ONLINE FLIPPED LEARNING WITH CANVAS

A dissertation of the project for the completion of PGCAP ADEV702 2020-2021

Abstract

This dissertation showcases the use of “Instructure Canvas” towards flipping the teaching and learning process for the Department of Computer Science module COMP222: “Principles of Computer Game Design and Implementation”.

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1. Introduction and Background

Overview of the problem

An “Instructure Canvas” use case for flipped teaching and learning in a module on computer game development. Flipped learning was used to substitute the traditional in-class person-to-audience past teaching dissemination of the module with an online fully remote hybrid active learning environment. This report contains the description of the flipping process implementation, the evaluation of the implementation and discussed derived results for improving this practice in the future. The main result is that the developed online teaching and learning environment succeeded in educating student on the practical engineering aspects of the module and that it can enhance traditional teaching as supporting material in the future.

Motivation

Motivated by the new educational policies adopted by the University of Liverpool Curriculum 2021 and necessitated by my absence from Liverpool throughout the teaching semester due to the COVID-19 pandemic, I decided to flip the learning in my undergraduate taught module using the online platform “Instructure Canvas” as suggested by the University. Besides remote teaching, flipped learning has more educational advantages, including online synchronous and asynchronous learning, live interaction and assessment of students, automated assessment and feedback resources, among others.

Background Study and Literature Review

Flipped (or inverted) learning is the teaching and learning paradigm that prioritizes active learning by assigning students lecture materials and presentations to be viewed at home or outside the classroom [FL]. It is enabled by the flipped classroom that is implemented by using online teaching platforms and can be used to enhance or even substitute traditional teaching methods.

The adoption of flipped learning is rapidly emerging by an increasing number of educational institutions around the world. A recent survey on flipped learning in the education of engineering (Karabulut-Ilgu, 2018) identifies the trends of the flipped classroom that have been followed in related taught modules, the theoretical frameworks evaluation methods that have been adopted to investigate flipped learning in them, and discusses the effectiveness, benefits and challenges of flipped learning in engineering education. This includes advanced engineering courses in material science (Clark, 2014), (Clemens, 2013), (Thomas, 2012), biomedical engineering (Ankeny, 2014), environmental engineering (Luster-Teasley, 2014), geological engineering (Hagen, 2014), hydrology (Ivala, 2013), fluid mechanics (McClelland, 2013), Newtonian (Swithenbank, 2014), chemistry (Nicole Naibert, 2020) and thermodynamics (Lemley, 2013), (Usón, 2018), astronomy (Margoniner, 2014); also, first-year undergraduate engineering education (Everett, 2014), (McGivney-Burelle, 2013), (Ossman, 2014) and in advanced basic engineering (Mason, 2013), (Papadopoulos, 2010) engineering to undergraduate students (Jungić, 2015), (Kalavally, 2014), college students (Davies, 2013) and high school students (Chao, 2015), and to non-engineering students (Chetcuti, 2014).

Regarding computer science, publications include computer programming (Amresh, 2013), systems design (Bailey, 2013), databases (Chiang, 2015), software engineering (Choi, 2013), signals and systems (Fowler, 2014), linear algebra (Love, 2014), (Talbert R. , 2104), and statistics (Olson, 2014), (Talbert R. &., 2012). This is the first study of adopting flipped learning in an advanced computer science and engineering module on computer game development.

2. Aims and Objectives

Aims

The aim of this project is to monitor, report and improve the flipping of the teaching and learning process that I have applied to the delivery of my 2nd year undergraduate module COMP222: "Principles of Computer Game Design and Implementation" in the 2nd Semester of the academic year 2020-2021 as part of the curriculum of the Department of Computer Science at the University of Liverpool. Specifically, this project report serves as an advisory manual to provide guidelines for improving the flipping process on this, and other modules delivered by the University of Liverpool, in the future.

Objectives

The achievement of the aims is materialized by the following separate, feasible and stratified Objectives:

1. Move the subject material of COMP222 online.
2. Deliver the subject material remotely throughout the semester.
3. Assess and provide feedback to students fairly and remotely.
4. Receive feedback from different sources.

3. Design

The main platform utilized for the realization of the Objectives is the educational online platform "Canvas", following the new Curriculum 2021 policy of the University of Liverpool. The followed implementation methodology transformed the teaching and learning process from the traditional live in class face to face delivery to an online hybrid synchronous and asynchronous active teaching and learning process.

Achieving the proposed aim comprises a significant part in realizing the two fundamental targets that are being implemented for the modules' future strategic development towards:

- Shifting the educational focus of the teaching dissemination to a more practical engagement of the student cohort with current and state of the art technologies, and
- Aligning the final grade distribution to the University's grading policy, as advised by the Board of Examiners of the School of Electrical, Electronic Engineering and Computer Science.

Hence, I gave more focus on the module's 2 associated assignments in terms of their implementation by students, as well as in improving their dissemination, rather than on the learning of more theoretical aspects contained in the subject material.

The transformation also modified the working hours dedicated to the module and the type of involved teaching and learning activities I engaged in during the semester as I elaborate in Section "4. Implementation". The previous way that the module was being delivered changed radically due to the total absence of person-to-person interactions. In the past I was delivering the module to a cohort of (an average of 50) Students attending in class, in 3 one hour long physical lectures, assisted by 2 one-hour long demonstration sessions run by each supporting Demonstrator. Instead, this year due to the COVID19 pandemic, the teaching delivery became much more remote and asynchronous. In particular, I was supervising only 1 one hour long synchronous Question & Answer (Q&A) session every week and was supported by 2 separate synchronous demonstration sessions supervised by each Demonstrator. Hence, to enhance the asynchronous delivery of the material, I also created many explanatory educational videos throughout the semester, which were uploaded along with the

corresponding subject material on Canvas. Assessment of student performance was effectively automized by the Canvas platform, alleviating me from a lot of working hours. To facilitate the remote delivery and receipt of feedback, several channels of communication were set up connecting me to participating Students, Demonstrators and the module's Moderator.

This project report facilitates the evaluation of my pedagogical performance on this new hybrid form of teaching and learning practice. Specifically in Section "5. Evaluation", I elaborate on specific issues regarding the flipping process that arise from the discussion in Section "4. Implementation".

In summary, this report comprises the output Deliverable of the module ADEV 702 of the PGCAP 2020-2021, since any interested reader, or preferably a University colleague can receive initial instructions on starting up the flipping process of his or her own module by reading only Section "4. Implementation". Further instructions on improving this process, along with enhancing the general teaching delivery in an online and fully remote active learning environment, are listed in Section "6. Results" as separate points of criticism about specific pedagogical, educational, and technical issues that arise from the discussion in Section "5. Evaluation". Finally, an overview of my usage of Canvas with pointers on how to combine its functionalities more effectively is found in the "Appendix".

4. Implementation

In this section I describe the methodologies I implemented to materialize flipped teaching and learning of the module this semester oriented around each Objective listed in Section "2. Aims and Objectives".

Objective 1: Move the subject material online

To realize Objective 1, I spent significant and laborious time and effort in enabling the asynchronous delivery of the subject material. The main problem tackled towards departing from the previous synchronous mode of teaching delivery, the full corpus of the material should be uploaded in a remotely accessible comprehensive and self-explanatory form on Canvas. To this end, I primarily utilized the functionality provided by Canvas called "Canvas Pages". In essence, Canvas Pages serve as an internal website accessible to the "Canvas People" associated with the module. More importantly for my case, the participating students are provided access to and thus can browse through the Pages at their own individual convenience and learning pace.

Therefore, before the beginning of the semester, I extracted the subject material from its previous form, which was simply a very large set of presentation slides and uploaded it on Canvas Pages in an online browsable html format. This approach was not at all straightforward, since the unstructured and linear delivery of the material had to be redesigned logically and semantically. In particular, the material should be first divided into logical sections, each corresponding to a separate Page. Moreover, the process did not simply boil down to copying the material from the slides and pasting it on Pages. I put a lot of effort in achieving a uniform visual design of the material on the Pages, and on highlighting with a concise semantic style which taught arguments were positive, negative or neutral. Also, because this year more weighting would be given to the grading of the two assignments associated with the module, I also extracted the material that was relative to the assignments from the slides, creating extra separated Pages with material dedicated to the study of the assignments only, independently from the main theoretical corpus of the material. Finally, as a failsafe strategy, I had the introductory Page refer to the old online webpage for the previous years of the module, and I uploaded the previous pdf files on "Canvas Files" as well.

The process of uploading the material on Canvas did not end with the above creation of Canvas Pages. As the semester progressed, and based on feedback I was receiving, I realized that simply

having the material online, would not be adequate for its comprehension by students who had not been exposed to these or similar subjects before. In other words, simply scrolling down over some of the Pages would not teach an uninformed or incompetent student about the subject to the degree that he or she could be fairly assessed on its understanding in the final exam. In fact, on some of those Pages, the delivered subject was too complicated to be absorbed asynchronously. Therefore, throughout the semester, I selected the Pages that contained such "heavy" subjects and created accompanying explanatory videos, which I pasted at the beginning of the corresponding Page. To create the videos, I used the open-source video capturing software "Open Broadcaster Software Studio", after seeking advice about its usability from colleagues in the Computer Science Department, who had experience from similar activities in the past.

The videos I created attempted to provide a "synchronous" flavor to the subject that were taught in the corresponding Page. They would digitally simulate the scenario where I and the observing Student virtually sat in front of the same computer monitor, and I would explain the subject currently presented on screen. This provided the opportunity to elaborate on technical issues and details that arose from the taught material but were not straightforwardly deducible from any uninformed student. Practically speaking, every video contained my face as captured from my laptop's camera on the top right corner, while the main part of the screen would contain the Page itself, as I was scrolling it down gradually and narrating over the taught subject. The common point of reference between the narrator and the observer of each video was the mouse pointer, which was effectively being captured by the recording software. All videos were uploaded to the University's streaming service and weblinks were added to the html code of the corresponding Pages. An introductory teaser video was uploaded on "Canvas Videos".

Objective 2: Deliver the subject material remotely

To realize Objective 2, the uploaded material was divided into separate batches that were disseminated to the students in a weekly basis. This was realized by publishing the relevant Pages in a timely manner, making them available to the students every Monday afternoon. In particular, in accordance with the difficulty of the weekly material, 2-5 Pages were published that the students had the obligation to access and study them throughout the week. A typical teaching week would also include the following synchronous teaching and learning sessions: a 1-hour long online Question & Answer session between me and the students taking place early in the week, and two separate 1-hour long online Laboratory sessions between each of the two Demonstrators and half the cohort of students taking place later in the week.

