

## **Engaging Biochemistry Students through Technology, Case Studies, and Individualised Assignments**

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Biochemistry of Human Diseases is an advanced third year biochemistry course in the Biomedical Science program at the University of Southern Queensland, and while it is routinely offered both on campus and online, a number of adaptations occurred as it moved solely online due to the recent pandemic. In any semester, the online class management software Moodle is essential, but it was even more so this semester, serving as a vital hub of course communications and organising weekly notes, class recordings, discussion forums, and links to external sources.

The course is designed around online lectures and on campus tutorials. TechSmith, a screen recording software, is used to pre-record lectures which are uploaded to the Moodle class page. While missing live lecture interactions, students who are balancing other demands appreciate being able to review the lectures on their own schedules and pace, pausing for note taking as needed.

Tutorials are normally offered on campus with live remote access through Zoom and class recordings are uploaded to Moodle for those unavailable for real time participation. With all classes moving online, the live tutorial was taught through Zoom which allowed for normal dynamic class interactions as participants could see each other and computer screens could be shared as needed. A surprising number of students were nervous to participate by Zoom, however the real time participation numbers were similar to what would have occurred on campus. Students who were nervous or concerned about privacy, left their cameras off during class or used a virtual background. First year students in a larger foundations course tended to leave their cameras off, however the third year biochemistry students seemed to enjoy the class interactions that the cameras allowed and it encouraged the sense of community. Being able to share computer screens allowed for normal inclusion of class materials and included a white board feature.

Medical biochemistry case studies (<https://sciencecases.lib.buffalo.edu/>) that challenge students to apply their biochemistry knowledge are a student favourite in tutorials. Having class online with significant asynchronous participation made it challenging to complete the case studies together and to ensure student engagement. To address this issue, students were assigned case study sections to complete in advance with their answers posted in a discussion forum for participation points towards their final course mark. Forum settings prevented students from seeing other posts with answers until they added their own post and forum posting closed once class began to decrease academic integrity issues. When this transition was made mid-semester, engagement increased in both live tutorials and the forums, and increased the interactions between the traditional on campus students and online students. This format will continue to

be used in future semesters and student case study groups may also be set up using group features of Zoom or Moodle.

To address the academic integrity concerns in online education, a number of precautions in addition to the tutorial forum settings were implemented including individualised assignments and submitting assignments through Turnitin to deter plagiarism. For the first assignment, each student investigated the biochemical causes of a different disease through a primary literature review and then designing an experimental proposal for an extension of the disease research. For the second assignment, the students explored the challenges of science communication with the public, analysing the publicly available information on their disease topic, and creating a work for the public that communicated the basic disease biochemistry.

For the final examination, the quiz feature of Moodle allowed for online exam delivery within a timed format. A pool of extended answer questions was used which required students to analyse and integrate course material from both the lectures and tutorials, and were less likely to be answered through a basic internet search. While the exam could have been completed as a take home exam and submitted directly through Turnitin, the timed feature of the quiz settings was deemed significant and exam answers could still be submitted manually through Turnitin if desired. For other classes that use multiple choice questions, Moodle can be set to deliver the questions from a question pool with varying order of both the questions and the answers within the question. The exam duration can also be adjusted to accommodate individuals with special needs.

While many of these adaptations will continue, lecture presentations in future semesters will be recorded with Panopto rather than TechSmith, as it has additional features such as adjusting the playback speed, video search features, and incorporating in-video quizzing to increase engagement, feedback, and comprehension. Other tools such as formative quizzes, HTML5 activities, and student polls through Moodle and Zoom will also be added to existing biochemistry course content. While moving classes online can be challenging, there are also many great opportunities for innovative teaching methods and student engagement.