

WEM: AN AV-TOOL FOR MOTIVATION IN ENGINEERING MATHEMATICS

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The study aims to present the making of WEM (Why Engineering Mathematics?), an audio-visual (AV) aid developed to motivate first year engineering students towards learning mathematics. The paper also investigates the effects of WEM on undergraduate engineering students. Pre-Survey and post-Survey tests were taken on the single group to check the effectiveness of the tool. The results indicated that WEM promotes students' motivation and positive approach towards learning engineering mathematics.

INTRODUCTION

Motivation in education plays a very important role in learning. One of the most difficult aspects of being a teacher is how to motivate students to learn your subject, especially when the subject is mathematics. Students who are not motivated will not learn efficiently. Either they will not retain information or will not participate in life-long learning or will become disruptive. For effective teaching, teachers must take students' learning motivation into consideration, because pupils learn only if they want to learn (Fairbrother, 2000). Students' motivations tend to focus on learning goals such as understanding and comprehensive knowledge of mathematical concepts (Ames & Archer, 1988; Dweck, 1986). How to encourage students' motivation and to understand their learning abilities in mathematics is very important. Some authors such as Klingbeil, Mercer, Rattan, Raymer, and Reynolds (2004), Middleton and Spanias (1999), and Zakaria and Nordin (2008) have addressed the issue of motivation in mathematics learning but as compared to other subjects, for mathematics education, motivation and the difficulty of finding reliable and valid methods for motivating learners is not discussed much. In this paper, the author presents WEM as one of the valid methods for motivating learners.

There are several reasons for students being unmotivated towards engineering mathematics learning. A survey was conducted at the beginning of the first semester of engineering. Around 240 first year engineering students of K. J. Somaiya College of Engineering, (KJSCE) Mumbai, were asked to answer some survey questions related to mathematics and their approach towards mathematics. All students, who participated in survey, were with above average academic score (Maharashtra Common Entrance Test (MH-CET) score more than 100 out of 200 marks). Findings are really surprising and some of them shocking!!

- More than 70% of students have learnt mathematics without relating it to real life.
- Around 60% students are unable to list a single application of mathematics in their day to day life or in any other field.
- Majority of students admitted that they don't know why they are being taught mathematics as they

have not yet applied any of maths concepts in their life!!

- Few students agreed and commented, “Of course math is useful but they don’t know where!”

Some interesting comments were, “Up to topics such as profit- loss, fractions etc. was useful but why this integration, differentiations, matrices etc. are been taught? It is completely abstract and useless!,” “I don’t understand why mathematics is included in engineering curriculum? Till now I have not used my 11-12th Grade mathematics anywhere,” “Math is only there to score well and raise pointer, nothing else.” Some students fear mathematics and are less motivated towards mathematics learning. Some of them commented, “I cannot see any physical relevance of Math! That’s why I don’t understand it at all.” The survey results clearly indicate the approach of teaching mathematics in their school level needs improvement. Engineering students remain demotivated towards their maths learning because they are not communicated about

- Usefulness of mathematics in core engineering subjects.
- Real life applications of mathematics.
- Requirement of mathematics in higher studies & research.

One approach to overcome this challenge is to provide the insight of applications of mathematics in day to day life, in student’s area of interest and their main domain of work.

To keep students motivated and to raise their inclination towards engineering mathematics, the author developed an audio visual aid “WEM: Why Engineering Mathematics?”

DEVELOPMENT OF ‘WEM’

WEM is an audio-visual aid, which contains interviews of selected teachers teaching core engineering courses (based on experience of subjects taught related to mathematical background), the Principal, Deans, alumni (working in fields having more applications of mathematics) and selected students from higher grades who can relate core subjects with mathematics.



Figure 1: Clips of WEM: Interview with the principal, faculty, alumni and students

These people were asked to share their experiences about applications of Applied Mathematics-I in core engineering subjects and day-to-day life. During interviews, they also talked about why students should learn Engineering Mathematics or why Mathematics is in Engineering Curriculum. They were also asked about relevance of mathematics in other subjects, higher studies and research. WEM was exclusively created for first year engineering students. The interviews were recorded in the form of audio-visuals. Total three videos were developed to address branch-specific requirement of different branches of engineering. For eg., the video developed for computer and IT engineering students, contained applications related to areas like cryptography, data analysis etc.