In more detail, every Monday morning, the latest 15 minutes before the allocated teaching hour, I would create a "Canvas Conference" session, generating a weblink to it. Then I would make a "Canvas Announcement" copying that weblink in the relevant text box, so that the students could access the conference at the designated and announced time. The students would also receive an accompanying email, that took 5-10 minutes to be sent from Canvas to all of them, after the announcement was made through the Canvas system. At the precise starting time of the allocated teaching hour, I would press the "Start" button for the generated conference, which activated the "Big Blue Button" software, an online platform that facilitates synchronous meetings of large cohorts over a common webpage. After this, all attending students could join the meeting, where we were discussing their questions about the currently disseminated subject material batch published in the previous week. When the session was over, I needed to exit the meeting, access again the "Canvas Conference" webpage and press the "End" button from there, otherwise the meeting would continue indefinitely without attendees, despite have pressed the "End Meeting" button when

exiting the live session. Later the same day and based on feedback from the conducted session, I would revamp the discussed Pages, and publish the next batch of Pages assigned for next week.

Besides the theoretical subjects delivered through Pages as described above, a significant portion of the module's material had to do with the implementation by the students of two large practical assignments. As module Coordinator, I directed the students to study the Pages dedicated to the material for the assignments, and also created a few mock "Canvas Assignments" containing the material of the laboratorial tutorials from previous years.

With this material aside, the main responsibility for guiding and advising the students with respect to the implementation of the assignments was drawn to the two assisting Demonstrators, as well as to Students themselves. To facilitate this collaboration, I divided the student cohort into groups of 10 students to create a forum in Canvas where they could engage in interaction. Moreover, I assigned half of the groups to each Demonstrator. Every Friday morning, each Demonstrator would run an online Laboratory session, where students from the assigned cohort would participate to discuss weekly issues that arose regarding the implementation of the current assignment. These sessions were run under "Canvas Conferences" moderated by each Demonstrator, in a mode similar my moderation of the Monday Question & Answer sessions. Finally, every Friday afternoon, when both laboratorial sessions were completed, I would meet with the Demonstrators in a regular and short online meeting over MS Teams to receive feedback from them about the conducted sessions.

Objective 3: Assess and provide feedback to students

To realize Objective 3, "Canvas Assignments", "Canvas Quizzes" and "Canvas Grades" were utilized to assess the student performance on their assignment submissions and the final exam and to provide formal summative and formative feedback. This year, the grading policy of all modules delivered by the Departments in the School of Electrical Engineering, Electronics and Computer Science, has changed due to their remote delivery imposed by the COVID19 pandemic. In particular, the final exam percentage to the final grade should not exceed 70%. I have reflected this policy in the delivery of my module by giving a lot of emphasis to the implementation of the module's assignments from the students, effectively separating it from the main theoretical material.

To keep all submissions tractable, comparable and automized I used "Canvas Assignments" as a platform, and "Canvas Announcements" to make their postings known. Regarding the assessment rubrics, I followed two approaches: the rubric of the first assignment was created by the associated "Canvas Rubric" which I populated and modified using as a source the assignment specifications listed from previous years; I refrained from doing so in the second assignment, where I simply posted a modified pdf file containing all information in order to support the fair assessment of the different options provided for the completions of this assignment. Although I have kept the old second assignment exercise from the previous years, I have also added an "experimental" option to fulfil this assignment by extending the deliverables from the first assignment towards incorporating aspects dictated by the existing Learning Outcomes specified for the second assignment.

The assessment of the assignments was primarily undertaken by the two Demonstrators under my weekly guidance. The students received summative feedback by the assignments marked according to the associated rubrics. They also received formative and criterion-referenced feedback through the comment section of the "Canvas Grades" platform guiding each individual student constructively. The students also were receiving informal continuous feedback and advice from the Demonstrators in the weekly laboratorial sessions, as well as from me in the Q&A sessions.

The grading percentage for each assignment was 15% of the final mark, i.e., 5% higher than in previous years. In regular meetings with the Demonstrators, I regulated and downgraded the distribution of the marks, besides following the University's grading policy, to also direct the Demonstrator to reward with excellence only very few distinguished assignments, including in their evaluation also creative and more artistic aspects of the submissions, valued by the nature of the module's subject, i.e., gaming.

The final exam was weighted with the remaining 70% of the total grade and was created by "Canvas Quiz". Multiple choice questions and other forms automatic answering methods provided by the standard edition of the Canvas Quiz were used. To reflect the 40 points usually graded by the Department of Computer Science grading policy, I created 30 questions, separated into 2 parts of 10 basic questions awarded with 1 point plus 5 harder questions awarded with 2 points. The questions covered all specified learning outcomes of the module and were moderated affirmatively by the module's Moderator. The examination process was also moderated centrally from the Department to avoid leakages of grades to the students. In the end, the exam ran smoothly and no feedback was required to be provided by me during the exam. The final grade distribution followed a normal Gaussian distribution with a slightly increased mean. In all, this year's grades were slightly lower than in previous years after moderation from the module's departmental Moderator.

Objective 4: Receive feedback about the module's delivery

To realize Objective 4, different channels of communication between me and the students, the Demonstrators and the Moderator were utilized. To facilitate constant interaction, a variety of interactive communication tools were used, including "Canvas Discussions", Chat in "Canvas Conferences", MS Teams Chat and Calendar, email correspondence, among others.

Students provided feedback in the Q&A sessions, by direct communication, as well as through the mid-term EvaSys evaluation survey incorporated to Canvas as a mock Canvas quiz. The Demonstrators were providing feedback in regular managerial meetings at the end of each week, as well as asynchronously during the week. Exam moderation provided summative and constructive feedback on assessment.

5. Evaluation

In this section we evaluate the level of achievement of the four Objectives identified in Section "2. Aim and Objectives". I address each Objective highlighting points of interest both about the successful and effective teaching and learning process, as well as about noted setbacks, presented in Section "4. Implementation" based on received feedback and self-evaluation.

Objective 1: Move the subject material online

From my overall practice with Canvas Pages, I conclude that its main usefulness is in concentrating and maintaining all the digital subject material uploaded on Canvas in a single and remotely accessible repository. It supports well the logical segmentation of the material and thus facilitates asynchronous teaching and learning effectively. The division of the material into logical sections listed as separate Canvas Pages created a large group of separate and equivalent Learning Units (around 35).

A first point of criticism is on the unequal weighting of the produced Learning Units. Indeed, the difficulty of the taught subject was increasing significantly as the semester progressed, since more involved theoretical aspects are being addressed there. To make up for this discrepancy, I designed and created the majority of the uploaded videos to be relatively longer (around 17 minutes long) in

order to cover in detail the more difficult subjects disseminated in the later Pages. Extra shorter videos were created for the introductory technical and mathematical subjects, while simpler Pages with more pictorial type of information do not contain videos. The formative feedback I have received from the final grading shows that the majority of student were able to be fairly tested on the comprehension of the material. In all, I received positive formal and informal feedback from the students about the material uploaded on Pages and in the corresponding videos.

However, technical problems about Canvas and the uploaded material were also pointed out, as well as negative feedback was received about the late dissemination of the videos in the semester (after the Easter break). Regarding the videos' technical issues, I remark that the free open-source Open Broadcaster Software Studio program is computationally heavy on laptops, especially while video is being captured from the camera. Even in lower resolutions, the quality of my captured face expressions was poor. Nevertheless, the audio information is adequate to deliver a comprehensible lecture. Regarding publishing the videos in the later part of the semester, I remark that I was creating the videos more or less in reverse order in order to align them timely with the material being currently disseminated. The shorter videos that contained lighter and more technical subject, which had also been disseminated earlier in the semester, were created and uploaded to Canvas early enough to support the students' preparation for the final exam.

The extra Pages containing material about the assignments were utilized frequently and effectively by the students and thus assisted constructively in their practice with the assignments. From a strategic point of view on the module's future development, this further allowed for successfully shifting the teaching and learning process to a more practical direction. I received positive feedback from the students about this aspect in many occasions, including EvanSys evaluation, as well as directly and informally from the students themselves. An illustrative example is that all students, who were attending the Q&A sessions regularly, agreed unanimously at the end of the semester that they had learned helpful new skills from my module.

The failsafe strategy allowed to limit the leakage of information from previous years' exams and solutions. This information is not useful to be uploaded on Canvas since its cascaded release to wider cohorts becomes a severe risk. Students were directed to this resource on demand and after contacting me in person. Nevertheless, the new type of exam delivery as a "Canvas Quiz" contains new created and modified questions that have been tested successfully this semester and in last year's resit examinations.

Objective 2: Deliver the subject material remotely

Canvas Pages alone is not adequate to regulate effectively the gradual and timely dissemination of the material over the semester's weeks. In fact, to keep track of timeliness, I had to resort to more manual types of announcements in the Q&A sessions and through "Canvas Announcements". Moreover, the online posting of the material was done by gradually publishing the created Pages on Canvas for the first time. To this end, the relevant service "Canvas Modules" provided by Canvas needs to be populated for this module in the future.

Simply having the material accessible online by the students in an asynchronous manner does not guarantee that they will absorb it to a degree that they can be fairly assessed on its comprehension at the end of the semester. Indeed, in the second part of the semester where the material was more involved, I enabled early full access to all relevant Canvas Pages, while shifting focus in creating explanatory supporting videos. Indeed, the videos enhanced the learning process and gathered a lot of interest from the student in the latest weeks of the semester before the exam.

The live discussions taking place at the synchronous Q&A and laboratorial sessions further boosted interaction with the students both in terms of disseminating the theoretical corpus of the material, as well as of tackling early technical or educational issues that arose from the practical assignments. The concluding weekly management meetings taking place at the end of each week between me and the Demonstrators enabled agreement in our responses to the students' queries, as well as addressing issues promptly in the beginning of the following week. In all, the timeliness of the delivery was effective, as also commented in feedback received from students.

Attendance to Canvas Conferences of the Q&A sessions, after a few early weeks, concentrated around 25% of the total cohort and remained steady for the duration of the semester. Live and interactive engagement was fairly limited, since the majority of students chose the Big Blue Button's option to enter the live session without microphone, mainly discouraged by psychological reasons. Hence, frequently and regularly I would receive feedback about the comprehension of my explanations and answers as well as extra questions from the attending cohort through the chat box function. In general, the communication was adequate to facilitate a comprehensive teaching and learning session. The final grade distribution between attending and non-attending students did not differ significantly.

Regarding the module's overall workload overhead against my other academic activities during the semester, I notice that the followed timetable is relatively convenient to manage. In particular, in terms of synchronous teaching delivery the allocated time is reduced, while extra effort and coordination is put on the managerial aspects of the module, such as receiving and providing asynchronous feedback to and from students and Demonstrators during all working weekdays. Indeed, the latter adds significant extra workload to the module Coordinator, which is nevertheless amortized over the duration of the week. However, this extra workload is manageable to the point not to hinder or prohibit teaching dissemination in the form of traditional live in class lectures. As such, I believe that the module's new online format can be used in the future rather as an auxiliary tool in support of regular teaching lectures in class.

Objective 3: Assess and provide feedback to students

The new adjusted grading policy supported positively the overall strategic shift of the module's development towards more practical teaching and learning. In particular, the extra grading percentages allowed this year to be associated with each assignment, besides implementing the University's grading policy, also facilitated effectively the new emphasis I want to give to the module in assessing the hands-on practice of the students by following basic underlying theoretical design principles, rather than teach in depth the details and intricacies of the theoretical material.

