Flipped classrooms: Action research to improve practice within an HE nursing context

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Abstract

This article explores the importance of careful design when using a flipped classroom to support the learning of an Anatomy and Physiology module for year one undergraduate nursing students. It is argued that an online platform of well-designed materials and activities will effectively support the retention of key information, thus increasing the time in synchronous classrooms for discussion, debate and assimilation of higher-order knowledge. An action research approach was taken in order to explore this particular issue underpinned by qualitative methodology. Data was gathered via a questionnaire from a group of students, and through an interview with an experienced colleague. Through careful analysis of the data, results from the research showed a positive reaction to the newly designed flipped classroom. The resource was easy to access and navigate and had increased a more self-directed approach to learning content. This had a positive impact on self-efficacy, as students reported having more belief in their ability to learn independently. As we move more towards the implementation of more flipped classrooms, further research exploring different elements for successful engagement with this resource will be inevitable. What this research has provided is a clear model for effective flipped classrooms which can be used as a basis for future developments.

Key Words

Flipped classroom; cooperative learning; collaborative learning; flipped learning environment

Link to article

Introduction

Teaching the Anatomy and Physiology (A&P) module to year one BSc nursing students, it became evident that the structure for this needed to be re-developed. This module includes the study of endocrines, and the endocrine system in particular is an area within A & P that nursing students have frequently struggled to comprehend. For example, there are numerous hormones that target specific areas of the body which students can find confusing to remember.

An action-research approach using qualitative data collection and analysis methods was used to conduct an in-depth investigation and explores the way in which a flipped classroom engages students while providing flexible learning opportunities. Initially there was an existing flipped classroom approach already in place for the module. However, students struggled with learning the content provided on this platform due to its complexity and the language used is not being currently accessible for the majority of them. Students have commented that, although they 'try and learn' the content, the existing flipped classroom lacks clear structure and student activities. Although students have demonstrated an attempt to develop self-efficacy, this is currently being hindered due to the design of the current online platform.

When flipped classrooms are properly implemented alongside cooperative learning it can lead to increased academic performance (Foldnes, 2016). Cooperative learning increases educational experiences through motivational and cognitive activities, which are conducted through peer interaction which takes place in a cooperative setting. Cooperative learning activities are implemented within synchronous sessions through a variety of ways and resources. The intention is to try and emulate this within the flipped classroom so that students become more able to construct new knowledge based on current existing knowledge (Anthony, 1996). The main objective is to create learning content that allows students to replace or adapt their existing knowledge and understanding (based on their prior knowledge) with deeper and more skilled levels of understanding (Ellis, 2016; Hmelo-Silver, 2004; Von Stumm and Furnham, 2012). This should ensure students develop sound knowledge of human anatomy and physiology,

a key requirement in the assessment, as well as treatment and ongoing care of patients (Johnston, 2009).

Flipped learning environments and cooperative learning

In the past ten years the flipped classroom has become standard practice within higher education (HE) as a way to foster active learning and engagement (Hamdan *et al.,* 2013). Flipped classrooms provide students with opportunities to access synchronous and asynchronous learning activities as well as online collaboration (Zainuddin and Halili, 2016). This student-centred approach to learning enables students to access the majority of content in their own time, thus allowing more time to be spent engaged in lecturer-facilitated discussions within the physical learning environment (Sams and Bergmann, 2012).

Flipped classrooms provide opportunities for the learning content to be assimilated with prior knowledge. This also puts the student in the driving seat, learning the content at a pace which suits their individual needs. This aligns with the principles set out in the cognitive domain taxonomy suggested by Bloom, and updated more recently by Krathwohl and Anderson (2010). It is more beneficial if the student spends time practising the lowest levels of cognition outside of the learning environment, freeing time for them to work on the higher levels of their knowledge construction within the classroom, supported by the teacher (Diagram 1).

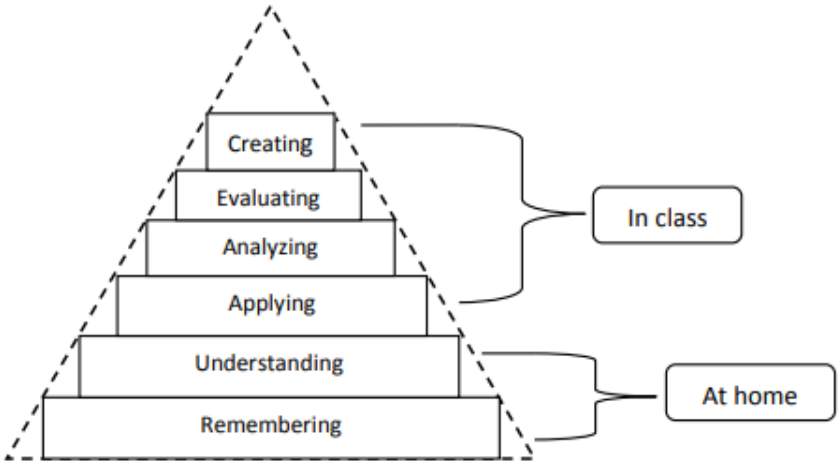


Diagram 1: *Bloom's revised cognitive taxonomy use in the flipped learning classroom (Bloom, 1994)*

Within this framework it is essential that sufficient well-considered materials and activities are provided on an accessible learning platform for students to access asynchronously (Nederveld and Berge, 2015). The flipped learning model provides more time within the classroom applying the concepts, as opposed to simply 'listening to lectures and other lower-level thinking tasks' (Zainuddin and Halili, 2016: 316).