This paper is discussed with the data related to department of computer engineering and department of Information Technology. The video can be accessed on the following link with prior permission.

https://drive.google.com/file/d/1KmSQrHZG-erTonlg7_y_iTlclPAjtY0/view?usp=sharing

The interviews were conducted by students of “Emfinty”, the official Math club of KJSCE. The video was shot and edited by students of “Team Shutterbug”, the official photography team of KJSCE.

The objectives for developing WEM were

- To motivate students towards learning engineering mathematics
- To increase awareness about mathematics and its requirement in curriculum of engineering
- To inform students about applications of mathematics in day to day life
- To connect mathematics with other subjects
- To inspire students to find more applications of mathematics

Some of the questions asked to interviewees were:

- What is the importance of mathematics in engineering curriculum?
- How does mathematics relate to other subjects?
- How can we use mathematics in our daily life?

DEMONSTRATION OF ‘WEM’

The WEM was shown to every student of first year engineering at KJSCE in the beginning of the semester. Before showing the video, data was collected through questionnaire about their knowledge and approach towards mathematics learning. Total 219 students from Computer engineering and Information Technology department participated in both pre and post invention survey. The students were called out of their regular class and were asked to sit in well-equipped seminar hall. Students got excited with the theatre kind of environment and felt like they were going for a movie with their friends. The excitement reached its peak when they realised that the movie which they are about to see is the complete effort of their own seniors and teachers of the college. This was the first time in their life when students were asked to see movie in their maths lecture!!

Students felt that every question which was posed in the movie was straight from their heart and was never

answered before in any of their maths classes before this. They were fascinated by witnessing many other students and teachers, including principal of the college, talking about mathematics. Before this, they had heard only maths faculty talking about mathematics. Students realised that mathematics is not just required to score marks in exams but it has relevance for other subjects in higher studies, research and also applications in day to day life. They could now see mathematics beyond the curriculum and subject.



Figure 2: Demonstration of WEM

STUDENTS SELF-ASSESSMENT ON 'WEM'

Students were asked to self-evaluate themselves through the questionnaire. The same questionnaire was floated to students before and after showing WEM. The following figures indicate the responses obtained on different items of the questionnaire.

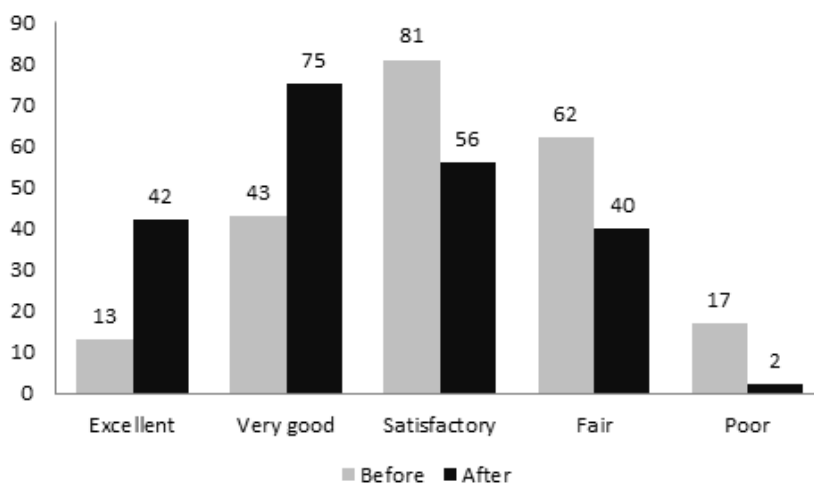


Figure 3: Rate yourself on the basis of your knowledge of application of mathematics in day to day life

