*Journal of Engineering Education Transformations ,*
*Volume 31 , No. 3, January 2018, ISSN 2349-2473, eISSN 2394-1707*

# Impact of Massive Open Online Courses and Best Practices: A Case Study on Social Network Analysis Course

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**Abstract:** Transformations in Engineering Education is to improve the quality of engineering education in learning and research as well as in student development, faculty development, curriculum development and teaching technology methods which involve active learning strategies. Nowadays teaching method takes a new transformation from the conventional method of learning to digital learning like e-learning and m-learning. To improve the students learning ability, a teacher will play a role as mentor/facilitator rather than a teacher. In this paper, we have considered the Impact of Massive Open Online Courses and its Best Practices as a case study on Social Network Analysis Course for the students of third-year Information Technology (IT) department.

**Keywords:** Engineering Education, Massive Open Online Courses, Social Network Analysis, Active Learning Strategies, Course Outcomes.

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## 1. Introduction

Social network analysis focuses on relationships between and among social entities. The objective of the course is to serve as an introduction to the various sources of network data, the different kinds of networks that one can construct from them, the various properties of these networks that people study and motivate this from a sociological point of view. On successful completion of the course, the students will be able to address five Course Outcomes. Active Learning Strategies like Flipped Classroom, Quiz, Group Discussion, and Think-Pair-Share are the methodologies we followed in this course. The students were asked to perform any one task mentioned above.

As a result of these students performance in continuous assessment test is improved and from the course end survey, it is clearly stated that Course Outcomes are attained and student's learning ability also gets improved. Social Network Analysis Course is a combination of Graph Theory and Networks. Social Network Analysis Course comprises of Basics of Graph Theory, Basics of Networks, Structural and Cascading Properties of Networks, Link Analysis, Social Network Analytic Tools and Techniques. And the well defined Course Outcomes of this Course are:

**Table 1.Course Outcomes of Social Network Analysis**

| On successful completion of the course, the students will be able to | | |
|---|---|---|
| Course Outcomes | | Bloom's Level |
| CO1 | Recognize the basic concepts of network data and tools for visualizing network data. | Understand |
| CO2 | Describe the Social Network construction from an online phenomenon. | Understand |
| CO3 | Predict the Network behaviour using network properties. | Understand |
| CO4 | Perform Link analysis for Web data. | Apply |
| CO5 | Solve various Social network problems using analytic tools and techniques. | Apply |

At the start of Social Network Analysis course, as a mentor, we informed the students regarding the Massive Open Online Courses (MOOCs) and identified two MOOCs courses for Social Network Analysis. The First one is Applied Social Network Analysis Using Python, which is an online non-credit course authorized by University of Michigan and offered through Coursera and the Second one is Social Networks, which is a 12 weeks course offered by NPTEL Online and Certification. We have used Canvas.instructure.com, an open Learning Management System for managing our course modules and assignments online, and EIAT (Enhanced Indirect Assessment Tool) for collecting feedback regarding Course Content/Course Outcomes, Content Delivery, Assessment Techniques and Course Teacher. To address different types of learner's ability different active learning strategies are used in this course.

## 2. Related Works

Nowadays OBE (Outcome Based Education) is followed in every engineering institution. Students are classified into different types based on their learning ability [1]. In OBE, every course has specific Course Outcomes and the attainment of Course Outcome is measured with Summative and Formative Assessment in Direct Methods and Course Exit Survey is used in Indirect Method [5]. Students learning ability can be measured with Massive Open Online Courses [2] [3].

## 3. Implementation and Results

Best Practices and the impact of NPTEL and Coursera are implemented with Third Year B.Tech