Research conducted into flipped classrooms identified that teaching students how to apply the knowledge provided through asynchronous learning materials is central to the success of this approach. Applying knowledge involves classroom-based problem-solving activities and group projects (Cheng *et al.,* 2020).

In order to effectively engage students in this style of delivery, a '…socratic method of teaching' (November and Mull, 2012: 42) is used. This involves asking questions and posing problems which students work together trying to solve. The teacher takes on a facilitator role, engaging with the group activities as required.

Cooperative learning, also referred to as collaborative learning, provides students with important skill development, particularly relevant for HE studies. Students are more likely to develop problem-solving skills and increase their engagement with the materials as active students. This also encourages self-efficacy to develop.

> As students move from seeing teachers and texts as the sole sources of authority and knowledge, to seeing peers, themselves, and the thinking of the community as additional and important sources of authority and knowledge, a course becomes more collaborative (Ravenscroft *et al.,* 1999: 16).

However, it is also important to recognise some of the challenges of cooperative learning. The success of this relies on social cohesion, underpinned by the students' respect for one another. Group dynamics should be carefully considered. Where necessary, particularly during the early stages of the groups being established, correct behaviours should be explicitly modelled (Ravenscroft et al, 1999). Where this does not happen, the groups can run into difficulties.

Cooperative learning, when managed effectively, can provide students with opportunities to practise and thus develop their knowledge and skills from novice, to

master in an engaging and social way. It also provides them with the support from their peers 'to help them when they run into difficulties' (Salvin, 2014: 24).

This paper presents the argument that a flipped classroom model and cooperative learning approach, will improve the knowledge construction for students studying an undergraduate nursing degree. It aims to explore the issues that exist within the current learning materials in order to make changes to this. The impact upon the students' engagement and self-efficacy will be explored. It is envisaged that a more flexible and individual approach to learning underpinning content will be achieved through the re-design of the learning materials and related activities, accessed asynchronously. This will be achieved by focusing on the views of the students studying the module, thus presenting a ground-level perspective.

The flipped classroom

After much deliberation within the nursing team, it was decided that the first years Anatomy and Physiology (A&P) module would merge with another module in the form of a flipped classroom. There has been a shift towards the implementation of flipped classrooms, but little is still known about how to evaluate and refine the flipped classroom within nursing programmes (Betihavas *et al.,* 2016). In our case issues became apparent with the first version of the A&P flipped classroom. The structure of the flipped classroom was not user friendly as students were required to press a 'home button' taking them back to the start of the session when in a chapter of the flipped classroom to move between the content. The amount of content being displayed made interaction and navigation of individual slides difficult and made it challenging for students to easily absorb the information. The image content was sporadic, the diagrams were difficult to make out and there were also concerns raised around the rights of some of the images being used. Figure 1 shows an example of a screen.

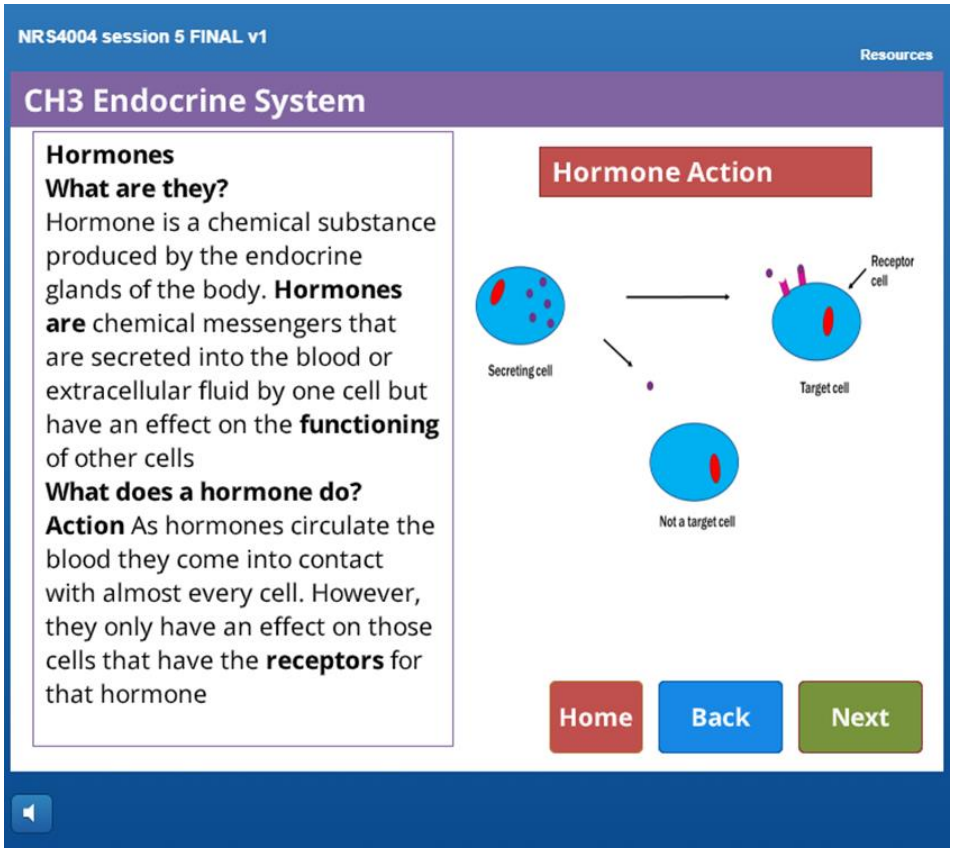


Figure 1: *Screenshot of VLE: Endocrine Explanation from BSc Nursing; Anatomy and Physiology (A & P) Module showing the home button which links back to the main course menu*