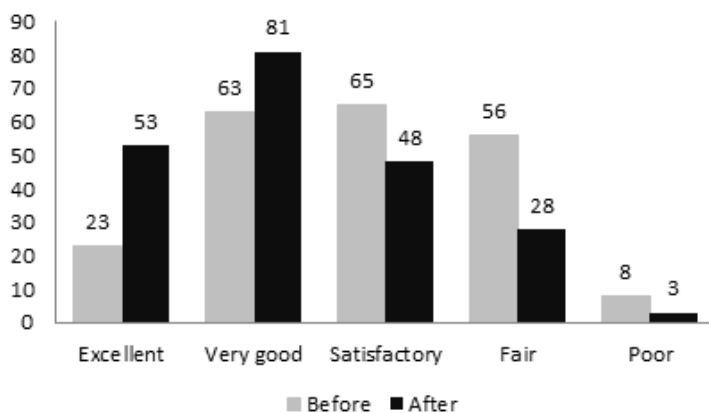


Figure 4: Rate yourself on the basis of your knowledge about connection of mathematics with other subjects

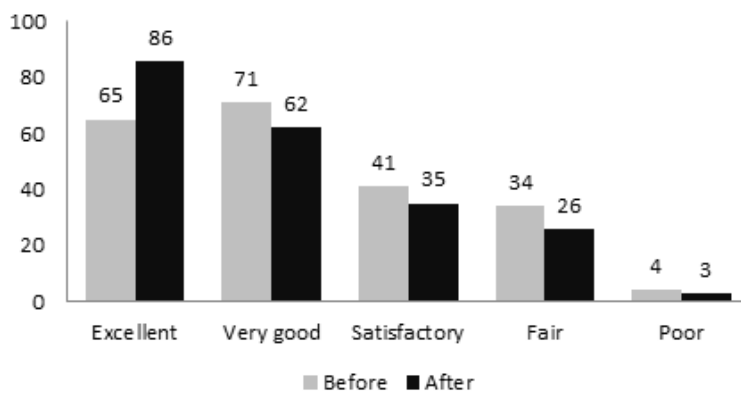


Figure 5: Rate yourself on the basis of your interest in learning mathematics

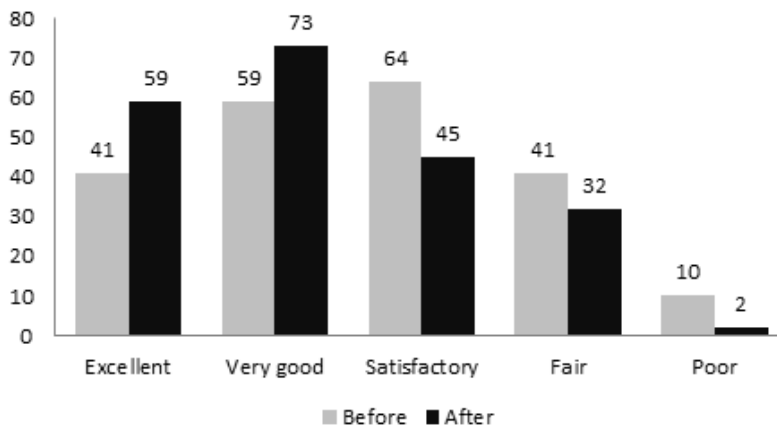


Figure 6: Rate yourself on the basis of your interest to find applications of mathematics

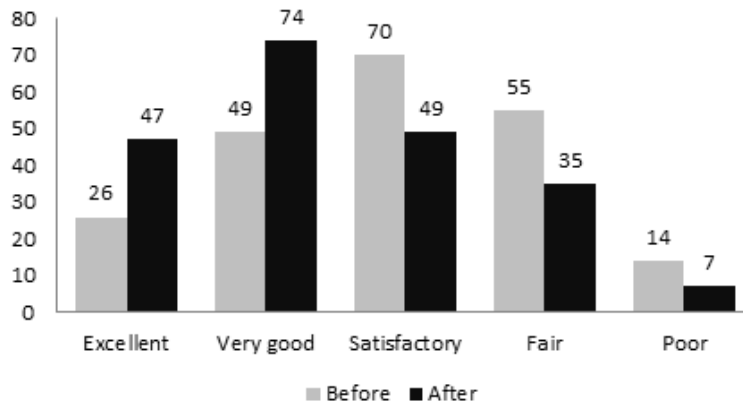


Figure 7: Rate yourself on the basis of use of internet in finding applications of mathematics

