

## EMBEDDING 'LEARNING & THINKING STYLES' INTO ENGINEERING MATERIALS COURSES

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**Abstract:** An area identified as useful for both staff and new students is 'Learning & thinking styles'. The majority of new students join the department being used to teaching styles that might be totally different to those they encounter in their first year at University. In addition if they are not aware of the different styles of teaching & learning they could potentially find themselves overwhelmed by any apparent lack of 'understanding' or failing to make the 'connection' with a subject.

Providing new students with awareness of their particular learning styles we hope to help them overcome any possibilities of 'mismatch' with the way various subjects being taught, as well as support them in improving on the weak sides of their learning capabilities. This is seen as part of the overall process of educating the 'complete' engineer, 'Broad minded, ethically and ecologically responsible agent of social and material change towards a socially just and ecologically sustainable world', not only in demand by industry but an absolute necessity for our societies when facing up to the challenges of the 21st century.

Having done this kind of work as part of research into 'Teaching and Learning' over a period of years with 1st year tutees, discussed by Kapranos (2007 & 2008), the process was until recently not formalised. The paper presents the results from the experience of running this scheme as part of an Introduction Week & Skills Week combination and discusses any possible benefits from embedding 'Teaching and Learning' as seen through personal feedback from students.

*Keywords; embedding skills in engineering education, learning and thinking styles.*

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## 1. INTRODUCTION

### 1.1 Intro-Week - What's Your Learning and Thinking Styles?

Learning styles refer to the ways students prefer to approach new information. The questions they preferred offered them insight about how they learn, what their primary and secondary processing

styles were.

Advice was

given to them

at the time as

to how to take

advantage of

their learning

styles in order

to learn more

efficiently. For

example, if the

primary

learning style

was visual,

they could

draw pictures

in the margins,

look at

graphics and

read text that explains the graphics. Envision a topic or play a movie and think of how they

