Analysis of Tutorial Classes Based on Question Answering System to Improve Teaching Learning

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Abstract : In this modern era of engineering education, teaching learning process must be taken in an effective way to enrich the knowledge of engineering community. The traditional teaching methods are not gaining much attention towards teaching young engineers. Hence, to fulfill the gaps laid by the traditional teaching approach almost every engineering faculty and institutions adopting various interactive teaching and learning methods. The tutorial based teaching is one among them and widely used one. The tutorial is a class which has student strength of 20 to 30 only, where the tutor can give individual attention to every student to improve their learning and problem solving skills. For many decades in Indian education, the tutorial is successful methodology to teach the students. However, tutors and students who participating in the tutorial classes having their own view of pros and cons on various elements of tutorial based teaching. In this paper we investigate the problems faced by the learners and tutors in tutorial classes and analyze their views to identifying and ensuring effective teaching inputs for tutorial classes using Question Answering System. This survey and interview methodology also used to ensure if students are encountering issues in fitting with tutorial class and to identify students' insight of an effective tutor.

IndexTerms **- Tutorial, Engineering Education, Tutor, Student, active and passive learner, Question Answering System**

I. INTRODUCTION

Today there is a need for the educators to possess the potentiality in order to harness the technology so as to bring a great impact in student achievement. This could be possible with the usage of digital technologies which leads to a thoughtful approach on societies which leads to the change in the work style, communication, participation in social activities. It is observed that there is a strong association between education and skills and the uptake and use of digital technologies in various ways of life. Enhancement in learning could be done either by conducting group activity, seminars, role-play, presentations and conducting tutorials etc. Tutorial sessions must be conducted in order to afford an interactive learning environment. This environment acts as a strong platform where students could enhance their knowledge by clarifying their doubts, discussions, working on certain issues, and other activities etc. This paper discusses in detail about the ways of enhancing learning through the usage of digital technologies in conducting tutorial sessions as said by Foo et. al. (1996).

Individuals could be empowered with the pertinent skills which is required for this digital world so as to enable them to contribute to economic, social life. The evolution in digital economy needs youth to get fiddle with the shifts in demand for skills and revolution in technology. To enhance learning, ICT devices are used to extend or integrate the range of time and places. It is understood that the technology alone would not be used for foster the learning process, but it also must be used by the teaching professionals so that they can attract the new generation. The technology has been blended much in education sector so that the teaching content and methods could be enhanced. Technology could be used to improve and enhance learning in the following ways.

1. Learning could be personalized through continuous learning. Experiences could be gained from the users who develop skills by writing essays, develop blogs, creating media and building websites etc.
2. Digital learning devices and resources could be used as project-based learning so to organize learning around real-world challenges.
3. Students could learn much more beyond the classroom and take advantage of learning opportunities. This is used to support learners through the experience that has been shared by them that has been obtained from various digital technologies.
4. Learners pursue personal interests and passion with the help of technology. With this ability, learners try to explore and research that could help inspire a mindset of lifelong learning.
5. Technology makes the transformation in learning opportunities that are available to all types of learners.

By using, these technologies associated with traditional educational systems and approaches, and then the benefit towards the engineering community will be very high. In this paper, “tutorial based classes” is considered as a students learning model to assess its pros and cons to improve its traditional teaching learning approach as discussed by Entwistle (1992). Weinstein (1998) says that the

