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Experimental Data Simulation Website for Strength of Material

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Abstract

Pandemic covid-19 has caused the change of education system in Malaysia into long distance edu**c**ation. The Ministry of Higher Education Malaysia has issued instructions that all teaching and learning activities (T&L) should be implemented online. It presents a new challenge for lecturers to teach especially for engineering subjects. Therefore, lecturers of the Department of Mechanical Engineering, Polytechnic Kuching has developed a website called "www.jomeksperimen.com". This website aims to help Diploma in Mechanical Engineering students for the DJJ30103 Strength of Materials course in understanding the experiments conducted in the laboratory through a variety of settings as variable parameters. The further aim of the project is to know the feedback of the students toward this website application. The results of the survey show that this website can help students improve their understanding in the implementation of experiments in the laboratory.

Key-word: - *Experiment Data Simulation, Website, Strength of Materials*

1. Introduction

Pandemic Covid-19 has caused the education system in Malaysia to change to distance education to prevent the spread of the virus among local and foreign students. Students in higher education have been limited in number so that social distance can be practiced while s**o**me others are allowed to go home. The second wave of Covid-19 has led to a higher increase in cases in some states. Therefore, the Ministry of Higher Education Malaysia in the latest statement stated that teaching and learning (T&L) should be implemented online.

Online learning that started in early 202 until now has given new challenges to lecturers especially for engineering courses. Courses containing various formulas and math calculation methods need to be taught and learned by students online. Even experimental and workshop assignments had to be postponed to a certain time. Therefore, this website was developed to assist Diploma in Mechanical Engineering students in understanding the experiments performed in the laboratory for the DJJ30103 Strength of Materials course.

2. Problem Statement

DJJ30103 Strength of Materials course is a course that provides students with the knowledge of calculating the properties of a material due to force action where it can also be observed by students through practical work. Diploma in Mechanical Engineering students who take this course consist of semester 3 students. They are a group of students who are not allowed to attend face-to-face learning until a certain period. This causes students to not be able to perform experiments in the laboratory and may result in failure to better understand the course content. Therefore, this website was developed to help students conduct experimental simulations performed in the laboratory and to be able to use the data obtained to relate to the theories learned.

3. Objectives

This project will identify the feedback of mechanical engineering students at Kuching Polytechnic on the application of websites in learning Strength of Materials through the following objectives:

i. Develop a website featuring experimental demonstrations for the DJJ30103 Strength of Materials course

ii. Identify student feedback on website demonstration application in improving understanding of conducting experiments for DJJ30103 Strength of Materials course.

4. Scope

This website was developed for the purpose of experimental learning for the DJJ30103 Strength of Materials course at Kuching Polytechnic, Sarawak, Malaysia. The display of this website is compatible with Mozilla Firefox and Android 10 browsers.

5. Methodology

The design development process of this website innovation is divided into 3 main phases namely Design Phase, Development Phase and testing Phase. as shown in Figure 1. The first phase of 'Information Design' is intended to list the information content for each page. Interaction design aims to determine how a website works and operates along with navigation control elements and so on. While the Interface Design determines how the site looks in the actual website view. The second phase is the phase of building html code programs using the Visual Studio Code editor version 1.51. The third phase is display and navigation testing as well as uploading to the internet using the 'domain' and 'hosting' packages from SyokHost.com.

