ISBN: 978-989-8533-68-5 © 2017

HOW TO FLIP A CLASSROOM AND IMPROVE STUDENT LEARNING AND ENGAGEMENT: THE CASE OF PSYC1030

Pedro Isaias[1], Blake McKimmie[2], Aneesha Bakharia[3], John Zornig[3] and Anna Morris[3]
[1] *Institute for Teaching and Learning Innovation (ITaLI), The University of Queensland, Brisbane, Australia*
[2] *School of Psychology, Faculty of Health and Behavioural Sciences, The University of Queensland, Brisbane, Australia*
[3] *UQx, Institute for Teaching and Learning Innovation (ITaLI), The University of Queensland, Brisbane, Australia*

ABSTRACT

The flipped classroom's pervasiveness in different educational contexts derives from the growing need to focus on student-centered and active learning approaches. The fact that the flipped classroom allocates the lecture delivery to the outside of the classroom endows teachers with the possibility of using the in-class time to develop active learning tasks. At the same time, since students gain insight of the learning material prior to attending the class, they are more prepared to actively engage with the resources and their peers inside the classroom. This paper presents a project developed by the School of Psychology from the University of Queensland in Australia that consisted in flipping a course, PSYC1030, and creating a series of four MOOCs. The students' evaluation of the experience was measured via a survey and showed that, in general, they found the outcomes to be positive, namely at the level of the assessment, collaboration, interaction and their understanding of the material.

KEYWORDS

Flipped classroom, MOOCs, active learning, higher education

1. FLIPPING THE CLASSROOM

The growing focus on student-centred approaches to learning has motivated the adoption of more flexible teaching techniques, inspired by the notion of active learning (Danker, 2015). Flipped classrooms can facilitate teaching strategies that focus on the students, namely inquiry-based and problem-based methodologies, by optimising in-class time (Sergis et al., 2017). This teaching style basically involves inverting the events that customarily take place inside and outside of the classroom, by resorting to technology and it is based on a model of blended learning (Kim et al., 2014). In general, the use of the flipped classroom method, entails the preparation of online lectures in an audio or video format that the students are asked to review prior to attending the class. Thus encouraging students to complete the information acquisition part of learning before the class (Phillips and Trainor, 2014). This then enables the development of interactive learning tasks within the time that is allocated for the lecture delivery (Aidinopoulou and Sampson, 2017).

There is a wide variation between what different studies report having used as the pre-class content delivery assignments, although the majority seems to use a combination of asynchronous online video and quizzes or closed-ended problems. This variation exists equally in the type of activities that the teachers design for the in-class engagement with the material. Most studies seem to have a preference for using interactive learning tasks based on group work (Bishop and Verleger, 2013). Teachers do not have to limit the presentation of the lecture to the use of video, they can create podcasts and use web-based whiteboards (Moffett and Mill, 2014). In terms of the support for the pre-class content attainment, the teachers can provide the students with a brief reading, a narrated presentation in PowerPoint, a brief audio or video lecture recording or ask them to use a discussion forum or chat room. With respect to the in-class activities the teachers can resort to a revision of the pre-class questions, tasks involving real life examples or case studies, simulations, group work, student presentations or field work and peer feedback (Loveys et al., 2016). During

the classroom the teachers predominantly assume the role of a mentor, guiding both individual and group work and prior to the class they are required to deliver learning content by using their technology competences (Dennen and Spector, 2016).

The flipped classroom approach has the advantage of empowering students to be in control of their learning through the preparatory work that they complete and through the adoption of a more interactive stance during the class itself. Also it allows the students to learn at their own rhythm, as they can access the digital material when it's more convenient, and it assists them to develop valuable lifelong learning skills (O'Flaherty and Phillips, 2015). This approach to learning demands the students to make an investment of their time, outside of the classroom for independent self-learning (Kurtz et al., 2014). Self-regulated learning constitutes a core competence for the promotion of lifelong learning (Ifenthaler, 2012). Whereas passive learning entails receiving content by listening to a teacher and promotes only surface learning, active learning goes beyond knowledge retention, encourages a personal involvement with the content and it is connected with deep learning (Phillips and Trainor, 2014). Active learning has a positive effect on the students' learning results and on their motivations and behaviours. At the same time, active learning is responsible for encouraging the learners' engagement and promoting reflection (McLaughlin et al., 2014). Focusing on active learning is particularly important to assist students to develop communication and critical thinking competences (Ferreri and O'Connor, 2013) as well as high-order cognitive skills (Danker, 2015).

Flipped classrooms are also associated with the improvement of the learners' results, the promotion of student engagement and the enhancement of classroom participation. Since the students have time to review the lectures before going to class they can acquire a deeper knowledge of the subjects and for that reason be more proficient when engaging in high-order actions, like discussions and problem solving. Additionally, given that this part of the learning is done in the classroom, the teacher is present and it is possible for the students to receive immediate feedback (Thai et al., 2017). During the class, the teacher becomes more capable of addressing the individual needs of the students and of designing learning practices that are more suitable for particular students (McLaughlin et al., 2014). This approach is also believed to enhance the interaction among learners and between the learner and the teacher (Phillips and Trainor, 2014). With this approach the students can make sense of the content and apply in class what they've learned, by engaging in collaborative problem solving (Danker, 2015). Furthermore, the use of a flipped classroom enables teachers to reinforce the material that was covered without having to sacrifice additional content and to deliver the content in a variety of formats, thus addressing different learning preferences (Mason et al., 2013).

