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Innovative Teaching-Learning Method for Engineering Mathematics Through Video Lectures in Rural Areas

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Abstract : Mathematics is an important subject required for the foundation and has applications in all branches of engineering. Mathematical knowledge and skills are required for higher study, developing new technology and innovations. But creating students' interest in learning activities is always a challenging task for every mathematics teacher. Many engineering students are failing in the first year of their studies. This problem becomes more important and challenging in rural areas. There is always a concern about the problem that why students are not taking interest in learning? Out of many possible ways to deal with this problem, the use of flipped classrooms (FCR) plays an important role. This paper deals with the use of FCR for engineering students from rural areas. In addition to classroom teaching, for technology-based learning, video lectures (VLs) are provided to students of first-year engineering for the subject of engineering mathematics. Starting with a review of FCR, experimentation of VLs, and its impact on learning activities and result has been presented. Various surveys at different levels and examination results are considered for conclusions. Through this action research, we have shown that VL is one of the most useful tools for enhancing learning and improving the results of students in rural areas. It has been further shown that this method is very much accepted by students.

Keywords: Educational technology, Mathematics learning, Short VLs, Flipped classroom, Engineering Education.

1. Introduction

For improving the quality of life of the people and for human resource development technical education has a vital role. There are many emerging challenges that human beings are facing, which can be handled using engineering and technology, (Rafiqul Islam, 2012). India is one of the largest countries by considering the number of institutions, teachers, and students. There has been phenomenal growth in the field of technical education during the past decades, (AICTE 2020). The gross enrolment ratio in HE has increased from 21.5% in 2012-13 to 26.3% in 2018-19, and it is 30.3% in Maharashtra. On the other hand, 14,16,088 students enrolled in engineering programs in India during 2018-19, and 55.9% of institutes are in

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the rural area, (UGC-Annual report 2018-19, Higher education All India state profile 2017-18, AICTE 2020).

There are however serious concerns about the quality of education, (Neeraj Sharma, 2014, Singh Antra, Singh Seema, 2014). For improving the quality of engineering education, there are some important factors such as students' problems at the entry-level (Sangal Rajeev, et al., 2016, Kristin Wood, 2008), subject-related problems, the difference in examination pattern, (Sazhin S.S., 1998), TL pedagogy, (Surender Kumar, Priya K.M. 2017), improving active learning, (Kristin Wood 2008, Sharma Megha 2018), web-based teaching-learning, use of FCR, (Jehad Alzabut, 2017, Natarajan R., 2002, Suresh D. Mane, S.P. Dodamani, 2015, (Maureen Lage et al., 2000, Azeem Unissa, et. al, 2018), use of information and communication technology, (National Policy on Education 2016), access of lectures and course material, virtual classrooms, and online tutorial techniques, (Joshi Namrata M, 2015).

Many researchers are trying alternative strategies for teaching and motivating students. The FCR is one of the alternatives, (Chen, Wang, Kinshuk, & Chen, 2014, Fautch, 2015). In this method, students learn by watching online lectures, participating in online discussions, and doing assigned homework under the guidance of a teacher, (Blerta Prevalla, Huseyin Uzunboylu, 2019, Roehl, Reddy, & Shannon, 2013). It gives more time for students to interact with their teacher and peers, and to help them involve more in the learning activities, (Bergmann & Sams, 2012). Classroom interaction enhances the students being connected (Abeysekera & Dawson, 2015), helps them for collaborative learning (DeLozier & Rhodes, 2017) and they get the opportunity to take valuable support from their teacher and peers. FCR helps students to improve their self-learning capabilities and for achieving higher learning outcomes (Lape et al., 2014).