In terms of assessing and providing feedback about the practical assignments, I remark that the students were receiving enough interaction and feedback from the Demonstrators throughout the semester to the point that my level of confidence about the fairness of their assessment was quite high. In particular, the Demonstrators were collecting interesting specialized or more common questions from the students that allowed me and the Demonstrators as a team to prepare an educative response by the end of the week, such that any rising issues would be addressed promptly in the beginning of the next week. Moreover, the frequent interaction between students and the Demonstrators further supported the continuous and ipsative assessment of the attending cohorts. Furthermore, in my regular weekly managerial meetings with the Demonstrators, I regulated the distribution of the assignment's grading to lower levels in order to both control the final grade distribution, as well as to reward with excellence, i.e., give full grades, only to the very select few distinguished submissions where students had also exhibited creative and artistic contributions,

besides simply implementing the basic technical functionalities specified by the assignment. Indeed, fairness in the assignments' assessment and personalized feedback instructions provided to each individual student were facilitated effectively by Canvas which automated the overall assessment process. Positive feedback about this has been received from both students and Demonstrators; one example is that there were very few complaints about unfair grading from students.

The final grade distribution, after the completion of the final exam, was downgraded by a small factor as had been done in previous years. Traditionally, the module's grading distribution is a normal Gaussian bell with concentrated mean averaged above 84%, while this year the mean dropped to 78% after moderation with the departmental Moderator. The University's grading policy dictates and even lower 70%. Hence, I receive the new distribution as a positive sign towards achieving the complementary strategic goal for the module's future development to align the final grades with the University's grading policy. However, this goal needs to be more firmly address in the future, with methods such as designing a stricter final exam and adding a 3rd assignment.

Objective 4: Receive feedback about the module's delivery

Feedback was received from various sources that assisted me greatly in guiding and improving my teaching practice during the semester. A first point of criticism is that the usage of the relevant "Canvas Discussions" service provided by Canvas was sparse and ineffective. Lacking this central forum of discussion, separate channels of interactions were implemented, adjusted to the student cohorts and colleagues providing the feedback. In particular, students were also contacting me individually over Microsoft Teams Chat and emails. Frequent synchronous and asynchronous contact was maintained with the Demonstrators over the Microsoft Teams calendar service.

In all, the received feedback was positive regarding the module's timely dissemination, the level of the students' comprehension of the taught material, the final grading distribution, the developed and newly published teaching material, the comprehension of the videos and other aspect of my teaching practice. This is also confirmed from the generally positive results I have received from the EvaSys mid-term survey that was delivered as a mock Canvas Quiz during the Easter break and received a representative amount of responses.

Especially, the new and novel practical focus of the module's dissemination was received very positively by both Students and Demonstrators, a fact that I attribute to their effective and continuous interaction throughout the semester. This aspect of dissemination has improved greatly compared to previous years and has also improved assessment, since the Demonstrator were in a position to evaluate each Student's progress more closely, thus providing relative, formative and ipsative personalized feedback. Indeed, the Demonstrators are worth of my appraisal, since they showed diligence and timeliness in their practice, learning a great deal about teaching themselves.

Regarding moderation of the final exam, its content was moderated early in the semester following the Department's specifications and its dissemination was coordinated centrally by the Department and ran smoothly and uninterrupted. The final grade distribution was slightly downgraded after agreement with the Moderator in order to meet the School's grading policy and to reward students more for their practice with the assignments. Feedback from the Moderator was received in concluding remote synchronous meetings where the overall positive dissemination of the module was asserted.

6. Discussion of Results

In this section we elaborate on the results extracted from the project towards improving the dissemination of the COMP222 module in the future. The pedagogical, educational and technical instructions listed below can facilitate flipping the teaching and learning process of other modules in the Department and the University as well. Specifically, below we propose methodologies to tackle the critical issues and comments raised in Section "5. Evaluation" separately addressing each Objective listed in Section "2. Aims and Objectives".

Objective 1: Move the subject material online

- To improve the uneven distribution of the taught material's difficulty against their division into Pages, next year I plan to expand the material contained in the later Pages in the semester by increasing their amount and dividing them in smaller and independently comprehensible Learning Units.
- To enhance active remote teaching and learning, I plan to create new supporting teaching videos that will be shorter in length (around 12 minutes long) and more in number (around 40), addressing each learning unit individually. The videos will be uploaded to the Page corresponding to each learning unit and populated in Canvas Modules and Canvas Syllabus.
- To improve the low quality of the produced videos, I plan to invest in a better camera and hardware, as well as to seek advice of technical matters from peer colleagues.

Objective 2: Deliver the subject material remotely

- The completely remote delivery of the module was inadequate in facilitating personalized interaction with and live feedback to and from Students, as well as frequent and regulated unsupervised peer interaction among Students. Hence, although assessing technical skills obtained by the students became fairer and easier to manage, the assessment of secondary educational, pedagogical and psychological factors became harder. To address this matter, next year I plan to hybridize the teaching dissemination between online and in person interaction by delivering lectures in class as the primary form of teaching and by adapting this traditional teaching form to be supported effectively by the new auxiliary online active learning environment I developed this year in Canvas.
- To improve the module's timely management and to enable more advanced functionalities in Canvas, next year I plan to utilize the "Canvas Modules" service as a primary means to control timeliness of the material delivery throughout the semester. This service coordinates through Canvas calendar with many basic Canvas functionalities achieving better overall management of the Canvas platform, e.g., it enables providing personalized assessment and feedback to individual students through Canvas Quiz and Canvas Assignments, tracking student performance under various types of assessment through Canvas Outcomes and Canvas Grades, keeping a central overview on the module's timely progress through Canvas Syllabus, among others. The main approach I will follow is to populate Canvas Modules with time sensitive and instructive educational material aligned with static material uploaded on Canvas Pages, Canvas Quiz and Canvas Assignments.
- To improve live interaction and boost student engagement in discussions during synchronous teaching and learning sessions, next year I plan to utilize "Canvas Conferences" more effectively, activating advanced functions such as Break Out Rooms, as well as to use more communication platforms, such as Microsoft Teams. I also plan to add to "Canvas Discussions" a section with frequently asked questions in order to guide the topics of offline peer discussions.

Objective 3: Assess and provide feedback to students

- To enable assessment in diverse forms, next year I plan to introduce a 3rd assignment that will be oriented around advanced methodologies and more creative aspects in the development of the students' basic implementation in the 1st assignment. The new assignment will incorporate to this implementation, aspects that the students will have learned from practice with the 2nd assignment. Hence, the assignment will combine all specified Learning Outcomes. Moreover, I plan to integrate 1 or 2 test quizzes to assess student performance in the semester's middle and end term.
- To improve the quality of provided feedback, next year I plan to utilize advanced functions from "Canvas Outcomes" and "Canvas Discussions". The former provides personalized formal feedback enabling relative and formative assessment of each student individually. The latter will facilitate online asynchronous discussions to provide informed feedback on common and current queries and other issues.
- To align the module's final grading with the University's policy, next year I plan to design new more difficult questions for the final exam to decrease its average grade. Moreover, I plan to incorporate more assessment tasks to the final grade, including a 3rd assignment and some test quizzes. The new assignment will receive a smaller grading percentage of 6% which will be absorbed by decreasing either the percentage of each existing assignment to 12% or of the final exam to 64%. Both grading approaches can be followed and adapted to integrate up to 3 smaller test quizzes.

Objective 4: Receive feedback about the module's delivery

- To improve receiving feedback from students, next year I plan to utilize "Canvas Conferences" more effectively, encouraging student participation with open microphones and cameras. Moreover, I plan to support student engagement with "Canvas Discussions" after structuring and populating the provided forum with appropriate sectioning.
- To promote peer collaboration and professional development, I also plan to interact with the academic community on provided advisory discussion fora in order to seek professional pedagogical and technical guidance and to provide informed feedback to peer colleagues. To this end, I have already engaged in dedicated services, such as "Canvas Help for Staff", "Growing with Canvas" and "Hybrid Active Learning Support" on Canvas, along with weekly informal live sessions with colleagues from the "Canvas Connect O365 Team" in Microsoft Teams. I further plan to attend conferences and webinars on Higher Education publicized by email correspondence from the University's central and dedicated peer working groups.

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Resources

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Hybrid active learning support, Instructure Canvas, University of Liverpool
https://liverpool.instructure.com/courses/24116

Canvas connect O365 Team, Microsoft Teams, University of Liverpool
https://teams.microsoft.com/l/team/19%3a18bcb09cdc804dcbaacd6e19be8da196%40thread.tacv2/conversations?groupId=8511373d-4523-4502-ab06-13e79f3cabc1&tenantId=53255131-b129-4010-86e1-474bfd7e8076

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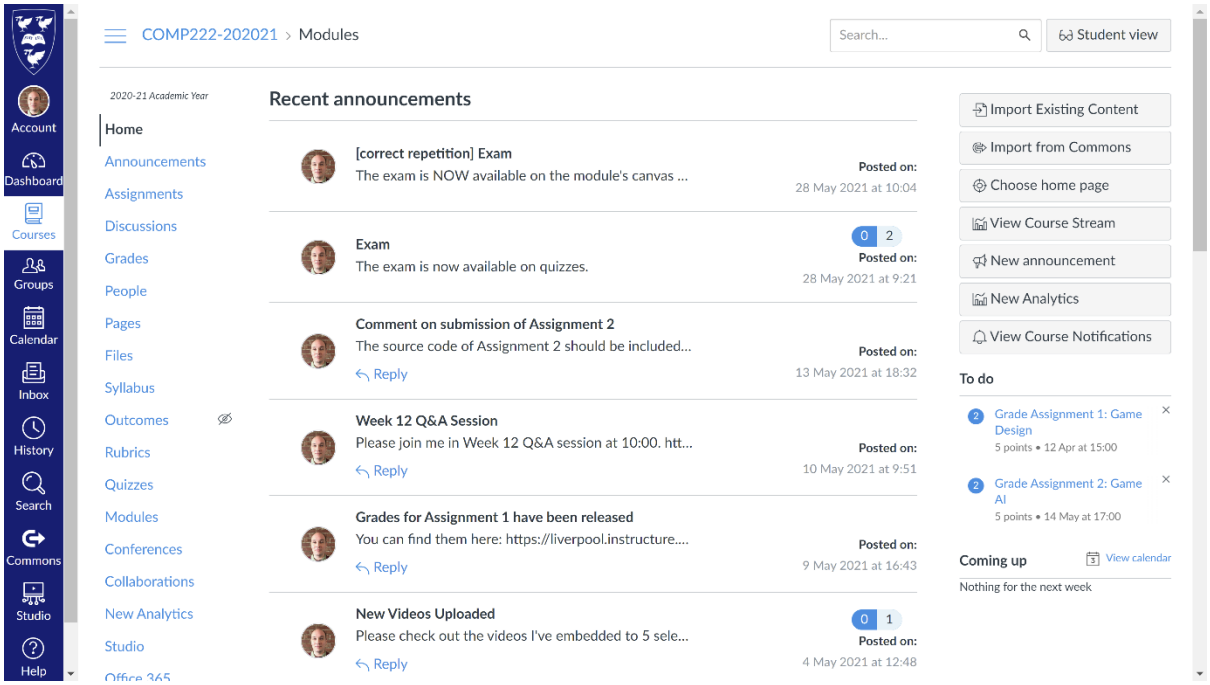
Appendix: Evidence of Implementation

Flipping teaching and learning for a module starts with implementing the following simple steps in Canvas:

1. Create and upload material using Canvas Pages.
2. Set up weekly interaction activities using Canvas Modules.
3. Create Canvas Assignments and Canvas Quizzes.
4. Manage dissemination using Canvas Announcements, Canvas Conferences and Canvas Discussions.

