. As a result, an online curriculum must also force students to learn via reasoning and to work independently on homework assignments while a teacher monitors their progress. The idea behind assignments and mini projects was to engage students in meaningful activities.
- b) The target audience for the course was final-year undergraduate students and master's students. The course contents (assignments and other activities) were redesigned in such a way that these students will be able to work independently and without much support in a typical classroom mode. It was felt that the online mode delivers cost and time effectiveness and presents opportunities for live engagement, high-quality learning, and more practical knowledge. Many studies have shown that students are found to be more focused on their studies in the institute/university environment. Environment plays a major role in the concentration and focus of the students. Though the Online classes during the Covid-19 provided the liberty to students for attending classes from their own space, this also reduced their focus and concentration.
- c) In industry, the basic principles of SCM are meaningful and directly applicable. However, the implementation of the same in the classroom environment (online or offline) presents various difficulties. A classroom is not a collection of employees; rather, students may be viewed as customers. One may designate students as the consumers of the services of the organization. The other major difference between a class and a workgroup is the time limit of the former, which in turn engenders low levels of commitment and inter-personal interaction among fellow students. These differences require that each SCM principle be examined from the perspective of the classroom. For example, students as customers pay money to buy a service with which they expect to satisfy their need for learning. Unlike customers of many other services, however, the satisfaction of one's need for learning turns out to be at least as dependent on how hard one works as on the "quality" of instruction "consumed". In graduate classes especially, not only one's learning outcomes but also those of fellow students often depend on how hard each works. The class disciplines also require that students must attend classes and submit assignments at fixed times, be subjected to rewards and penalties based on performance evaluation, and generally do what they are told to do - they begin to look a little like "employees"!
- d) The author switched to online teaching without any time to learn the technology, or standard quality online teaching practices. We had many years (more than 30 years!) of experience teaching in-person, and we had developed pedagogy, lessons, and interactive elements around the offline mode of learning. We had very little experience teaching online. Shifting from offline to online mode was a challenge for both students and teachers.

The students' experiences in these online learning environments, which were thrown together at the last minute, are not necessarily indicative of students' experiences in a quality online course based on principles from Quality online education!

- e) The students expressed in informal ways that online teaching with a lack of social interaction leads to reduced learning space and lower levels of motivation and well-being. Concerns about lack of face-to-face contact may have been aggravated by the stressful situation due to Covid-19. Face-to-face interactions provide the foundation for social communication, the lack of which can be viewed as a disadvantage of the online mode. Face-to-face interaction may be crucial for students who are expected to have good communication skills while implementing SCM initiatives (these are especially desired for SCM professionals!).
- f) The basic strategy in the online environment consisted of transferring a substantial portion of the power of the instructor to the students, allowing them to structure the learning environment and make many decisions concerning the course (choosing teammates, choosing the topic for the mini-project etc.). Overall, the students were satisfied with the online teaching, although they experienced self-perceived reduced learning outcomes compared to the pre-pandemic situation. It appears that they adapted quickly to the new situation, but they also reported difficulties with the transition to new teaching methods. Based on personal interactions with students, the most important concerns among students were a lack of social interaction, technological challenges such as insufficient data bandwidth, and a sense of reduced motivation and effort. The application of the online pedagogy implies a paradigm shift from the view of students as passive consumers of information to active participants in the achievement of their educational goals through the notion of the empowered customer, especially in an online environment when there are no requirements of attendance! However, it may be noted that the empowerment of students can result in a much greater burden on the teacher who must be fully prepared to implement any one of the numerous options he/she makes available for the students, especially in the online platform. The teacher must acquire competencies in many different formats for the conduct of classroom activities (from lecture to discussion to managing and processing online group exercises).
- g) Shifting from an offline to an online environment required the acquisition of a new skill set for the instructor. The supply chain of the online environment involves extreme close coordination and cooperation of various agents involved- the computer service centre (through which MS Team is administered), Teaching assistants, Proctoring team, departmental service etc. In a physical mode, these agents are somewhat invisible!

