2017

VLE based analysis and design

Chetwynd, A.

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Appendices

Appendix A - Participant Information Sheet

**MARINE
SCIENCE
& ENGINEERING
WITH
PLYMOUTH
UNIVERSITY**

Project Information Sheet – Student Focus Groups

Principle Investigator: Andrew Chetwynd

Project Supervisor: Mike Buller

Title of Research: Virtual Learning Environment (VLE) Based Design

Project Aims

The aim of the project is to determine the way in which engineering students learn. The initial aim is to find a topic of general weakness for students within the Structural Analysis and Structural Design modules. Once this weakness has been obtained and outlined, a Virtual Learning Environment model is to be created to aid in the teaching of this subject. After completion of this model, it will then be tested, with feedback analysed to show how the model can be developed.

Data Collection

The data will be collected over 2 focus groups. The initial focus group will be used to attain which areas students have found most challenging within the Structural Analysis and Structural Design modules. An additional focus group (with the same attendees) will be held once the model has been completed. This will allow the group a chance to test the model and provide feedback. Each session should not exceed 20 minutes in duration. The attendees will comprise of 3-6 participants, plus the researcher. The focus groups will be video recorded.

Confidentiality

All participants, as well as the discussions held, will be regarded as confidential. All electronic data will be kept on a password protected computer; this is inclusive of the video recording and scanned versions of any paper based documents produced. All paper based documents will be destroyed upon completion of the project. In order to maintain confidentiality, any participants must not disclose any information regarding any other participant, the researcher or the study.

Figure 1 - Participant Information Sheet (Part 1 of 2)

Right to Withdraw

Participation within this study is voluntary; therefore each participant has the right to withdraw at any point of the focus group. The recording can be stopped by request at any point in time, no prejudice will be held at the participant if they choose to do so. Due to the nature of focus groups, it will not be possible to retract data prior to the withdrawal. The right to withdraw will be outlined verbally prior to each focus group.

Feedback

On completion of the study, a digital copy of the published paper will be made readily available to all participants. This feedback is optional and will only be sent to the participant if the relevant selection has been made on the Project Consent Form.

Acknowledgements

Special gratitude is given to all participants. This project is driven by the outcome of the focus group(s) and would not have otherwise been possible.

Contact

Initial contact should be made to the Principle Investigator, using the information listed below. The Principle Investigator will aim to respond within 2 working days. If for any reason it is not appropriate for the participant to contact the Principle Investigator, the Project Supervisor's details have also been listed below.

Principle Investigator: Andrew Chetwynd
E-Mail: andrew.chetwynd@students.plymouth.ac.uk