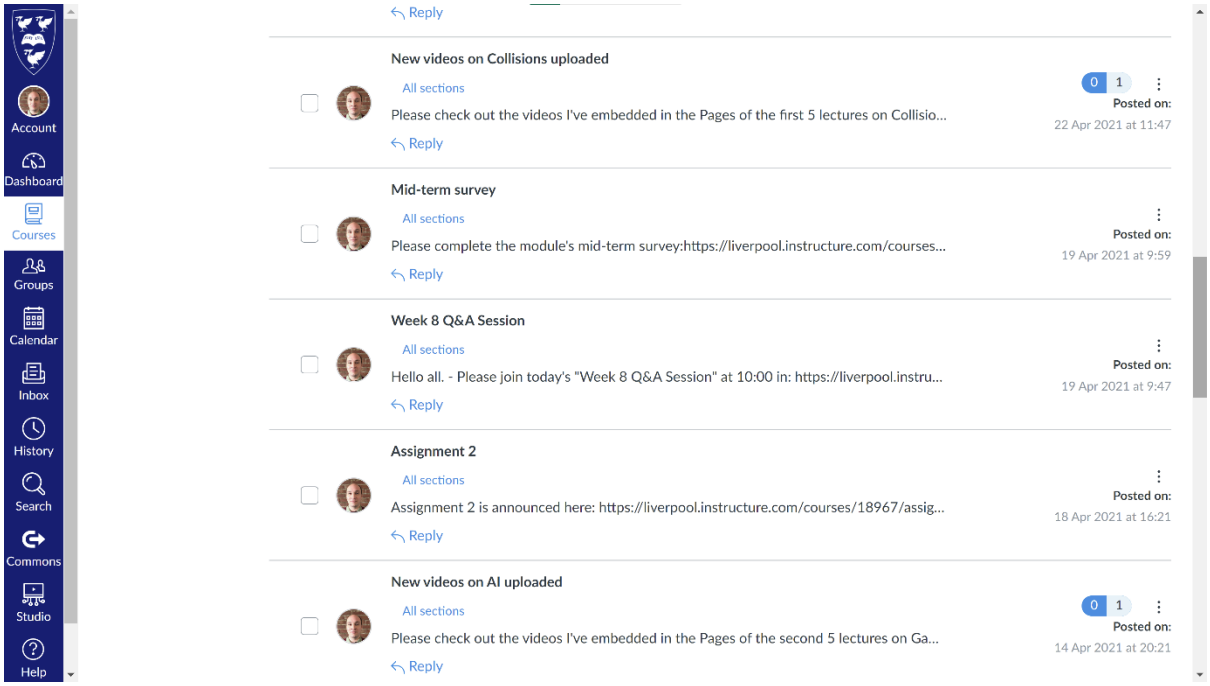
Below I present evidence of my practice with the functionalities of Canvas I used this semester.

Canvas Home



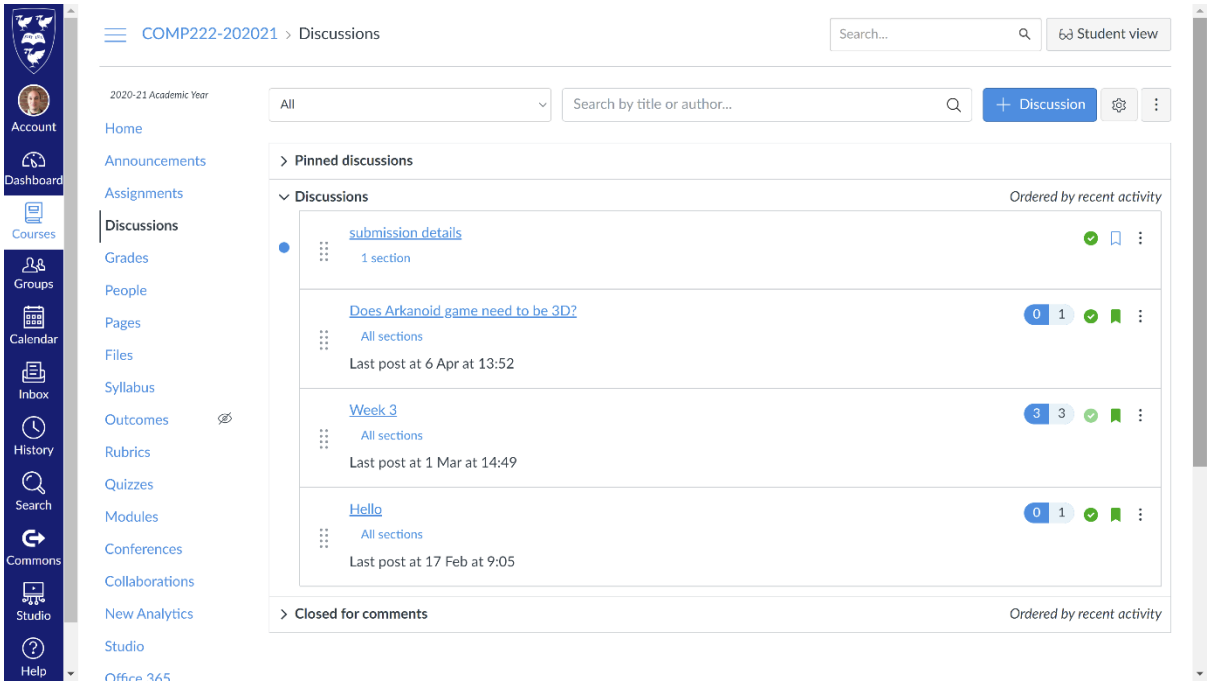
"Canvas Home" is the main page of the module. The main banner shows the content of "Canvas Announcements" and the side banners provide more functionalities and overview of the module.

Canvas Announcements



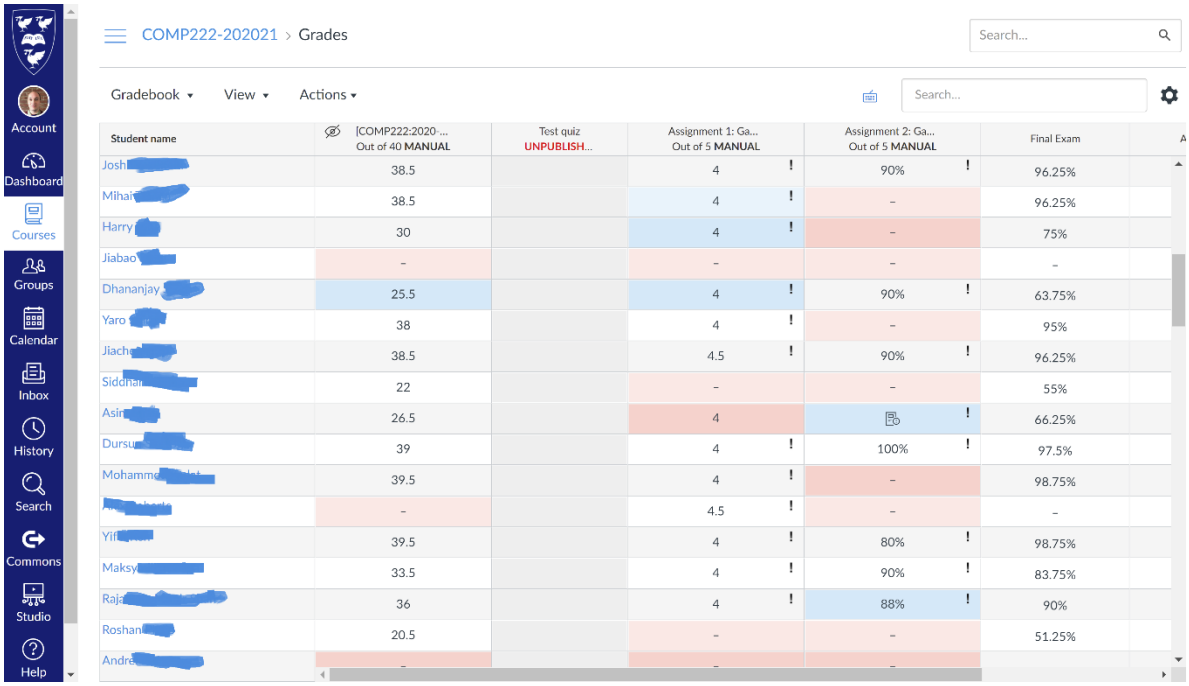
"Canvas Announcements" was the main channel of communication with the full student cohort. Specifically, announcements were made shortly before the commencement of the live Q&A and Laboratory sessions, on updates applied to the module's content in "Canvas Pages", on publication of assignments, on the commencement of the exams, among others.

Canvas Discussions



"Canvas Discussions" was the main platform for discussing arising issues with the full student cohort. Its use as an offline posting forum was very sparse and this functionality should be utilized better in the future.