2. EVALUATION OF FLIPPED CLASSROOMS

Existing research about the evaluation of the flipped classroom reports an assortment of student's perceptions, nonetheless, they seem to be globally positive (Bishop and Verleger, 2013). There is a scarcity of quantitative research that supports the effectiveness of using the flipped classroom approach (Findlay-Thompson and Mombourquette, 2014) and solely a very reduced number of studies actually offers an objective assessment of the students' learning results (Bishop and Verleger, 2013). Moreover, despite the importance of evaluating the opinion of the teachers, the majority of the existing studies focuses on assessing the viewpoints of the students (O'Flaherty and Phillips, 2015). Current research on the assessment of the flipped classroom generally falls into two categories: comparison studies and case-studies (DeLozier and Rhodes, 2017).

Comparative studies establish an analogy between the conventional classroom and the flipped technique and can be more generalizable, but since sometimes they use so many different variables (teaching methods, technology, learning material) between the two types of approach it becomes difficult to conclude which of them have influence over the findings (Jensen et al., 2015). Strayer (2012) compared two classes, one had been flipped and the other had remained in the conventional format. The author used a questionnaire, field notes, interviews and focus groups to examine both classes. The students in the flipped classroom manifested a lower satisfaction level with the classroom's orientation to the learning activities, but were more welcoming of collaboration and innovation in teaching styles. Mason et al. (2013) also conducted a comparison study, where three dimensions were evaluated: content, students' performance (in quizzes and exams) and students' perceptions (via a survey). The authors concluded that the flipped classroom, allowed a wider coverage of content, the students' performance was as good or better and despite the initial difficulties, the students were

satisfied and they perceived it as being effective. Findlay-Thompson and Mombourquette (2014) compared the results of students within a traditional lecture-based class and a flipped classroom and concluded that there were no differences between the two teaching styles in terms of grades. In post-term interviews, the students from the flipped classroom had mixed feelings about the experience, but appreciated the extra time to ask questions in class and they felt that they did better, even though their perceptions were not corroborated by higher grades.

Case-studies, on the other hand, usually offer a depiction of implementation practices and present mainly affective data. While they provide valuable information, they aren't usually generalizable nor do they usually offer a causal explanation (Jensen et al., 2015). Young et al. (2014) designed a quantitative questionnaire based on a Likert scale to assess the opinions of the students about the flipped classroom sessions that they had attended and used qualitative items in their inquiry of the faculty's perceptions. The students highlighted the positive side of material retention, of having a more interactive class and of actively participating. The faculty stated that the main advantages pertained to the possibility of providing feedback and of assessing the students' knowledge. Butt (2014) measured the perceptions of students that participated in a flipped classroom during a semester, using a survey at the start of the course and another survey at the end. The authors findings show that in the initial survey there was a 50/50 division between the students who believed that the flipped structure would be advantageous and those who didn't. The survey that was administered at the end of the course, after they had experienced this approach showed that 75% of the students considered the flipped classroom to be advantageous to their learning process.

3. FLIPPING A COURSE AT THE UNIVERSITY OF QUEENSLAND

In line with the goals of the Student Strategy (The University of Queensland, 2016), The University of Queensland in 2016-17 undertook a project to flip a large first year undergraduate course and evaluate its impact on students and teaching staff so as to create an exemplar for other courses to follow. The course, Introduction to Psychology: Developmental, Social & Clinical Psychology (PSYC1030) from The Faculty of Health and Behavioural Sciences at The University of Queensland has one of the largest enrolments of all courses across the institution.

The course coordinator had successfully used a UQx MOOC project in 2014 to flip a smaller second year course. In mid-2016 a collaboration with the UQx online learning unit was initiated to transform PSYC1030 in time for the Semester 1 teaching period in 2017. As in the earlier course the content for flipping PSYC1030 would be developed both for a MOOC and a SPOC (Small Private Online Course) for PSYC1030 students. Unlike many other flipped class projects, the SPOC for PSYC1030 would totally replace the content delivery, formerly the task of lectures. The MOOC course style utilised by UQx relies heavily on embedding activities for students throughout the predominantly video presentation of core concepts. These activities reinforce learning and allow students to judge how well their understanding is so that they can better direct their engagement with the content.

PSYC1030, in previous years, comprised a traditional 2-hour lecture, 1-hour tutorial format for 12 weeks of the teaching period. When flipped, it consisted of a SPOC presenting the content and a single weekly contact hour which took the form of a 120 student workshop (4 times) and a 25 student tutorial (9 times). The MOOC style of active online learning contained in the SPOC allowed students to be prepared to participate in the peer to peer and group activities orchestrated by the teaching staff during the weekly workshop or tutorial.

