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Beyond PowerPoint: Creating a Love for Revision

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This paper will look at the various online resources that can be used to encourage and support students in their studes. The foundation year at Loughborough University teaches four modules to students who will progress to the School of Business and Economics: Micro-economics, Macro-economics, Business Finance and Marketing. Other than PowerPoint used in lectures, online resources were created to aid students in their learning such as: mind maps, hot spot graphs, online glossaries and flash cards, as well as multiple choice questions and games. Mind maps, flash cards and multiple choice questions were valued by students. The game had potential and should be better utilised. However, the online glossary and hot spot graphs must be reviewed.

Introduction

Writing four new modules for foundation year students studying business or economics is a daunting task. During the first year of running the modules, the focus was on creating the core information and the PowerPoint slides to use during lectures. With the basics done, the second year allowed for the development of additional resources that can support students in their learning. Alton (2016) discusses the need for meta-learning strategies in learning pharmacology. It can be argued that foundation year students may face the same challenges as pharmacology students as the work may contain basic concepts that must be mastered before more challenging work can be approached. It is also important that students have the opportunity to practise testing (Smith and Karpicke, 2014), an opportunity provided to the students through the various resources created as discussed in this article.

Teaching a generation that relies more on technology than pen and paper allows for the development of alternative learning support for students. This paper will look at the various online resources that can be used to encourage and support students in their studies. A discussion with a group of foundation year students who studied both the economics and business modules provided some feedback regarding the use of these resources. Online resources such as electronic flash cards and an online glossary, hot spot graphs, multiple choice questions, and games and mind maps will be discussed. Each section will contain three parts: what was done on the foundation year course, previous studies done, and student response to the resources provided.

Online Glossaries and Flash Cards

The first two resources created were online glossaries and flash cards to provide students with the basic concepts that they needed for different modules.

The facility for creating **online glossaries** is currently available from most of the virtual learning environments (VLEs) used by various universities and does not need any additional software. The glossary made available in the Business Finance module contained an alphabetical list of the words used in that unit. Students could use this list to familiarise themselves with the basic concepts, but they could not add to it or engage with it in any other way. Glossaries are not time-consuming to create and teaching staff can use them to create short questions in the exam. It is also good practice and often requested in cases where students require more support.

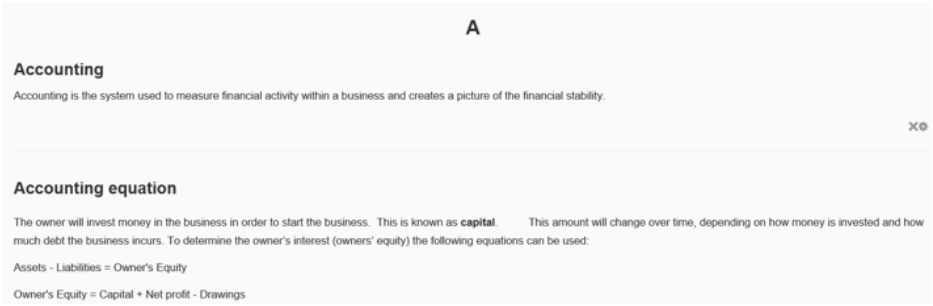

Figure 1. Example of an online glossary.

Abdin et al. (2011) found that using an electronic glossary improves marks amongst students with a lower proficiency in the English language compared to a printed list. Unfortunately, the majority of studies focus on learning a language and not how the lists add to the understanding of basic concepts.

After a discussion with students, it turned out that they did not engage with this resource and that some did not even realise that it was available. The resource was listed with all the other resources available so there was no reason not to access it.

Flash cards were created by using the dialogue cards function in *h5p* (https://h5p.org/) for both the economics modules. *h5p* is an online resource that can be used to create various types of resources to aid learning. A free account can be created, and the cards can be exported by using the embedded function then pasting it into the 'page' resources available in the VLE. There is no limit to the number of cards that can be created but it does not work well with mathematical formulas. However, formulas can be inserted as a picture. Each flash card can include a picture (the same picture is visible on both sides of the card) with a key concept on the first card and the definition or explanation on the back. The list is not alphabetical, and students will have to trail through the entire stack. Although the students are not creating the cards, they allow for a limited level of interaction. Students will see the keyword, look at the picture that may create a visual cue, and then test themselves by reviewing the answers when the virtual card is turned. These cards are very time-consuming to create, especially as *h5p* does not have a spell-checking function. Nevertheless, these concepts are useful when creating questions for assessments.