We did not collect person-sensitive data, and thus we know little about the students' circumstances. This may be considered as a limitation of the study.

7. Concluding Remarks

- a) Online teaching exposed both students and teachers to a set of challenges. Some of these challenges are generic (common to almost all courses) while some could be specific to a course like SCM.
- b) During the last more than 2 years, various editions of the SCM course were run. This provided an opportunity to look at the teaching-learning process. A process-based perspective in line with the philosophy of SCM is subscribed while designing and delivering the contents.
- c) The process philosophy is built around three basic ideas: become customer-driven instead of being self-focused, concentrate on the processes rather than being preoccupied with results; and use students' thinking ability to enhance the quality of the learning. This assumes more significance in online mode.
- d) Various concepts like Continuous Improvement, Customer Focus, and Teamwork are closely related to each other. Continuous improvement is required to achieve higher customer satisfaction (in this case 'student'), and it is most effective when driven by customer needs with empathy in mind. Based on the feedback received from the students, an attempt was made to improve the content design and delivery of the course. Continuous improvement transcends hierarchical, functional, and organizational boundaries; therefore, teamwork is essential. Thus, teaching SCM also involves a set of mutually reinforcing principles, which are ultimately based on fulfilling customers' needs.
- e) The underlying educational process is based on learning methodology rather than teaching-based programs. In this process, the virtual classroom is equipped with IT support (MS Teams, Moodle etc.) based on learning and the teacher is acting as a guide for the students. This perspective facilitated students to share knowledge and experience and hence their learning outcomes improved. The learning process can be evaluated using continuous feedback from students.

- f) The application of PDCA enabled to make improvements in the prevailing Covid-19 environment. This was necessary in the absence of face-to-face interactions with students.
- g) Technology platforms in a smart classroom setting can enhance the teacher student experience when both can see each other creating a virtual class room experience.

We have not only facilitated and coached students in the SCM course but have also applied some of the lessons learned in the course to other courses as well (For example a course on Industrial Engineering systems (for students of the MEE programme), or Statistics for Manufacturing Managers).