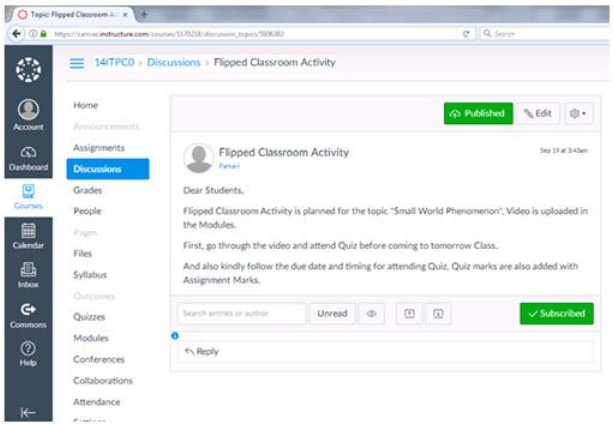



**Fig. 1 Discussion Forum for Flipped Classroom Activity**

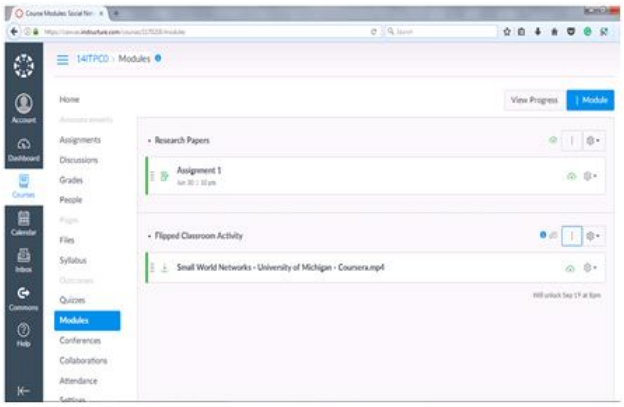



**Fig. 2 Coursera video is uploaded for Flipped Classroom Activity**

students in the Department of Information Technology, Thiagarajar College of Engineering, Madurai. The Different Active Learning Strategies used for the Social Network Analysis Course are described as follows:

Flipped Classroom: The topic given for the Flipped Classroom Activity is "small world phenomenon". For this activity we have used Canvas.instruture.com, an open source Online Management System [4]. At the start of the course students are enrolled in the canvas.

Out of Class Activity: The Out of class activity segment requires students to watch the Coursera video which is uploaded by the mentor and all students are advised to attend the Graded Quiz followed by the video for the topic "small world phenomenon". Mentor intimates the students by using discussion forum in the canvas to watch the video and attend the Graded Quiz followed by the video. The marks obtained by the students in the Graded Quiz will be added to assignment I marks. As a result, 90% of the

students attended the Quiz and above 80% of students got full marks in Quiz.

In Classroom Activity: Followed by the Flipped Classroom activity, Think Pair Share (TPS) is given as the first in-class activity to the students in the next day class. With the in-class activity all students are advised to think about a real world scenario related to small world phenomenon about 5 minutes and pair with their neighbour discusses about the real world scenario problem for about 5 minutes, finally each one in a pair is instructed to share their ideas to the entire classroom. As a mentor, teacher clarifies all the doubts regarding the activity at the end of the session. Structured Group Discussion is the second in-class activity executed among the students to come up with answers related to the flipped classroom activity.

Feedback is collected from all the students regarding the Flipped Classroom activity, from the feedback given by the students more than 85% of students really enjoyed the activity and their learning ability is increased in the out-of class activity and collaborative learning is also improved during think-pair share and structured group discussion activity.

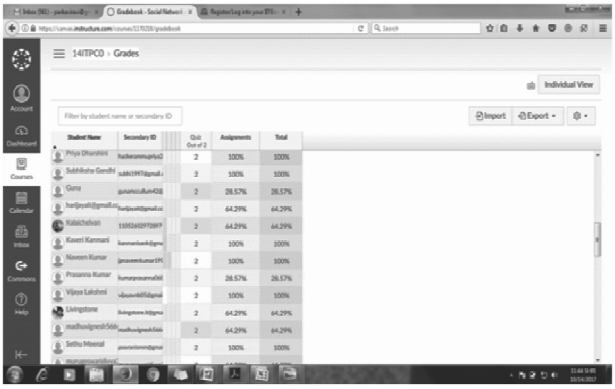



**Fig. 3 Graded Quiz Result for Flipped Classroom Activity**

Reflection on the Usage: Out of 62, 10 students did not attend the Quiz due to some network problems, and 45 students out of 62 liked to have Active Learning Strategy. And to make 100% students successfully involved in such kind of activities, we planned to have Active Learning Strategies once in a week.

Collaborative Learning: Collaborative Learning is a type of learning method in which two or more people learn together. As a collaborative Activity Students are split into teams, team size is five with a Team Leader for each team are done with canvas. Various research papers are taken from IEEE, Springer, Elsevier and ACM related to social network analysis and uploaded in the canvas learning management system. Each team is advised to take one paper on their own interest and with that paper they are asked to complete three Assignments.