one-way communication between the student and tutor will deteriorate the learning process in case of passive learners. Vander Wiele (1995) explains that the most important thing in teaching process is the communication between the department and its professors . Yair (2008) says that the professors need to be given freedom to follow innovative and creative methods so that the teaching learning process is improved. Armbruster et. al. (2016) developed an instructional design which focused on incorporating active-learning and student-centered pedagogy explained by Armbruster et. al.(2009) into the traditional lecture-based introductory biology course. Boekaerts et al., (2005) describes that learners performed better through Self-learning approach by Boekaert et. al. (2005). The main reason for the widespread acceptance of Spoken Tutorials is self-learning capability (Moudgalya (2014),) and it involves behavioral motivation and meta cognitive understanding of social perspectives as said by Moudgalya et.al. and Pintrich et. al. Madhu Siddhartha et. al. explains more elaborative classification of questions along with some major approaches used for classification in order to design a suitable question answering (QA) system (MAdhu Siddhartha et. al. (2017)) QASs focuses on the types of questions asked generally asked by the users, characteristics of data sources consulted and the forms of correct answers generated. Amit Mishra et. al. (2016) classifies them based on different criteria.

1.1 Types of Tutorial

Supervision tutorials: In this tutorial, the responsibility of the teacher is to choose the students those who are above average intelligence. A student is selected from that group and a specific problem is given to him/her in order to solve the problem and the student is asked to present the solution. The student explains the solution in the classroom. The way of presentation might attract and make the students to easily understandable the solution and which might lead students to induce their interest in further solving the problems and present the solution. Before the presentation, the student could get guidance from the teacher. At the end of the session, there might be a questionnaire session in which the student might clear the doubts posed by the students. When the student is not able to answer the question, the teacher might clarify the doubts.

Group Tutorials: This type of tutorial is mainly for those students who possess low intelligence and understanding capacity in classroom teaching. The solution is to group them based on the subject and the teacher takes remedial classes in order to make the students to clearly understand the topics. Ambrose et. al. (2004) explains that students complete the exercises in small groups and the teacher circulates to the groups to ask targeted questions and to assist discussion.

Practical Tutorials: The main objective of this tutorial is to identify and remove the difficulties in understanding the practical course. This tutorial could be organized for programming courses, problem and analysis oriented courses as said by Gibbs et. al. (1989).

1.2 Pros and Cons of Tutorials Method

Advantages

- Tutorial is considered as an effective and efficient way of teaching since individual differences are taken into contemplation
- The main objective of the teacher is to make all the students to understand the subjects and must be in such a way to reproduce what they have understood which can be achieved through tutorial.
- Teacher helps the students and cooperative to the learners which create the confidence in the students so that they might solve the problems (Denicolo (1992)).

Disadvantages

- Conducting remedial classes is always a difficult problem due to tight schedule.
- Large number of students in tutorial class
- In group work student may sometimes compare with each other.
- Partiality shown among students by the tutor.
- Difficulty in guiding students to solve problem for every subject due to over-crowded classes.
- Some students may dominate in the group so others may not get equal opportunity (Denicolo et. al. (1992)).

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II. METHODS AND MODEL

In this section, we conducted questionnaire based survey to identify and analyze various advantages and drawbacks associated with the tutorial sessions which are currently adopted right now as part of teaching learning process. This survey has been conducted with 120 engineering students and 20 faculty members who already contributed themselves in conducting tutorial classes. We randomly chosen 120 students who already attended tutorial classes and 20 faculties are chosen based on their experience which varies from 2 to 15 years in engineering teaching. This survey is designed to answer with a grade which differs from 1 to 5. The grades are considered and designed on the following basis,

Grade 5: Excellent
Grade 4: Very Good
Grade 3: Good
Grade 2: Fair
Grade 1: Poor

The survey form for the students having the two major areas, in which the first one is, consists of 10 questionnaires to assess the pros and cons of “tutorial classes” and the second one consists of 10 questionnaires to evaluate the “tutor’s” performance in the tutorial classes. Generally, the faculty member who handles the tutorial class is referred as tutor.

2.1 Graded Questions for students on “Tutorial class”

1. How much you are interested in tutorial classes?
2. How important/useful the tutorial classes for you?
3. Rate the importance of tutorial class to fill the knowledge gap in your subject?
4. How do you rate the content delivered in the tutorial class?
5. Rate the comprehensibility of tutorial classes.
6. Rate the clarity of the outcomes obtained in the tutorial classes.
7. Rate the relevance of the problem solved with content of the syllabus
8. Rate the Faculty-Student ratio of the tutorial classes.
9. Rate the importance of ICT enabled teaching for tutorial classes.
10. How will you rate the overall conduction of tutorial classes?