One of the goals of the project was to create a MOOC, called PSYC1030x, that would represent as well as could be done in a fully online and self-paced mode, the new transformed on-campus flipped PSYC1030. Experience from earlier MOOCs indicates that learners prefer shorter MOOCs with focused learning goals and narrow topics, and that this improves student engagement. This experience informed the choice to modularise PSYC1030x as a series of four MOOCs covering the primary topics. The goal of replacing the lectures entirely led to the MOOCs being very comprehensive and including content that was often skipped from lecture delivery because of time constraints and only available to students via the prescribed text book. The usual practice in MOOCs is for the content to stand alone without need for a textbook thus maintaining the goal to have the course available to a massive global audience for free. The result was that neither PSYC1030x or the transformed PSYC1030 require a textbook.

The whole process of flipping the course took eighteen months with the evaluation of the results continuing after the completion of the course delivery. The flipping process consisted of the UQx project team working with the lead course academic (course coordinator) of PSYC1030 to collaboratively create videos and activities. All previous lectures from 2015 PSYC1030 were transcribed and used as a starting point to create short video scripts of the lecture content. The lead academic created slides and some video material for insertion into the videos. The team also consisted of a UQx learning designer and faculty project officer with subject matter knowledge who worked with the course academics to refine video scripts and create interactive activities. The UQx media team filmed and edited the videos. The UQx technical team developed custom Learning Tool Interoperability (LTI) tools that the course utilised to deliver formative assessment activities. The UQx learning designer developed the created videos and formative assessment activities in the edX EDGE platform to create the SPOC. The faculty project officer built the summative quiz pools for assessment in Blackboard. A team of beta-testers from the faculty and members of the UQx team (who had not been involved in production) reviewed the four individual SPOC courses before they went live.

The tutorials were adapted from the existing tutorial sequence for PSYC1030, and focussed on supporting students to write a laboratory report on a study. This formed a major assessment item in the course and was supported by video resources created for the fourth MOOC in the PSYC1030x series. The workshop activities, one for each of the three major content areas corresponding to the first three MOOCs in the PSYC1030x series, were developed in junction with the content-area expert in that area and a lead tutor from the course.

4. EVALUATION METHODOLOGY

The evaluation methodology has been designed to include students, tutors and the course development team in the evaluation. In addition there were regular student surveys at the end of the semester to assess their satisfaction with the course and the teaching team (SECaTs).This paper focus specifically in the students' results and analysis of learner clickstream data from Blackboard.

The student experience survey included questions on Engagement, Flexibility, Assessment and Instructional Methods. The student experience survey also included two free text questions asking what the students liked about the flipped classroom model and what improvements they would suggest.

5. PSYC1030 EVALUATION RESULTS

This paper focuses on presenting results from the student experience survey, as well as an analysis of the learner clickstream data from BlackBoard. This more thorough evaluation will include student surveys of the three main course blocks, interviews with course developers and surveys and interviews of tutors. It will also include an analysis of the Blackboard clickstream data, as well as engagement with previous offerings of the course via ECHO 360 data.

This section analyses the valid responses of the 237 students who completed the student experience survey in a population of 1250 students of this course (there were 288 total responses).

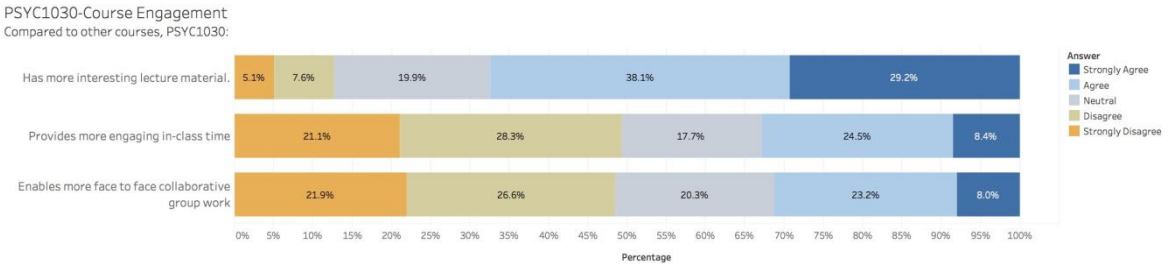

Figure 1. Course Engagement results from Student Survey

In Figure 1 we can see the results for the Course Engagement section questions of the student experience survey. This shows that compared to other courses, PSYC1030 has more interesting lecture material (29.2% strongly agree; 38.1% agree – these figures correspond to a majority of respondents). Only about 1/3 of the respondents consider that it provides more engaging in-time class and also more face to face collaborative group work, with around 18%-20% respondents in both questions being neutral about it. It must be noted that engagement goes beyond this question since it can also be assessed by how many students were watching the videos and doing the activities each week.