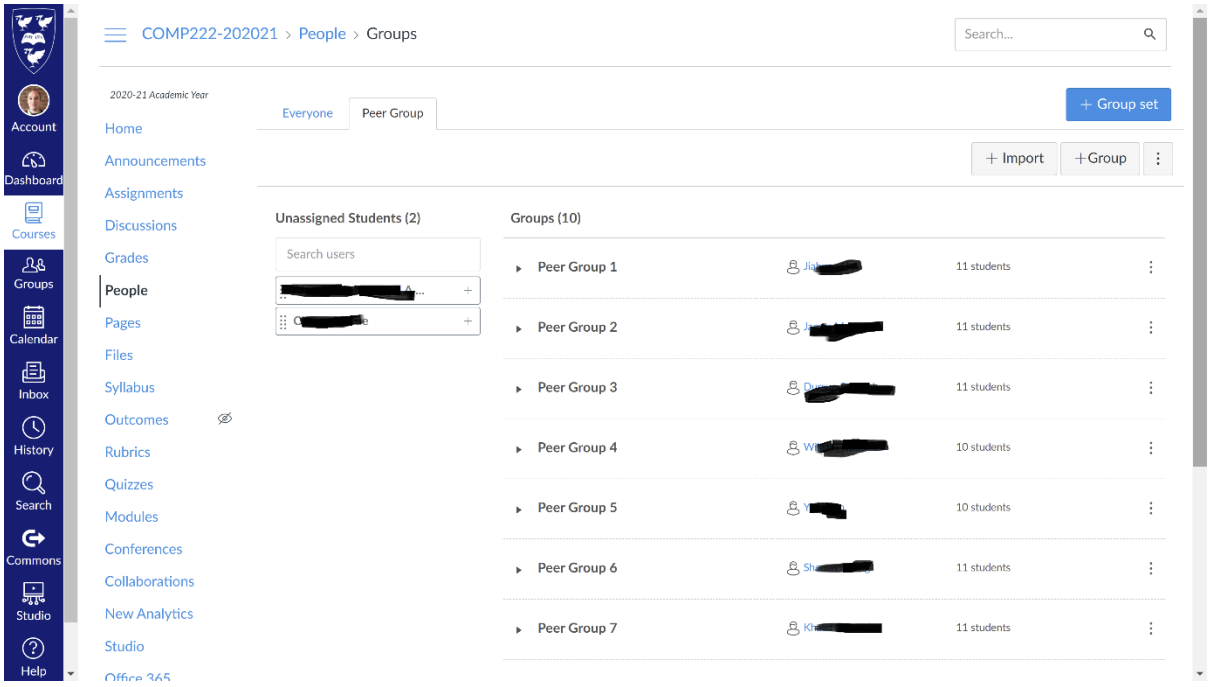
Canvas Grades



Student name	[COMP222:2020 ... Out of 40 MANUAL	Test quiz UNPUBLISH...	Assignment 1: Ga... Out of 5 MANUAL	Assignment 2: Ga... Out of 5 MANUAL	Final Exam
Josh [redacted]	38.5		4	90%	96.25%
Mihai [redacted]	38.5		4	-	96.25%
Harry [redacted]	30		4	-	75%
Jiabao [redacted]	-		-	-	-
Dhananjay [redacted]	25.5		4	90%	63.75%
Yaro [redacted]	38		4	-	95%
Jiach [redacted]	38.5		4.5	90%	96.25%
Siddhar [redacted]	22		-	-	55%
Asi [redacted]	26.5		4		66.25%
Dursu [redacted]	39		4	100%	97.5%
Mohamme [redacted]	39.5		4	-	98.75%
[redacted]	-		4.5	-	-
Yif [redacted]	39.5		4	80%	98.75%
Maksy [redacted]	33.5		4	90%	83.75%
Raja [redacted]	36		4	88%	90%
Roshan [redacted]	20.5		-	-	51.25%
Andre [redacted]	-		-	-	

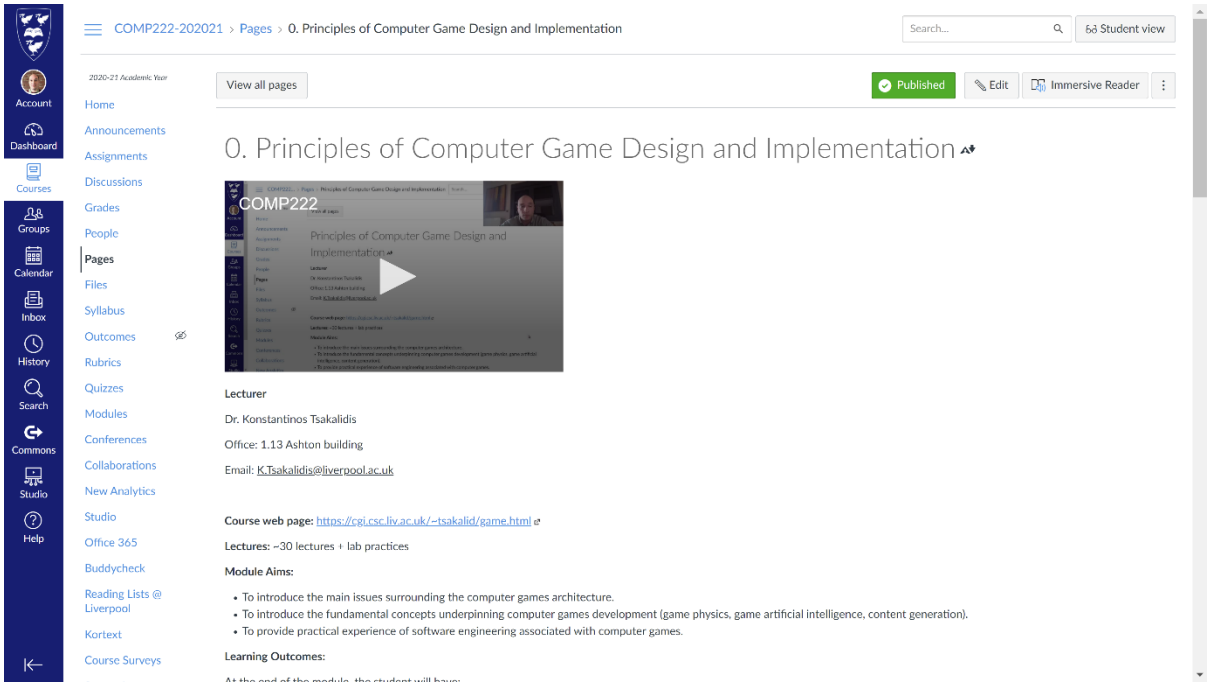
"Canvas Grades" was used to provide feedback to the students about their assignment submissions and final exam results. It automated the assessment process effectively. More extensive use of this functionality will be made in the future by adding extra assessed quizzes and assignments, as well as by connecting the output to "Canvas Outcomes".

Canvas Groups



"Canvas Groups" was used to split the student cohort in groups of 10 peers and assign half the groups to the supervision of each Demonstrator. More extensive use of this functionality will be made in the future by enabling within Canvas: asynchronous peer discussions of students in each group accompanied by synchronous live peer sessions after the Laboratorial sessions, utilizing the Breakout Rooms during the Q&A sessions and more.

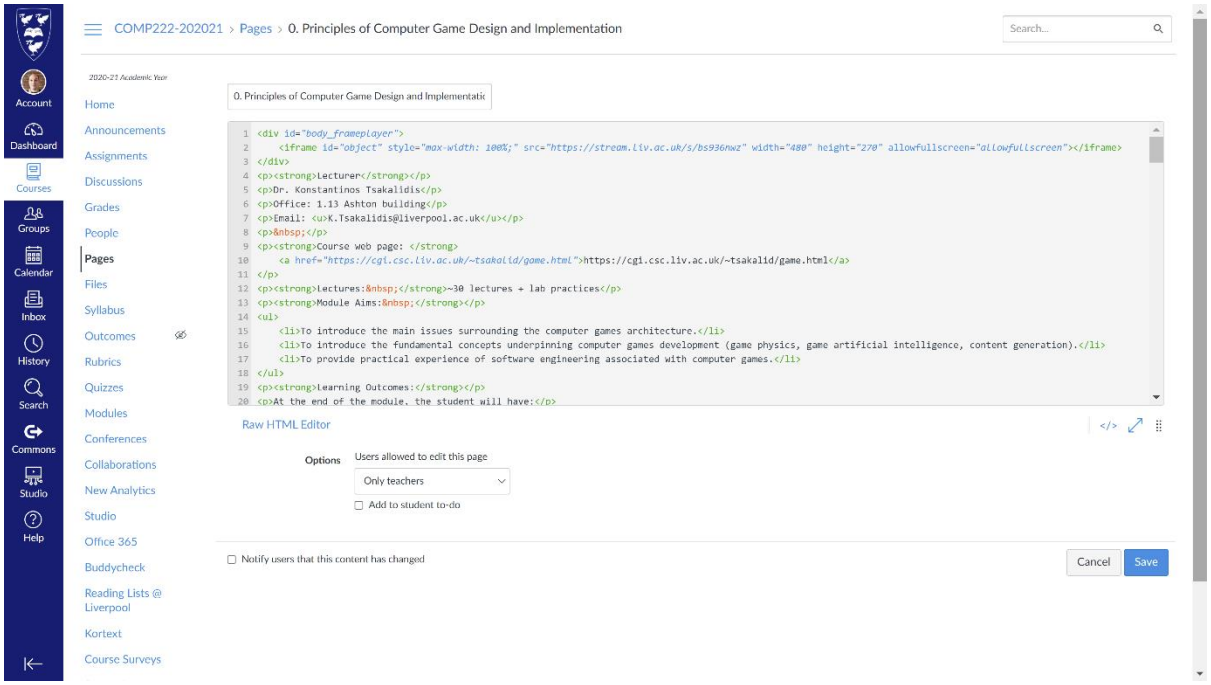
Canvas Pages



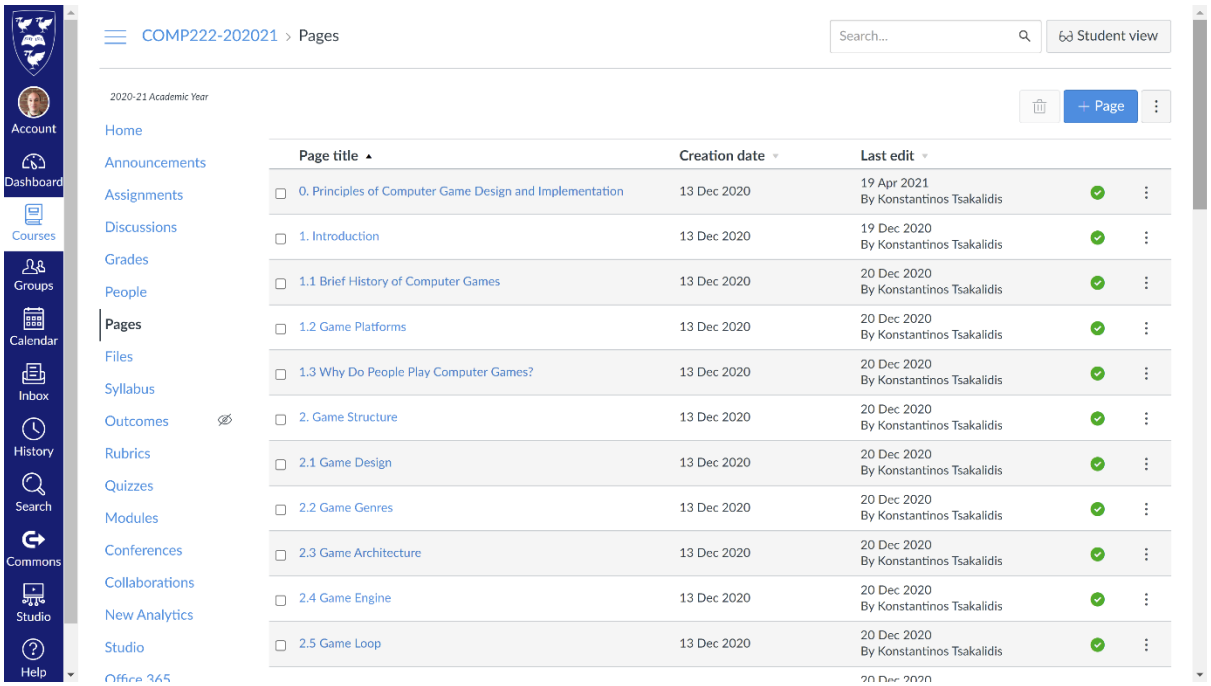
"Canvas Pages" was extensively used to support the online asynchronous dissemination of the subject material to all students. In particular, most of the material was transformed from static pdf slides into browsable html format, structured in a semantically logical and educationally gradual form and uploaded to Pages.