2.2 Graded Questions for students on "Tutor's Performance"

1. How knowledgeable your tutor is on the subject?
2. How much interest is shown by the tutor towards effective conduction of tutorial classes?
3. Rate your tutor's teaching skills/methodologies.
4. How do you rate the quality of content delivered by the tutor?
5. Rate the problem solving skills of your tutor.
6. How friendly is the tutor with the students?
7. Rate the teaching aids available in tutorial classes.
8. How effectively the tutorial classes utilized by the tutor?
9. Rate the communication skill of your tutor.
10. What is your rate on overall performance of your tutor?

Similarly, the survey form for the faculty having two parts, in which the first part deals with "student's performance" on the tutorial classes with 10 graded based questionnaire and the second part of the survey analyze the various factors of the respective "tutorial based courses" in 10 graded questionnaire.

2.3 Graded Questions for faculties on "Student's Performance"

1. How important is the tutorial classes for engineering students?
2. How do you rate the level of student's interest on learning in tutorial classes?
3. Rate the student's cooperation with tutors in the tutorial class.
4. Rate the student's skill on solving the problems.
5. Rate the student's active attention towards the tutor/class.
6. How do you rate the pre and post preparation of the students to attend the class?
7. Rate the student's level of completion of problems with correct solution.
8. How do you rate the student's performance in obtaining the outcomes of the course by tutorial classes?
9. How do you rate the discipline of the students?
10. What is your overall rate on student's performance in the tutorial classes?

2.4 Graded Questions for faculties on "Tutorial based courses"

1. How much you are interested in handling tutorial classes on this course?
2. Is this necessary to have tutorial class for this course?
3. What is your rate on tutorial classes to fill the knowledge gap of the students on this course?
4. How do you rate the allotted duration for tutorial classes?
5. What is your rate on faulty-student ratio (1:20) allocation for tutorial classes?
6. How do you rate the way of tutorial classes being conducted?
7. Rate the ICT facilities available for conduction tutorial classes.
8. What is the level of difficulty to handling tutorial classes when comparing with lecture classes?
9. Rate the level of knowledge/skills you earned/learned from the tutorial classes.
10. How do you rate your managerial and communicational skills to handling the tutorial classes?

It is the intention of the survey to confirm if students and faculties are experiencing any difficulties in tutorial classes which using the present mode of conduct. In addition, students were also asked to identify common problems, their preference on how such tutorial classes should be conducted and their perception of a good tutor. From the analysis we can identify the specific inputs to tutorial classes for improving the teaching learning process.

As part of the survey, additional four methods were identified and the student was asked to choose the most useful and efficient method among them which helps in their learning process:

1. Solved by the tutor
2. Solved by the individual student and evaluated by tutor
3. Solving the problem in group and tutor evaluating it

4. Solving the problem with tutors.

III. RESULTS

Based on the survey conducted with both students and faculties, the summarized graded 'values are presented in the following tables.

Table 3.1: Shows the readings taken from student's survey for analyzing pros and cons of "tutorial classes".

S.No	Question	Grade	% of students opted this grade
Q1	How much you are interested in tutorial classes?	4	30%
Q2	How important/useful the tutorial classes for you?	4	57%
Q3	Rate the importance of tutorial class to fill the knowledge gap in your subject?	3	54%
Q4	How do you rate the content delivered in the tutorial class?	3	34%
Q5	Rate the comprehensibility of tutorial classes.	2	60%
Q6	Rate the clarity of the outcomes obtained in the tutorial classes.	2	41%
Q7	Rate the relevance of the problem solved with content of the syllabus	3	68%
Q8	Rate the Faculty-Student ratio of the tutorial classes.	2	77%
Q9	Rate the importance of ICT enabled teaching for tutorial classes.	3	51%
Q10	How will you rate the overall conduction of tutorial classes?	3	60%

Table 3.2: shows the graded readings taken from the student's survey for analyzing the performance of the tutor.

