

Summary of Action Research Tool (ART)

Bending moment sign misconceptions for the students at the collegiate level

April, 2016

Course:
Mechanics of Materials

Lecturer:
Dr. Belal Mahmoud Almassri (mbelal@ppu.edu),
Assistant Professor of civil engineering department, PPU
Palestine Polytechnic University, PO Box 198, Hebron, West Bank, Palestine



Report Outline:

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Abstract This section includes an overview for this report, overview for the course and the post-test results.	The main objective of this report is to present a systematic solving mean of teaching problem, the subject of this problem is related to Mechanics of Materials course which is one of the fundamental courses for Civil and Mechanical Engineering students, the basic mechanic's course should develop the ability to analyze a given problem in a simple and logical manner and to apply to its solution a few fundamental and well-understood principles. The students had a problem to distinguish positive and negative concentrated bending moments applied to structural members as beams and frames, this problem showed up in the part of drawing the Moment Diagrams, the engineering software ETABS as well as additional practical sessions with student's groups was used to solve this problem, the post-test showed an important advancement in the results as many students have no more understanding problems of this point.
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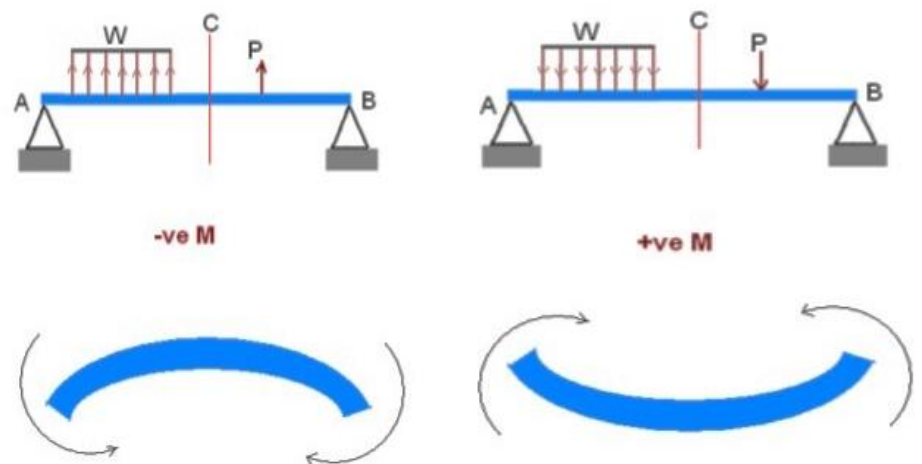
Introduction

This section indicates:

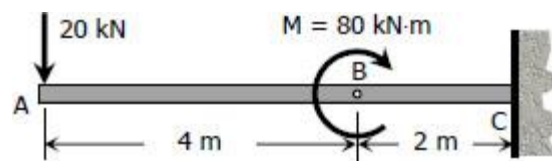
- The underlying teaching problem.
- Current relevant literature that supports this research.
- The suggested hypothesis.

The Bending Moment of a force is a measure of its tendency to cause a body to rotate about a specific point or axis. This is different from the tendency for a body to move, or translate, in the direction of the force. In order for a moment to develop, the force must act upon the body in such a manner that the body would begin to twist. This occurs every time a force is applied so that it does not pass through the centroid of the body. A moment is due to a force not having an equal and opposite force directly along its line of action.

A moment is expressed in units of foot-pounds, kip-feet, newton-meters, or kilo newton-meters. A moment also has a sense; when the section is made to the left of the beam, A clockwise rotation about the center of moments will be considered a negative moment; while a counter-clockwise rotation about the center of moments will be considered positive. The most common way to express a moment is:



The problem of this research has showed up in the part of drawing bending moment diagrams for beams and frames, as many students could not distinguish the positive and negative moments in case of concentrated bending moments acting on the beam on some points as shown below the $M=80 \text{ kN}\cdot\text{m}$ acting on point B:



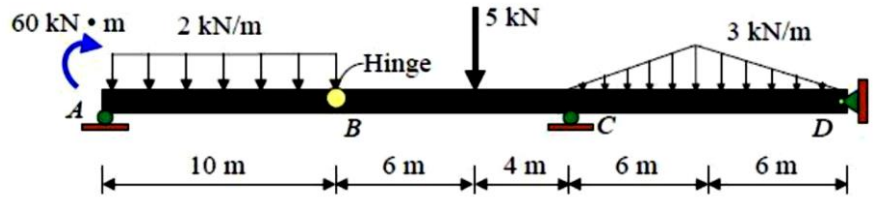
The systematic mean of problem solving used here is a combination between the technology using the engineering software ETABS and practical sessions with separate groups of students.

Methodology

This section provides enough information about:

- The participants:
- Who was involved in the project,
- How they were selected /identified,
- Relevant characteristics
- The materials we used
- The procedure you followed,

This problem showed up in a pre-test made at the beginning of the semester, this quiz showed a crucial number of students who could not distinguish the positive and the negative concentrated bending moment. The quiz question is shown below, it was required to draw the shear force and bending moment diagrams for the following beam:



The problem was to consider the 60 kN.m positive or negative, to be drawn above the line or below the line. 156 students participated in this quiz, and the results are listed in the following table:

Category A	Category B	Category C
Students who could distinguish the sign of the couple moment and could draw it correctly	Students who could distinguish the sign of the couple moment but could not draw it correctly	Students who could neither distinguish the sign of the couple moment nor draw it correctly
88 Students	22 Students	46 Students

The results showed almost 68 Students out of 156 had problems in this point.