Project Supervisor: Mike Buller
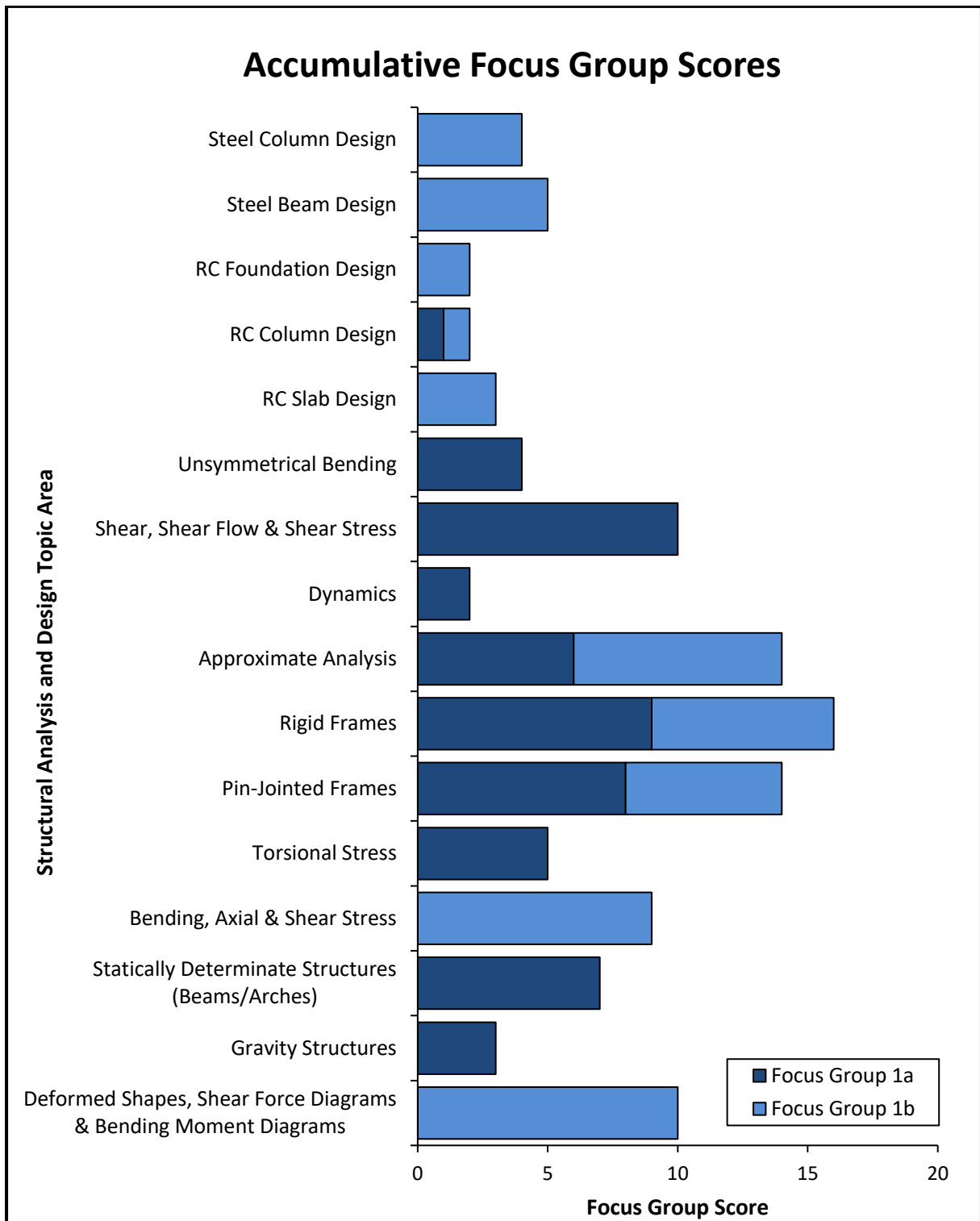**E-Mail:** michael.buller@plymouth.ac.uk

Figure 2 - Participant Information Sheet (Part 2 of 2)

Appendix B - Participant Consent Form

**MARINE
SCIENCE
& ENGINEERING**
WITH
**PLYMOUTH
UNIVERSITY**

Project Consent Form – Student Focus Groups

Principle Investigator: Andrew Chetwynd

Project Supervisor: Mike Buller

Title of Research: Virtual Learning Environment (VLE) Based Design

I understand the aims and objectives of this research project. ☐

I understand that I have right to withdraw from the focus group(s) at any stage. The right to withdraw will be outlined verbally and within the Information Sheet. ☐

I understand that my anonymity is guaranteed, unless I expressly state otherwise. ☐

I understand that the Principal Investigator of this work will have attempted, as far as possible, to avoid any risks, and that safety and health risks will have been separately assessed by appropriate authorities (e.g. under COSSH regulations). ☐

I understand the Information Sheet and have been provided a personal copy. ☐

I understand that I will be contacted at a future date to participate in a secondary focus group, providing feedback on a working prototype. ☐

Under these circumstances, I agree to participate in the research:

Full Name: _____

Signature: _____   Date: ___ / ___ / ___

I would like to receive an emailed copy of the published paper ☐

Figure 3 - Participant Consent Form

Appendix C - Initial Focus Groups Topic Scoring

Accumulative Focus Group Scores

Y-axis label: Structural Analysis and Design Topic Area

X-axis label: Focus Group Score

Legend:
- Focus Group 1a
- Focus Group 1b

Topics (top to bottom):
- Steel Column Design
- Steel Beam Design
- RC Foundation Design
- RC Column Design
- RC Slab Design
- Unsymmetrical Bending
- Shear, Shear Flow & Shear Stress
- Dynamics
- Approximate Analysis
- Rigid Frames
- Pin-Jointed Frames
- Torsional Stress
- Bending, Axial & Shear Stress
- Statically Determinate Structures (Beams/Arches)
- Gravity Structures
- Deformed Shapes, Shear Force Diagrams & Bending Moment Diagrams