Mathematics is the backbone of engineering subjects. Teaching engineering mathematics is always challenging. Many students find difficulties in understanding the subject and passing the examinations. Students are unable to understand mathematics concepts as they are very weak in the foundation of subjects such as algebra, geometry, trigonometry, derivatives, integration, vectors, differential equations, etc. The syllabus of engineering mathematics is very vast compared to the 12th level. There is less time to cover a large amount of syllabus and it is very challenging for the weak students to perform well. These problems become more critical for students in rural areas. To address issues researchers have recommended the use of technology for mathematics teaching. (Lazakidou & Retalis, 2010). But there are many issues in rural education for using various technologies, (Sandeep Sandhu et al., 2019), such as internet facilities, and bandwidth, getting experienced, qualified, and quality teachers. On the other hand, students are facing many problems related to awareness and access to the internet, and other technology useful for study. Due to low income, less awareness, and other problems, parents are not able to provide suitable computers and mobile phones to their wards at the right time. Many students in rural areas are not able to be successful in the examinations and may lose interest in studying engineering. Thus, it is challenging for the teacher to deal with this situation and improve students' performances.

To address some of the issues, this paper presents an experiment on VL for the teaching of engineering mathematics for students of the first year at their entry level and studying in rural areas. Starting with a review of the work, followed by experimentation of FCR at various stages. Further, through statistical analysis, it has been shown that this method has a positive impact on improving results. Finally, it is shown that this method is acceptable to students in rural areas.

2. Research Questions

At the entry level of an undergraduate course for the subject of engineering mathematics in at rural area

1. Is it possible to attract students to learn by giving technology-based input?
2. Is it possible to improve results by using VLs?
3. Will students accept this approach of FL or not?

3. Method

In this study, students of first-year engineering for the year, 2019-20 were considered located in a rural area. In this study action research method is used at various stages, such as at the beginning of the semester, at the mid-semester, and after the final university examinations. Starting with a literature

review on VLs, requirements for making VLs, and factors affecting their effectiveness. For this purpose, various student feedback through Google forms, oral feedback, and teachers' observations are used. Also, result analysis of internal tests and university examinations are used for the conclusions. Various stages of this experiment are shown in the following Table 1.

Table 1: Various Stages

Sr. No.	Item	Period
1	Review of previous research	Aug. to Nov. 2019
2	Study of the syllabus of M-I	Aug. 2019
3	Collection of student's difficulties	Aug. to Nov. 2019
4	Requirements for making video lectures	Sept. 2019
5	Making PPTs	Sept. to Nov. 2019
6	Recording of VLs	Sept to Nov. 201 9
7	Students' feedbacks	Aug. 2019 to Jan. 2020
8	Result analysis	Sept. 2019 to Jan.2020

4. Review Of Work

From the literature review, it is seen that Alison King, 1993 recommended the use of class time for the constructive and her results are very important in the development of active learning and FCR. Eric Mazur (1997) developed an instructional strategy, his approach was based on learning outside the classroom and in the classroom, (C. Crouch & E. Mazur 2001). Lage, Platt, and Treglia, (2000), focused on college-level economics courses and observed that FCR was found useful for the students. J. Wesley Baker, (2000) presented a paper on flipped learning with a model of TL which was the first among all papers in which flip word appears. Kaw and Hess (2007) proved that web-based modules are more effective as compared to other modules. Bergmann and Aaron Sams and his team, (2007) observed that Chemistry teachers at the school level recorded their lectures and shared them with students who missed their classes. They found that it was very useful to them. Aliye Karabulut-Ilgu, et al., (2018) studied many articles published between 2000 and May 2015 on flipped learning approach in engineering education. The results indicated that flipped learning becomes popular in engineering education after 2012.

Many colleges and universities have adopted the FCR learning model, which promotes the involvement of learners by providing study material, (Johnson L., et al., 2015, 2016). This approach has become popular in higher education, NMC Horizon Report 2015 suggested that it should be adopted on a large scale. According to a survey by the Center for Digital Education and Sonic Foundry, for higher education in the US 29% of faculty are implementing flipped learning, and 27% are planning to implement it in the future, (Bart, 2013, Aliye Karabulut-Ilgu, et al., 2018). Biggs, (2011) obtained results of the active learning of individual students and determineed what and how they learned and assessed. Toqa Jameel Abbas Busebaia and Bindu John, (2020) studied class engagement and academic performance of students of nursing courses using an FCR. They explored their results on the use of FCR in comparison to the current teaching methodology. Their results show FCR helps for getting better learning outcomes in terms of retention of knowledge, augmenting critical thinking, and reflective practice. José A. Gómez-Tejedor, (2020) studied the use of FCR in the physics lab for undergraduate engineering students. They were provided with VLs to the students well in advance before their practical sessions. They observed that students got more time in the lab. sessions which were used for the organization of results and further discussion. He Shen et al., (2019) have shown the effective use of FCR helps for the optimizing learning experience of students of engineering courses. Abdelhak Aqqala, et al., (2017) have shown that both students' learning achievement and satisfaction can be enhanced by using FCR teaching and has shown to be effective in science education. Blerta Prevalla, Huseyin Uzunboylu (2019) studied the comparison of FCR models over the traditional lecture exercises for engineering education.