The 156 students in 3 classes were divided into groups, each group included students from two different categories (A and C or A and B), discussion sessions were held at the last 15 minutes for each lecture and for 2 successive weeks. These sessions included beams questions with concentrated bending moment acting on them.

Moreover, the engineering software ETABS were used in front of the students to draw the bending moment diagrams for different beams. The students learned how to use this software in order to draw bending moment diagrams for beams and frames.

Results / Discussion

This section contains an analysis of the data we obtained.

Posttest result

At the end of this semester, a post-test made and the different categories of students participated in this quiz, the quiz had only questions that have concentrated bending moments acting on different beams along with other types of loadings, the students had to draw the bending moment and shear force diagrams, the part related to shear force diagrams, 95 % of students had no problem drawing which is considered a very good result.

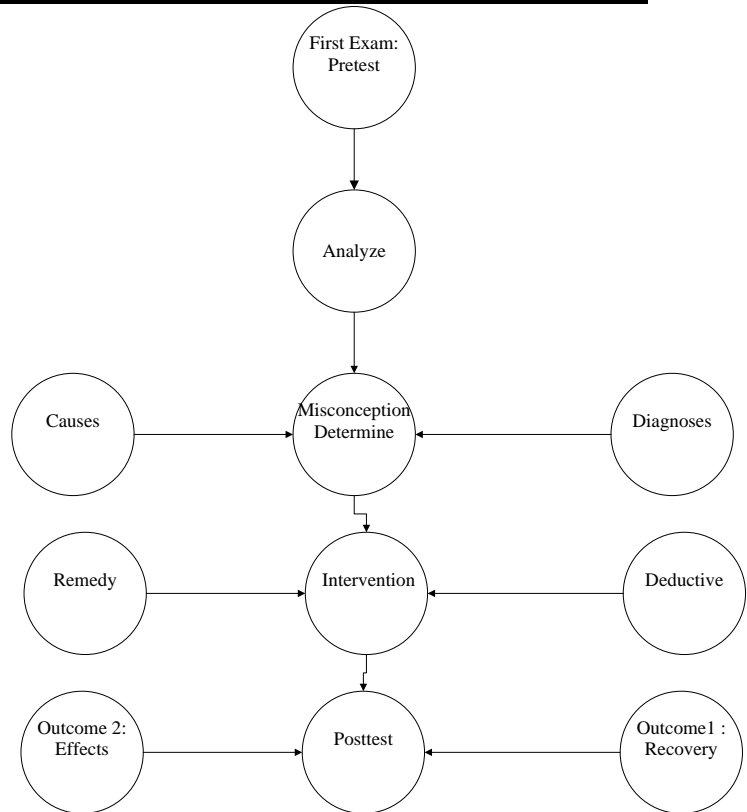
The other part related to the students who had problems in drawing the bending moment correctly (the students who were listed in categories B and C, see the previous section), the results showed a good improvement in the number of students who could draw it with no problems, only 17 % had problems now in the drawing process, this percentage was 43 % before applying the remedy plan which included both engineering software and discussion sessions.

Result:

Category A	Category B	Category C
Students who could distinguish the sign of the couple moment and could draw it correctly	Students who could distinguish the sign of the couple moment but could not draw it correctly	Students who could neither distinguish the sign of the couple moment nor draw it correctly
129 Students	11 Students	16 Students

The post test results showed only 27 Students out of 156 had problems in this point. (and 41 students had no problems drawing the bending moment diagrams any more).

The data collection and remedy plan is shown below:



Conclusions:

From this ART report, the following points can be concluded:

- Organizing, planning and presenting lectures, may include challenge for teacher in such classes as student's abilities might differ considerably.
- There is another difficulty related to the learning process. In fact, the learning process may not be easy in a crowded class, as shown in the remedy plan when students divided into small groups it had a crucial effect on the results.
- In a large class, it would benefit from technology resources such as computers, engineering software, etc.
- It would be a great idea to train students to work in small groups. And when working in groups, it would be beneficial for students to sit around the same table so that everyone could have a chance to participate.

References/ Bibliography	<p>Elliot, J. (1991). Action research for educational change. McGraw-Hill Education (UK).</p> <p>Johnson, A. P. (2005). dshort Guide to Action Research.</p> <p>Karama, M. (2013). using the definition to find the first derivative of functions: Misconceptions and remediation at the Collegiate level. PPU, Palestine.</p> <p>Sagor, R. (1992). How to conduct collaborative action research. Association for Supervision and Curriculum Development, 1250 N. Pitt St., Alexandria, VA 22314.</p> <p>Zuber-Skerritt, O. (1992). Action Research in Higher Education: Examples and Reflections. Kogan Page Limited, 120 Pentonville Road, London N1 9JN England, United Kingdom.</p>
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