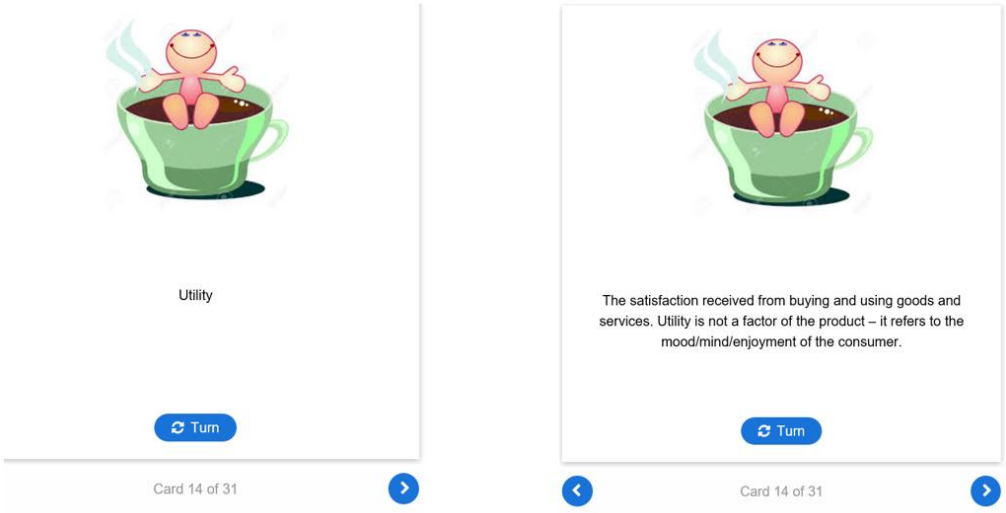

Figure 2. Example of flash cards.

Alton (2016) focuses on the 20/80 rule where the focus should be on 20% of the most important information discussed in the class or lecture environment. The remaining 80% is studied by the students in their own time. Flash cards support the 80% of the more basic information that students need to master allowing more time in class for complex work and discussion. Smith and Karpicke also suggested that a transfer-appropriate processing framework may be useful. This means that retrieval should be in the same format as when information was processed (Morris, Bransford, and Franks, 1977 in Smith and Karpicke, 2014). The use of similar pictures or icons used in the flash cards may be helpful if used in an exam to stimulate recall.

Although in its current format the flash cards do not create the opportunity for students to have control or to contribute to the information, alternatives are available. Senzaki et al. (2017) investigated how student contribution to the creation of flash cards promotes learning. If students create their own cards, it increases the possibility of retaining, comprehending and applying information in multiple-choice exams. To be successful, students must use the Flashcards-Plus method. The cards can contain three types of questions, measuring retention, comprehension and application. However, the key is practice testing. Practice testing is important and combined with flash cards can be a more effective way of studying. Flash cards on their own may not be so beneficial and are found to improve the score of a first exam but the effectiveness of the cards is reduced in subsequent exams (Golding et al. in Senzaki et al., 2017 and Smith and Karpicke, 2014).

Traditional flash cards are used by students to test what they know at that moment and not to learn more. They are also used to learn vocabulary and not to develop deeper understanding (Senzaki, 2017). This was probably the case for the foundation year cohort who were provided with the ready-made cards.

However, Senzaki (2017) states that the Flashcards-plus method is designed to promote deeper learning. Following this method, a student will go through four steps:

- Write key words (e.g., bold words in textbook) on one side of card.
- Write a definition from the textbook on the back.
- Rephrase the definition in their own words. This means the student is actively involved in learning and will remember the information better.
- Generate an example to illustrate the concept. This is useful especially if the example can be linked to the student's own experience – this will also help with recall of the material.