Figure 4 - Initial Focus Groups Topic Scoring

Appendix D - Prototype Conception Storyboards

Figure No. 1a

x m

ω kN/m

Rigid Frame
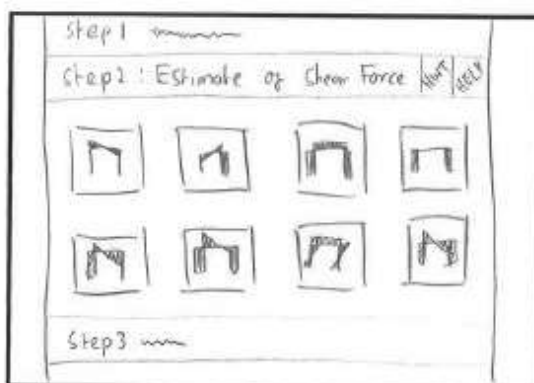
y m

Step 1: ———
Step n: ———
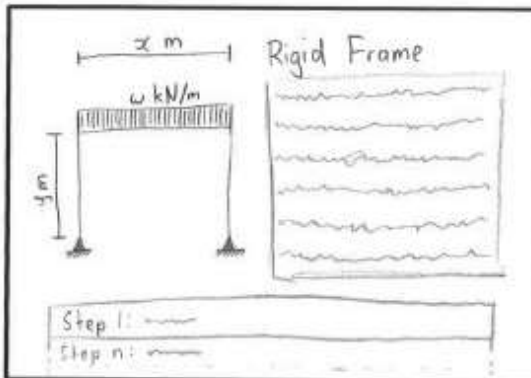
- ω variable ranges between 10 and 150, randomly selected in increments of 5.
- y variable ranges between 2 and 5, randomly selected in increments of 0.5m
- x variable ranges between y and 3y, randomly selected in increments of 0.5m

Figure No. 2a

Step 1: Estimate of Deformation | HINT | HELP

Step 2: ———
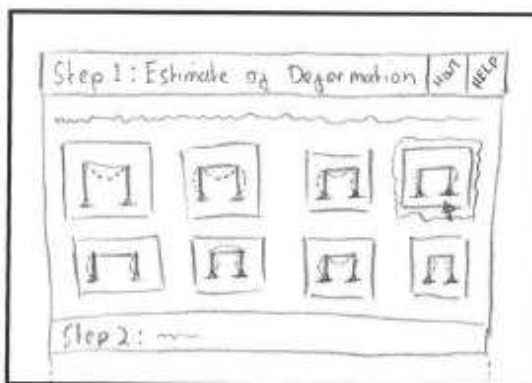
- 'Hint' and 'Help' boxes available on each step of example
- Multiple choice of diagram displayed above (1a)
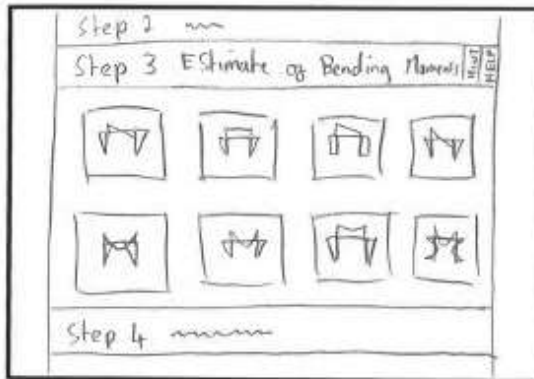- Highlight correct choice green
- Highlight incorrect choice red

Figure No. 3a

Step 1 ———
Step 2: Estimate of Shear Force | HINT | HELP

Step 3 ———

- As 2a

Figure 5 - Prototype Conception Storyboards (Part 1 of 4)

Figure No. 4a

Step 2 ~~~
Step 3 Estimate of Bending Moment [HINT] [HELP]