For Assignment I-As an assignment I, students were advised to study any one research paper and present the contents of the same with problem definition, possible solution to overcome the problem, Tools, Algorithm, Code used to implement the paper. Assignment I is assessed with the standard rubrics shown in Fig 4. All students have completed their Assignment I within time.

For Assignment II- Students have implemented their work and presented the paper in front of the class. Assignment II is assessed with separate rubrics and two types of assessment is done. One is Mentor Assessment (done by Course Teacher) and the second one is Peer Assessment (done by students). At the end of Assignment II out of 12 teams 11 teams completed their assignments within time.

Final part of Assignment II is Paper Presentation. As a team students publish papers in various International Journal and International Conferences. Outcome of Assignment III is students published their papers in various International Journals and

| Criteria | Ratings | | Pts |
|---|---|---|---|
| Paper Title,Published in Journal,Year,Authors | Full Marks 5.0 pts | No Marks 0.0 pts | 5.0 pts |
| Objective of paper / Problem addressed | Full Marks 5.0 pts | No Marks 0.0 pts | 5.0 pts |
| Specific Details of Solutions | Full Marks 5.0 pts | No Marks 0.0 pts | 5.0 pts |
| Theoretical/ Mathematical basis of solution | Full Marks 5.0 pts | No Marks 0.0 pts | 5.0 pts |
| Result level (Simulation/ Experiment/ Real Implementation/ other (specify)) | Full Marks 5.0 pts | No Marks 0.0 pts | 5.0 pts |
| Setup - Environment & Tool | Full Marks 5.0 pts | No Marks 0.0 pts | 5.0 pts |
| Performance Metrics | Full Marks 5.0 pts | No Marks 0.0 pts | 5.0 pts |
| Conclusion | Full Marks 5.0 pts | No Marks 0.0 pts | 5.0 pts |
| | | | Total Points: 40.0 |

**Fig. 4 Rubric for Assignment I**

Conferences as shown in Fig 7.

## 4. Performance Evaluation

Performances of the students are measured with

both Direct and Indirect Assessment methods. Direct Methods includes Continuous Assessment Test (CAT) and indirect methods include feedback and course exit survey shown in Fig 7 and Fig 8. And to ensure that the learning ability of the students are really changed and improved in a good way several methods like Online Certifications from NPTEL and Coursera is also considered. At the start of the course mentors identified Massive Open Online Courses related to Social Network Analysis and students are asked to enroll in the courses.

From Continuous Assessment Test it is clearly shown in Fig 5 that after using Active Learning Strategies and MOOCs course the performance of fast learners (quick learners) is drastically improved far better when compared to the previous Continuous

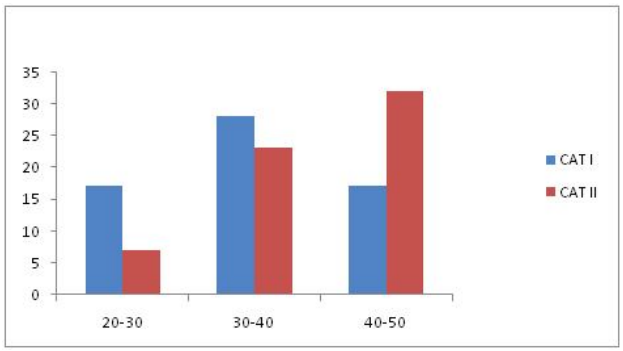



**Fig. 5 Fast Learners Performance in Continuous Assessment Test**

Assessment Test. Fast learners are learners who are all learning by doing.

Students are advised to register in two MOOCs courses such as Social Networks Course which is a 12-

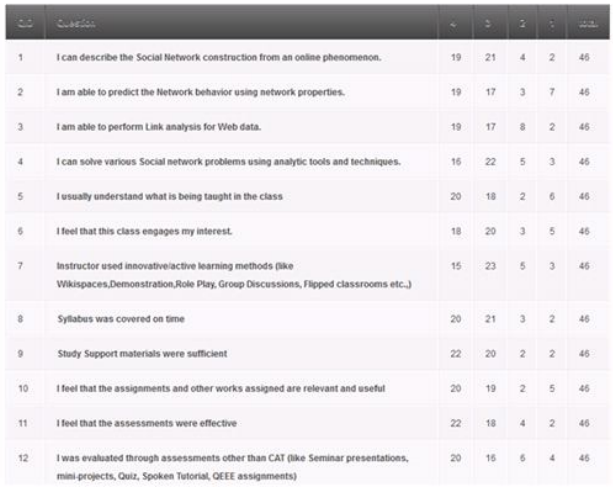

**Fig. 6 Student Certification from Coursera**

week course offered by NPTEL and Applied Social Network Analysis Using Python is a 4-week course offered by Coursera.