would act out

the subject

matter. If their

primary

learning style

was auditory,

they could listen

to the words as

they read, try to

develop an

internal

conversation

between

themselves and

the text and

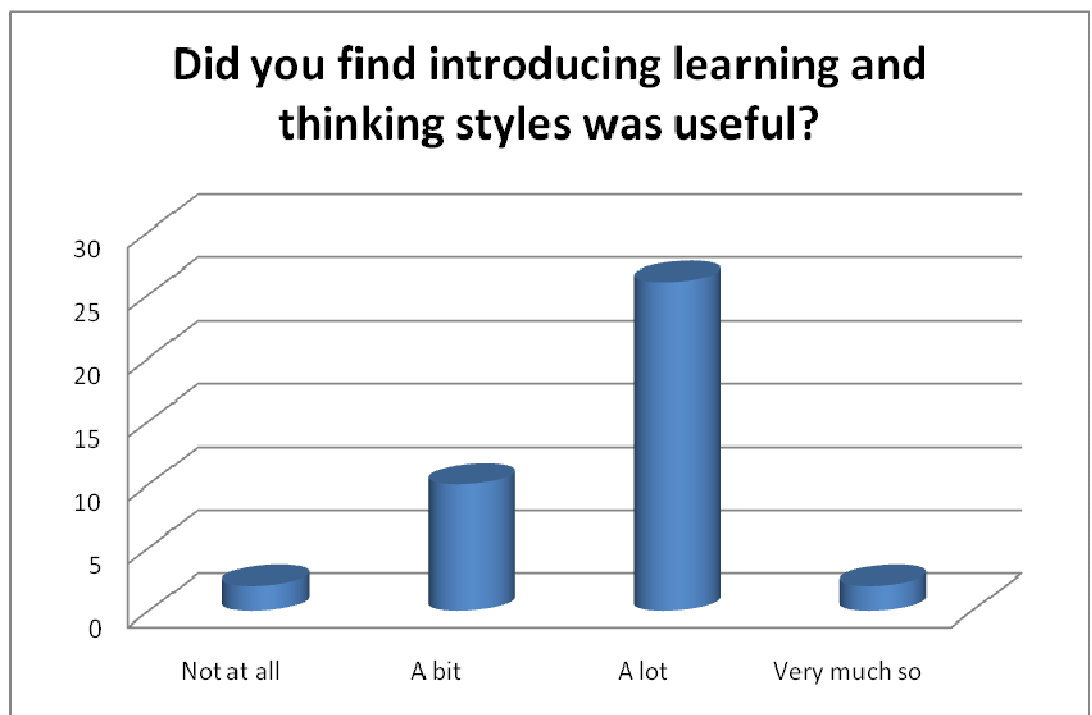
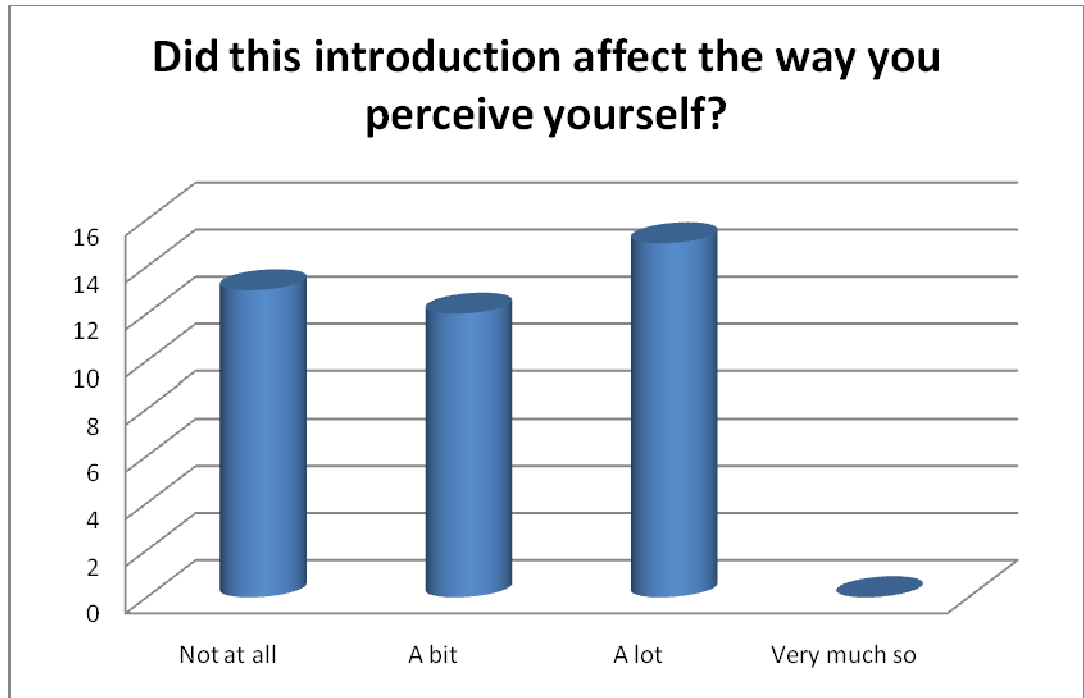
don't be

embarrassed to

read aloud or

talk through the

information. If



on the other hand their primary learning style was tactile/ kinaesthetic, they were encouraged to use a pencil or highlighter pen to mark passages that are meaningful to them, take notes, transferring