[eight sketch boxes showing frame bending moment diagrams]

Step 4 ~~~~~

• As 2a

Figure No. 5a
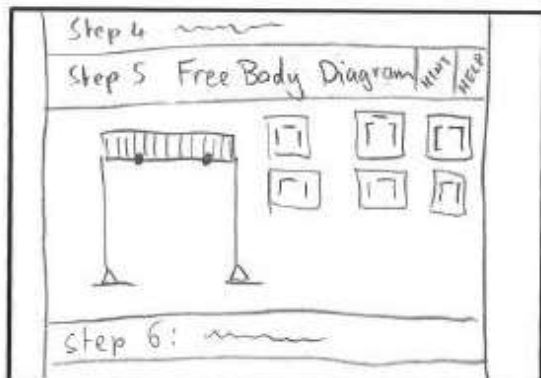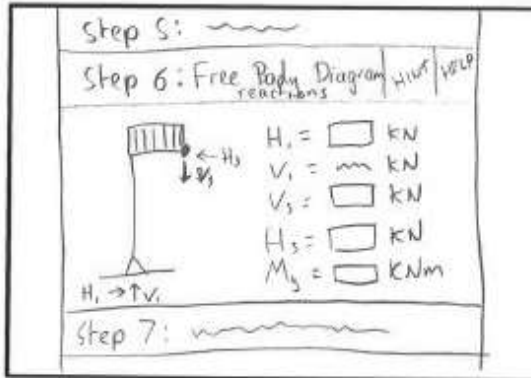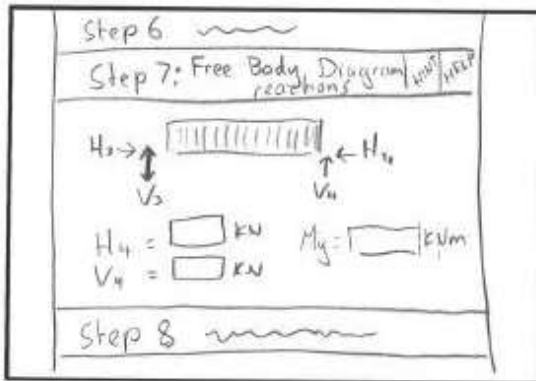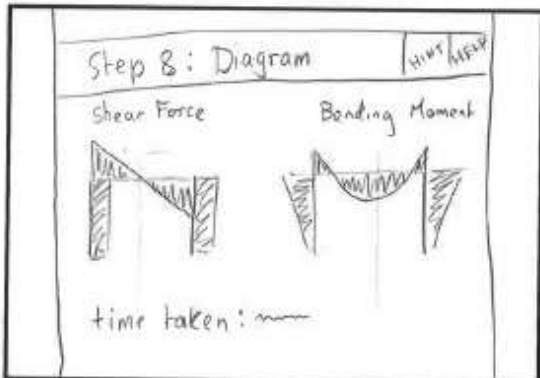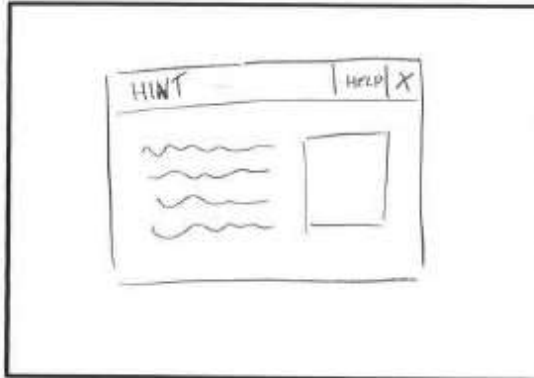
Step 3 ~~~~~
Step 4: Support Reactions [HINT] [HELP]
~~~~~

[sketch boxes of support reaction diagrams]

Support 1:
moment = [ ] kNm
vertical = [ ] kN
horizontal = [ ] kN

Support 2
moment = [ ] kNm
vertical = [ ] kN
horizontal = [ ] kN

Step 5 ~~~~~
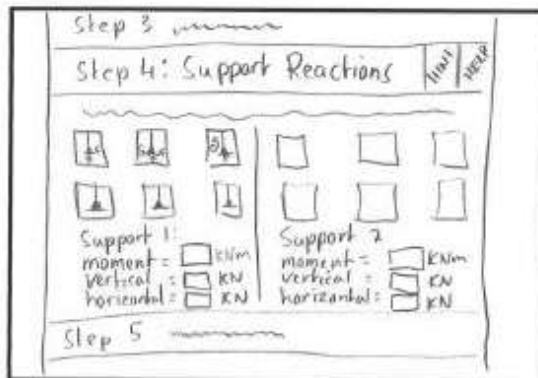
• multiple choice, select reactions that occur at either support
• boxes available to enter support reactions
• support reaction boxes framed with green or red if correct or incorrect respectively

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Figure No. 6a

Step 4 ~~~~
Step 5 Free Body Diagram [HINT] [HELP]

[sketch of portal frame with distributed load and supports, plus six small free body diagram option boxes]

Step 6: ~~~~

• Points of Contraflexure given
• choose which free body diagram can be used to analyse frame
• As 2a

Figure 6 - Prototype Conception Storyboards (Part 2 of 4)

Figure No. 7a

Step 5: ~~~

Step 6: Free Body Diagram |HINT|HELP|
reactions

$H_1 = \square$ kN
$V_1 = $ ~~~ kN
$V_3 = \square$ kN
$H_3 = \square$ kN
$M_3 = \square$ kNm

$H_1 \to \uparrow V_1$

Step 7: ~~~~

• As 5a

Figure No. 8a

Step 6 ~~~

Step 7: Free Body Diagram |HINT|HELP|
reactions

$H_3 \to$ $\uparrow$ $\leftarrow H_4$
V_3 V_4

$H_4 = \square$ kN $M_4 = \square$ kNm
$V_4 = \square$ kN

Step 8 ~~~

• As 5a

Figure No. 9a

Step 8: Diagram |HINT|HELP|

Shear Force   Bending Moment

time taken: ~~~

• All components displayed
• Time taken displayed
• Hint/Help lead to progressive reading.

Figure 7 - Prototype Conception Storyboards (Part 3 of 4)

Figure No. 10a

HINT   HELP X

- Basic diagrams and concepts displayed.
- Allow to access help if still stuck.
- Dialog box, greyed out background.

Figure No. 11a

HELP   X

- As 10a
- video option available
- links to external sites
- recommended reading

Figure No. 12a

- Dictionary/definition tool
- hover over bold word to find technical definition
- function also available on notation.

Figure 8 - Prototype Conception Storyboards (Part 4 of 4)

Appendix E - Initial Focus Groups General Feedback
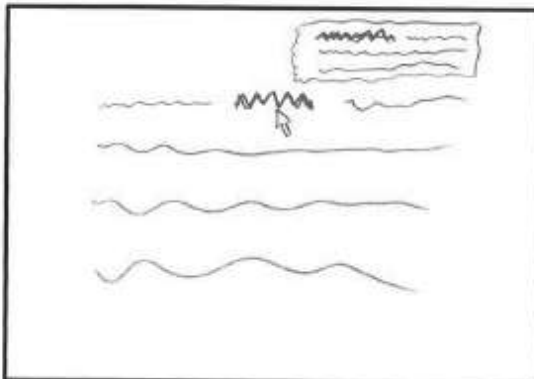
From the Initial Focus Groups the following observations were made:

- There was a direct correlation between the difficulty in learning a topic and both the quality and integrity of the materials produced by the teacher.
- A better understanding of a topic was acquired when the rationale behind the topic was explained extensively, prior to learning the technical content.
- Confusion arose when teachers used different notation and terminologies to describe the same attributes.
- More extensive worked examples had been provided in Structural Design, over Structural Analysis.