To address these issues, it was decided to completely redesign both the structure and content delivery of the flipped classroom from scratch, to focus on the key learning required and show a menu instead of unclear links. An example of the re-configured page is shown in Figure 2. The way the flipped classroom had been built originally made it difficult to restructure from an e-learning information technology perspective. The original flipped classroom had been created using an old version of the VLE which lacked some features which we wanted to utilise within the new design.

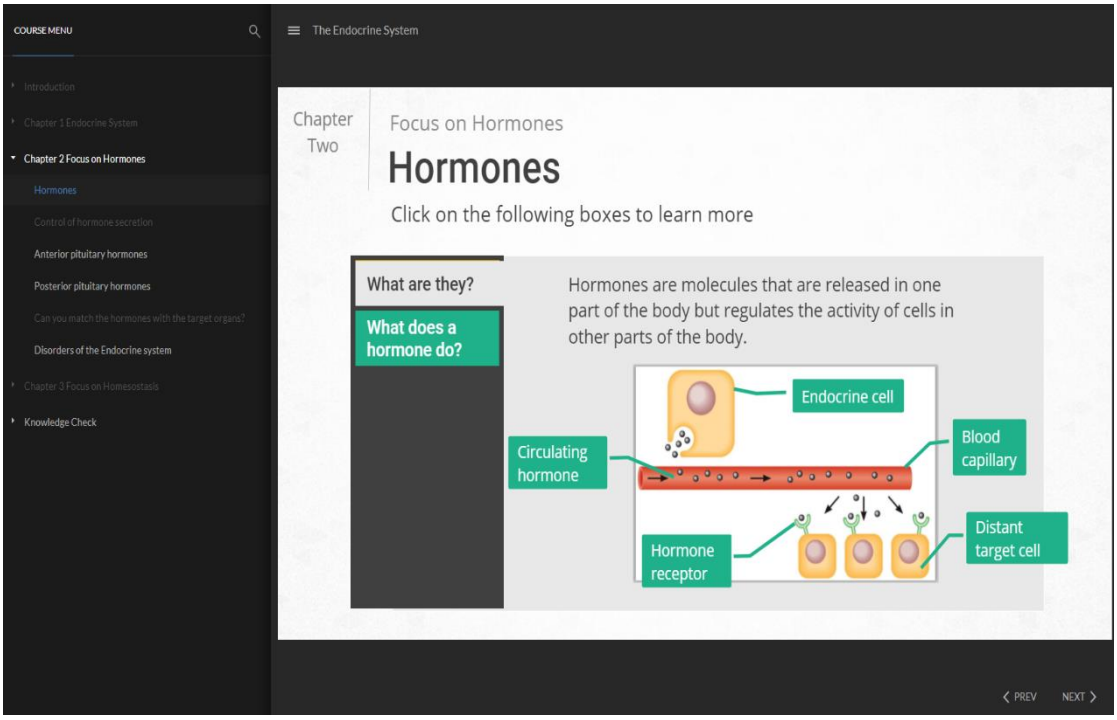


Figure 2: *New Endocrine VLE page showing easily accessible course menu on the left along with an example of the new layout of content*

It was also envisaged that the new endocrine flipped classroom would facilitate the students' development by engaging them as active students, so knowledge check points were created at the end of each chapter. These consisted of drag and drop activities (See Figure 3) and five multiple-choice questions to enable students to assess their understanding of each chapter of the module. The final section of the flipped classroom consists of ten multiple-choice questions that test the student's knowledge retention across all the chapters covered (See Figure 4 for example).

