

Tablets to promote active learning in the EDP biology flipped classroom

Faculty of Sciences | Department of Botany and Zoology

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Context

Background overview

In 2014, the Extended Degree Programme (EDP) biology class consisted of 109 students, studying a variety of B.Sc. degree courses in the faculty of Science at the SU. The Department of Botany and Zoology is responsible for the BIOL 146 module, which is intended to introduce the following biological concepts to these students: 'What is life?', biological evolution, biodiversity, the 'Tree of Life', the chemical basis of life, biological molecules, enzymes, biological membrane structure and function, cell structure and function in pro- and eukaryotes, as well as animal- and plant cells, Mendel, genes and inheritance, introduction to animal phylogeny and lastly vertebrate life.

Possible advantages associated with the integration of technology

Research has shown that active engagement of students in purposeful academic activities advance academic outcomes and the overall progress of students. Moreover, many researchers regard student engagement as one of the key pillars of higher education. One way of promoting student engagement is by encouraging active learning activities where students can engage with learning material in meaningful ways through reading and reflection, talking and listening activities, as well as writing and thinking. Direct interaction between students and subject related learning material therefore replaces the lecturer with the student, as the active party in the learning experience.

The model of the flipped classroom is an example of active learning, characterized by high levels of student engagement. In this case, the role of the lecturer switches from being the active role player 'delivering' the information, to a facilitator of sessions where students are encouraged to take ownership of their own learning process. Students often watch video's or are required to prepare reading material, which is then followed up by group discussions and a variety of other activities. This method typically allows lecturers to gauge the degree of learning taking place and enable them to correct any misconception immediately. This method also creates a platform for discussions and 'playing with ideas' which in turn leads to inspiring, innovative and communal classroom climates, conducive to learning.

Students of today are also known as the Net Generation as a result of being

born into a world dominated by technology. A study by Barnes, Marateo and Ferris (2007) proposed that these students are autonomous learners who rely greatly on instant gratification and quick access to information. Lecturers are therefore urged to take advantage of these media for educational purposes. With universities finding themselves increasingly more in a highly competitive arena in education in recent times, finding innovative ways of actively engaging modern students, might therefore be the decisive edge. Our introduction of tablet PCs into the EDP biology is one first step in this direction. Our aim is therefore to firstly find ways in terms of methods, apps and programmes to engage these biology students in active learning experiences by flipping the classroom. Secondly, to evaluate the impact of this intervention on student engagement and learning on the following levels: concepts, ways of experiencing and approaches to learning, as proposed by Case (2008).

Students attend three classes (1hr each), as well as one practical class (3h) per week during this module. The module is presented by one lecturer (Dr. Marnel Mouton) with a teaching assistant (Mr. Edward Archer) to one English and one Afrikaans class, during the second semester of the year. Twenty tablet PCs were purchased using a FINLO grant to be used in these classes. Students worked in groups of two to three and students with their own tablets were encouraged to use them during these activities with the learning material loaded onto SUNLearn.

Learning and assessment activities

Learning activities

This study commenced in middle August of 2014. Classes in this module were presented in a variety of ways with the aim of raising student engagement. These included lecturing using PowerPoint, group work using the jigsaw method, preparing video's to cover certain topics, quizzes, open book tests and playing 30 Seconds to impart the fundamental biological concepts and terminology. The tablets were then introduced to enhance the learning experience even further and activities used to date and planned for future use are presented in Table 1. Lecturers are in the process of exploring additional apps that are aimed at combining lecturing and active learning activities in such a way that students would be able to raise questions via the tablets or even 'flag' topics/concepts that are not understood, in real time.



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Tablet computer preparation	Tablet computer assignments and activities
1. Information was uploaded onto tablets and students had to complete an appropriate assignment.	Jigsaw: Different themes were loaded onto different tablets. Students in one group did an assignment on one topic, while students in other groups researched other topics. At the end, students from different groups shared their findings with one another on their related topics and contributed to one central theme. Group Sharing: Different topics were loaded onto every tablet. Every member of a group studied one topic which was shared in the end with all members of the group.
2. Video material was uploaded onto the tablets or students accessed a video via a web link where after students completed an appropriate assignment.	Timeline: Students constructed a timeline of events as they occurred in the video presentation. Group Sharing: Students worked in groups and every member of the group took responsibility for a certain topic covered by the video presentation. Topics and data were shared after group discussions and eventually covered the complete topic presented in the video.
3. No preparation activities.	The tablets were used in clicker tests and surveys. Video Presentations: Students prepared their own presentation using the tablets where after video presentations were shared with and assessed by fellow students in the class to also promote peer instruction.