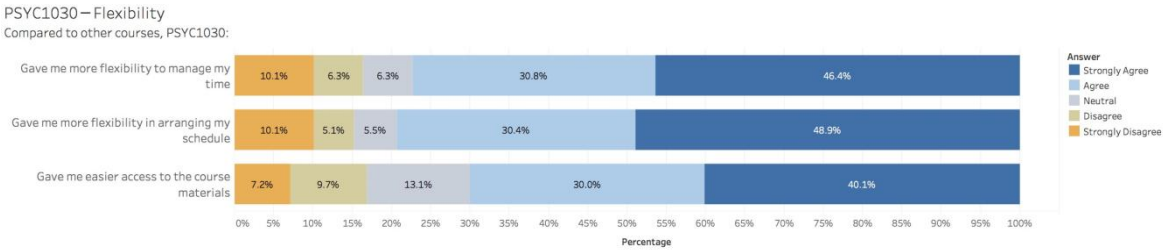

Figure 2. Flexibility results from Student Survey

In Figure 2 we can see the results for the Flexibility section questions of the student experience survey. This shows that a significant majority of students (more than 2/3) considered that it gave them more flexibility to manage their time (46.4% strongly agree and 30.8% agree) and also gave them more flexibility in arranging their schedules (48.9% strongly agree and 30.4% agree). A majority of respondents, but to a lesser extent, considered that it gave them easier access to the course materials (40.1% strongly agree and 30.0% agree).

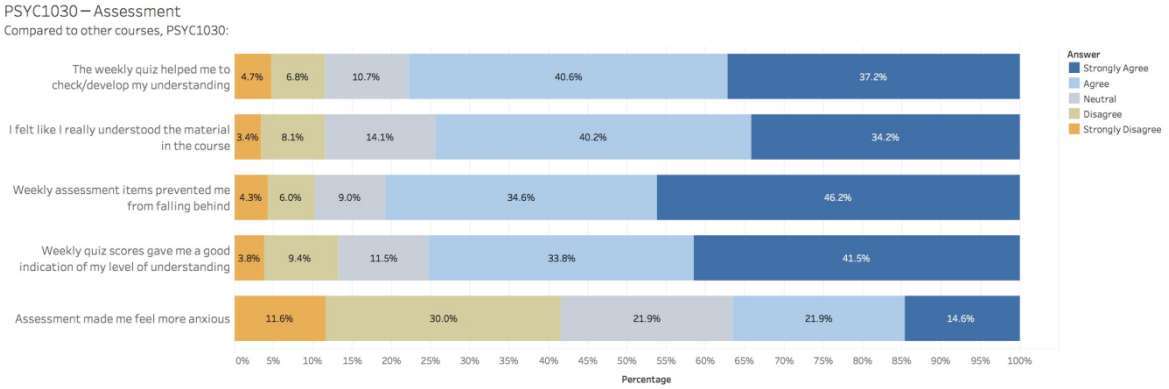

Figure 3. Assessment results from Student Survey

In Figure 3 we can see the results for the Assessment section questions of the student experience survey. This shows a very positive outcome for the first four questions. More than 2/3 of respondents strongly agree or agree that assessments were positive for them and that they also understood the material in the course. About ⅓ considered that assessments made them more anxious.

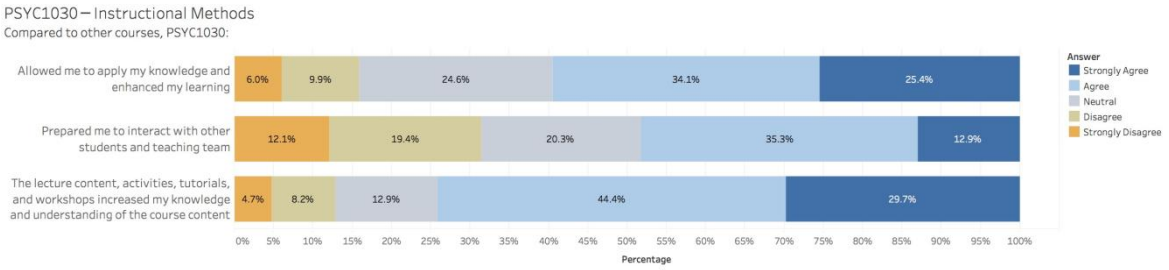

Figure 4. Instructional Methods results from Student Survey

In Figure 4 we can see the results for the Instructional Methods section questions of the student experience survey. This shows that more than 2/3 of respondents acknowledge that lecture content, activities, tutorials, and workshops increased their knowledge and understanding of the course content. Only about half of the respondents consider that it allowed them to apply their knowledge and enhanced their learning, as well as prepared them to interact with other students and teaching team.

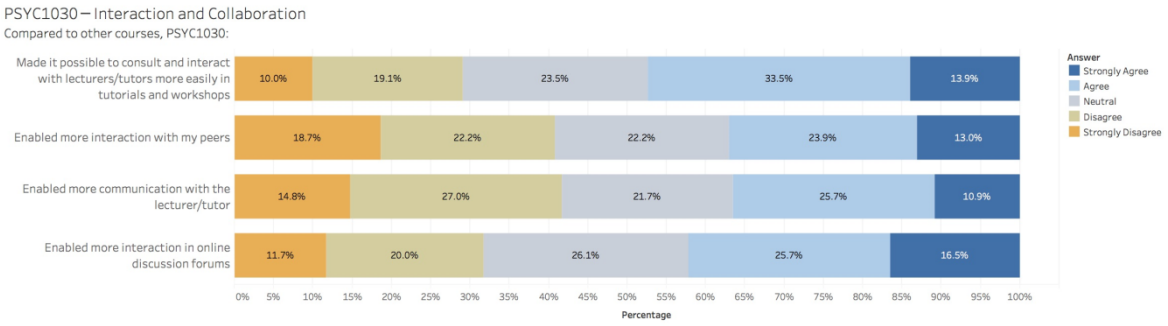

Figure 5. Interaction and Collaboration results from Student Survey

In Figure 5 we can see the results for the Interaction and Collaboration section questions of the student experience survey. This shows that only 1/3 of respondents considered that it enabled more interaction with their peers as well as more communication with the lecturer/tutor. 47.4% considered that it made it possible to consult and interact with lecturers/tutors more easily in tutorials and workshops, whilst 42.2% signalled that enabled more interaction in online discussion forums.