This method allows for scaffolding, enabling students to move beyond retention and form a deeper understanding of the concept. Using this method will also provide students with the basic academic skills needed:

- They receive clear instructions on how to complete the cards.
- They develop an example and can apply the concept, leading to a deeper level of learning.
- They participate in active retrieval of information and are continuously practising retrieval of that information.

Senzaki et al. (2017) found that the students who used the flash cards performed better. Engagement with the cards increased when marks were assigned to the creation of the flash cards. These cards were used beyond the standard use of flash cards where only basic concepts are studied, and students were much more capable of creating their own examples. The increase in performance can also be assigned to the higher level of engagement in practice testing, therefore students had a practice run in the recall of information before writing a test or exam.

Flash cards also allow for different types of information to be studied: verbatim definitions (remembering basic information), accurate paraphrases (showing comprehension/ understanding), and realistic examples (used for application questions) (Appleby, 2013). Appleby is also of the same opinion as the previous authors in that flash cards promote practice testing. Making the cards available online also allows students to retrieve and use them where needed. Although Senzaki et al. (2017) advocate that students should create these cards, Appleby warns that there is a risk that they may use incorrect definitions or examples. Therefore, support must be in place, for example through sharing and feedback on the cards created.

The students' response to this resource was extremely positive. They used it as a revision tool and found it very useful. Of all the resources created, this was possibly the most useful. Based on the article by Senzaki et al., further development of the use of the flash cards may be valuable. A free online source, *opencards* (http://opencards.info/), is available and may provide more functionality when it comes to flash cards. Another free resource, *PeerWise* (https://peerwise.cs.auckland.ac.nz/docs/), may also be beneficial as students can comment on answers. *Peerwise* allows for peer monitoring between students, improving the quality of the questions created.

Hot Spot Graphs

The **hot spot graphs** were created to illustrate important information on graphs relating to economics. The image hot spot function in *h5p* (https://h5p.org/) was used to create the graphs with various hot spots that a student can click on. Each hot spot provided more information regarding that specific point. The code created by *h5p* was then embedded in the VLE, using the book function as a resource. The advantage of the book function is that a table of contents is created, making it easier for the student to find a relevant graph that they need to learn or understand better. Students could not create the graphs, but they were a source that could be used for practice testing (Senzaki et al., 2017). These graphs provided the students with more control as they could test themselves in terms of their understanding of the graph before revealing the relevant information.

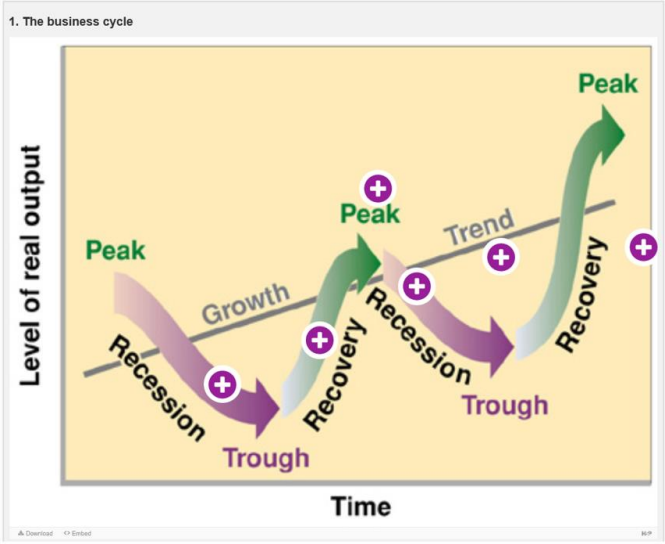

Figure 3. Example of a hot spot graph.

Creating the graphs is not as time-consuming as the flash cards, however spell-checking is still a problem. This resource has the potential to be used for formulas and financial statements. It is also useful when setting an exam as all graphs or diagrams are grouped together on the VLE. The biggest problem with this resource is the sizing of the graph once exported. To make it fit, the actual screen size needs to be reduced to about 50%.

No previous studies could be found relating to 'hot spot' specifically. Yeo et al. (2004) look at the use of interactive multimedia in physics and found that students often do not use the program as intended and only once the instructors intervened did they get the full benefit of the program.