Out of 62 students 10 students are registered for both the courses, 15 students are registered with Coursera

**Table 2.Course Outcome Attainment**

| CO | CO target (%) | CO Attainment (%) | Student Count |
|---|---|---|---|
| CO1 | 80 | 86 | 52 |
| CO2 | 75 | 70 | 32 |
| CO3 | 80 | 76 | 33 |
| CO4 | 80 | 71 | 35 |
| CO5 | 90 | 94 | 58 |



| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | I can describe the Social Network construction from an online phenomenon. | 19 | 21 | 4 | 2 | 46 |
| 2 | I am able to predict the Network behavior using network properties. | 19 | 17 | 3 | 7 | 46 |
| 3 | I am able to perform Link analysis for Web data. | 19 | 17 | 8 | 2 | 46 |
| 4 | I can solve various Social network problems using analytic tools and techniques. | 16 | 22 | 5 | 3 | 46 |
| 5 | I usually understand what is being taught in the class | 20 | 18 | 2 | 6 | 46 |
| 6 | I feel that this class engages my interest. | 18 | 20 | 3 | 5 | 46 |
| 7 | Instructor used innovative/active learning methods (like Wikispaces,Demonstration,Role Play, Group Discussions, Flipped classrooms etc.,) | 15 | 23 | 5 | 3 | 46 |
| 8 | Syllabus was covered on time | 20 | 21 | 3 | 2 | 46 |
| 9 | Study Support materials were sufficient | 22 | 20 | 2 | 2 | 46 |
| 10 | I feel that the assignments and other works assigned are relevant and useful | 20 | 19 | 2 | 5 | 46 |
| 11 | I feel that the assessments were effective | 22 | 18 | 4 | 2 | 46 |
| 12 | I was evaluated through assessments other than CAT (like Seminar presentations, mini-projects, Quiz, Spoken Tutorial, QEEE assignments) | 20 | 16 | 6 | 4 | 46 |

**Fig. 7 Course Exit Survey Questions**

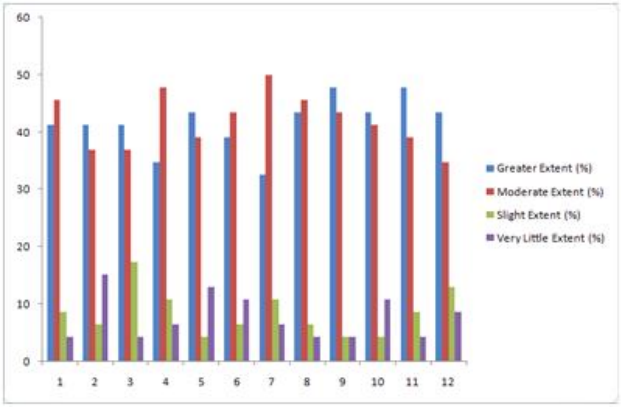



**Fig. 8 Course Exit Survey Analysis**

and 35 students are registered with NPTEL Course. As a result of this certification course 5 students got certificate from both courses 10 students got certificate from Coursera (Fig 6) and 32 students got certificate from NPTEL course.

From Table 2 it is very clear that CO5- Solve various Social network problems using analytic tools and techniques (Apply). Percentage of Attainment is above 90%. By using various MOOCs, students learning ability and thinking skills got improved


**Fig. 7 Sample Proof for Paper Publication**

thereby it makes students to learn the tools and techniques related to social network analysis and as a result of this, students have publish their research in various international conferences and journals.

## 5. Conclusions

In this paper best practice of using Active Learning Strategies and the Impact of Massive Open Online Course for Social Network Analysis Course is discussed. The Impact of MOOCs not only improve the students learning ability but also it provides a pathway for students to communicate with professors from standard and reputed institutes and universities., thereby top performed students get internship with foreign universities. Therefore every course offered to students in engineering education get better learning outcome if it is provided with MOOCs.

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