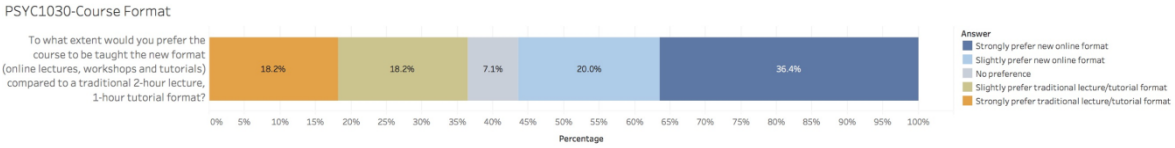

Figure 6. Preference of the course in the new format results from Student Survey

In Figure 6 we can see the results for Preference of the course in the new format question of the student experience survey. This shows that 55.4% considered that overall they preferred the course to be taught in the new flipped format, with 1/3 considering the contrary.

Qualitative content analysis was performed on the two free text questions included in the student survey. Each student response was tagged with the course element that the student was referring to (i.e., a primary category) and the feature that the student found effective (i.e., a secondary tag). Categorising student responses by both the course elements and the related aspect that the student was referring to allowed for fine grained analysis and visualisation. The main course elements included as primary categories were: Online Lectures, Weekly Quizzes, Lecture Videos, Tutorials, Workshops, Video Interactivity (i.e., the ability to pause, seek and speed up a video) and Interactive Course Elements (i.e., the inclusion of online interactive social polls and discussion forums). Only course elements (i.e. nodes) and edges mentioned by more than one student have been included in the resulting network visualisations. Edge weights represent the number of students that mentioned the primary and secondary categories together.

ISBN: 978-989-8533-68-5 © 2017

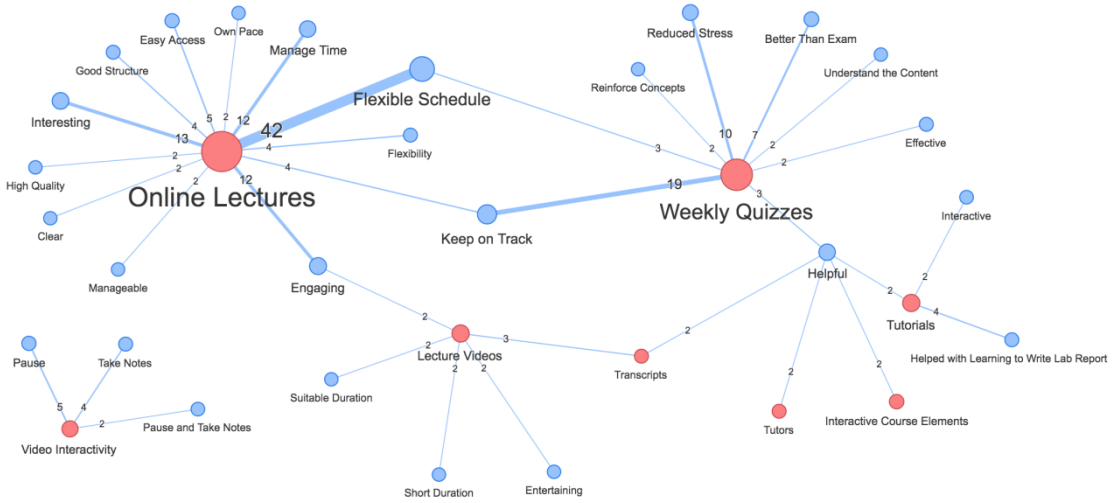

Figure 7. Network Diagram with visualization results from Student Survey – Question: "What were the most effective parts of PSYC1030?"

Figure 7 is a network diagram visualization for the open-ended survey question: "What were the most effective parts of PSYC1030?". Results show that students thought that the online lectures provided them with a flexible schedule (n=42). Students also valued the weekly quizzes because smaller quizzes helped keep them on track (n=19), reduced stress (n=10) and were preferred over a final exam (n=10). Students felt that the duration of videos (i.e., 3 minutes on average) was also appropriate and found the Online Lectures to be engaging (n=12), interesting (n=13) and easy to access (n=5).