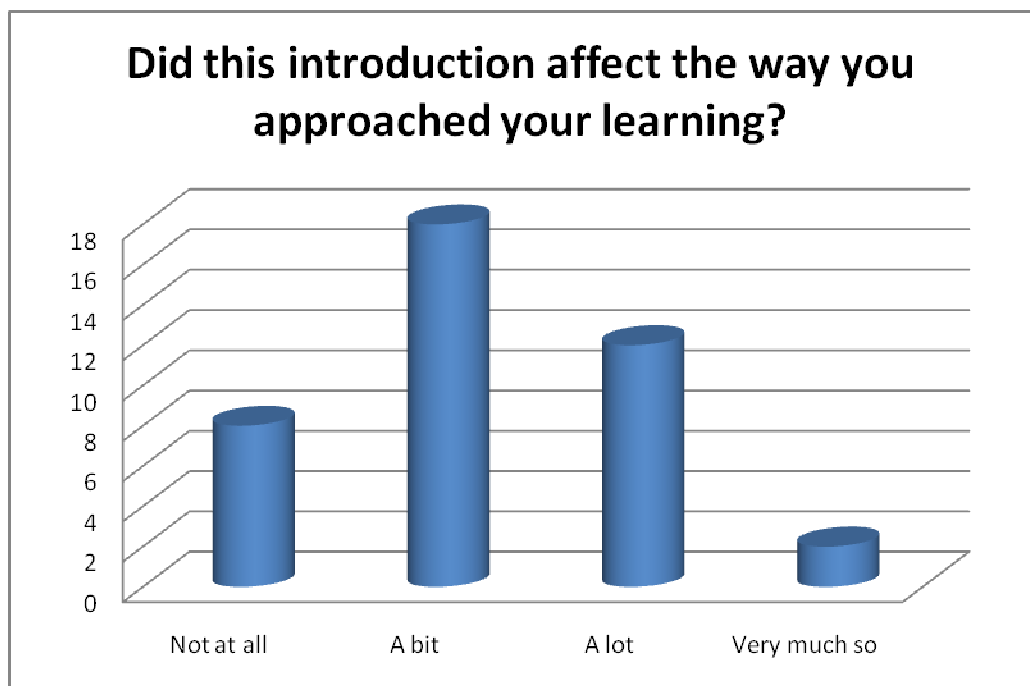
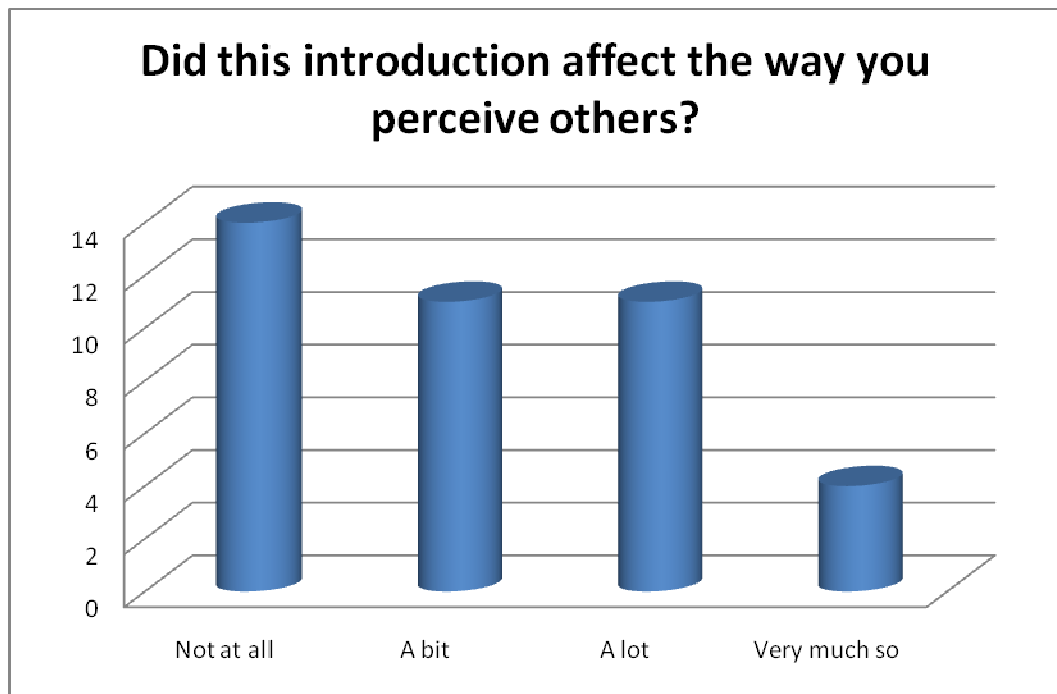
the information they learn to the margins of a book, into a journal, or onto a computer. Doodle whatever comes to mind as they read, hold the book in their hands instead of placing it on a table, walk

around as they read, feel the words and ideas, in general to get busy—both mentally and physically.

It was discussed that not only do we all have our preferred learning and working styles but we also have our favourite thinking styles.

It was shown that Concrete Sequential Thinkers tend to be based in reality. They process information in an ordered, sequential, linear way. Concrete Random Thinkers are

experimenters. Abstract Random Thinkers organize information through reflection, and thrive in