S.No	Question	Grade	% of students opted this grade
Q1	How knowledgeable your tutor is on the subject?	4	83%
Q2	How much interest is shown by the tutor towards effective conduction of tutorial classes?	3	60%
Q3	Rate your tutor's teaching skills/methodologies.	3	46%
Q4	How do you rate the quality of content delivered by the tutor?	3	56%
Q5	Rate the problem solving skills of your tutor.	2	33%
Q6	How friendly is the tutor with the students?	1	46%
Q7	Rate the teaching aids available in	4	74%

	tutorial classes.		
Q8	How effectively the tutorial classes utilized by the tutor?	**3**	**72%**
Q9	Rate the communication skill of your tutor.	**3**	**85%**
Q10	What is your rate on overall performance of your tutor?	**3**	**66%**

Table 3.3 representing the values graded by the faculties for analyzing the performance of the students.

S.No	Question	Grade	% of faculties opted this grade
Q1	How important is the tutorial classes for engineering students?	**5**	**68%**
Q2	How do you rate the level of student's interest on learning in tutorial classes?	**3**	**49%**
Q3	Rate the student's cooperation with tutors in the tutorial class.	**2**	**33%**
Q4	Rate the student's skill on solving the problems.	**2**	**39%**
Q5	Rate the student's active attention towards the tutor/class.	**4**	**45%**
Q6	How do you rate the pre and post preparation of the students to attend the class	**2**	**52%**
Q7	Rate the student's level of completion of problems with correct solution.	**2**	**68%**
Q8	How do you rate the student's performance in obtaining the outcomes of the course by tutorial classes?	**2**	**61%**
Q9	How do you rate the discipline of the students	**4**	**53%**
Q10	What is your overall rate on student's performance in the tutorial classes?	**3**	**55%**

Table 3.4 depicts the graded rates given by the tutors for analyzing the strength and weakness of the course which having the tutorial option.

S.No	Question	Grade	% of faculties opted this grade
Q1	How much interested you are in handling tutorial classes on the course?	**5**	**78%**
Q2	Is this necessary to have tutorial class for the course?	**5**	**84%**

Q3	What is your rating on tutorial classes to fill the knowledge gap of the students on the course?	**4**	**59%**
Q4	How do you rate the allotted duration for tutorial classes?	**3**	**47%**
Q5	What is your rate on faulty-student ratio (1:20) allocation for tutorial classes?	**4**	**61%**
Q6	How do you rate the way of tutorial classes being conducted?	**4**	**63%**
Q7	Rate the ICT facilities available for conduction tutorial classes.	**4**	**43%**
Q8	What is the level of difficulty to handle tutorial classes comparing with lecture classes?	**3**	**56%**
Q9	Rate the level of knowledge/skills you earned/learned from the tutorial classes.	**4**	**62%**
Q10	How do you rate your managerial and communicational skills to handle the tutorial classes?	**4**	**64%**

The additional part of the survey tends the students to answer for 4 different methods of handling tutorial classes. From their answers we tried to derive their psychological aspects of student's participation in the tutorial classes. It is represented in the table 3.5.