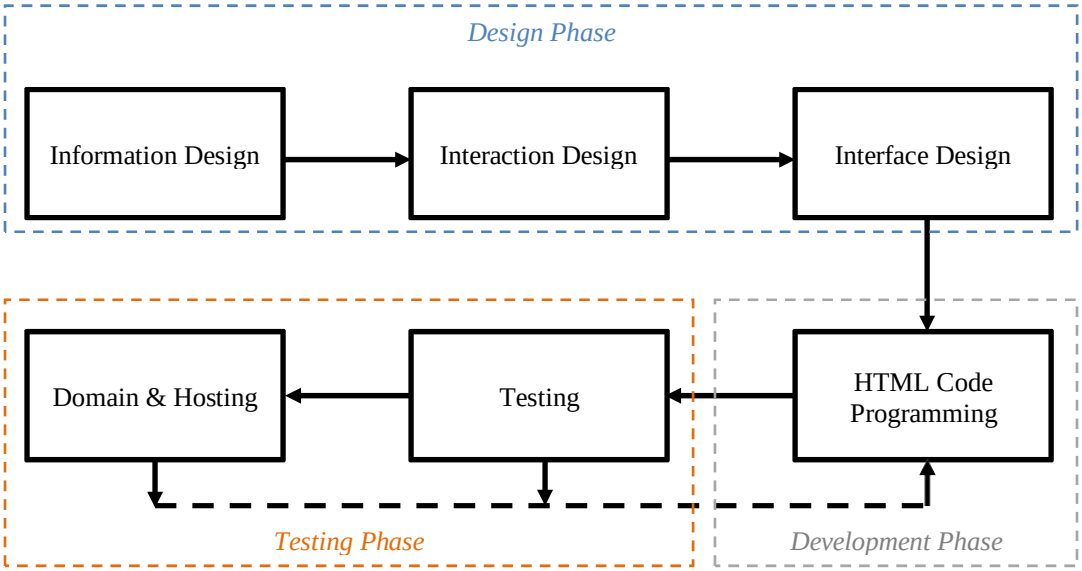


Figure 1 Design, Development and Testing Process

Information design for the website consists of 7 pages, namely the main page and 6 pages for each experiment as follows:

i. Home: Home
ii. Experiment 1: Tensile test of a material
iii. Experiment 2: Shear stress and strain on a block of material
iv. Experiment 3: Reaction force of simply supported beam
v. Experiment 4: Shearing force of simply supported beam
vi. Experiment 5: Deflection of simply supported beam with single load at the center
vii. Experiment 6: Deflection of cantilever beam with single load at the end

The interaction design used in this site is of the network structure type (Figure 2) where each page can be linked to all other pages via the navigation bar.

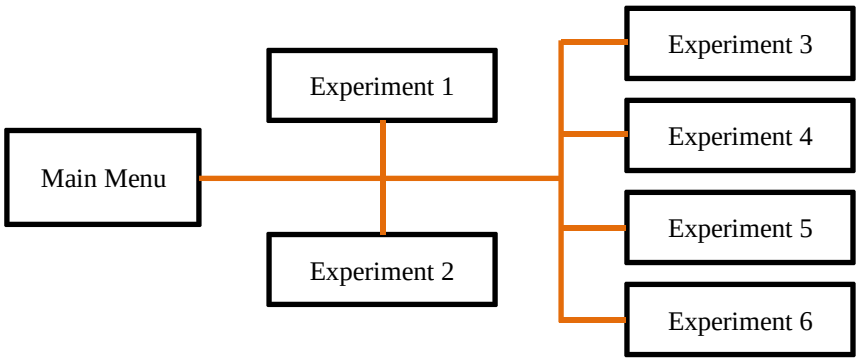


Figure 2 Network Structured Interaction Design

The interface design involves display style, information layout, color selection using text, graphics and video. This website is developed using a single column layout style where the content of the site is displayed in the middle of the website vertically. Headers and Footers are used on the homepage only. The same navigation bar is used on each page with contrasting color options, bright and prominent compared to the background color.

The Visual Studio Code program is used to write program code using html language because it is easy to use and display testing can still be seen. Thus, any errors can be detected earlier and can continue to be corrected. Next, the resulting html file needs to be uploaded in the hosting server of SyokHost.com for a fee for one year along with the domain name.