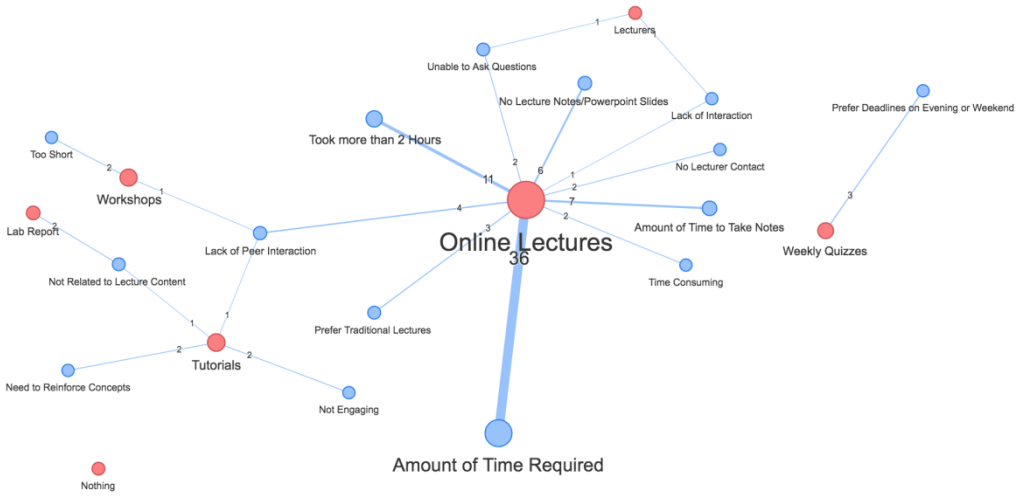

Figure 8. Network Diagram with visualization results from Student Survey – Question: "What were the least effective parts of PSYC1030?"

Figure 8 is a network diagram visualization for the open-ended survey question: "What were the least effective parts of PSYC1030?". Results show that students thought that watching the Online Lectures and taking their own notes required a lot of time (n=36). Some students mentioned the amount of time they took to work through the online content which was between 3 to 6 hours. The University expects that students will allow 10 hours per week for each 2 unit course (PSYC1030 is a 2 unit course), however it was clear from conversations with some students and their feedback on the survey that their expectations were that they

would spend two hours per week on the course content (this is the time for a traditional on campus lecture). The remainder of the time would presumably be caught up during the vacation period for courses with final exams. A small percentage of students requested Lecture Notes or Powerpoint Slides (n=5). It is not known whether the students requesting Lecture Notes were aware that a transcript was able to be downloaded. The ability to download a transcript was acknowledged as an effective course feature by students responding to the "What were the most effective parts of PSYC1030?" question. Students also referred to the lack of both peer and teaching staff interaction.

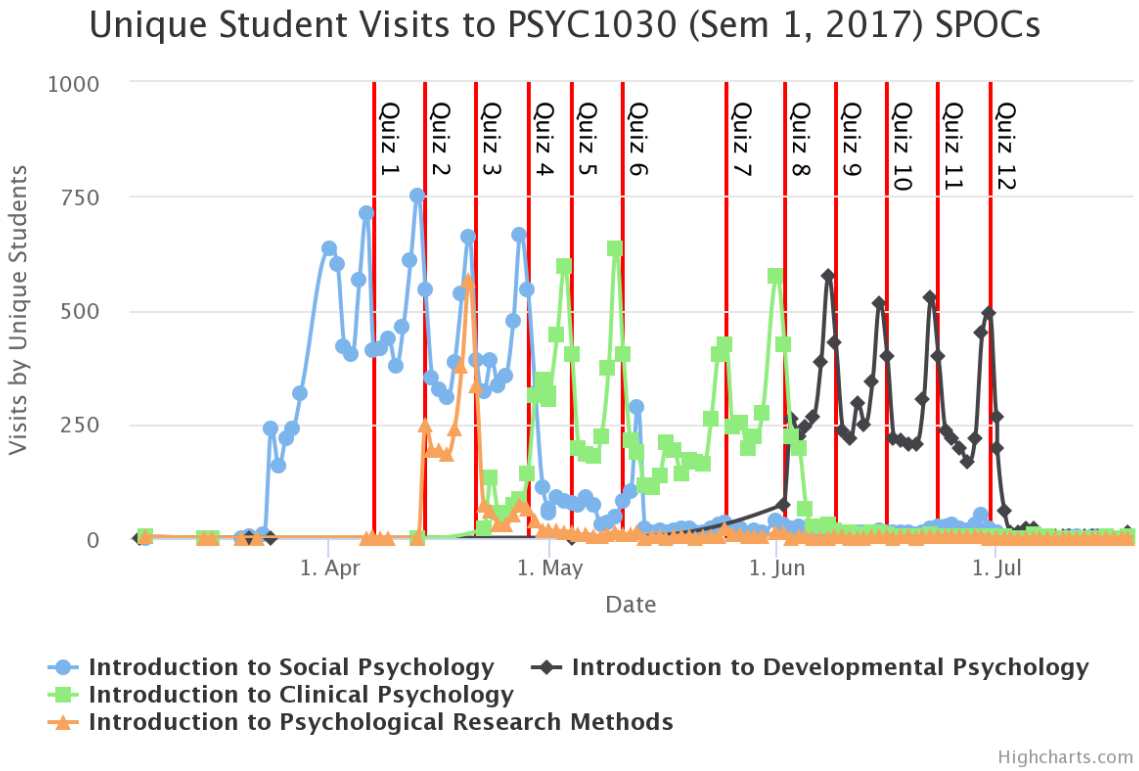

Figure 9. Unique students visiting PSYC1030 SPOCs each day in Semester 1, 2017

Figure 9 shows the unique student visits to each of the PSYC1030 SPOCs, during Semester 1 2017. The 12 quizzes deadlines are also indicated. From the figure analysis, it can be stated that the students accessed the quizzes in the days before the respective deadline, and after that, there is a clear drop rate in access. There is an interesting tendency for student access to decrease throughout the semester. This can be explained because, according to the course profile, only the 10 best scores out of the 12 quizzes' scores, are considered. Therefore, as soon as a student gets his best scores, he or she won't proceed to continue doing the quizzes. In addition to this aspect, there is a normal drop-out rate of students during the semester and thus the decrease shown.