Associated explanatory videos were also created for most Pages and added to the beginning of each one. To do so, I clicked on the "Edit" button of the particular Page, then on the "View" tab where I selected the "HTML Editor" option; then, I pasted at the top of the code the embeddable html code produced from the University's streaming service, which I had received by email immediately after the video was uploaded to the service. The full process for creating and uploading a typical 15 minute long video would take at least 60 minutes in total. This is because after recording the 15 minutes, the same amount of time was necessary to: postprocess the video, upload it to the streaming service and to render it accessible to the service.

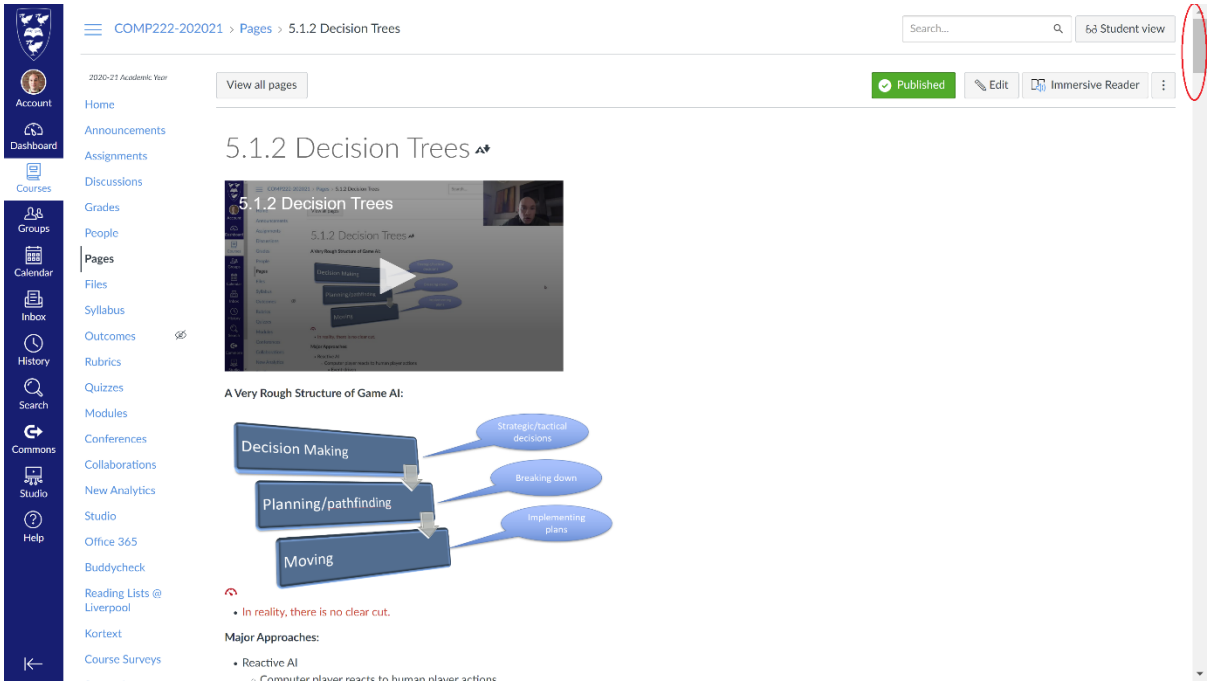
The screenshot Picture below shows the html code that creates the browsable introductory "Page 0" showed in the Picture above:



The semantic structure of the Pages was created by dividing the subject material into separate Learning Units associated with each Page and by titling the Pages in an alphanumerically sortable format, as shown below:

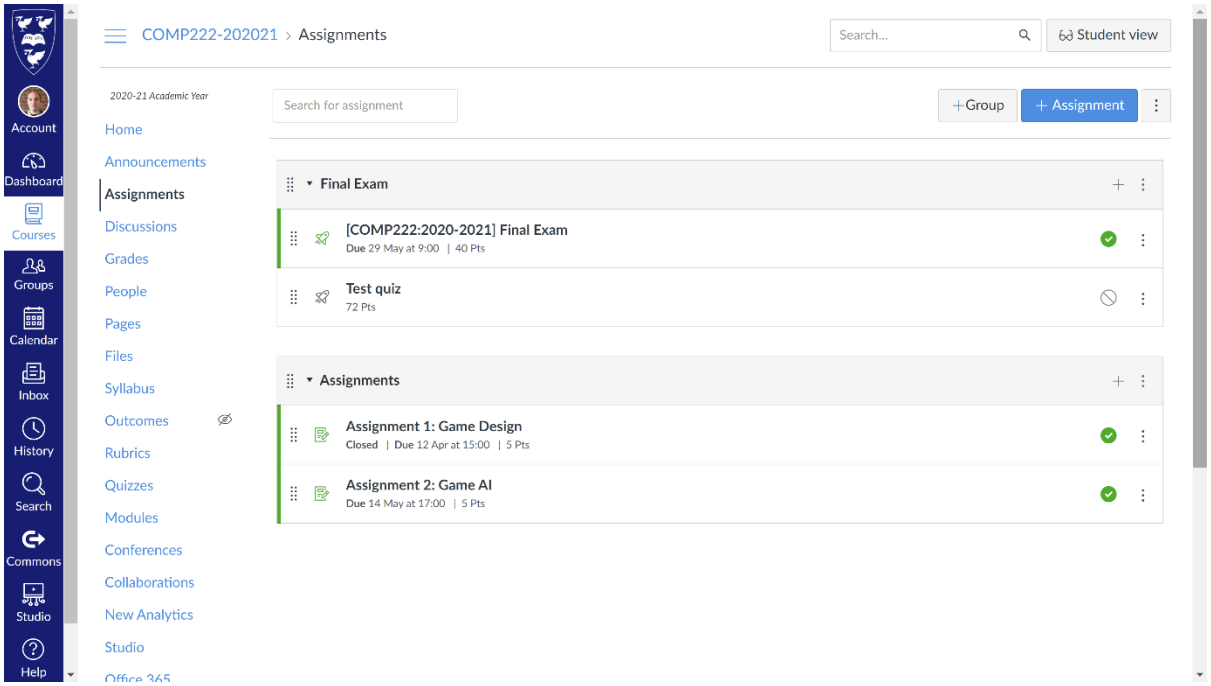


A typical sample Page looks like the one below, where the disseminated material is large and the associated video is long (around 20 minutes long). For example, notice the tall scroll bar at the top right of the following Picture:



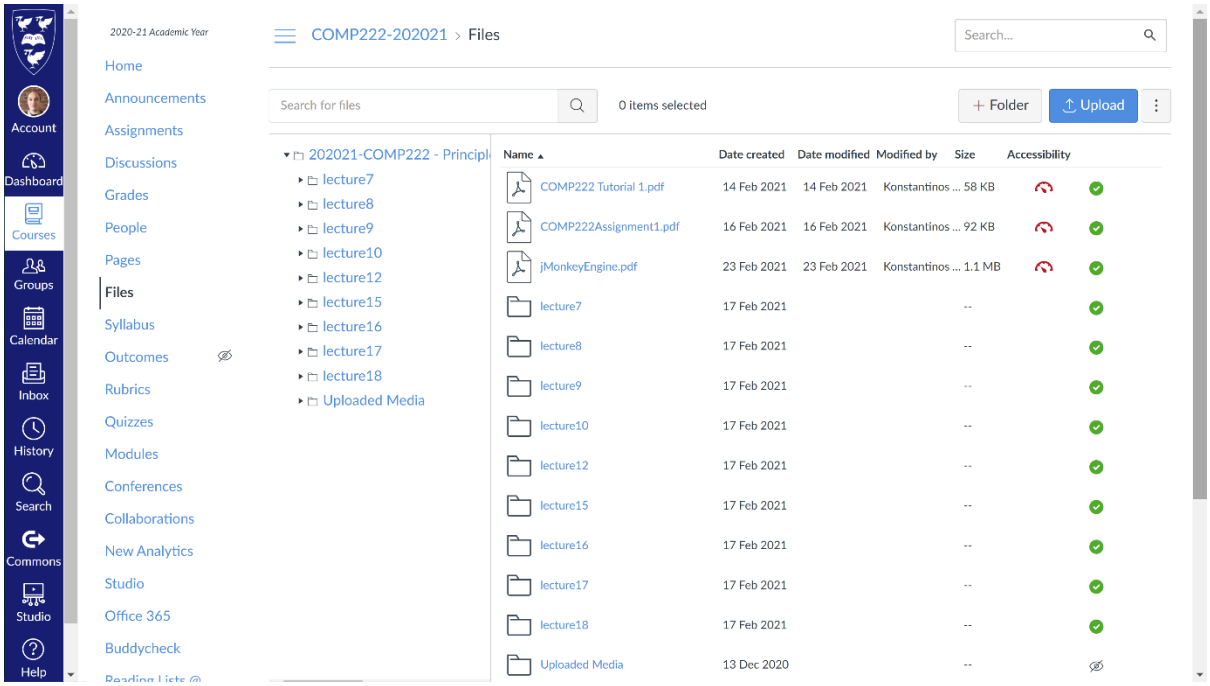
More extensive use of this functionality will be made in the future by dividing longer Pages into more and shorter Learning Units, revamping the old Learning Units and Pages, creating new shorter videos of better technical quality associated to each Learning Unit, as well as by connecting the produced Pages to "Canvas Modules".