- A virtual learning environment (VLE) would have been more beneficial for learning Structural Analysis rather than Structural Design, as Structural Design is built upon the fundamentals of Structural Analysis, so this was the topic of higher importance at the early stages of the course.
- A VLE would have complemented a Structural Design question, due to the lengthy nature of the topics. A VLE would have been able to confirm that the learner was answering a question correctly at key locations in the question, rather than at the end.
- A VLE for Structural Design would be less beneficial as there are already extensive notes on each of the topics.
- A VLE would be preferential in learning the fundamentals within each topic area, but should not be used to replicate examination style questions. Revision for examinations should be undertaken by hand to reflect the way in which the examination is carried out.

Appendix F - Initial Focus Groups Implementation Options

It was also ascertained that the following potential features within a virtual learning environment (VLE) would be desirable in learning a topic:

- A visual representation of the learner's progress in the current topic example, as well as an overview of their progression in the subject as a whole.
- The facility to time how long it takes the user to carry out a given worked example and to record that information for the next time they undertake that same example.
- A dynamic nomenclature, which would clarify any technical symbols or phrases, as well as their origins.
- Range in the difficulty of questions within each topic area, allowing the learner to grasp several basic theories before they are amalgamated into a more challenging question.
- Randomly generate a set of variables to create unique examples and to prevent the VLE being used as a calculator.
- Highlight areas that have previously been problematic for other learners.
- Provide links to external documents, allowing the learner to read around the topic area. Also, provide a description of precisely where to look if it is a large or challenging technical document.
- A clear and unambiguous topic diagram, with all known attributes, clearly labelled. Where possible, all of the information should be displayed on one diagram.
- Provide dynamic feedback to the teacher, to allow for areas of weakness to be ascertained and addressed by either a simpler example, further notes of face-to-face contact.
- A tool to question the integrity of the website and the material, so that if multiple learners question the integrity of the same area, the teacher can confirm or change the content.
- Provide a large number of answers when using a multiple choice functionality, minimising the chance of selecting a correct answer by luck.
- A clear step-by-step breakdown of each question, allowing the learner to understand the process fully.