The feedback from the students was not as positive as expected. Some used it, but it lacked the level of enthusiasm that the flash cards received. Incorporating the graphs into the lecture may generate more enthusiasm. Students must also be reminded of the value of practice testing and how this resource will help them to prepare for an evaluation. The results of the study done by Yeo et al. (2004) also indicated that more guidance should be provided.

Multiple Choice and Games

Multiple choice questions are simple to create by using the quiz function on the VLE. Marks are easy to allocate, and once questions have been created, they are marked without staff involvement. Students can use the questions to test their knowledge at the end of each session. If the effort is made, students get immediate feedback regarding marks and are also told certain answers are not correct. Although a multiple choice quiz is time-consuming to create, it is a resource that can be used throughout the year to remind students of the basic concepts that they need to know.

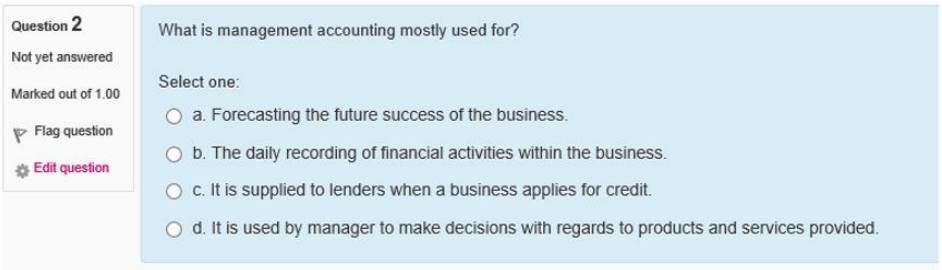

Figure 4. Example of online multiple choice questions.

A **quiz game** using a PowerPoint template can also be used to review short answer questions (up to five facts). This is in a game format where the student can select a question in a specific category for a certain number of marks. It is uploaded onto the VLE in the same way as any PowerPoint file. Students can also download the file and create their own questions.

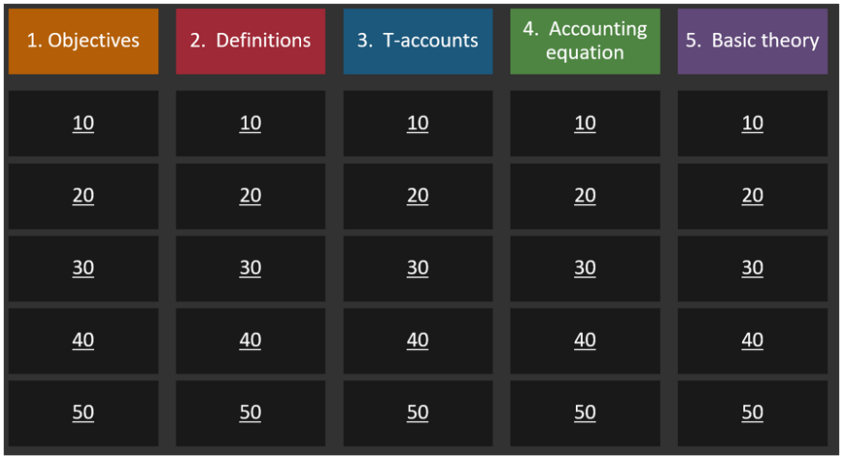

Figure 5. Example of the first slide of the game quiz.

Maiga and Bauer (2013) found that multiple choice games improve exam marks when the following sequence is followed:

> Ask question from data bank → student attempt to answer the question → can ask for support from tutor or fellow student if unsure → answer the question → feedback not provided → if answer is incorrect the student can't progress → the game is now stopped.

The student must therefore review the material before starting a new game. Each game consists of 16 questions and several sets are available. Completing all the sets will take approximately 3-4 hours for each unit of learning. This relates to the study done by Grühn and Cheng (2014) where they discovered the value of self-correction.