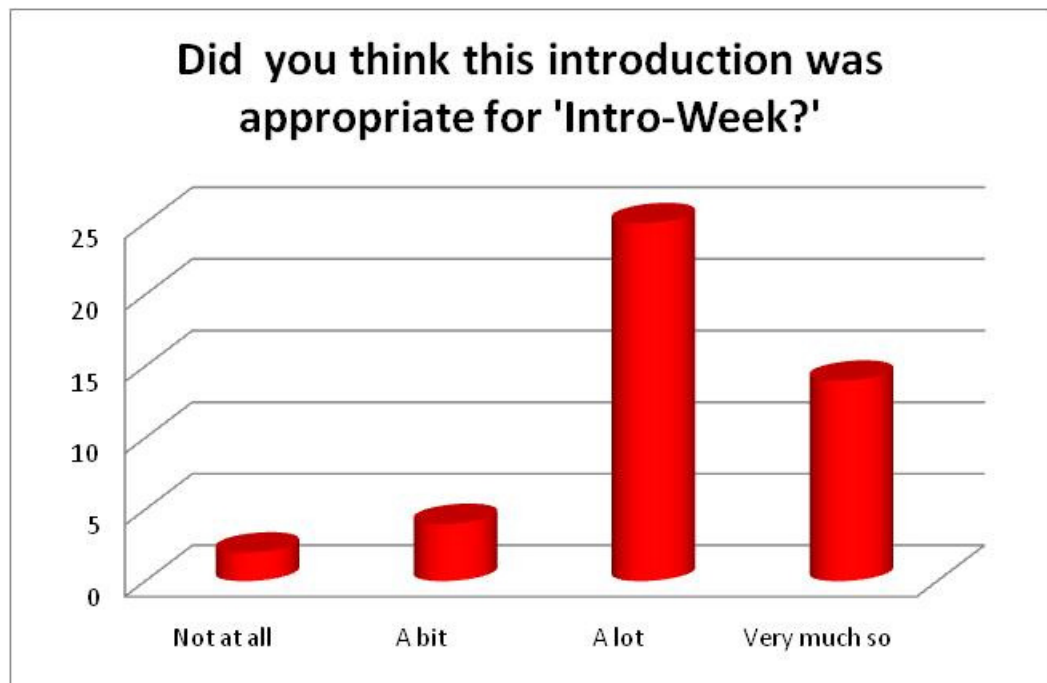
unstructured, people-oriented environments. Abstract Sequential Thinkers love the world of theory and abstract thought. It was also stressed that no thinking style was superior to another; they are simply different. Each style can be effective in its own way. The important thing was that students became more aware of which thinking style works best for them. Once one knows their particular style they can then analyze the styles of others helping them to understand other people better, making them more flexible and perhaps more effective.

Felder has published extensively among others on the use and validity of learning styles and his work provides a good summary of the work in the field (1988 and 2005). The work of Ammerman et al (2005), Sutliff and Baldwin (2001) and Larkin & Bundy (2000), further discuss learning styles relating them to technological subjects and psychological types respectively. Kellogg et al (2005) also provide useful insights in to the development of the complex thinking skills required by the global economy from today's engineers.

### 1.2 Skills Week

During Skills Week, the above theme was followed up in more detail and students completed a follow-up questionnaire (see Appendix 1) the results of which are shown graphically below:

In addition to the responses to the questions, the students made comments for the future direction of this 'Introduction to Teaching & Learning' exercise. A summary of their



comments and recommendations are shown in Appendix 2. It is clear from the above graphs that although the majority of the students felt introducing the teaching and thinking styles as part of the overall Transferable Skills programme was useful, it is only natural that not everybody felt it neither changed their perceptions of others nor the way they approached their learning.

*Marco Polo describes a bridge, stone by stone.*

*“But which is the stone that supports the bridge?” Kublai Khan asks.*

*“The bridge is not supported by one stone or another,” Marco answers, “but by the line of the arch that they form.”*

*Kublai Khan remains silent, reflecting. Then he adds: “Why do you speak to me of the stones? It is only the arch that matters to me.”*

*Polo answers: “Without the stones there is no arch.”*

*Now Kublai Khan no longer had to send Marco Polo on distant expeditions: he kept him playing endless games of chess. Knowledge of the empire was hidden in the pattern drawn by the angular shifts of the knight, by the diagonal passages opened by the bishop’s incursions, by the lumbering, cautious tread of the king and the humble pawn, by the inexorable ups and downs of every game.*

*The Great Khan tried to concentrate on the game: but it was the game’s purpose that eluded him. Each game ends in a gain or a loss: but of what? What were the true stakes? A checkmate, beneath the foot of the king, knocked aside by the winner’s hand, a black or a white square remains. By disembodiment his conquests to reduce them to the essential, Kublai had arrived at the extreme operation: the definitive conquest, of which the empire’s multiform treasures were only illusory envelopes. It was reduced to a square of planed wood: nothingness....*