Engagement with SPOCs seems to be very much quiz driven. Compared to previous years' face to face course attendance, these figures show higher engagement. There's more students accessing the SPOCs and engaging with them, compared to students attending face to face lectures in previous years.

6. DISCUSSION AND LESSONS LEARNT

Similarly to what previous research has concluded (Findlay-Thompson and Mombourquette, 2014, Ferreri and O'Connor, 2013, Mason et al., 2013), the project to flip PSYC1030 and create a MOOC with the same content and learning outcomes has shown that the effort involved is considerable. Hence, it should not be taken on without good resourcing and a clear vision of the end results.

The project gave an opportunity for more academics from the School of Psychology to participate in the creation of the course than would have been involved in the previous lecture style of delivery. This can be seen as both a professional development and a school collaboration outcome. Also, in agreement with Mason et al. (2013) findings on the capacity of the flipped classroom for a wider coverage of content, in this project the replacement of the entirety of the lectures caused the MOOCs to include content that was not possible to include in the lecture delivery format.

With concern to the students' evaluation of the experience, in comparison to other courses, they stated that the flipped PSYC1030 has more interesting lecture material, it endowed them with more flexibility in terms of time and arranging their schedule and provided them with an easier access to course materials. They've equally highlighted the importance of the weekly assessments as a method to prevent them from falling behind and as an indicator of their level of understanding. Also, they stated that the lecture content, its activities, tutorials and workshops did increase their knowledge and understanding of the course content, which was also reported by previous research (Young et al., 2014)

Students in the flipped course like the scheduling flexibility of fewer contact hours and the on-demand access to the content presentation in the SPOC. There was an acknowledgement from the students that the active learning format and comprehensive coverage of the content in the online materials took longer to do than simply watching two hours of recorded lectures. Current student's expectations of study hours don't appear to align with the institution's expectations, but the presentation of the content in the SPOC does seem to increase the time students spend on the course vs. the lecture format of their other courses.

7. CONCLUSIONS

Flipping courses with high quality online learning resources allows for many improvements in student experience, such as increased opportunity for staff, student and peer-to-peer interactions, greater flexibility, lower costs and more immediate feedback. Nonetheless, it is important to account for the substantial effort that this conversion means to the teaching team.

The benefits of the flipped classroom have been extensively researched, but more data of its real effectiveness is necessary. Hence, it is important to document the outcomes of the experiences with this type of teaching method. In the case of the project, the PSYC1030 course was converted into a series of four MOOCs covering the main topics and SPOCs derived from these MOOCs were used to flip the course. The results of the students' evaluation are overall positive, in particular in terms of assessment, collaboration, interaction, time management and comprehension of the material. However, the students reported that watching the lectures online and taking notes demanded a substantial amount of time.

The project's aim to be an exemplar for future course transformations has been achieved with improvements in student engagement and experience aligning with the broad goals of the The University of Queensland (UQ) Student Strategy.

Having the MOOCs and the flipped course sharing most content and learning goals will allow for a detailed assessment of the benefits to students' learning and engagement of the on-campus workshops and tutorials. The University of Queensland does not offer fully online undergraduate programs and so the value of active small group interaction in the on-campus workshops and tutorials is important to both develop and to quantify.

REFERENCES

Aidinopoulou, V. & Sampson, D. G. 2017. An Action Research Study from Implementing the Flipped Classroom Model in Primary School History Teaching and Learning. *Journal of Educational Technology & Society,* Vol. 20, No. 1 pp. 237-247.

Bishop, J. L. & Verleger, M. A. The flipped classroom: A survey of the research. ASEE National Conference Proceedings, Atlanta, GA, 2013. 1-18.

Butt, A. 2014. Student views on the use of a flipped classroom approach: Evidence from Australia. *Business Education & Accreditation,* Vol. 6, No. 1 pp. 33-43.

Danker, B. 2015. Using flipped classroom approach to explore deep learning in large classrooms. *IAFOR Journal of Education,* Vol. 3, No. 1 pp. 171-186.

DeLozier, S. J. & Rhodes, M. G. 2017. Flipped classrooms: a review of key ideas and recommendations for practice. *Educational Psychology Review,* Vol. 29, No. 1 pp. 141-151.

Dennen, V. P. & Spector, J. M. 2016. The Flipped K-12 Classroom: Implications for Teacher Preparation, Professional Development, and Educational Leadership. *In:* Avgerinou, M. D. & Gialamas, S. P. (eds.) *Revolutionizing K-12 Blended Learning through the i²Flex Classroom Model.* Hershey, PA, USA: IGI Global.