Multiple choice questions may not be ideal for testing knowledge in exams, however they are a useful tool when preparing for exams. Little and Bjork (2016) found that using multiple choice questions as a learning tool before the exam aids learning as it attracts attention to all four answers and not only the correct answer. Short answers only focus on the correct answer and other possibilities are not considered. Smith and Karpike (2014) also support the idea that the retrieval of information must be practised and that multiple-choice questions are a useful tool to do so, but also state that short answer questions can be used as well. Both methods have

their own advantages and disadvantages. Multiple choice questions are not as effective in the long run but initial retrieval is more than for short questions. However, students may remember incorrect answers if feedback is not provided to multiple choice questions. Short answer questions are often more engaging as they lead to discussions and the study showed that students who used the short question method retained more information. Regardless of the method, feedback is important before a final test is taken. Like Alton (2016), Smith and Karpicke (2014) also refer to the transfer-appropriate processing framework as discussed by Morris, Bransford and Franks in 1977 where they state that retrieval should be in the same format as when information was processed. However, it can be argued that this is not what will be expected of a student at university level. The focus should be on the ease of retrieval. If it is too difficult, later retention will suffer and multiple choice questions are often easier to retrieve. Ideally a hybrid learning system should be used: multiple choice for ease of retrieval and short questions that require more effort to help students remember more information. Therefore, short questions should be asked first, followed by the multiple-choice questions (Smith and Karpicke, 2014). Students using this method performed better than the ones who just relied on multiple choice questions. Smith and Kapicke (2014) also found that practising retrieval can double the performance of a student when tested.

Smith and Karpicke (2014) mention the importance of feedback but do not state how it should be done. Marsh et al. (2012) provide a clear outline of how feedback should be delivered. Providing feedback at the incorrect moment can be detrimental to performance. It is less useful when given before answering the question and providing the correct answer is counterproductive when time is limited (time should be used for other activities). Feedback is more useful when there is a delay between the answer and receiving the feedback. Marsh et al. (2012) state that a delay helps to correct errors, rather than just maintaining the correct responses.

Three types of feedback were investigated in the study:

1. *Verification feedback*: labels a response as correct or incorrect but no further details are provided. This will have the same results as when no feedback is provided. If this method is used, all the multiple-choice options must be visible, or the student will have to rely on memory to recall possible answers. Verification feedback is more useful with fewer alternatives.
2. *Answer feedback*: provides the correct answer. Follow-up testing resulted in better results when answer feedback was provided compared to verification feedback, although Marsh et al. (2012) reported that previous studies found no difference in later results or that verification feedback provided better results. Findings are therefore contradictory at this moment.
3. Multiple choice questions are most likely only to provide verification feedback (less work for teaching staff) and this is equivalent to *answer-until-correct feedback* (Marsh et al., 2012). Using this method, a student can continue until the final answer is reached. Options can therefore be reduced in a meaningful way, but no additional feedback is provided.

Due to the contrasting results, it may be best to consider the abilities of the students being taught. High ability students may benefit from verification feedback as it leads to the 'stimulation of meaningful discovery', according to Marsh et al. (2012). These students have the ability to deduce the correct answer after verification feedback is provided. Less able students may benefit from the answer-until-correct method. They may not be able to deduce the correct answer, therefore they must continue until the correct answer is found. If a student answers a question correctly, verification and answer feedback should provide equivalent information. This should lead to better performance compared to when no feedback is provided.

If no feedback is provided (Marsh et al., 2012), then students will only be able to correct a small proportion of errors. Self-correction improves when verification feedback is provided as

students develop the ability to identify the correct answers. Providing a student with any form of feedback also exposes the student to the question for longer. Montepare in Grühn and Cheng (2014) develops this idea of self-correction further. An overall mark is provided but the wrong answers are not indicated. Students must determine their own mistakes and correct the questions before submitting the answer again, thus creating a self-correcting test/exam suitable for smaller groups. The advantage of this method is that deeper learning is achieved as additional interaction with the material is required.

Grühn and Cheng (2014) studied the effectiveness of a self-correcting approach and found that student grades improved during the self-correcting process as well as in the final exam. Using this method is even more beneficial for lower performing students. Students who had more to correct scored higher in the final exam as there was more 'room for improvement'. When this method is used, it is important for both tests to count for marks in order for students to engage. Lower performing students are less likely to drop out if marks are assigned to both. The following was also found:

- Students' knowledge of that particular area improved.
- Retention of the self-corrected material improved.
- Improved engagement of students in large classrooms.
- Information learned was not transferable to any new material.
- Must apply self-correcting approach regularly throughout the semester or course to encourage student engagement with the material.