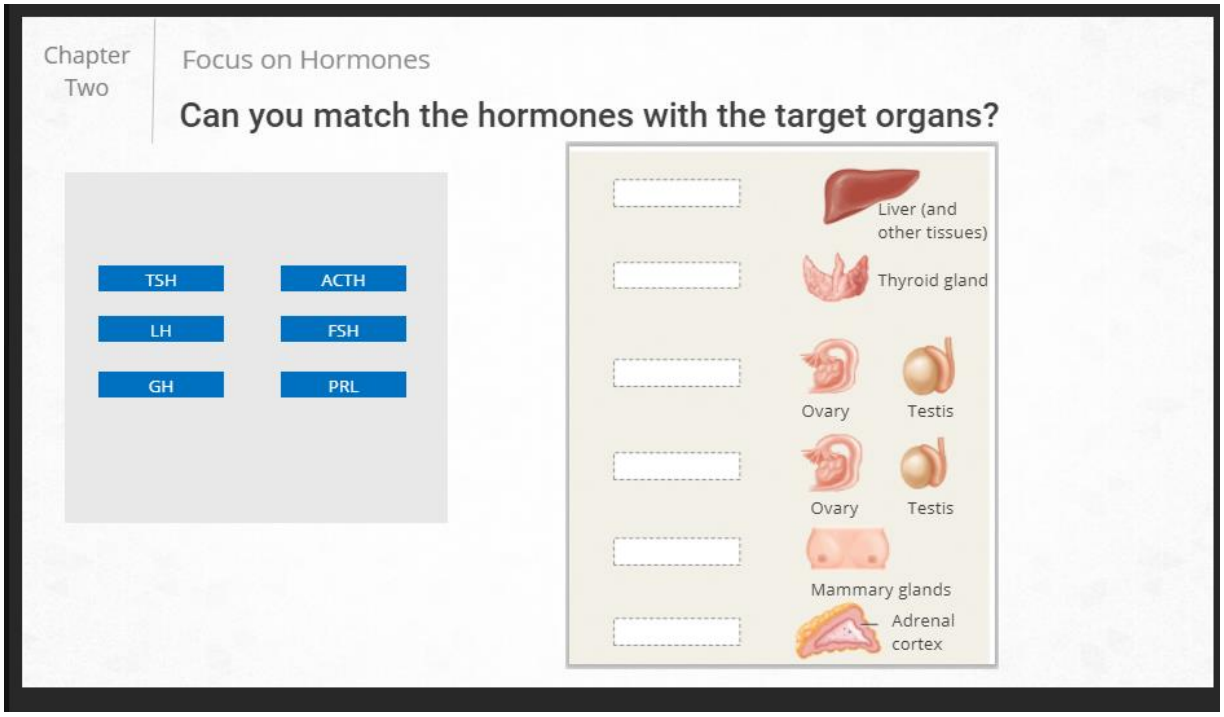


Figure 3: *An example of a drag and drop activity within the new Endocrine flipped classroom*

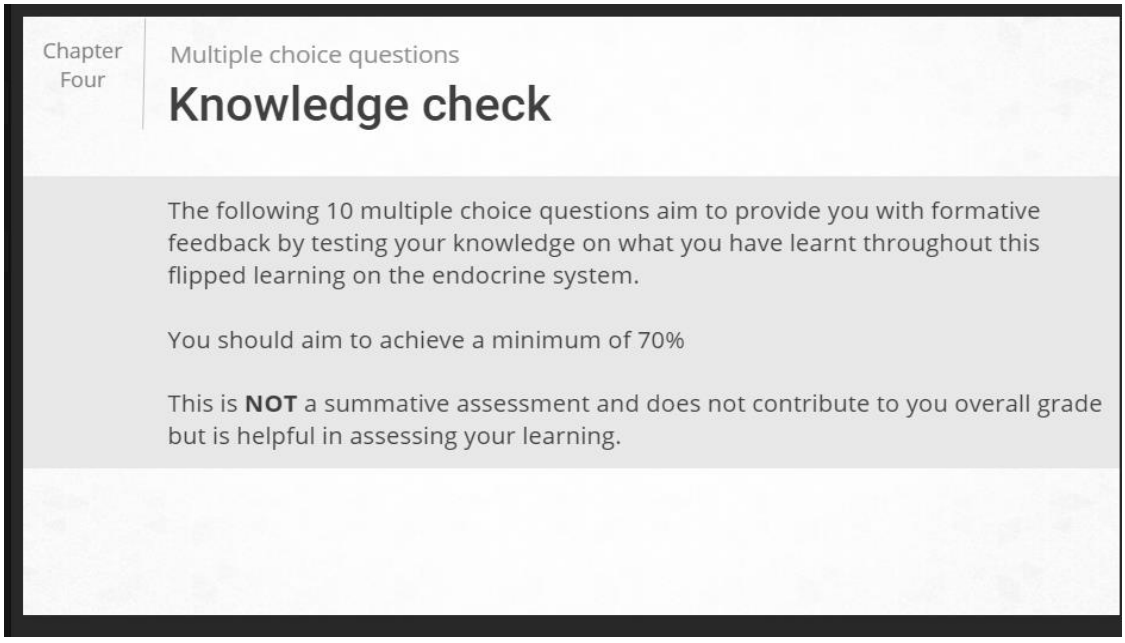


Figure 4: *Multiple choice questions providing to test the knowledge*

Methodological approach and data collection

The research was undertaken within a higher education institution in the North West of England. An action-research approach was used which enabled students' feedback

to form an integral part in the new flipped classroom design. The primary data was collected from 63 students enrolled on the first year of an undergraduate nursing degree.

In order to increase validity, thus enabling credible conclusions to be drawn from the data, it was important to carefully consider the design of the research tools being used (Sapsford and Jupp, 1996). Due to time limitations, data was gathered over a one-month period at the end of the module. Serrant-Green (2008) argues that data gathering is one of the most important stages when completing any research, irrespective of the philosophy or theoretical framework that the project is underpinned by.

As the research aimed to capture opinions from a wide sample of participants, two types of data collection tools were used. The first of these was a questionnaire. It is critical that the questions are structured in a way that ensures the students understand what is being asked. Stopher (2012) explains the goal of question creation within questionnaires is to have every respondent interpret the question in exactly the same way and to have the respondents able to respond accurately to each question. The questionnaire was short, containing easily-interpreted questions to ensure a maximum return within a limited time-frame (Bell, 2010). By using only a small number of questions, it is more likely that students will engage with the questionnaire (Franklin, 2012).