Tablet computer preparation	Tablet computer assignments and activities
4. Information and video clips were loaded onto tablets that were placed at specific stations in practical classes.	The tablets were used during practical classes to supply additional information or video material on specific topics at certain work stations. Information was accumulated by students over the semester to be used in an open book practical exam at the end of the semester.
5. E-books were uploaded onto the tablets and students were given various assignments to complete from sections in the book.	Brain maps and diagrams: Students compiled brain maps or schematic representations of certain concepts. During these exercises students learned to research and summarize information while learning about the topic/concept itself.
6. Course applicable apps were uploaded onto the tablets to illustrate certain processes.	Students had to complete certain levels of course applicable gaming apps.

Table 1: Tablet activities used/planned during active learning experiences in the class.

Assessment activities

Assessments evaluating the impact of the intervention included clicker tests, open book tests, semester test results, as well as open ended



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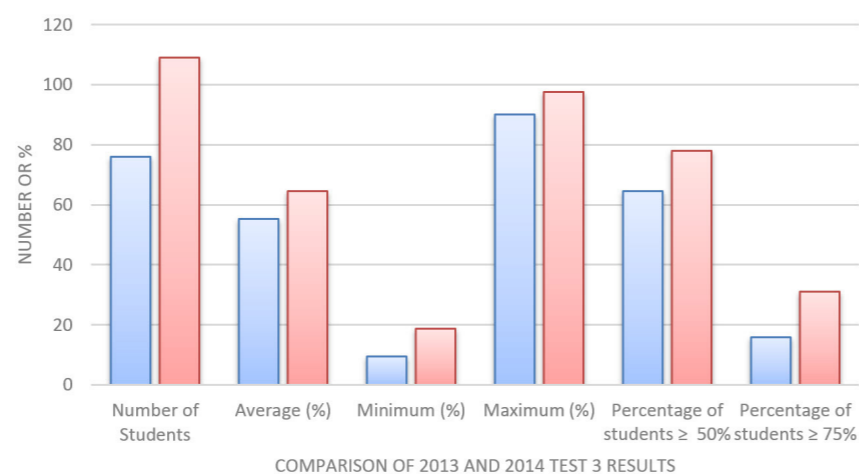
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interviews with randomly selected students from the class. By the time the class reached the final two topics of the module, the lecturer had a good idea of how to structure classes and assessments incorporating the tablets. Both these topics were taught in 2013 in the more traditional lecturing way, whereas in 2014 blended learning techniques were used. Consequently, semester tests covering these two themes from the two year groups could be compared.

Student Experience

Preliminary assessment results

Comparing semester test results between the two year groups of 2013 and 2014 showed that the average mark was notably higher after that intervention of the tablets; 55.2% and 64.6% respectively. The minimum and maximum marks (%) were also higher, as well as the percentage of students scoring $\geq 50\%$ and $\geq 75\%$. Since the learning material for the two tests was identical and the tests were comparably similar, it appears that the intervention indeed had a positive impact on the amount of learning that took place. However, more research is needed to make meaningful conclusions.



Student Feedback

To assess 'ways of experience' and 'approach to learning' in the EDP biology class, open ended interviews were conducted with students from both EDP biology classes. These conversations dealt with the use of the tablets and other ICTs, but also how students experienced classes and their approaches to learning biology.

Generally, students were very positive about their experience in this biology class. The biology classroom was perceived as relaxed, fun and conducive to learning. They enjoyed using the tablets but felt that combining it with other active learning activities, made it even more effective because the fun and anticipation aspect could be retained. Group work was perceived as a positive experience and the students felt that it was because they had a choice in selecting group members that they were comfortable with, and who would work together more constructively. Students found the formative assessments very valuable to determine what concepts had to be worked on or explained again.

General

An ideal classroom setting would provide one tablet per student in class. However, with logistical issues accompanying the transport of such a number of tablets between teaching venues, one tablet between two students should also work well. At the moment, the lecturer is in need of additional tablets to account for the growth in student numbers. Moreover, when the Wi-Fi system is upgraded in all class venues on campus, the use of the tablets can be maximized and should lead to a whole new and even more effective learning experience and environment.

This experience and data gathered to date show that using tablet PCs in class has the potential to revolutionise teaching and learning, since it allows alternative engaging methods and therefore another level of teaching. Student engagement is notably higher and the learning of fundamental concepts therefore more effortless. It unquestionably adds another fun aspect to learning and delivers a much wider scope to active learning activities in the flipped classroom. With new apps becoming available all the time, the teaching team are currently experimenting with apps that will allow real time interaction with the slides in class by both the lecturer and the students. To assess impact on learning, more research is needed although our preliminary findings show positive prospects. In future, universities will need to act strategically to compete with competitors such as MOOCs. Using innovative teaching methods, such as tablets PCs in flipped classrooms in combination with other active learning activities to dynamically engage students, may provide a vital competitive edge.



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