If the self-correcting method is used, Grühn and Cheng (2014) recommend that exams should be more difficult as students should be able to think about the information and not just copy the answers from the text book.

Sinha and Glass (2015) also indicate that using delayed feedback on the multiple-choice questions leads to better performance in short answer questions. They found that various studies showed that students in labs who received delayed feedback performed better in subsequent exams, however this is not true for students on a classroom-based course. However, the lab students were given short questions and the classroom students were given multiple choice questions. When the two techniques are combined, and feedback is provided in multiple choice questions, then short answers in future exam questions are improved. By providing delayed feedback the information is separate from the question and it acts as a cue for later recollection.

The multiple-choice questions were used in the finance module and students found them to be very useful in testing basic theory, especially as most finance questions are practical in nature. Although only verification feedback was provided, the students still found it useful. The game containing short questions was provided online, but not used in class, therefore students did not engage with it. Based on the previous discussion, it may be helpful to use both methods actively in class as it may improve exam results when basic theoretical questions are asked.

Mind Maps

An outline of each chapter was provided in the form of a mind map. Mindjet MindManager was used as it is available from the university. However, there are several free online mind-mapping applications available. Once created, the document is imported to the VLE as a file. Care should be taken to set appearance to ‘force download’ or students may struggle to access the file. The purpose of the mind map was to provide students with a basic outline of the chapter in order to track progress. They could add to the mind map as information was discussed during a session.

The maps were also useful in the economics modules to indicate important diagrams and formulas.

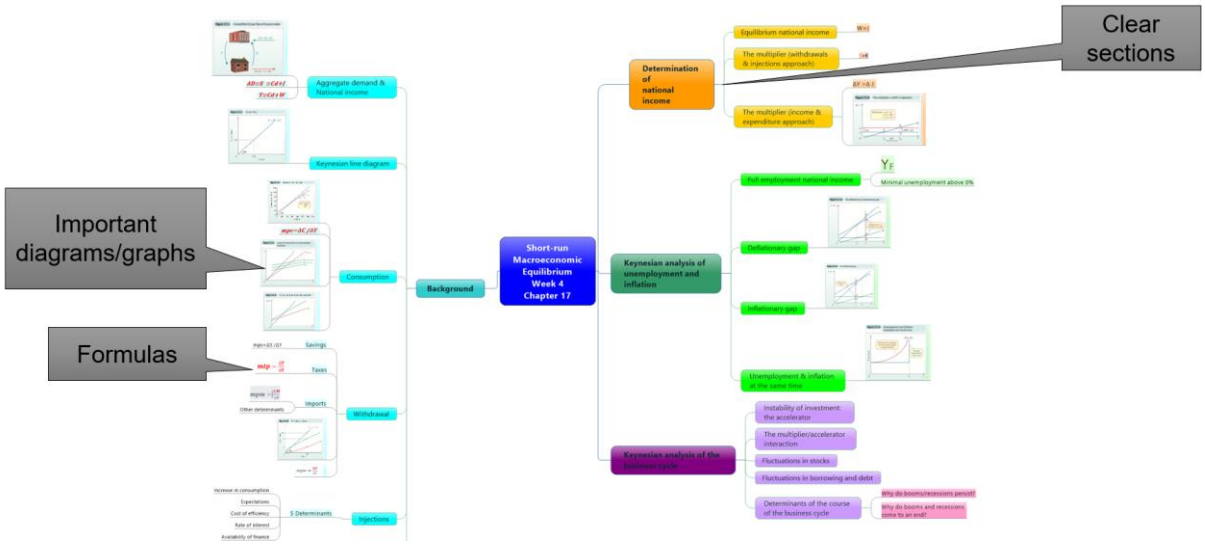

Figure 6. Example of a mind map.