*Then Marco Polo spoke: “Your chessboard, Sire, is inlaid with two woods: ebony and maple. The square on which your enlightened gaze is fixed was cut from the ring of a trunk that grew in a year of draught: you see how its fibres are arranged? Here a barely hinted knot can be made out: a bud tried to burgeon on a premature spring day, but the night’s frost forced it to desist.”*

*Until then the Great Khan had not realised that the foreigner knew how to express himself fluently in his language, but it was not his fluency that amazed him.*

*“Here is a thicker pore: perhaps it was a larvum’s nest; not a woodworm, because, once born, it would have begun to dig, but a caterpillar that gnawed the leaves and was the cause of the tree’s being chosen for chopping down...”*

*This edge was scored by the wood carver with his gouge so that it would adhere to the next square, more protruding...”*

*The quantity of things that could be read in a little piece of smooth and empty wood overwhelmed Kublai; Polo was already talking about ebony forests, about rafts laden with logs that come down the rivers, of docks, of women at the windows....*

***From Invisible Cities – Italo Calvino***

## 2. SUMMARY

If some general conclusions are to be drawn from running the ‘Learning & thinking styles’ exercise as part of Intro-Week to be followed up during Skills Week, they could be expressed as follows:

- Students gave the ‘thumbs-up’, as far as the appropriateness of including ‘Learning & thinking styles’ as part of an Intro-Skills Week combination.
- A satisfactory first attempt; we are on the right track.
- Need to tweak the content to reflect the students needs and perspective.
- More hands on group or individual activities.
- Ensure the students perceive the connections and the value to be derived from this exercise.

A very interesting point is a comment made by one student that *‘it would be very useful if individual students received personal feedback on their learning/thinking styles’*.

Although a fairly reasonable demand, having to cater for 67 individuals on a personal basis (in the current cohort) would probably generate a lot of additional work for the person(s) responsible for this exercise. However, part of the value of what is being introduced must be that the students understand their styles and make full use of such understanding.

This work has been carried out as part of my own research in ‘Teaching and Learning’ over a period of nine years with my 1st year tutees, and up to now I did not have to formalise the process. Nevertheless, having now had the experience of running this scheme as part of the Intro & Skills week combination I can see that in order for the students to derive the full benefit from this process, the presentations must become much more focussed around the learning/thinking style questionnaires, to be followed by short personal feedback to each student. Efforts will also be made in order to increase the group activities provided as something explicitly preferred by the students, and as experiential learning is expected to provide the framework and the group work the catalyst in engaging the students in active learning as described by Holzer and Andruet (2000).

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**APPENDIX 1**

Follow-up Questionnaire on the use of Learning and Thinking Styles

1	2	3	4	5
Not at all (No)	A bit		A lot	Extremely (Very much so)

1. Did you find introducing you to your learning and thinking styles was useful? 1 2 3 4 5
2. Did the introduction affect the way you perceived yourself? 1 2 3 4 5
3. Did the introduction affect the way you approach your learning? 1 2 3 4 5
4. Did it have an effect as to how you perceived others? 1 2 3 4 5
5. Do you think it is appropriate that all 1st year students should be introduced to these concepts as part of their induction week? 1 2 3 4 5
6. Propose three things you would keep and three you would change in the introduction to learning and thinking styles.

1.	
2.	

3.	
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## APPENDIX 2

Students in their own words:

*'Keep the survey; it is easy to fill and encourages students to reflect upon their styles'*

*'It is fine as it is'*

*'Expand on what each thinking/learning style means and how to take advantage of it'*

*'Thinking/Learning style questionnaires should be filled during intro week rather than given out to be returned during Skills Week; that way you will ensure that everybody gets the results back to you!'*

*'Would not change much. Make quiz compulsory.'*

*'Too much time between Intro-Week and Skills Week. Quiz should be done during intro-week.'*

*'More exercises!'*

*'I would keep everything to be honest! More questions and more details about thinking/learning styles; it was vey interesting!'*

*'Keep the enthusiasm (the presenter made me understand); add more real life examples'*

*'Give individual feedback to the students!'*

*'Keep questionnaires and group activities'*

*'Dr. Kapranos' approach was very helpful and informative'*

## ACKNOWLEDGEMENTS

The author would like to acknowledge the support of Claire Allam, Jane Spooner of Learning & Teaching Services (LETS) of the University of Sheffield for their support for this work through the Inclusive Learning and Teaching Project and Elena Rodriguez-Falcon, Director of Learning and Teaching Development (Inclusive Curricula), Department of Mechanical Engineering, The University of Sheffield for starting the ball rolling.