The FCR pedagogy is popularized and some of the institutions including OCW, MIT, and Khan Academy proposed the use of educational video resources for better learning. Further, these ideas were used by professors Sebastian Thrun and Andrew Ng. They developed an academic partnership between several universities for multimedia-based educational courses (Bissonnette & Gauthier, 2012). MIT and Harvard University have launched Edx courses, due to their competitive approach, these initiatives help universities to offer their courses with similar flexibility and further improvements. Also, ABET has issued the specifications to be respected and the capacities to be developed over technical engineering training; namely ABET-2013. A review of flipped learning at various levels are included in, Blerta Prevalla, and Huseyin Uzunboylu (2019), and its importance are found in (Akçayır & Akçayır, 2018; Lo

et al., 2017).

Various stages in the development of FCR clearly show that it becomes popular among teachers, students, and educationalists. From the literature review, it is observed that many researchers contributed to its use up to some extent for the subjects: English (Hung, H.-T. 2015)., Chemistry (Fautch, J. M. 2015, Seery, M. K. 2015), Statistics (Wilson, S. G. 2013), Social science, Science, High school Mathematics (Bhagat, K. K. et al., 2016). etc. But very less work is available on engineering mathematics at the entry level for students studying in a rural area which is presented in the next section.

5. Experimentation

In this work, we consider a subject as engineering mathematics of first-year engineering from Savitaribai Phule Pune University in the state of Maharashtra, India which is located at Taluka place, rural area. 90 % of admitted students in our institute are from rural areas. As per University norms, there are mid-semester and end-semester examinations, and passing every subject requires at least 40 percent marks.

Syllabus of M-I: University syllabus consists of six units of engineering mathematics. Generally, teaching starts in August and the In-Sem (Mid-Sem.) examination starts in October and ends the semester examination in December. Students need to study five theory subjects along with practicals and non-credit courses. One of the important subjects for the first semester is M-I. Detailed analysis of the Syllabus shows that 50% of the syllabus is based on differentiation, 34% is based on linear algebra and 16 % is based on integral calculus.

To make teaching-learning more effective, there are many possible ways, but still, some students are not motivated to learn mathematics. By observing students during the first month of their first semester, it is observed that many students are not performing well. Therefore, it is decided to take a review of it, which is included in the following:

Collection of student's difficulties: In addition to regular oral feedback during classes, after completing two units, unit No. I and II (see Appendix-I) out of six, the feedback was taken. The purpose of this activity was to know the students learning progress, which topic they feel to be difficult and why. While interacting with students 90% of them replied that Unit No.-II (Fourier series) was the most difficult. During personal interactions with them, it was observed that they were unable to apply proper formulas for a particular problem and were not able to solve the complete problem. Based on the unit test results it is observed that 80% of students performed very badly in the test and it was an indication that they are having difficulty in the topic. Through interactions with each student, their difficulties are divided into the following three categories:

Table 2 : Students difficulties

Sr. No.	Difficulty	Reasons / actions
1	Weak in fundamentals	Lack of understanding in trigonometry, integration, even and odd functions, and in applying proper limits.
2	Partial understanding of concepts	Weak in the understanding of basic concepts, formulae, not able to apply the proper formula for a particular problem . Make mistakes while solving problems and no accuracy.
3	Less motivated	Not actively participating in learning activities. Not responding to questions. Not able to cope up with the lectures during regular classes.

Considering all the difficulties of students, it has been decided to provide them with VLs on this topic.