Canvas Assignments



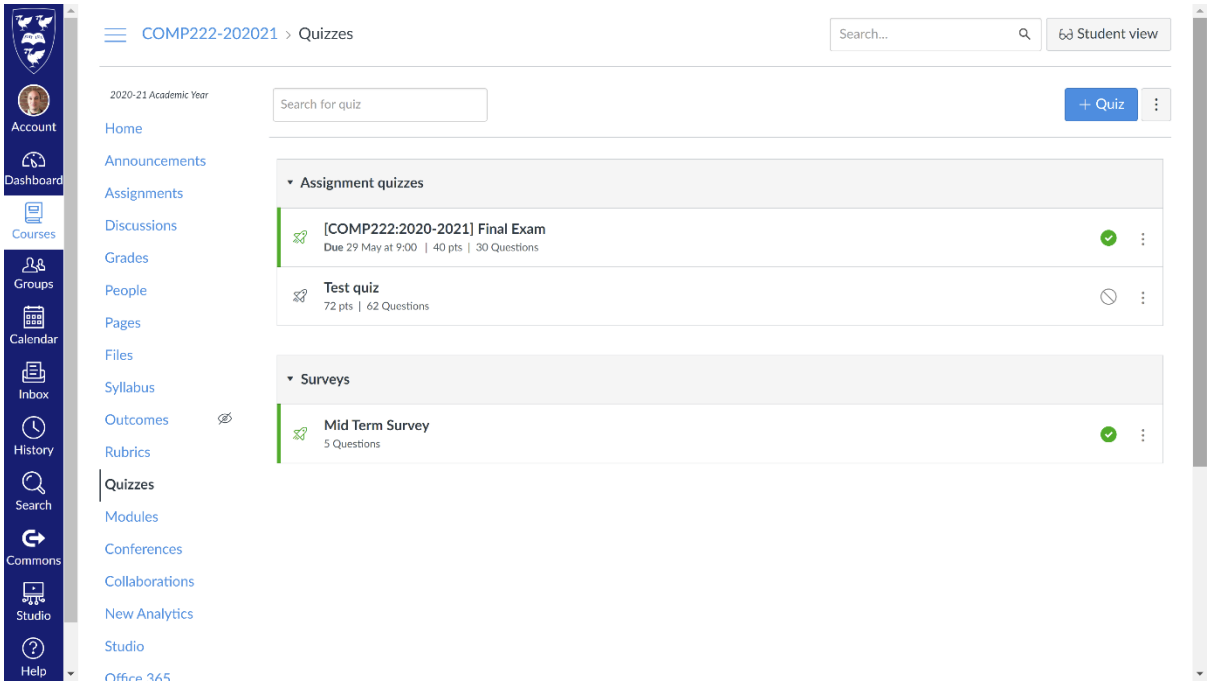
"Canvas Assignments" was used to upload, announce and assess the module's two assignments and the final exam. More extensive use of this functionality will be made in the future by creating an extra smaller experimental 3rd assignment and at least one new mid-term evaluation quiz test.

Canvas Files



"Canvas Files" was used as an unstructured back up repository for all uploaded files supporting the created Pages and Assignments, as well as for safekeeping the old lectures' slides. More extensive use of this functionality can be sought in the technical interaction of Canvas with provided third-party services, which I will experiment with in the future.

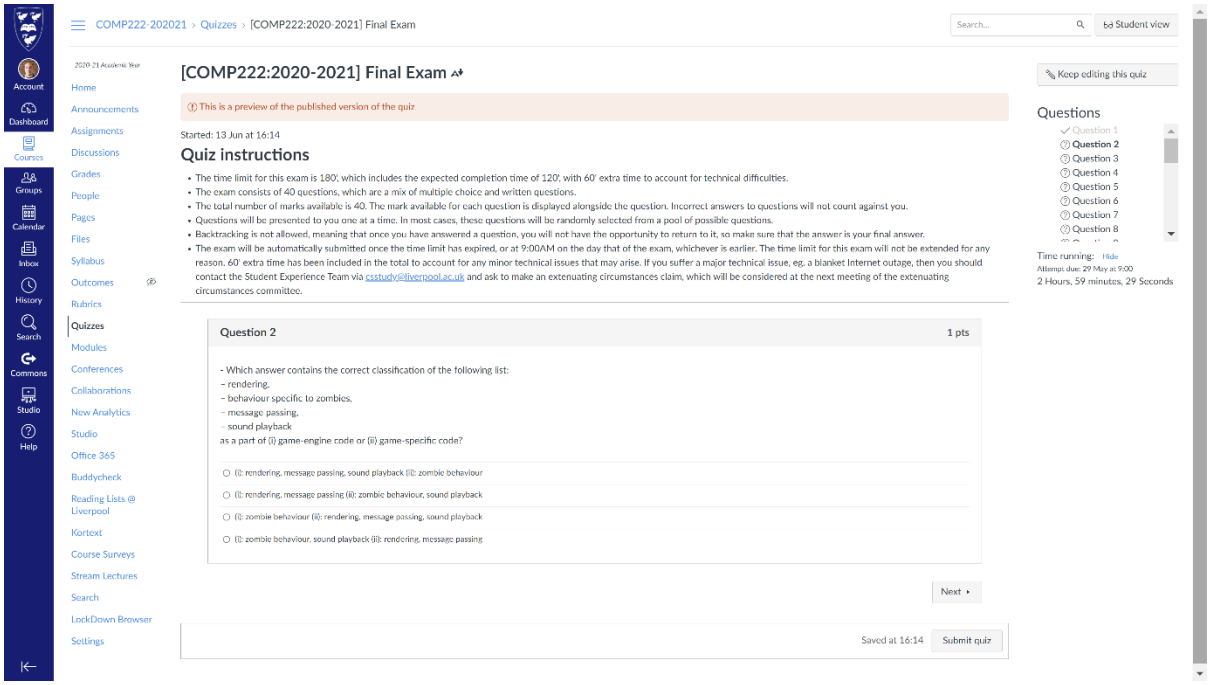
Canvas Quizzes



"Canvas Quizzes" was used to create the final exam and the EvaSys mid-term evaluation survey. The exam was created after specific centralized instructions sent from the Department, regarding the exam's rubrics, the total weight of the marks, and set up on Canvas. For the latter, explicit instructions were given to avoid early leaks of the exam's results to the students before the determined deadline. In particular, results can be made directly or indirectly through the setting

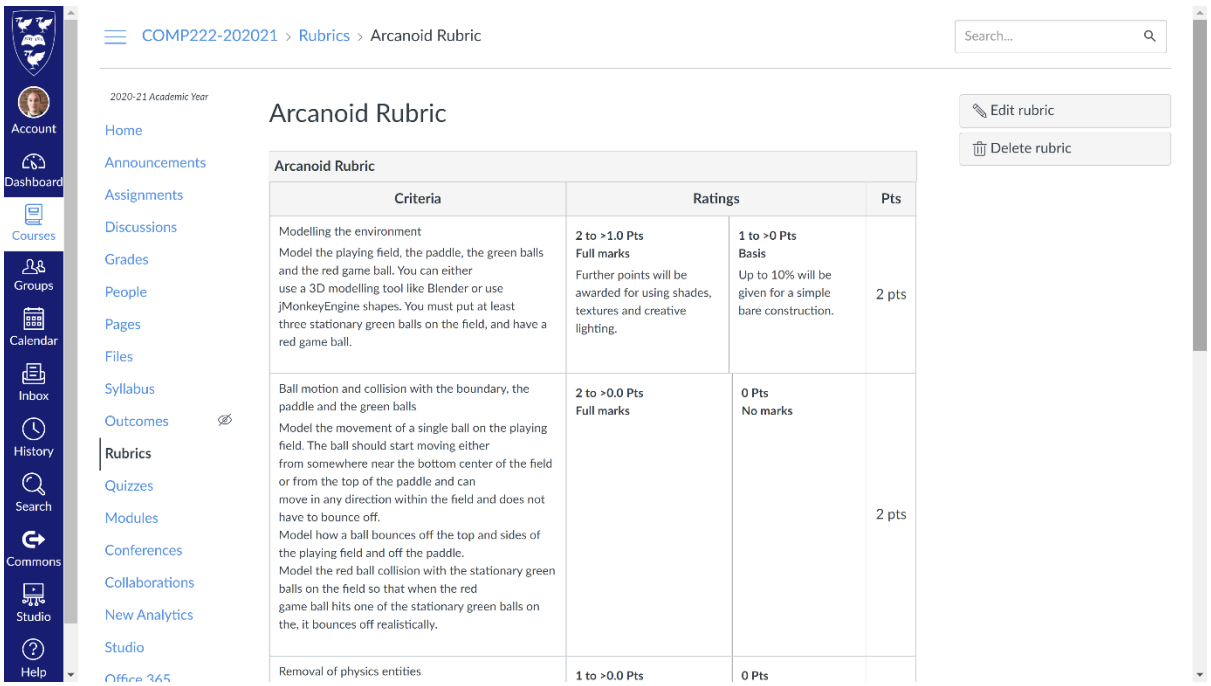
inside the Canvas Exam and also in Canvas Grades, which have to be switched off manually and in advance within Canvas.

The online exam was populated with new questions, as well as with questions modified and adapted from previous examinations to facilitate automatic assessment. The following Picture shows the preview of a typical sample exam question in multi choice format:



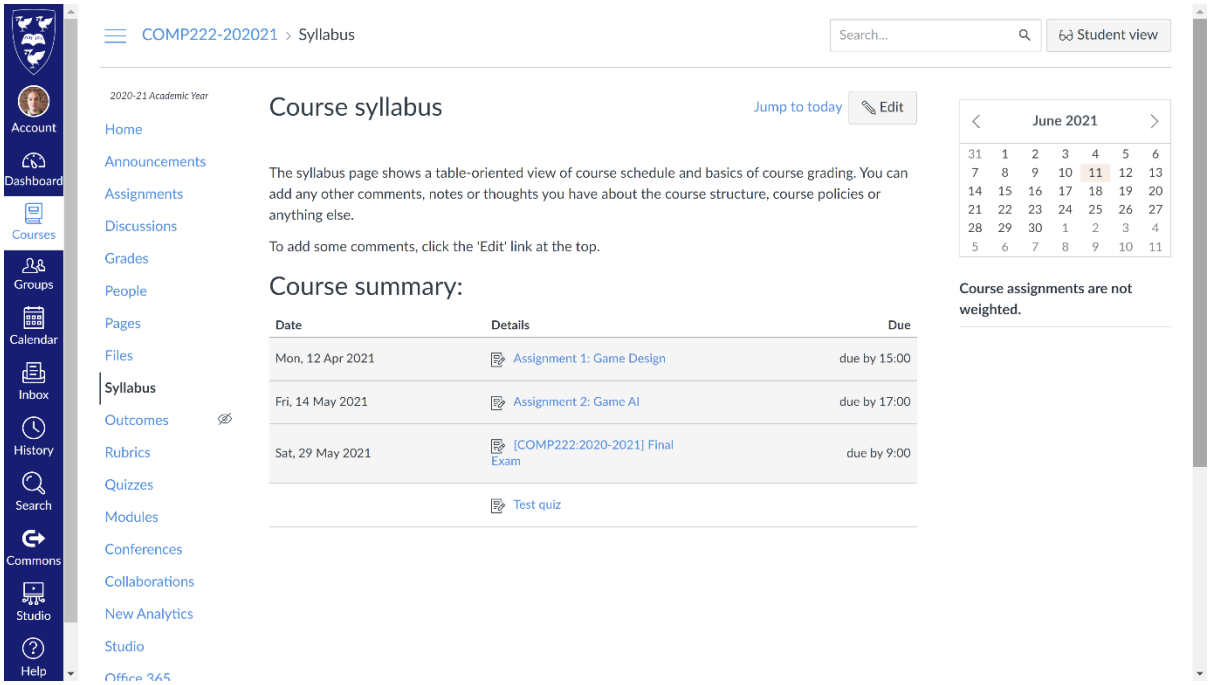
More extensive use of this functionality will be made in the future by creating new questions, using different automatic assessment question formats provided by more advanced examination functions within Canvas, as well as by connecting the output to “Canvas Outcomes”.