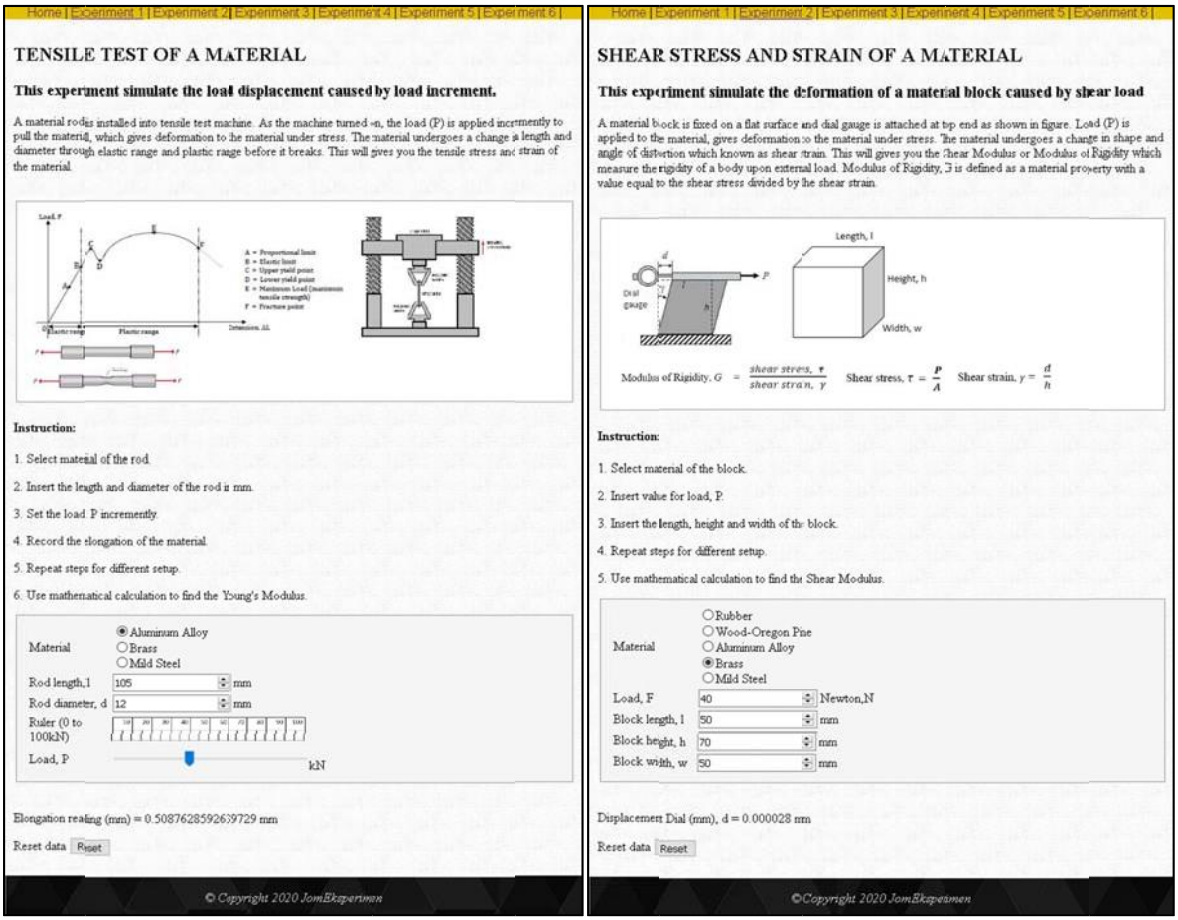
Feedback surveys were conducted using a questionnaire on students on the application of website demonstration with mean descriptive data measurement methods and standard deviation. The instrument developed consists of a questionnaire containing 15 questions including information from respondents from part A of 3 questions and student feedback from part B of 12 questions. A total of 28 mechanical engineering students from DKM3D-S4 class were selected to provide feedback on this application.

6. Results and Discussion

The results of the development of this application have been accessed in the website as shown in **Figure 3 to 6** which shows the interface for each page.

Figure 3 Main Menu

Figure 3 shows the main page for this site. It displays a **b**rief description of the purpose of this website being developed as well as a synopsis of the DJJ30103 Strength of Materials course along with a list of experiments. At the bottom, there are videos embedded from Youtube.com showing the common mechanical test on a material.