- Provide video tutorials outlining the basic principles behind each topic, providing bookmarks for locations in the tutorial at each respective stage of the worked example.

Appendix G - Secondary Focus Groups Prototype Appraisal

From the Secondary Focus Groups the following observations were made:

- Having the accordion panels locked to begin with, unlocking a step at a time, allowed the user to focus on that particular aspect of the question without trying to look too far ahead.
- Allowing an optional timing feature makes it appeal more to a wider audience of users. A small amount of the users were discouraged by having their first attempt at the question timed, but would like it as a future option.
- Offering a range of correct answers, dependent on the calculation method, allowed the users to attempt the question in a preferred method.
- Displaying which aspects of a multiple answer question were correct or incorrect allowed the user to determine where their mistake could have been made.
- Conveying additional material using short and concise videos is a quick and easy way to access the information.
- Having an optional nomenclature available for the technical notation allowed the user to understand the content quicker and enabled for them to keep a focus on the worked example, rather than research the meaning of the notation in an external source (e.g. textbook or search engine).

Appendix H - Secondary Focus Groups Further Implementation Options

It was also established that the following features could be implemented or adapted to develop further the virtual learning environment (VLE) prototype:

- There was a risk of the user clicking each of the multiple choice answers until the correct answer was selected. This was dependent on the enthusiasm of the learner, to whether they wanted to learn or just progress in the question. A system could be generated to minimise the amount of attempts that could be taken before the answers would refresh or lock.

- The multiple choice options were easy to memorise, without learning the rationale behind the choice. The answers should change position each time a new question is generated. The options could also have been taken from a larger library of pictures, allowing for a larger variety of choices for the user. If a larger library were to be used, the content must still be similar enough to challenge the user into deciphering the correct answer.

- When answering using checkboxes, it is not clear to the user when they are correct. A submit button would allow the user to see which elements of an answer were correct and would prevent a user choosing the correct answer by mistake (if they were going to add incorrect options also). This concept could have also been used for the multiple choice sections, with a submit button making the user think deeper about their selection.

- When a numerical answer was inputted incorrectly for the second time, there was nothing to distinguish between the first and second attempt, as the border remained red. An animation could be used to allow the border to fade prior to the question being reattempted.