Due to the qualitative nature of the research, it was important to gather data from another source to triangulate the results (O'Donoghue and Punch, 2003). According to Patton (1999) multiple data sources allow a comprehensive understanding of phenomena. To achieve this, a semi-structured interview with a colleague was also carried out in order to corroborate the results from the questionnaire completed by the students. By using triangulation, the data is more reliable and valid (Bell, 2010; Polit and Beck, 2012).

The colleague being interviewed was familiar with both the original and the new flipped classroom format and has taught the students synchronously so was able to provide comparisons and feedback based on experience. Wengraf (2001) and Kelly (2010) highlight a certain level of previous knowledge or study on the research topic area is required when conducting semi-structured interviews.

Franklin (2012) suggests that research interviews take many forms and can be carried out in various ways such as face-to-face, or by phone. The recent shift to online platforms has enabled primary researchers, who would have previously relied on face-to-face methods, to now utilise online platforms with confidence.

A semi-structured interview technique was used due to the versatility and flexibility of the approach (DiCicco-Bloom and Crabtree, 2006). This allowed a certain degree of reciprocity between interviewer and participant (Galletta, 2012), affording the interviewer the ability to improvise follow-up questions based on a participant's response (Rubin and Rubin, 2005; Polit and Beck, 2010). Three predetermined questions were set to provide some structure and correlation with the data gathered from the questionnaire. However, there was also the opportunity for the direction of the interview to change along the way, dependent on the information the researcher wants to elicit (Franklin, 2012).

The three predetermined questions are:

1. How do you find navigating the Endocrine flipped classroom?
2. Did you find it easy to access the information within the flipped classroom?
3. What improvements could be made? Please specify.

The primary data collected will provide an insight into previously unexplored areas (Serrant-Green, 2008). Although research is increasing around A&P Flipped Classroom's (Bingen *et al.,* 2019; Ford, 2019; Pickering, 2018), it is still somewhat limited.

Interpretation of the data

Qualitative research can produce vast amounts of data, collected using a variety of different methods (Pope *et al.,* 2000). No matter what form data is collected in, it means very little until the raw data has been analysed and evaluated (Bell, 2010). It is essential to analyse the data in order to draw valid conclusions from the research, using content analysis (Krippendorff, 1980). Using content analysis, it is possible to compress text into a few categories, thus making it possible to identify patterns and assess meaning and significance (Stemler, 2001). Through the act of 'encoding' and 'decoding' (Hall, 1996), the researcher's task is to unearth the inner or perhaps even

hidden significance of the message in context (Franklin, 2012). Although the most common recording unit is a singular word, it is also possible to use joint terms (Duffy, 2010).

Three separate joint terms have been chosen to categorise the feedback from the student questionnaire: Enhancing learning, Barrier to learning, Closed response. A thematic approach was also adopted when analysing the transcribed interview carried out with a colleague to identify, analyse and report patterns (themes) that form within data (Braun and Clarke, 2006). This approach will enabled comparisons and contradictions to be made between the data gathered during the questionnaire and the interview.

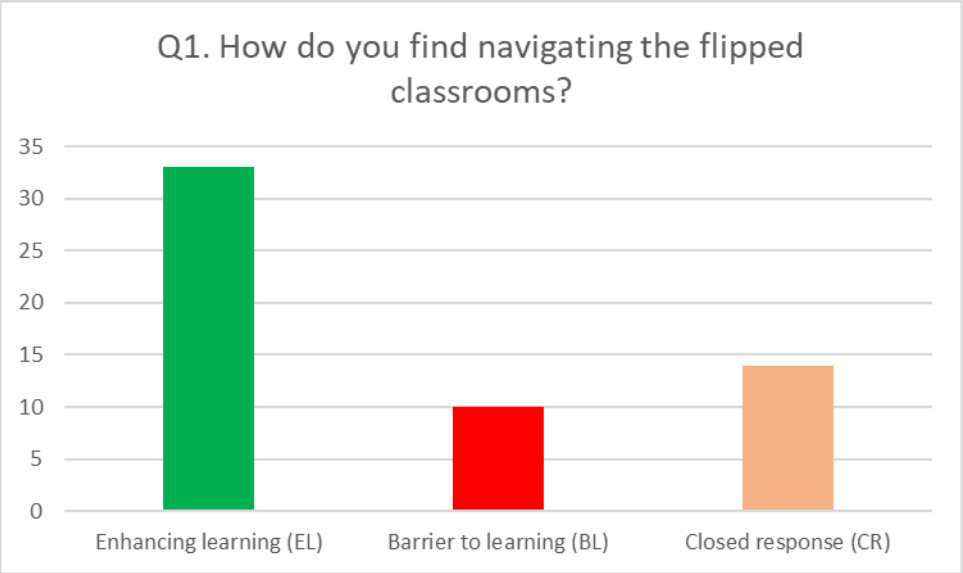
Laws *et al.* (2003) highlight that feedback collected from different perspectives may not match, but the mismatch and even conflict between them may not necessarily mean that the data collection process is flawed. Rather that it could be that people just have very different accounts of similar phenomena, and thus it requires careful examination of any mismatches to try and make sense of them. It is therefore critical to keep an open mind when carrying out data analysis and to be mindful to not jump to any conclusions before a thorough review into the data has been completed.