Tony Buzan (in Guo, 2014) is the best-known author of the study of mind maps. Mind maps appeal to a range of cortical skills through word, image, number, logic, rhythm, colour, and spatial awareness. Jarvis (in Hay, 2007) states that memorising is part of learning, though recalling information without understanding implies non-learning. Therefore, students should not recite information, but construct knowledge in a way that will lead to deeper understanding and meaningful learning. Furthermore, Jarvis indicates that learning may occur in different ways and is not always chronological. This supports the idea that mapping creates a learning environment where the student may select the order of learning, identify areas of current knowledge and identify gaps in that knowledge. This links to Novak (in Hay, 2007); prior knowledge must be relevant to the new material being introduced and new information must be presented in a meaningful manner. Farrand, Hussain and Hennessy (2002) found that mind maps lead to a 10% increase in retention compared to other methods, and 15% if adjusted for lack of motivation.

To ensure meaningful learning, different methods of teaching can be employed. The value of mapping in the transfer of knowledge is seldom considered. Wills and Miertschin (2006, p. 266) state that "visual (non-linguistic) thinking is a fundamental and unique part of human cognition, and it should be a partner to the linguistic ways of expressing ideas and thoughts." A visual map allows a student to make abstract ideas visible and connects prior and new knowledge, creating a framework for ideas used in assignments and discussions, further emphasising ideas that lead to better understanding and interpretation (Wills and Miertschin, 2006).

A mind map is a visual diagram that serves as a "semantic organisational tool" that can be used to organise information (Wills and Miertschin, 2006, p. 267). A central idea is created, with subsequent ideas flowing from the central point. Colours and diagrams can be used to represent ideas (Buzan and Buzan, 2006). This allows a student to create a schematic framework of current knowledge to which new knowledge may be added. Using a mind map in class allows for active learning instead of passive listening in a traditional lecture. This should lead to meaningful learning (Wills and Miertschin, 2006).

Students used the maps as guidance but did not add to the original document. Some did use the outline and then made their own notes as they could write on a tablet screen. Students

must still learn how the maps can help them in the writing of a longer answer such as a case study or an essay. The maps were also very useful at the start of each lecture as students had a good overview of what was discussed previously and what was going to happen during the current session. Students struggled with understanding how a report should be written in the marketing module. Once a map (in a linear format) was provided, it all become very clear to them.

Conclusion

The **online glossary** was less successful due to the lack of awareness by students, but they valued the **flash cards**. Students should be encouraged to develop their own flash cards and not to rely solely on the online flash cards provided. Student response to the **hot spot graphs** were mixed. This resource may be used more if it is integrated with the teaching material, for example if it forms part of the PowerPoint slides during a lecture. The **multiple choice** questions were also well received. It is clear from previous studies discussed in this article that multiple choice questions can be used more effectively to provide feedback to students. The **multiple choice game** should also be integrated in lectures to promote the use of this resource. **Mind maps** were successfully used in the economics modules and can be further used in the marketing module. Other uses of mind maps should also be encouraged, for example in the planning of essays or reports.

As advised by Alton (2016), students should be informed why the techniques work and how they will benefit them. Goals must be set and linked to their future career or studies. All the techniques discussed are used on an individual basis, but creative groupwork and peer learning should not be underestimated. The use of freeware such as *PeerWise* should be further developed. It has also become clear that practice testing is important. Techniques such as multiple-choice questions may not be the best form of evaluation, but they serve a purpose in preparation for an exam, especially when combined with short questions. It is also important to consider how the knowledge obtained can be used in different settings, for example how multiple-choice questions can be used in an essay or case study. The techniques used at Loughborough are just a starting point. Some evidence in the literature supports these techniques, but there is room for further development, especially to encourage students to be involved in their own learning.

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About the Author

Anje completed her master's degree at the University of Stellenbosch in 2001 where she created a training program for the South African Defense Force to teach new recruits how to read maps using computer-based training which included virtual reality software. After her degree, she authored a series of textbooks for Oxford University Press. After relocating to the United Kingdom, she lectured at Durham University for nine years, developing the Study Skills and Business modules for the Foundation Centre. New beginnings in 2016 saw the start of a new adventure at Loughborough University where Anje is the module leader for the Business and Economics modules.

Anje is passionate about the foundation year as it is a wonderful opportunity to contribute to the academic future of a new student. This passion is also reflected in researching alternate modes of representing new information, such as mind maps, flash cards and interactive graphs.