Making PPTs: When careful consideration is given to the format, content, and accompanying activities, VLs have the potential to deliver course content effectively and help students for learning, (Johanna Inman and Simuelle Myers, 2018). For making VLs, PPTs play a very important role. For effective PPTs, it is decided to choose proper design, font size, effective use of animations, and color combinations. At the beginning of the presentation, the following questions were answered: why to learn a particular topic? And how it will be useful for further study. Secondly, all the basic formulas required for the topics are provided. It has been tried to answer the following questions: How to decide the correct formula to solve problems of full-range Fourier series, half-range Fourier series, or general Fourier series? How to solve problems of Harmonic analysis and their applications? A good combination of theory and problems with applications is used.

VLs for Fourier series: For making effective VLs, the latest research available in the literature was studied. In this regard, short videos are more effective than long videos Hanna Kinnari-Korpela, (2015). Therefore, it has been decided to make short videos. It is decided to maintain the pace of explanation which

will be suitable for all types of learners to develop interest. Also, the voice must be audible, PPTs must be visible, and overall, it creates learning interest. The first lecture was on Introduction to the Fourier series, which includes areas of applications of the Fourier series, particularly in engineering and technology, its importance for their further study, comparison of the Taylors series and Fourier series, formulae required for most general Fourier series, even and odd functions, cosine, and sine Fourier series, etc. The second lecture was about the method of dealing with the problems of the Fourier series, how to choose the correct formula, how to apply limits of integration, and how to get the correct final answer. The third lecture was about the Half Range Fourier series. And the fourth lecture was on Harmonic analysis: starting with all standard results of first, second, third, etc. harmonics, then how to prepare a table. How to calculate the values required in the table? How to apply the formula and calculate the required coefficient? Four videos on the Fourier series were provided and uploaded on YouTube and shared with the students. We have provided entire technical support to students including internet, Lab. and other required facilities.

Video lectures for other topics: After giving these VLs on the Fourier series, Hiwarekar [2019], it is observed that almost all students watched these videos at least once, some of them watched them many times and they realized their importance. They found this new way of learning was more interesting and they were able to solve problems in it. Surprisingly more than 90% of students performed very well in the internal examination which was conducted within eight days after providing them with VLs. During interaction with students, after providing VLs, it was asked, do they like the new way of TL or not. Almost all the students replied that they liked it. It has been observed that many students had approached and took a keen interest in learning mathematics which was a very positive sign for enhancing learning.

Once it is confirmed that they like this new technique for learning, VLs on other topics were provided which includes the Taylors series, Indeterminate forms, Partial differentiation (seven lectures), Matrices (seven lectures), and basics of engineering mathematics (four lectures). Students are very much satisfied with it.

The details of various feedback techniques at different stages are shown in the following Table-3:

Table 3 : Various stages of Feedback

Sr. No.	Feedback Type	Period	Purpose
1	Students feedback I	Oct. 2019	Information from students about their progress, their views about VLs on Fourier Series·
2	Students feedback-II	Dec. 2019	Continuous observations and their views about VLs . Acceptance of new ways of learning using VLs. Improve results.
3	Students feedback-III	Jan. 2020	Overall feedback on technology-based teaching-learning and about the impact of teacher's efforts.
4	Oral feedbacks	Aug. 2019 to Jan 2020	To decide new strategies based on feedback from students and further modifications for effective learning.

The conclusions which are based on the feedback, and analysis are included in the next section.

6. Statistical Analysis And Conclusions

Various surveys and feedback are presented for the conclusion.