References

- Al-Shammari, M.M. ,An exploratory study of experiential learning in teaching a supply chain management course in an emerging market economy, *Journal of International Education in Business*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/JIEB-09-2020-0074>, 2021
- Bak, O., Jordan, C. and Midgley, J. ,The adoption of soft skills in supply chain and understanding their current role in supply chain management skills agenda: A UK perspective. *Benchmarking-An international Journal*, 26(3), 1063-1079, 2019
- Birou, L., Lutz, H. and Walden, J. L., Undergraduate supply chain management courses: content, coverage, assessment and gaps, *Supply Chain Management: An International Journal*, 27(1), 1-11, 2022
- Birou, L., Lutz, H. and Zsidisin, G., Current state of the art and science: a survey of purchasing and supply chain management courses and teaching approaches, *International Journal of Procurement Management*, 9(1), 71-85, 2016.
- Blanchard, D. Supply chain & Logistic: The competitive advantage of a supply chain/article/2196345/available at: <https://www.industryweek.com/supply-chain/article/2196345/supply-chain-logistics-the-competitive-advantage-of-a-supply-chain>, 2014
- Deshmukh S. G., Vision for engineering education in India: Some considerations, *Journal of Engineering Education*, 27, (2/3),71-83, 2004.
- Deshmukh S. G., Some perspectives on Total Quality Management (TQM) in Technical Institutes, *Journal of Engineering Education*, 29(3), 44-59, 2006
- Ferguson, M., and Drake, M., Teaching supply chain risk management in the COVID-19 Age: A review and classroom exercise, *Journal of Innovative Education*, 19, 5-14, 2020
- Folinasa, D., Chatzipanagiotib, M., Mylonasc, D. and Diamantopoulod, E., Using Simulation Software to Support Learning: Empirical Findings from Teaching Key Supply Chain Management concepts, *SPOUDAI Journal of Economics and Business*, 70 (3-4), 12-2, 2020
- Gupta, N., Prem Vrat and Ojha, R., Achieving Education Excellence Through Teacher & Student Duality: An Analysis of NIRF Scores, *Metamorphosis: A Journal of Management Research*, 19(2), 79-93, 2020
- Gravier, M.J. and Farris, M.T., An analysis of logistics pedagogical literature, *The International Journal of Logistics Management*, 19 (2), 233-253, 2008
- Johnson, M. and Pyke, D., A framework for teaching supply chain management, *Production and Operations Management*, 9(1), 2-18, 2000.
- Kotze, T. J. and Plessis, P. J. du., Students as 'co-producers' of education: A proposed model of student socialisation and participation at tertiary institutions, *Quality Assurance in Education*, 11(4), 186-201, 2003
- Lutz, H. and Birou, L., Logistics education: a look at the current state of the art and science, *Supply Chain Management: An International Journal*, 18 (4), 455-467, 2013.
- Lutz, H., Birou, L. and Walden, J., Survey of graduate supply chain courses: content, coverage and gaps, *Supply Chain Management*, <https://doi.org/10.1108/SCM-12-2020-0637>, 2021
- McCulloch, A., The student as co-producer: learning from public administration about the student–university relationship, *Studies in Higher Education*, 34(2), 171–183, 2009
- Mishra, L., Gupta, T., and Shree, A., Online teaching-learning in higher education during lockdown period of COVID-19 pandemic, *International Journal of Educational Research Open*, 1, 10012, 2020
- Ozelkan, E. and Rajamani, D. An effective framework for teaching supply chain management, *In the 2006 Annual Conference and Exposition, Chicago, IL*, available at: <https://peer.asee.org/1435>, 2006
- Perrine, K. and Curkovic, S., A Framework for Continuous Improvement in Supply Chain Management Education, *Creative Education*, 13(2), 466-483, 2022
- Soni, G. and Kodali, R., A critical review of supply chain management frameworks: proposed framework, *Benchmarking-An international Journal*,20(2), 263-298, 2013.

Sangpikul, A., Implementing academic service learning and the PDCA cycle in a marketing course: Contributions to three beneficiaries, *Journal of Hospitality, Leisure, Sport & Tourism Education*, 21, 83-87, 2017
Sparks J. J. Quality in Higher Education, *Indian Journal of Engineering Education*, 8,9-17, 1996.

Biographies

S G Deshmukh is a professor of Mechanical Engineering at IIT Delhi. He has more than 32 years of experience in teaching, research, and consultation. He is on the editorial boards of several international journals. His areas of interest include Supply chain Management, Manufacturing competitiveness, Quality.

Prem Vrat is the Pro-Chancellor of the The Northcap University, Gurgaon, India, former Professor of Eminence, Management Development Institute, Gurgaon; former Vice Chancellor, U.P. Technical University, Lucknow, India and Founder-Director, Indian Institute of Technology (IIT) Roorkee, India. He obtained his Ph.D. degree from IIT Delhi in 1974. He was an honorary Research Fellow (1975-76) at the Department of Engineering Production, University of Birmingham (U.K) and at present is also serving as an honorary Professor at IIT Delhi. His co-authored book *Productivity Management: A System Approach* received Delhi Management Association (DMA)-Escort Book award and also award from the Indian Society for Training and Development. He received "Lillian Gilbreth Award" for his outstanding contributions to Industrial Engineering and Productivity in India and Dr. C.M. Jacob Gold Medal of Systems Society of India (SSI) for his outstanding contributions to Systems Modeling and Management. He is the recipient of the distinguished alumnus award from IIT Kharagpur and the distinguished service award from IIT Delhi. He has guided 50 doctoral students and has authored/co-authored more than 400 papers.