Results discussion and analysis

Navigation of the new endocrine flipped classroom using the updated structure was seen as an improvement to the old version. The majority of the participants agreed that the new format (Graph 1) enhanced learning.

- Massive improvement to the previous version (Student 7).
- A lot better than the previous flipped classroom sessions. Everything is a lot clearer (Student 42).
- Really good. I felt as if I was in class (Student 14).

This was also supported by the feedback from the interview with a colleague who felt that it was easy to navigate. They agreed that navigation was improved due to the side bar within the flipped classroom, which made it possible to scroll down and click on specific areas.



Graph 1. Student responses to Q1 in the three individual joint term categories.

However, some participants found the updated format difficult to navigate. This was due to their familiarisation with the previous format and a lack of guidance around how to operate the updated version. Although this is currently seen as a barrier to learning, it can be easily solved through tutorial support and reassurance.

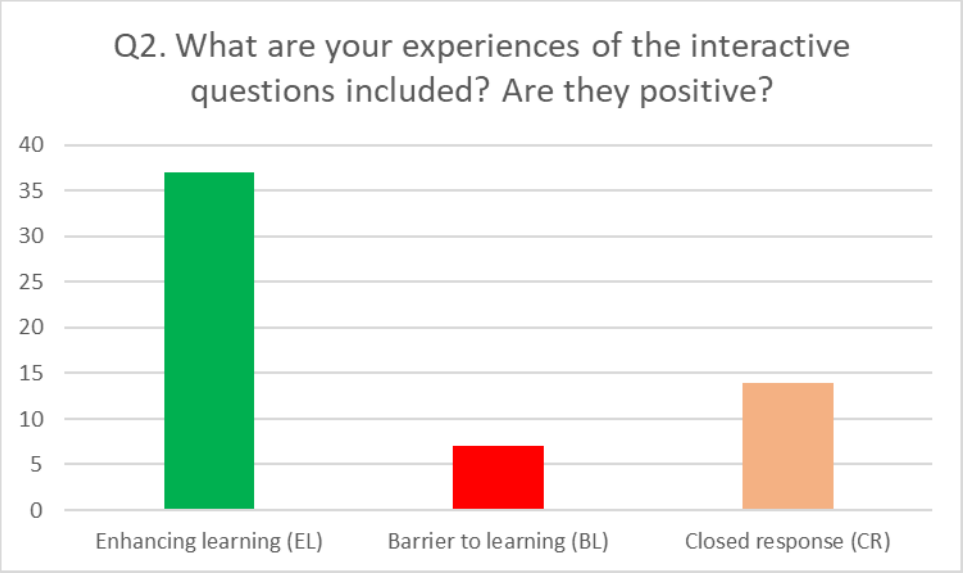
The feedback from participants was very positive about the inclusion of the interactive drag-and-drop questions that had been implemented. The majority of participants (65%, n=37) felt that this was a positive way of testing the knowledge gained within the flipped classroom (Graph 2). One participant found this particularly useful as it provided independent learning opportunities.

> [I] was sceptical at the beginning of learning the science by myself. But I have surprised myself. I have found it easy to follow and have learnt a lot more by myself rather than listening to a PowerPoint or lecturer (student 2).

This demonstrates that the design of the flipped classroom has enabled students to become more independent and develop self-efficacy, as their belief in their ability to learn independently has improved. This was corroborated by feedback from the interview which confirmed that the interactive questions were a positive addition and a '…really good assessment of the information that preceded the assessment [in class]' (interview).

There was very little negative feedback about the use of interactive questions. However, one participant did not find the interactive questions very interactive and found them difficult to understand (student 16). This appears to be an isolated incident, and as such it does not impact on the future design of the flipped classroom. However, it is important that the instructions are clear at implementation stage.

One student felt that there should be more questions at the end (Student 26). Although this is a good suggestion and would be easy to resolve, it may not be conducive to the students' learning. The questions that are currently in the flipped classroom are designed to check knowledge against set learning objectives. In order to consider the validity and usefulness of including additional questions, a focus group will be established to see what other students' thoughts are on this.