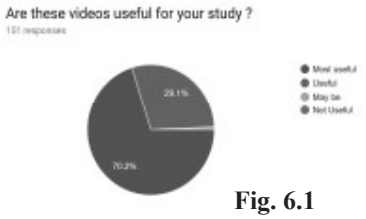

Fig. 6.1

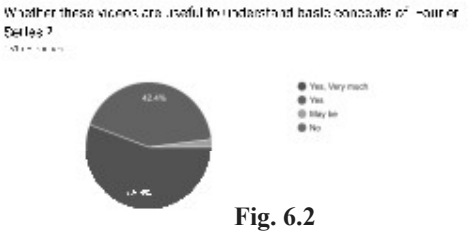

Fig. 6.2

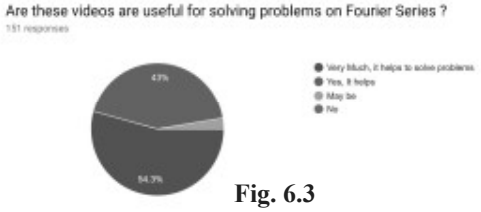

Fig. 6.3

Fig. 6.4

6.1: Teaching-Learning through video lectures: Students' feedback-I on VLs on Fourier series was taken during Oct. 2019, (Sample size is 151). According to the feedback, 98% of students felt that these VLs are useful to understand the basic concepts of the Fourier Series. 90 % of students felt that these VLs helped them to complete their studies in a short period. 98 % of students felt that these VLs created an interest in learning Mathematics. In this survey 99 % of student's opinions were that these VLs were useful for their study. More details are shown in the following Pi diagrams (Fig. 6.1 to 6.4).

6.2: Acceptance of flipped classroom approach: This survey was conducted during Dec. 2019 after completion of all topics of M-I (Sample size is 130). Details are shown in the following table (Feedback-II) followed by a diagram.

Table 4 : Feedback - II

Sr. No.	Question	Students Responses (in percentage)				
		Excellent	Very good	Good	Fair	Bad
1	Way of explanation	66.9	26.2	6.9	0	0
2	Pace of lecture	54.6	36.2	9.2	0	0
3	These videos helpful to understand basic concepts of the topics	73.3	23.1	4.6	0	0
4	Creates interest for learning	60	33.1	6.9	0	0
5	Quality problems covered	59.2	31.5	6.2	3.1	0
6	Helpful for examination preparations	68.5	23.1	8.5	0	0
7	Overall quality of Videos	62.3	30	7.7	0	0
8	Helpful to complete study in short period of time	66.2	26.2	5.4	2.3	0
9	Average	63.88	28.68	6.93	0.68	0

The diagram is shown in following Fig.6.5

FCR is an experimental pedagogical approach that increases student satisfaction with the learning environment (O'Flaherty & Phillips, 2015; Seery, 2015, Lo and Hew, 2017). From the above table, it is clear that 92.56 % of students are very much satisfied with all aspects of VLs and 99.49% of students are satisfied. Also, there are a few students (0.68 %) who are not satisfied with it. Moreover, the pi diagram, it shows that 98 % of students felt that these VLs created interest in learning Mathematics. More details are shown in the following diagram (Fig. 6.5).

6.3: End semester overall feedback from students (after university examination- Jan. 2020): It was told

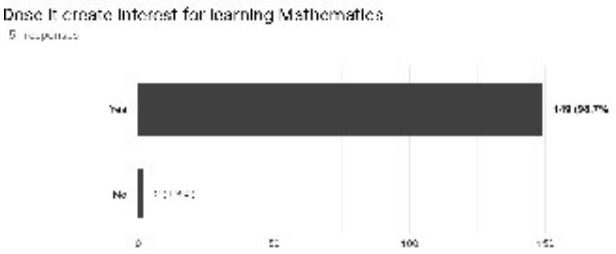

Fig 6.5

to students to write their overall opinion on this experiment of VLs. Here some sample responses are shown in Appendix-II:

Here are pi diagrams that show that students set a high target for their results. Also, they are expecting VLs for next semester:

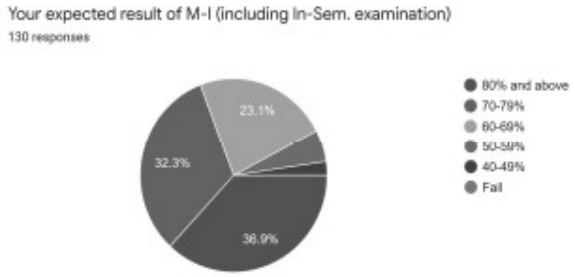

Fig.6.6

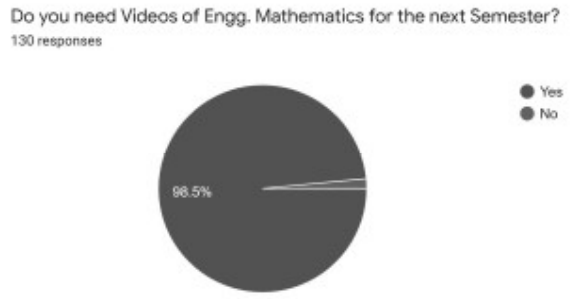

Fig.6.7

These responses show that students were motivated to learn engineering mathematics. Obtained results support the approach of Abeysekera and Dawson (2015) who hypothesize that an FCR can satisfy students' ability to learn effectively through self-motivation.' (Ryan & Deci, 2000).

6.4: Improvement in results: University result analysis of one batch of all students and its

comparison with the previous year's results is carried out in the following table:

Table 5 : Result analysis

Sr. No.	Year	% of students who scored marks in University examination (M-I)					
		Pass (Min 40%)	40-59	60-69	70-79	80-89	90-100
1	2019-20	78.19	32.18	12.50	15.43	10.37	7.71
2	2018-19	41.5	20.50	10.53	6.37	3.88	0.28
3	2017-18	58.47	30.69	11.90	10.58	3.97	1.32

From the above table, it is very clear that the passing percentage increased by 28.19 as compared to the average of the last two years and by 36.69 as compared to last year. There is a 21.59 % increase in the results of students who scored 60% or more marks in the university examinations as compared to the average of the last two years. Also, there is a measurable increase of 13.37 % of students as compared to the average of the last two years who scored 80 % or more marks. Thus, it shows that there is an improvement in the results in terms of quality and quantity. Through this experiment following conclusions are presented:

6.5: Created learning interest: From an educational psychological perspective, learning happens when the learner is actively involved instead of only passively receiving information (Wittrock, 1992). Fig. 6.5, Fig.6.7, and from students' overall feedback (see sections 6.1, 6.3) it shows that to enhance learning, in addition to classroom teaching, VLs helped students to develop their interest. In a short period, single teachers can give valuable input to students. Also, students can watch videos many as per their requirements and at their suitable time. It is possible to pause VL and concentrate on a particular concept until they understand it. They can reverse a video and watch it again and again, which is not possible in the regular lecture method. Some students lose their interest due to less understanding, but if they watch it a greater number of times, they can understand a particular concept thoroughly (Bhagat, K. K., Chang, C. N., & Chang, C. Y., 2016). This may lead to creating learning interest through their active participation.

6.6: Focused on a particular topic: When students are watching VLs, they are focused, but during lectures, they may or may not always be focused. It helps them to perform very well in the examinations (see Fig. 6.2, Fig. 6.3, and section 6.4). If they pass the examinations, it reduces the further burden, and they can perform very well in the next years of their study. They can utilize their time for gaining knowledge, acquiring skills, the study of competitive examinations, MOOCs courses, and other self-learning activities, (Bergmann & Sams, 2012, Roehl, Reddy, & Shannon, 2013). It will help to improve the habit of learning, which will help them to get better jobs and exposure.

6.7: Slow learners: Teaching slow learners is challenging due to their very less speed of learning. According to Chi and Wylie (2014), students can achieve a better understanding if they are engaged more in learning activities. The advantage of VLs is that students can learn at their pace, (Davies, Dean, & Ball, 2013), they can watch VLs as many times as they want, and they can pause it and focus on a formula or part of the topic. Many students while interacting gave feedback that they watched videos 3 to 4 times or till they understood the concept. It will surely help such students in many ways and increase their confidence level and for better learning outcomes, (David C.D. et al., 2019, Lape et al., 2014). Result analysis Table 5 indicates that FCR helped slow learners (see section 6.4).

6.8: Fast learners: The result analysis shows that there is an increase in the result of students who scored at least 60% marks in the university examination (see section 6.4). FCR helps fast learners, as they use VLs and complete their studies in a very short period (see section 6.5, Table 4). They can utilize their saved time to solve problems of advanced level, (Lazakidou, G., & Retalis, S. 2010) to study the latest developments in the field and they can learn new things.