Table 3.5. Methods of handling Tutorial classes

S.No	Methods	No of students opted this method
M1	Solved by the tutor	**21**
M2	Solved by the individual student and evaluated by tutor	**17**
M3	Solving the problem in group and tutor evaluating it	**23**
M4	Solving the problem with tutors guidance	**59**

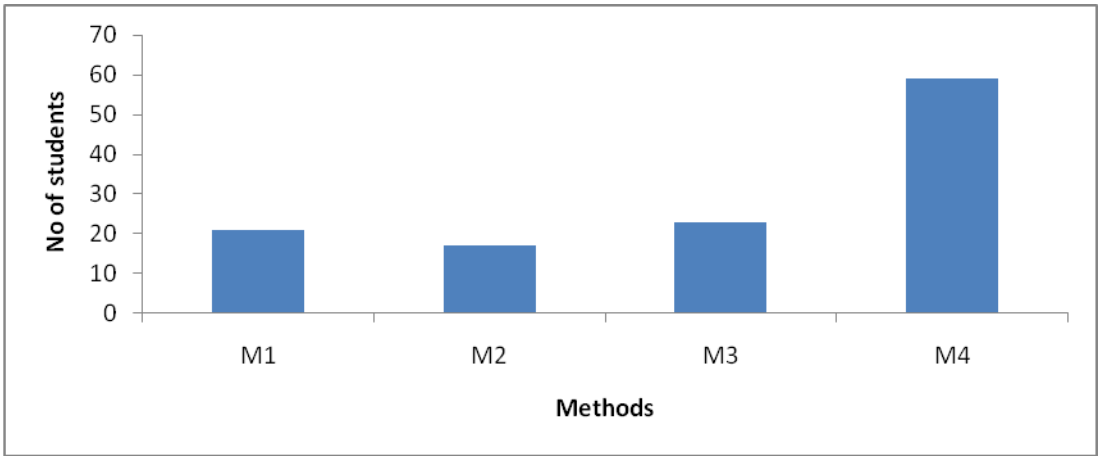

Figure3.1 Interest of students on various methods of handling Tutorial classes

IV. DISCUSSIONS

The survey result shows the following observation in student's point of view regarding assessing the quality of tutorial classes. It clearly depicts that student are having much interest in attending tutorial classes because it is being conducted in student centric way. Many students agreed that the tutorial classes are important for them, while around 50-60% of students only understood that how these classes will help them to fill the knowledge gap. Also, 77% of students not satisfied with tutor-student ratio, 60% of students not completely understood comprehensibility of tutorial classes and 41% students struggles to arrive and understands the outcomes of the tutorial classes.

So, it is important to brief the objective and outcome of the particular classes to the students is must. Also, the ratio of tutor-student must be decreased from 1:20 or 1:25 to some good level to improve the student centric class.

Regarding the performance of the tutor in tutorial classes, 46% of students want the tutor to be friendly to them in solving the problems. Also, 33% of students are not satisfied with tutor's problem solving skills. The survey from the tutors on performance of the students in the tutorial classes reveals that, student's basic skills are not up to the level to solve the problems and students are not doing self preparation to attend the tutorial classes. On the other hand, to analyze the strength and weakness of the tutorial courses, tutors suggest allotting more hours for tutorial classes. Hence, the tutor's knowledge enhancement and upgrading becomes major part of teaching learning process. Also, tutors have to improve their problem solving strategy to get more attention of students in the class. In the additional part of the survey, 59 students suggest to solve the problem with the guidance of tutor rather than solving by themselves (only 17 students). This clearly shows that the students are expecting more participation of tutor in the tutorial classes to solve the problems.

V. CONCLUSION

Considering the tutorial classes is one of the most successive methods to enhance the teaching learning process. This paper identifies various aspects and areas in which the tutors and students facing the inconvenience to participate in tutorial classes. The survey form designed for both tutors and students. It has been taken from randomly chosen 20 tutors and 120 students of computer science and engineering specialization. Based on the survey results, this paper suggest some aspects to be improved like, tutor-student ratio, make the students to understand comprehensibility of the tutorial classes, completely assist the students to solve the problems, help the student to obtain the outcomes of the tutorial classes, encourage the students for active participation and to give clear objective to students. The most important thing is the active participation of the students in the tutorial classes. It also reveals that programming and problematic subject requires tutorial classes in order to make them apply and analyze what they have learned to achieve the course outcome.

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