- A scoring feature could have been implemented alongside the progression toolbar. The progression bar alone gave a false sense of success to the user, with the user possibly taking several attempts to answer a question correctly, but still capable of achieving 100%. A score alongside the completion would have given the user a realistic view of how well they did.

- If a scoring feature had been implemented, it could have worked in a multitude of ways. A suggested method was to have a three strike method; this would have allowed the user to have three attempts at each question segment, before locking the question and pointing the user in the direction of additional content on that subject. Another method would have been to award a score for each element that progressively descended from 100% each time the user had a new attempt (e.g. the user only got 80% of the available marks as they took two tries to answer a question element correctly).

- It would have been beneficial to request the units alongside each numerical answer, ensuring that the learner gets into the habit of stating units.

- The video help feature could have given the subtitles as an optional extra. Whereas some users preferred the text, others found it to prove as a distraction, detracting from the video.

- The content within the video could have been slowed down; the audio content was acceptable, but if the user wanted to follow using the subtitles, then there was too much text. If key statements were made using the text, rather than subtitles, this could allow users to read the material at a slower pace.

- A basic frame simulation program could have been available as help for each of the multiple-choice question sections. The user would have been able to

apply different load types at different locations and see how the frame reacted.

- The functionality of the video slider was not entirely intuitive. The slider allowed the user to reposition the video time by performing a click, but did not enable the user to drag the slider to the new location, which is what the user wanted to naturally do.

- The information on how to carry out the question was not clear for the user; there could have been several improvements to make it more prominent. The button could have contained text as well as a symbol. The information could have automatically loaded at the beginning of the question, allowing the user to dismiss it, but reopen it at a later stage if required. Another option could have been to direct the user to the information button by describing it in the question text (e.g. 'for more information on how to carry out the question, select the info button').

- When the links to additional online reading content (external sites) were clicked, they took the user to the given page in their current window, in turn allowing for the question that the user was completing to be lost. If the link prompted the user to choose between a new window and using the current window, it would give the user the option to maintain the worked example if they wished to do so.