(a) (b)

Figure 4 (a) Page of experiment 1, **(b)** Page of experiment 2

Experiment 1 is a voltage test on a material as shown in Figure 4 (a). Examples of test data **u**sed and reading results are as follows:

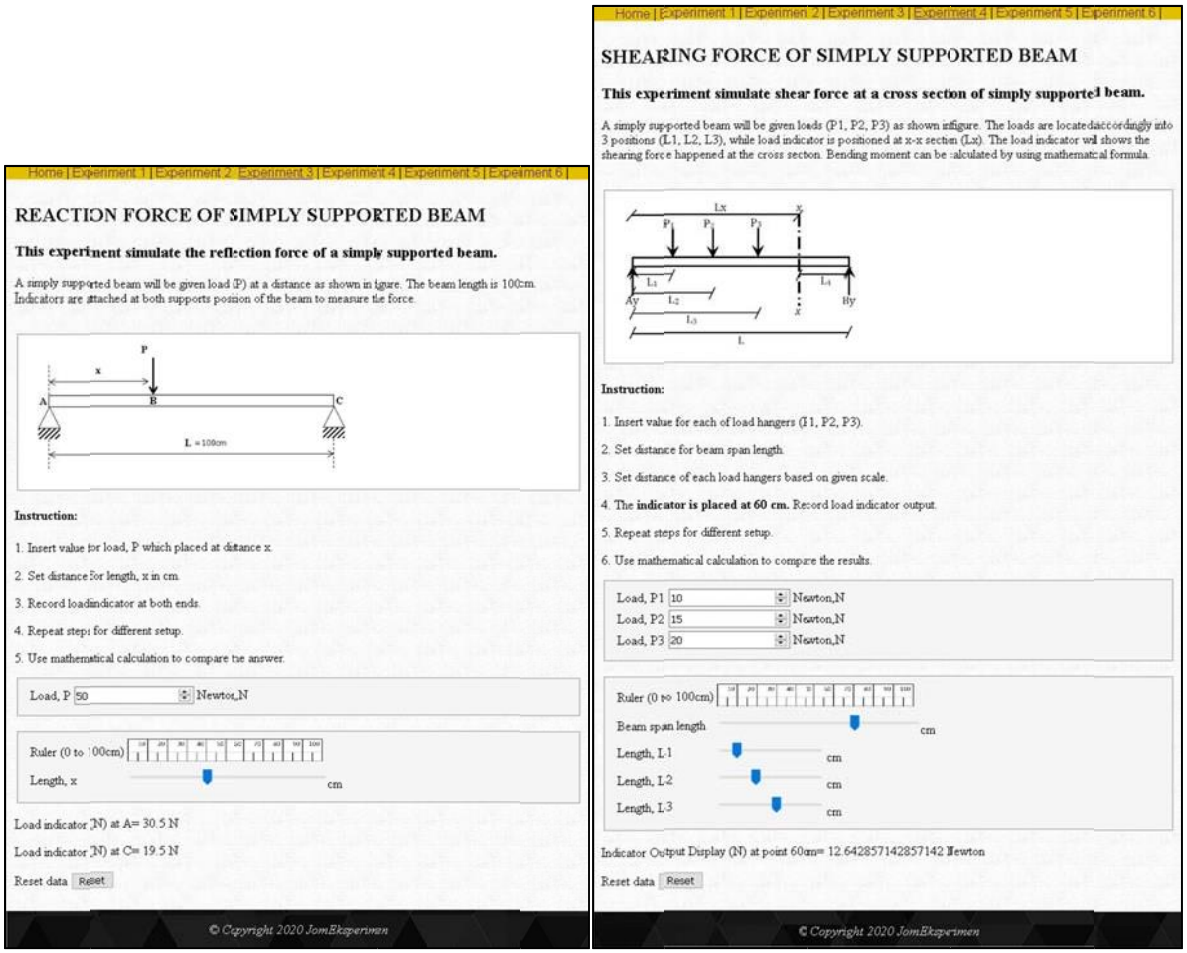
Table 1 Example of data testing for experiment 1

Material:	Aluminium Alloy	**Load:**	40,000N
Rod length:	105mm	**Rod diameter:**	12mm
Elongation reading:	**0.509mm**		

Experiment 2 is a stress test and shear strain on a material as shown in Figure 4 (b). Examples of test data used and reading results are as follows:

Table 2: Example of data testing for experiment 2

Material:	Brass	**Load:**	40N
Block length:	50mm	**Block Height:**	70mm
Block width:	50mm		
Elongation reading:	**0.000028mm**		



(a) (b)

Figure 5 (a) Page of experiment 3, **(b)** Page of experiment 4

Experiment 3 is a reaction force response on a simple support beam as shown in Figure 5 (a). Examples of test data used and reading results are as follows:

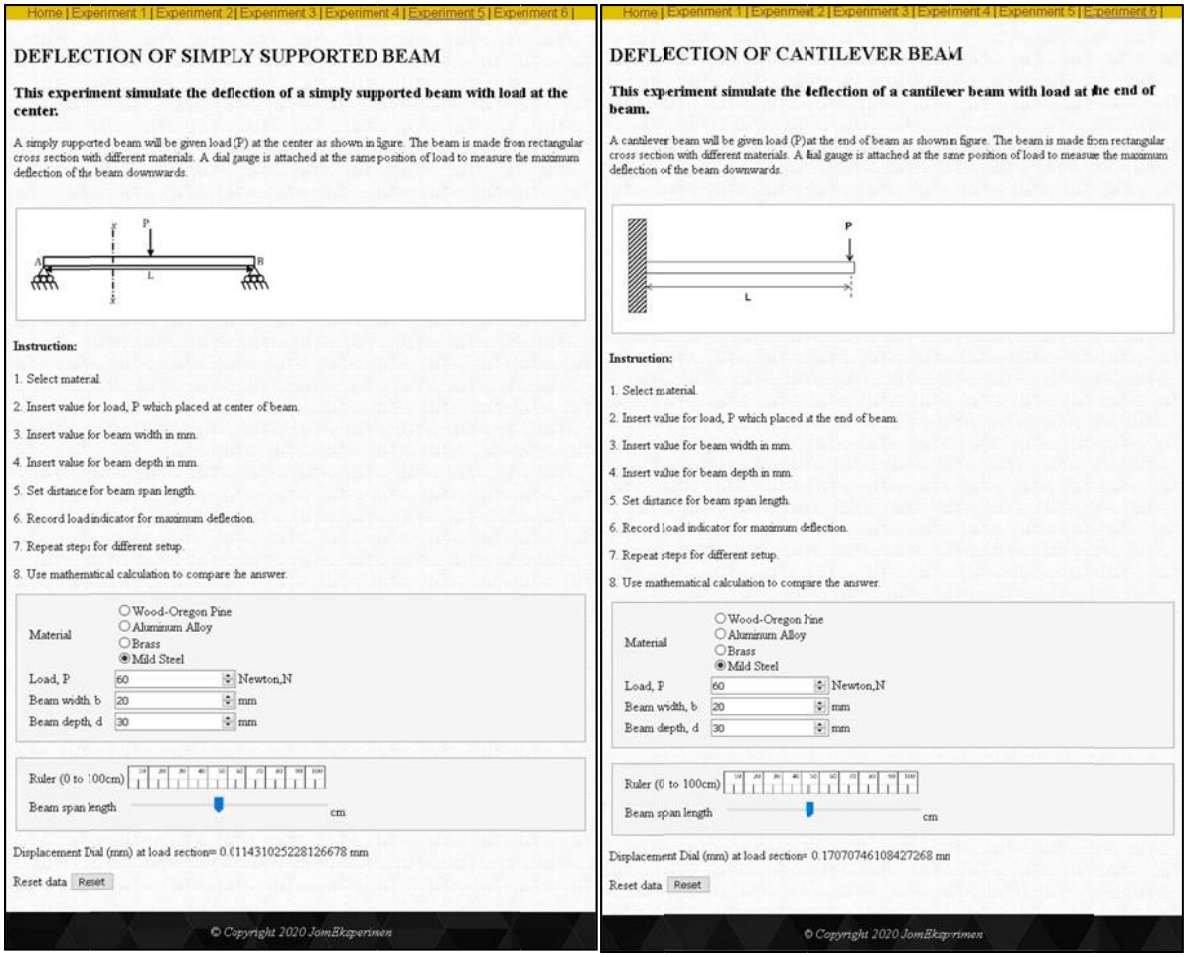
Table 3: Example of data testing for experiment 3

Beban:	50	**Length x:**	40cm
Indicator A reading:	**30.5N**	**Indicator B reading:**	**19.5N**

Experiment 4 is a shear force test in a simple support beam as shown in Figure 5 (b). Examples of test data used and reading results are as follows:

Table 4: Example of data testing for experiment 4

Load P1:	10N	**Length L1:**	10cm
Load P2:	15N	**Length L2:**	20cm
Load P3:	20N	**Length L3:**	30cm
Beam length:	70cm		
Indicator reading:	**12.643N**		



(a) (b)

Figure 6 (a) Page of experiment 5, **(b)** Page of experiment 6

Experiment 5 is a simple support beam deflection test with a load position in the middle as shown in Figure 5 (a). Examples of test data used and reading results are as follows:

Table 5: Example of data testing for experiment 5

Material:	Mild Steel	**Load:**	60N
Beam width:	20mm	**Beam depth:**	30mm
Beam length:	45mm		
Deflection reading:	**0.01143mm**		

Experiment 6 is a protruding beam deflection test with a **l**oad position at the end as shown in Figure 5 (b). Examples of test data used and reading results are as follows:

Table 6: Example of data testing for experiment 6

Material:	Mild Steel	**Load:**	60N
Beam width:	20mm	**Beam depth:**	30mm
Beam length:	45mm		
Deflection reading:	**0.1707mm**		

The results of the descriptive analysis of the feedback survey form on the application developed are as shown in Table 7. Overall, all items have a mean score above 3.49. This shows that all students agreed that the application of this website can help improve their understanding in conducting DJJ30103 Strength of Materials experiments. The small standard deviation value indicates that there is no significant difference between the students' scores for each item.

Table 7: Results of descriptive analysis of feedback survey form

No	Items	N	Score Min	Standard Deviation
1	This website is very relevant to the course taken.	28	4.037	0.8381
2	This site is similar and consistent with experiments in the laboratory.	28	3.7778	0.9162
3	This website can help me understand the implementation of experiments in the laboratory.	28	3.5185	0.9952
4	This website can help me perform practical tasks.	28	4.000	0.9813
5	This website can help me understand the theories learned for this course.	28	3.7407	0.8429
6	This website is easily accessible using a smartphone device.	28	4.5926	0.7332
7	This website is easy to understand.	28	3.8148	0.723
8	This website provides easy-to-use experimental demonstration settings button interaction.	28	3.7778	0.7370
9	I can record readings resulting from variations of experimental settings.	28	3.8519	0.9311
10	I can compare the resulting readings with the values from the calculations	28	3.7037	0.8081
11	I can use this website according to the flexible learning time.	28	3.9629	0.8811
12	I found this site suitable as a learning tool or demonstration.	28	3.9259	0.9399
	Average		*3.8919*	

7. Conclusion

In conclusion, the application of this website has been successfully implemented and meets every objective. The first objective of the website was successfully developed based on experimental demonstrations with variation of parameter settings. While the second objective, this website has been able to help students improve their understanding of experiments conducted in the laboratory. With this website, it is hoped to help students get good results in the DJJ30103 Strength of Materials course.

References

Department of Mechanical Engineering. “Practical 1”. Lab handsheets. Polytechnic of Kuching, Sarawak. 2020. Printed. Department of Mechanical Engineering. “Practical 2”. Lab handsheets. Polytechnic of Kuching, Sarawak. 2020. Printed. Department of Mechanical Engineering. “Practical 3”. Lab handsheets. Polytechnic of Kuching, Sarawak. 2020. Printed. Department of Mechanical Engineering. “Practical 4”. Lab handsheets. Polytechnic of Kuching, Sarawak. 2020. Printed. Department of Mechanical Engineering. “Practical 2”. Lab handsheets. Polytechnic of Sultan Haji Ahmad Shah, Kuantan. Pahang. 2015. Printed.

Department of Mechanical Engineering. “Practical 4”. Lab handsheets. Polytechnic of Sultan Haji Ahmad Shah, Kuantan. Pahang. 2015. Printed.

Jon Duckett (2011).HTML and CSS: Design and Build Websites. John Wiley & Sons, Inc.. Indianapolis, Indiana.

Noor Azean Binti Atan dan Siti Nur’ain Binti Mohd.Said (2010). “Pembangunan Laman Web Berasaskan Pendekatan Pemikiran Kritis Dan Penyelesaian Masalah Bagi Subjek Bahasa Pengaturcaraan I (C++)”. Universiti Teknologi Malaysia.