6.9: Helping teachers: Many mathematics teachers spend a lot of their time in solving students' difficulties. It affects their administrative as well as important academic duties such as research, and attending academic programs. It may increase teachers' stress and afftet their professional growth. But if VLs are provided to students then most of their difficulties get solved by watching VLs and it helps the teacher to save their time. During 2019-20 it is observed that 60% of the time on solving students' difficulties was saved by the teacher. It helps the teacher to cover content in a short period. The saved time was used for giving valuable inputs on the latest developments, further scope, applications, research, and developments and providing support to students (Van den Bergh, Ros, and Beijaard, 2014).

Thus, this approach is very useful to slow learners, fast learners as well as teachers.

7. Concluding Remarks

Through this experiment, the following conclusions are incorporated. FCR is a very effective tool to enhance learning. From section 6.1 to 6.9 use of VLs helps in many ways such as: attracting students for learning activities,improve results and this approach is very much acceptable to students from rural areas. We have provided all facilities to students including internet, Labs. etc. VLs are very much acceptable to students, and it improves overall learners' involvement, the student becomes an active learner. It is suitable for slow learners as well as fast learners. It helps to complete the study in a short period and to increase the effectiveness of students and teachers. This approach promotes the requirements of the National Education policy-2020 of India, in which there are many points related to technology-based education, e-contents developments, and the promotion to online education, (NEP Policy 2020, MHRD, Gov. India).

8. Limitations And Future Scope

In this study, the conclusions are obtained from action research based on one subject M-I, and a group of students at the college level in the rural area. It can be extended further and can be applied to other subjects as well as to different educational institutes and Universities. Further extension is possible for comparison of students with different demographics and internet facilities; users and non-users; Comparison between the same strength level student class, etc. The Study can be extended by considering some points discussed by Batra Shefali, et. al (2021).

9. Abbreviations

ABET-Accreditation Board for Engineering and Technology, AR-Action research, FCR-Flip classroom, Lab.- Laboratory, HE-Higher Education, MIT-Massachusetts Institute of Technology, OCW-Open Course Ware, TL-teaching-learning, VL-video lecture.

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Appendix-I: University Syllabus for M-I

Unit I: Differential Calculus: Rolle's Theorem, Mean Value Theorems, Taylor's Series and Maclaurin's Series, Expansion of functions using standard expansions, Indeterminate Forms, L' Hospital's Rule, Evaluation of Limits and Applications.

Unit II: Fourier Series: Definition, Dirichlet's conditions, Full range Fourier series, Half range Fourier series, Harmonic analysis, Parseval's identity, and Applications to Problems in Engineering.

Unit III: Partial Differentiation Introduction to functions of several variables, Partial Derivatives, Euler's Theorem on Homogeneous functions, Partial derivative of Composite Function, Total Derivative, Change of Independent variables.

Unit IV: Applications of Partial Differentiation (08 Hrs.) Jacobian and its applications, Errors, and Approximations, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

Unit V: Linear Algebra-Matrices, System of Linear Equations (08 Hrs.) The rank of a Matrix, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations, Application to problems in Engineering.

Unit VI: Linear Algebra-Eigen Values and Eigen Vectors, Diagonaliztion (08 Hrs.) Eigen Values and Eigen Vectors, Cayley Hamilton theorem, Diagonalization of a matrix, Reduction of Quadratic forms to Canonical form by Linear and Orthogonal transformations.

Appendix-II: (Feedback-III)

Response 1: The teacher's effort for students' preparation for the subject is excellent. They always keep in touch with students by VLs. It helps to understand the concept clearly.

Response 2: Very excellent work by sir and thank you for creating videos because of these videos we require less preparation time.

Response 3: This is very helpful for all to study in a limited time and one can learn any chapter anywhere in case of sickness or other considerable reason. students hope that they will get these VL next semester also.

Response 4: Excellent videos which are very useful for understanding.

Response 5: The teacher took huge challenges for FE students to make them able to score with excellent numbers. Hard work and dedication are his perfect corner.

Response 6: The effort taken by the teachers has helped me to understand the concepts easily and quickly and thanks to the teachers.

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