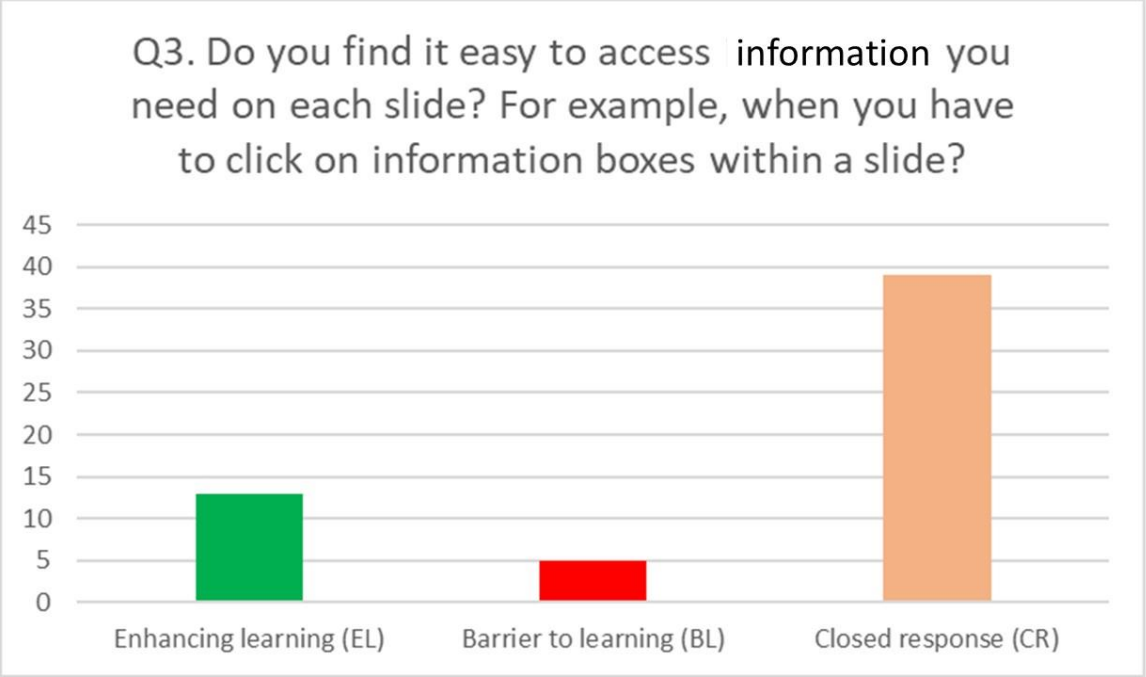
Graph 2: depicting student responses to Q2 in the three individual joint term categories

One area of concern raised was the struggle experienced in relation to the clarity of diagrams used in the interactive questions section (colleague interview; Student 3). However, A&P diagrams are "very hard to pinpoint especially when you're looking at organs such as the pituitary gland and other smaller organs" (interview) as the detail of images is difficult to display within digital learning platforms, due to the intricate details. They felt it was beneficial to have the diagram included as part of the interactive, formative assessment questions. Students are not penalised for incorrect guesses within the drag and drop exercises, and this should enable further learning opportunities. It is also worth pointing out that the clarity of the diagram is dependent

on the technology students use to access the flipped classroom. A mobile phone will not provide the same learning experience for a student, compared to one accessing the flipped learning through a laptop or computer, due to the size of the device.

Question three elicited a large number of closed responses due to the structure of the question (Figure3). Providing a list of predetermined responses for respondents to select from, creates more reliable answers for quantifying purposes (Franklin, 2012). Although predetermined answers were not provided, giving the option for students to make a comment, a high number of single word responses were given. The majority of the students found the information in the flipped classroom easy to access (68%, n=39).

The information provided within the flipped classroom also enhanced the students learning, because the information boxes allowed them to gain a better understanding of the A&P topic (Students 55 and 57).



***Graph 3: S**tudent responses to Q3 in the three individual joint term*

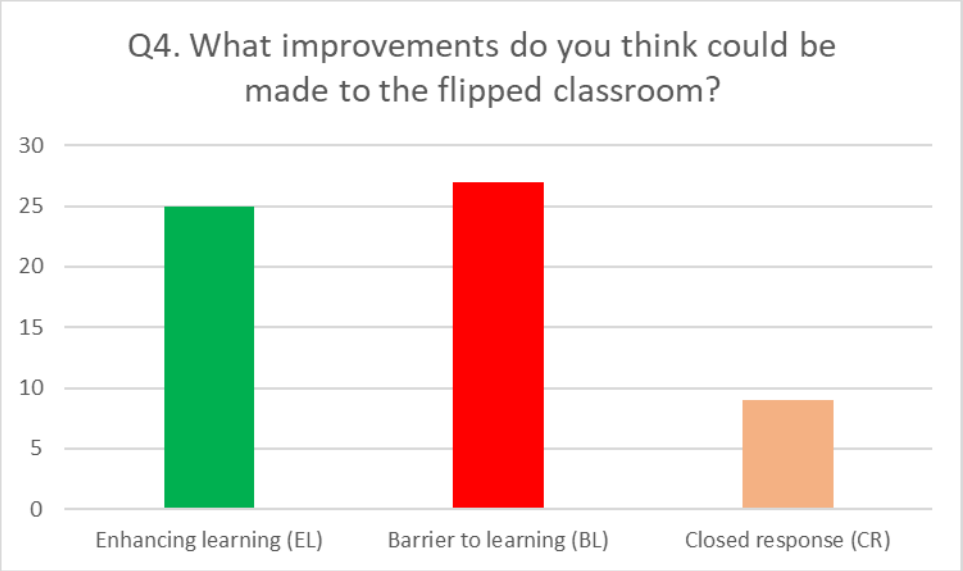
Graph 3 shows the results from question three. My colleague corroborated the results by checking input, figures and workings, also finding the information easy to access within the flipped classroom.

> I have to say, having looked at the previous flipped classroom. This one is so easy to navigate and the fact that you can keep your course menu there the whole time, means you can flip back and forth and you don't get stuck. So, you're not having to kind of backtrack or whatever, you know, if you didn't want to do a little bit of a test or anything you're not stuck there, you can just carry on and yeah, it's really up to the student where they want to move within it and there's no kind of boundary on that. That's great. (Interview)

Accessing information on the old flipped classroom structure was difficult due to a saturation of content. This made it confusing for students to determine exactly what they needed to learn in order to meet learning outcomes. All of the responses categorised as barriers to learning related in the main to Information Technology (IT) issues, which requires further investigation going forwards.