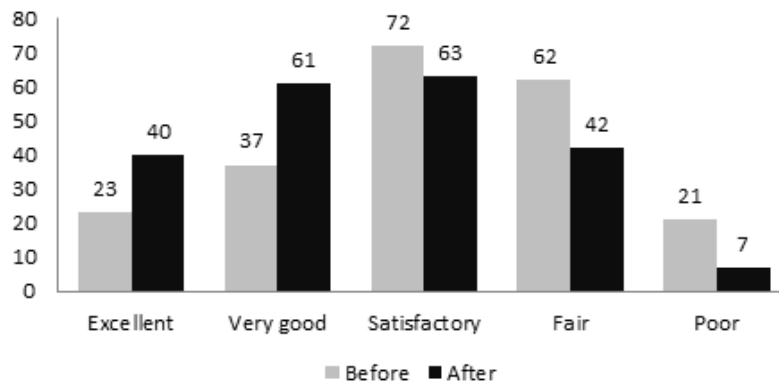


Figure 8: Rate yourself on the basis of your interaction with other world about applications of mathematics

Do you think the Math Video was motivational teaching tool?

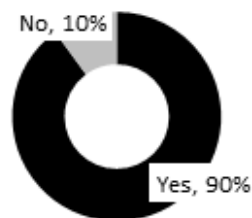


Figure 9: Math Video (WEM) as a Motivational Tool

Overall, 90% of students agreed that WEM had acted as motivational tool and it had helped inspire students to search more about application. Students were also interviewed on the following questions where they were allowed to give more than one answer and also they could choose their own answer. Most favoured answers are listed in the following figure.

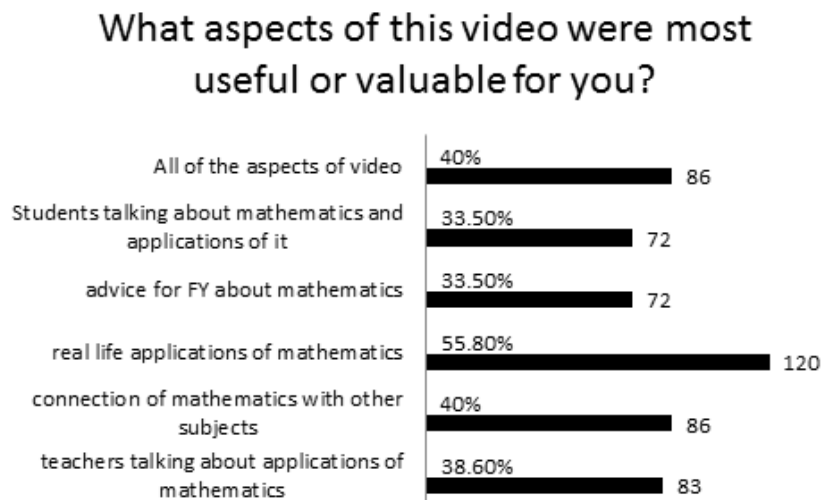


Figure 10: Overall impact of WEM

CONCLUSION

WEM widely left its impact on students. WEM was the first ever surprising experience for almost all students in mathematics classroom. Majority of students have changed their perception towards mathematics and started using internet to find other applications of mathematics. They have started approaching core engineering faculty to relate mathematics with other subjects. Students have understood the importance of mathematics, especially topics covered in Applied Mathematics-I in first year B.Tech at KJSCE. Most of the students considered WEM as one of the best and innovative teaching tools. Students involved in the development process of WEM commented that other than mathematical benefits, development of WEM also helped improve their creativity, vision and other lifelong learning.

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