- The flags used to display an increase in difficulty were not prominent enough for the user. The flags could have also been utilised further; some users would have liked for a system of multiple flags to be used as a rating system, showing the difficulty of each section with between one and three flags.

- Dependent on which method of calculation the learner used, not all of the information required was readily accessible, with some of the information in previously completed accordion panels. The initial question diagram could have been updated to show all of the information currently calculated or the information could have been shown in the current step.

- The question should have allowed for 'method marks' in a similar way to examinations. Users should have been able to attempt a question a few times, if they were still incorrect, they should have been allowed to move on with all of the subsequent scores based upon the calculations using their incorrect answer.

- At the end of the question, a personalised feedback should have been generated. The feedback should have given a report with a full worked example, highlighting the sections that the user was not able to do or took a few attempts to complete. The feedback should also generate a list of worked examples and further reading that would be appropriate for the user, given the questions that they struggled with.

Appendix I - Global Browser Usage Table

Table 1 - Global Browser Usage (w3schools.com, 2016)

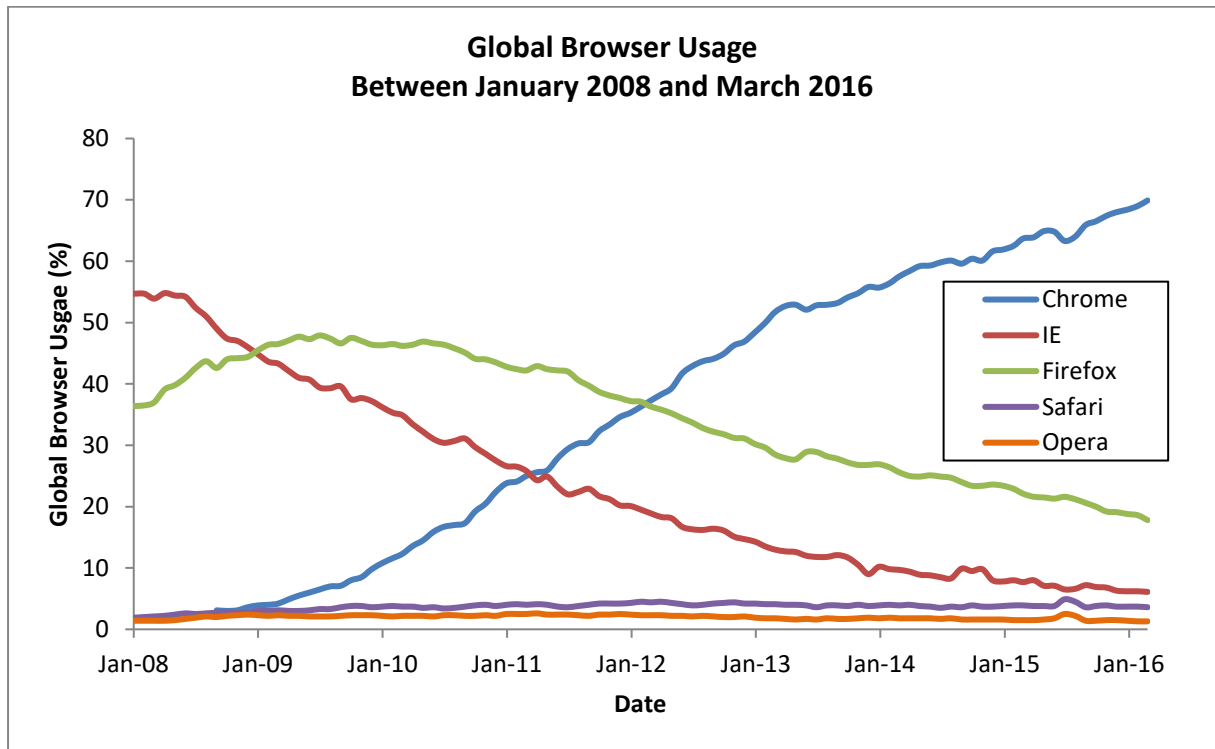| Date	Global Browser Usage (%)					
	Chrome	IE	Firefox	Safari	Opera	
03/16	69.9	6.1	17.8	3.6	1.3	1.00
12/15	68.0	6.3	19.1	3.7	1.5	1.00
09/15	65.9	7.2	20.6	3.6	1.4	1.00
06/15	64.8	7.1	21.3	3.8	1.8	1.00
03/15	63.7	7.7	22.1	3.9	1.5	1.00
12/14	61.6	8.0	23.6	3.7	1.6	1.00
09/14	59.6	9.9	24.0	3.6	1.6	1.00
06/14	59.3	8.8	25.1	3.7	1.8	1.00
03/14	57.5	9.7	25.6	3.9	1.8	1.00
12/13	55.8	9.0	26.8	3.8	1.9	1.00
09/13	53.2	12.1	27.8	3.9	1.7	1.00
06/13	52.1	12.0	28.9	3.9	1.7	1.00
03/13	51.7	13.0	28.5	4.1	1.8	1.00
12/12	46.9	14.7	31.1	4.2	2.1	1.00
09/12	44.1	16.4	32.2	4.2	2.1	1.00
06/12	41.7	16.7	34.4	4.1	2.2	1.00
03/12	37.3	18.9	36.3	4.4	2.3	1.00
12/11	34.6	20.2	37.7	4.2	2.5	1.00
09/11	30.5	22.9	39.7	4.0	2.2	1.00
06/11	27.9	23.2	42.2	3.7	2.4	1.00
03/11	25.0	25.8	42.2	4.0	2.5	1.00
12/10	22.4	27.5	43.5	3.8	2.2	1.00
09/10	17.3	31.1	45.1	3.7	2.2	1.00
06/10	15.9	31.0	46.6	3.6	2.1	1.00
03/10	12.3	34.9	46.2	3.7	2.2	1.00
12/09	9.8	37.2	46.4	3.6	2.3	1.00
09/09	7.1	39.6	46.6	3.6	2.2	1.00
06/09	6.0	40.7	47.3	3.1	2.1	1.00
03/09	4.2	43.3	46.5	3.1	2.3	1.00
12/08	3.6	46.0	44.4	2.7	2.4	1.00
09/08	3.1	49.0	42.6	2.7	2.0	1.00
06/08		54.2	41.0	2.6	1.7	1.00
03/08		53.9	37.0	2.1	1.4	1.00

Appendix J - Global Browser Usage Graph

Figure 9 - Global Browser Usage, Data from Table 1