Question 4 provided some interesting responses outlining improvements that students thought could be made to the endocrine flipped classroom. A large majority reported a barrier to learning (47% n=27) (Figure 4). These responses included recommendations for different elements to be embedded within the flipped classroom. One of these was for a voice-over to be included within each of the slides to help with technical terms and pronunciations (Students 7, 14, 49 and 56). My colleague also suggested implementing audio, but stressed that it is “quite difficult to get the audio correct, especially when you’ve got maybe an American voice-over and things are pronounced differently… So, I would say, unless it’s perfect I wouldn’t even bother” (interview). This is something that I have been looking into going forward.

One student would have liked more “advice on the kind of device required, I have an S9 Samsung which might need updating” (Student 35). The flipped classroom was not intended to be accessed from a mobile phone device due to the size of the screen, which could prevent students from engaging with the interactivity. When questioned about this, my colleague felt that it is already a really good tool as it is, but agreed that “improvements are just going to come with more improvements in technology’” (interview).



Graph 4: *Student responses to Q4 in the three individual joint term categories*

Nine students clarified that they felt nothing needed to be improved in the flipped classroom.

Through the interview with a colleague, an in-depth perspective from a colleague has been possible (Feldman *et al*. (2018). In particular this provided feedback about the way the flipped classroom has been combined with a weekly recap lecture to form a blended learning approach. Khalil *et al.* (2018), suggest that blended learning strategies have been shown to improve a number of factors from students' academic performance, motivation, attitudes and to provide convenient and flexible learning. The Monday morning recap sessions provide an overview of the content contained within the flipped classroom learning, with the inclusion of interactive group activities. This has provided an opportunity for the students to embed the learning content from the flipped classroom and to raise any specific questions (interview).

Conclusion

Creating interactivity within a flipped classroom is a difficult challenge, but with more degree programs choosing to implement flipped classrooms into their programs, it is an area that will continue to be researched and debated for the foreseeable future. Students are clearly engaging with the new version of the flipped classroom. This is mainly due to the improved design which has increased accessibility. Through a blended approach to learning, students are practicing areas of their knowledge, both

independently via the flipped classroom, and within the synchronous, re-cap sessions held on a Monday morning. This provides opportunities for cooperative learning activities and peer interaction, providing the space for learners to practise together what they have learnt independently. This concurs with finding from previous research studies ((Ellis, 2016; Hmelo-Silver, 2004; Von Stumm and Furnham, 2012).

Through the use of regular feedback and in class assessment, students are more aware of the areas that they need to continue to practise. This is an important aspect of this type of learning. Logan (2015) argues that 'Instructors must diagnose and delineate areas of concern about what students are not learning as well' (p.6).

Roediger and Karpicke (2006) describe this as a two-stage testing paradigm which results in a longer-term retention of facts and concepts, something referred to as 'the testing effect'. What their research concluded was the positive impact that collaboration had during the recap stage, after exposure to the materials and initial assessments. They noticed an increase in metacognitive skills as well as a reduction to student stress and anxiety, something which may also positively impact on final assessment performance (Ford, 2019).

Clear language used within the flipped classroom and a simple navigation system has improved accessibility to the content and this has had the added benefit of increased self-efficacy in some students.

What's next and recommendations

A number of recommendations and changes will be made to the flipped classroom, based on the findings from this piece of research. Initially, further questions will be asked to test student learning from the chapters studied on the flipped classroom. A longer-term aim is to carry out further research to investigate different types of questions that can be included within a flipped learning classroom. A study into the effectiveness of multiple-choice questions, open and interactive questions on knowledge retention will take place. Research suggests that multiple choice questions are not as rigorous in terms of testing student knowledge. However, through further research it will be possible to explore student preferences with regards to question format, particularly in terms of which ones aid their learning. This will also enable further improvements to the structure and content of the flipped classroom.

Word pronunciation will be included on some of the more complex A&P terminology. However, it is important to ensure that the quality of this is good enough to provide clarity.

The diagrams provided were considered to be an improvement to the ones contained within the old flipped classroom. Having the ability to reveal a further, more detailed diagram within slides was “fantastic” and “provided more insight than to that of the big diagrams that you got lumbered with in the old flipped classroom” (Interview). However, going forward, the diagrams will be enlarged and embedded within the flipped classroom as PowerPoints that can be opened up separately. This will provide the students with the added ability to zoom into diagrams to provide greater clarity.

In order to demonstrate the flipped classroom to new students, a session will be included during induction week. This will provide an opportunity to show students how to navigate around the flipped classroom and what IT devices will provide the students with the greatest learning experience.

Due to the success of the flipped classroom, I will be working towards converting all of the eleven body systems covered within the module, into the new flipped classroom format. Due to time restraints and the enormity of the task, this will be carried out over a period of time.

Although it has been possible to draw conclusions from the data collected during this action research, follow up research will hopefully provide a more detailed analysis of the flipped classroom, in relation to student learning experience.

Ethical Consideration

Ethical considerations were put in place and permission to research obtained fully complying with the University Research Ethics Regulations, ensuring informed consent, anonymity and data protection. This enabled participants to provide detailed answers which would lead to insights about the flipped classroom aiding future developments.

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