Canvas Rubrics



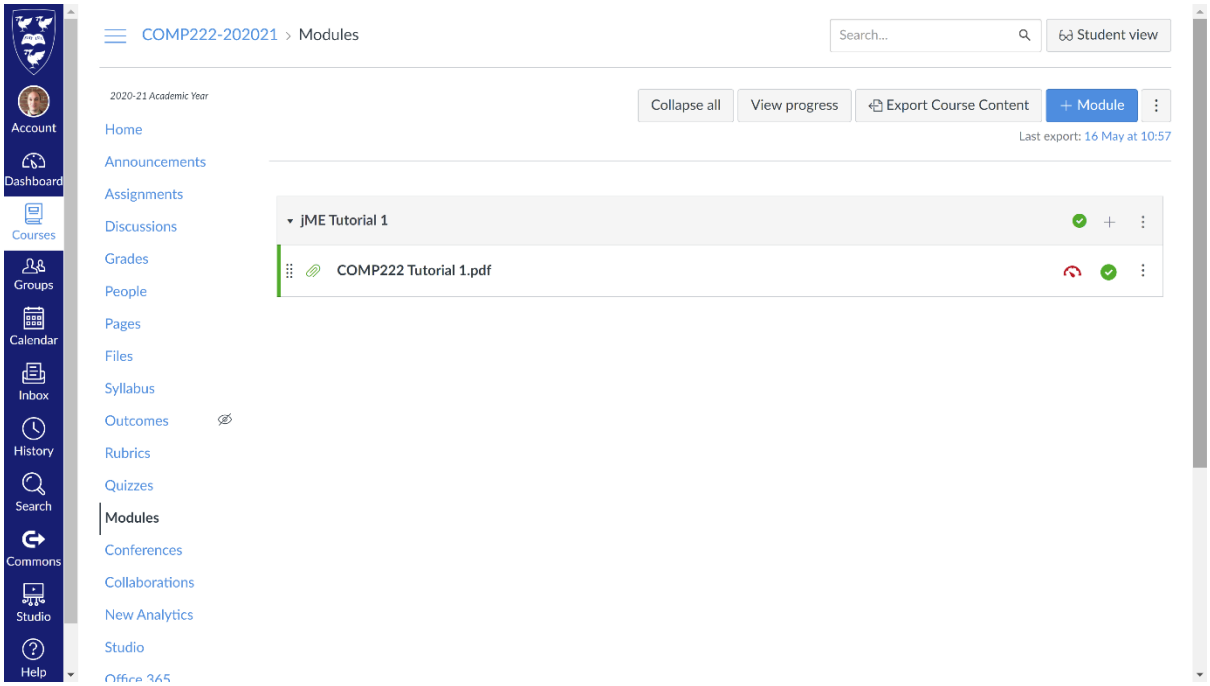
“Canvas Rubrics” was used to specify and announce the structure for grading the first assignment. The second assignment feature different options for implementation and thus the automated rubric was not used, while the final exam rubric was explained in text in the associated Canvas Quiz. More extensive use of this functionality will be made in the future by creating rubrics for more assignment, developed from the options of the second assignment, and by coordinating assessment with “Canvas Grades”, “Canvas Assignments”, “Canvas Quizzes” and “Canvas Outcomes”.

Canvas Syllabus



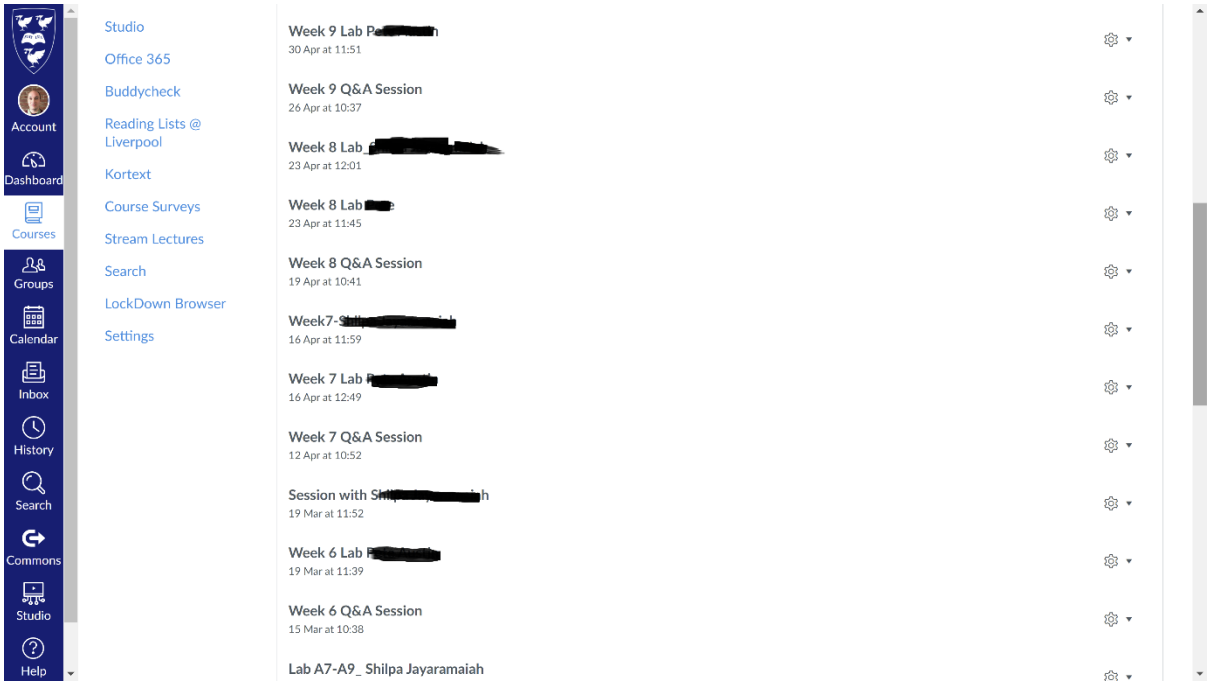
“Canvas Syllabus” was merely used as a collection point for the uploaded assessed submissions. More extensive use of this functionality will be made in the future by adding extra submissions and, as well as populating it with time sensitive content uploaded to “Canvas Modules”, in order to facilitate the concentrated overview of the module’s timely dissemination and management.

Canvas Modules



"Canvas Modules" was used rudimentarily to support the laboratorial activities. However, its importance in the dissemination and management of teaching in Canvas is great. Hence, in the future I plan to focus on orienting the module's overall Canvas development around this functionality. Its impact to the effective use of Canvas is central, as it interfaces various other functions, such as "Canvas Pages", "Canvas Assignments", "Canvas Quizzes", "Canvas Syllabus", "Canvas Outcomes" and more.

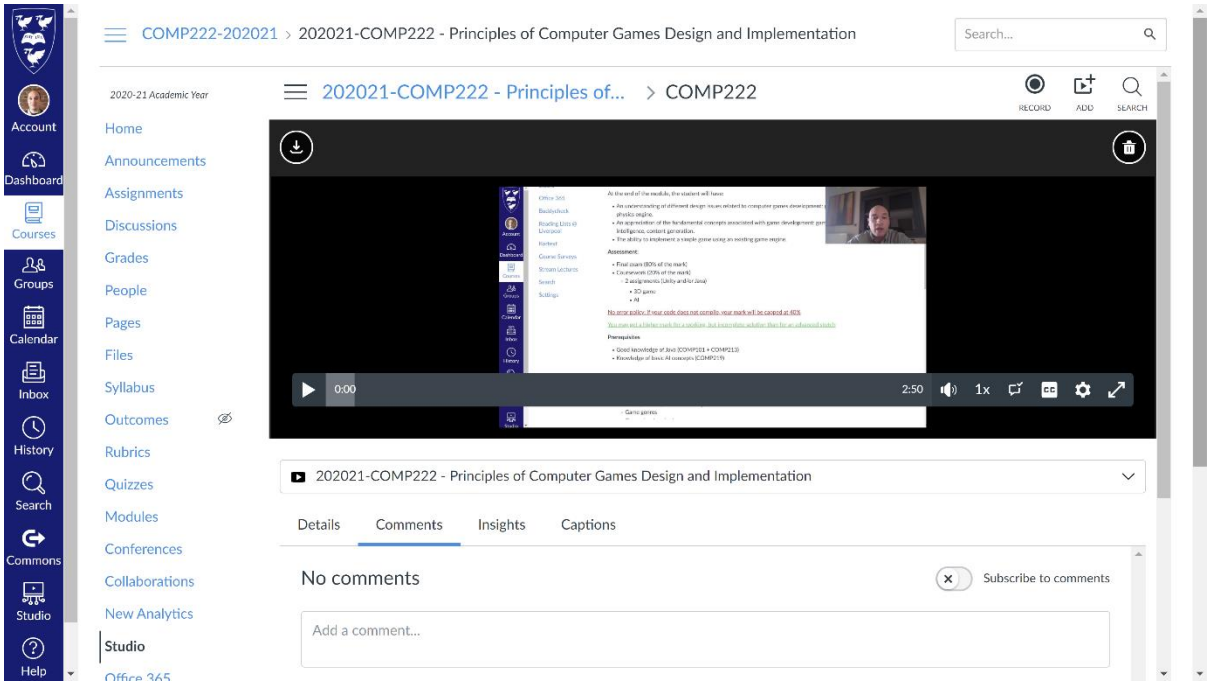
Canvas Conferences



"Canvas Conferences" was utilized effectively to engage in synchronous interaction with the students. Although Conferences has technical shortcomings, which I analyzed in Sections "4. Implementation" and "5. Evaluation", the supporting online software "Big Blue Button" is overall a

robust communication platform for large cohorts that facilitated the delivery of the live sessions very well. More extensive use of this functionality will be made in the future by utilizing Break Out rooms and encouraging access with open microphones and cameras by the students, as well as by resorting to more technologies enabling live communication, such as Microsoft Teams.

Canvas Studio



"Canvas Studio" was used to upload a short teaser video (around 2 minutes long) with general introductory information about the module to serve in advertising the module to new student cohorts and external audiences. The automatically subtitling of the video was corrected manually in post-processing it before upload. More extensive use of this functionality will be made in the future by uploading the new short videos to this streaming service as well, and by connecting the output to "Canvas Pages".

Canvas Outcomes

"Canvas Outcomes" was not utilized and published this semester. Initial use of this functionality will be made in the future to facilitate personalized assessment and feedback to individual students, after populating Outcomes with assessment results from "Canvas Quizzes", "Canvas Assignments" and "Canvas Grades".