Ferreri, S. P. & O'Connor, S. K. 2013. Redesign of a large lecture course into a small-group learning course. *American journal of pharmaceutical education,* Vol. 77, No. 1 pp. 1-9.

Findlay-Thompson, S. & Mombourquette, P. 2014. Evaluation of a flipped classroom in an undergraduate business course. *Business Education & Accreditation* Vol. 6, No. 1 pp. 63-71.

Ifenthaler, D. 2012. Determining the effectiveness of prompts for self-regulated learning in problem-solving scenarios. *Educational Technology & Society,* Vol. 15, No. 1 pp. 38-52.

Ifenthaler, D., Sampson, D. G. & Spector, J. M. 2015. Interactions between cognitive psychology, educational technology, and computing in the digital age. *Technology, knowledge and learning,* Vol. 20, No. 2 pp. 129-131.

Isaías, P., Miranda, P. & Pífano, S. 2009. Designing E-Learning 2.0 courses: recommendations and guidelines. *In* A. Méndez-Vilas, A. Solano Martín, J.A. Mesa González & J. Mesa González (Eds), *Research, Reflections and Innovations in Integrating ICT in Education*. (Vol. 2, pp 1081-1085). Badajoz, Spain: FORMATEX.

Jensen, J. L., Kummer, T. A. & Godoy, P. D. d. M. 2015. Improvements from a flipped classroom may simply be the fruits of active learning. *CBE-Life Sciences Education,* Vol. 14, No. 1 pp. 1-12.

Kim, M. K., Kim, S. M., Khera, O. & Getman, J. 2014. The experience of three flipped classrooms in an urban university: an exploration of design principles. *The Internet and Higher Education,* Vol. 22, No. pp. 37-50.

Kurtz, G., Tsimerman, A. & Steiner-Lavi, O. 2014. The Flipped-Classroom Approach: The Answer to Future Learning? *European Journal of Open, Distance and E-Learning,* Vol. 17, No. 2 pp. 172-182.

Loveys, B., Riggs, K., McGrice, H., Snelling, C., Winning, T. & Kemp, A. 2016. The Rise of the Flip: Successfully engaging students in pre-class activities through the use of technology and a flipped classroom design template. In Barker, S., Dawson, S., Pardo, A., Colvin, C. (Eds*) Show Me The Learning. Proceedings ASCILITE 2016*, pp.312-317 2016.

Mason, G. S., Shuman, T. R. & Cook, K. E. 2013. Comparing the effectiveness of an inverted classroom to a traditional classroom in an upper-division engineering course. *IEEE Transactions on Education,* Vol. 56, No. 4 pp. 430-435.

McLaughlin, J. E., Roth, M. T., Glatt, D. M., Gharkholonarehe, N., Davidson, C. A., Griffin, L. M., Esserman, D. A. & Mumper, R. J. 2014. The flipped classroom: a course redesign to foster learning and engagement in a health professions school. *Academic Medicine,* Vol. 89, No. 2 pp. 236-243.

Moffett, J. & Mill, A. C. 2014. Evaluation of the flipped classroom approach in a veterinary professional skills course. *Advances in medical education and practice,* Vol. 5, No. pp. 415-425.

Natividad, G., Mayes, R. & Spector, J. M. 2015. Balancing stable educational goals with changing educational technologies: challenges and opportunities. *e-mentor,* Vol. 1, No. pp. 83-94.

O'Flaherty, J. & Phillips, C. 2015. The use of flipped classrooms in higher education: A scoping review. *The Internet and Higher Education,* Vol. 25, No. pp. 85-95.

Phillips, C. R. & Trainor, J. E. 2014. Millennial students and the flipped classroom. *Journal of Business and Educational Leadership,* Vol. 5, No. 1 pp. 102-112.

Sergis, S., Vlachopoulos, P., Sampson, D. G. & Pelliccione, L. 2017. Implementing Teaching Model Templates for Supporting Flipped Classroom-Enhanced STEM Education in Moodle. *In:* Marcus-Quinn, A. & Hourigan, T. (eds.) *Handbook on Digital Learning for K-12 Schools.* Cham: Springer International Publishing.

Strayer, J. F. 2012. How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environments Research,* Vol. 15, No. 2 pp. 171-193.

Thai, T. N., De Wever, B. & Valcke, M. 2017. The impact of a flipped classroom design on learning performance in higher education: Looking for the best "blend" of lectures and guiding questions with feedback. *Computers & Education,* Vol. 107, No. pp. 113-126.

The University of Queensland, 2016. The University of Queensland student strategy. Retrieved from https://www.uq.edu.au/teaching-learning/student-strategy/content/front-page

Tucker, B. 2012. The flipped classroom. *Education next,* Vol. 12, No. 1 pp. 82-83.

Young, T. P., Bailey, C. J., Guptill, M., Thorp, A. W. & Thomas, T. L. 2014. The flipped classroom: a modality for mixed asynchronous and synchronous learning in a residency program. *Western Journal of Emergency Medicine,* Vol. 15, No. 7 pp. 938-944.