Towards a Digital Classroom

A report on switching from paper-based to digital homework

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Abstract

   This paper looks at the initial steps towards creating a digital classroom. As the first step of a larger project of digitizing the classroom, in place of filling out paper homework assignments, students were sent links to Google Forms to complete with the same set of questions, which they could complete on their phone or on a computer. Students were asked to complete simple surveys at the beginning and the end of the semester regarding their attitude towards this new format. Progress test results were also used to compare the students' comprehension and retention levels. The research suggests that the digital homework was popular, but the test scores were somewhat ambivalent, suggesting more work is required.

Keywords: digital classroom,　Google Forms,　homework,　English language education

1. Introduction

   As a foreign English language teacher in a non-English major department, a key problem is providing the students with enough study time. At the time of this study, the students of Kyoei University's Education Department had a very busy schedule, and were given only one required class of English conversation a week with a native speaker, for fifteen periods a year, for the first two years of their four year program (this has since been reduced to one year for the higher level students). In addition, they have optional English Grammar and ESP classes with a Japanese teacher. By any reasonable measure, this is not enough for them to retain, let alone improve upon, any English language skills they acquired at high school.

   In order to expand the students' exposure to English, they were given extensive homework assignments in their conversation classes. These included: reading graded readers and writing a brief book report or completing a mini-test (downloaded from the publishers' websites); online homework and tests provided by the textbook publisher (Oxfordlearn.com); and additional homework provided by the teacher, with tests on these every two or three assignments.

   The readers and the teacher-provided homework consumed a great deal of paper and produced a great deal of paperwork. A department of 120 or so students, doing seven homework assignments plus reader assignments uses up reams of paper and a lot of expensive printer ink — much of it to be thrown away at the end of the semester (if not sooner). As any teacher knows, paper homework is also easily lost or damaged, meaning the teacher or student has to print it up again. Copying/plagiarism is also made rather easier when it is all written down on paper. Students would often miss deadlines due to tardiness, laziness or their other study commitments, such as on-site work experience at elementary schools. At the same time, rather a lot of

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teacher-time is spent marking papers and manually inputting grades into spreadsheets (occasionally resulting in errors).

Just about every student carries around with them in their pocket or bag an incredibly powerful computer and potential study-aid. 'Potential', as most students seem only to use their smartphones as gaming and communication devices. Informal inquiries with Kyoei students suggested that almost none of the teachers had the students using their phones as a study-aid. This is rather a pity and, to remedy this and cut down on the use of paper, a decision was made to try and shift as much of the homework to the internet as possible. It was also hoped that — given how increasingly wedded to their digital devices people are — allowing students to use their smartphones as a study aid would engage them with the content more and give them more opportunities to return to the homework to review it.

However, a major concern with the whole project is that the process of writing homework is a very important part of learning. Time and a degree of concentration is necessary to sit and write down the answers. With paper-based homework, students are encouraged to work in a quiet space and focus on their work. In using phones, students would no longer be writing their answers and therefore lose this physical aspect of the homework experience. They would also be more likely to do the homework on the train or other less than ideal place, possibly reducing their concentration and retention (this, however, has not been tested in this paper).

With all this in mind, a pilot scheme was put together. At the time these measures were taken, I was teaching all the second year students in the Education Department, allowing me to carry out the research on all of them. The paper homework was copied over into Google Forms, a surprisingly easy-to-use and free online tool that is part of the Google Docs suite, which allows students to answer multiple choice, true/false, short and long written answer questions. To see how effective this change would be, half the four second year classes were given the Google Forms based homework, the other half paper-based homework. It was decided to carry the research out on the second year students, as they had already spent their first year doing comparable paper-based homework.

This report examines how the students handled the digital format, what impact it had on their progress, and what measures were taken to cope with the issues that arose. Analysis of regular progress tests based on the homework content and the results of two surveys were used to assess the impact digitizing the homework had on the students.

2. Background

2. 1 Students & Classes

In the year the research was carried out (2016), there were about 109 second year students who completed the English course in the Education Department of Kyoei University. At the beginning of the first year, students were divided by ability into four classes by a placement test (PET), provided by the course textbook, Stretch One (Stempleski, OUP). However, scheduling clashes meant that all the first year classes were of mixed ability; an issue that held true for the second year classes too. Furthermore, even without the scheduling issues, with only four classes to band the students into, abilities inevitably varied greatly. By coincidence, the two classes participating in the experiment were the most diverse. Three students did not complete the course (or dropped out of university) so their results have been removed.

Students were expected to have a bilingual dictionary, either a paper one, a dedicated electronic dictionary

or (most popularly) a dictionary app on their smartphone. As first year students, all the students were given weekly vocabulary and grammar homework, and regular reading homework. All the homework was paper-based and all took tests assessing their knowledge of the homework. The tests were taken using a web and phone-based application called *Socrative - Student*, a free application that allows teachers (using *Socrative - Teacher*) to put together exams that students can complete on their phone, and are then given their results immediately upon completion. The test can then be immediately analysed and discussed with the students. This is a very good time- and labour-saving system that minimises the amount of limited classroom time consumed with testing (previously, the tests were peer marked which took up a lot of time and often required re-marking and meant any discussion of the test had to wait - and take time away from - the following class).

As part of the digital classroom project, second year students were encouraged (but not required) to use *Quizlet*, a free phone application aimed at improving vocabulary. A digital flash card app, students were given words used in each textbook unit, useful vocabulary for their classroom presentations (essentially pre-teaching the vocabulary), and were also encouraged to create their own sets or search for other useful sets amongst the millions created by other users. *Quizlet* allows for a very fun and competitive group game called *Quizlet Live*, which was often used as a warm up, and for vocabulary review at the beginning or end of the class.

As this suggests, all the students were used to doing paper-based English homework during the first year, but were also used to using their smartphones in the English conversation classroom.

The two higher ability classes were on Tuesdays, the lower two on Thursdays. The first of each class in the day was asked if they would like to participate in an experiment. The first Tuesday class voted by a decent majority to participate and have digital homework, the first Thursday class overwhelmingly voted against participating, meaning the second Thursday class was left without a choice other than to participate. In both cases, the students were clearly told they were participating in an experiment to reduce paper use and improve the homework experience. It should also be stated that the vast majority of the students were enthusiastic and lively learners, regardless of their level, and the classes were generally fun and active. On the basis of their first year test results, the highest and lowest classes would be doing the paper-based homework.

2. 2 Using Google Forms

Google Forms is part of the Google Drive suite, and is a surprisingly easy and intuitive application to use. It is rather limited in formatting options, but allows the user to add photos and videos, and choose from a variety of question formats, including multiple choice, word or sentence, and paragraph. A link can then be emailed to the students which opens the form in their browser (either on their phone or computer) which on completion sends the results back to the teacher's Google Drive to be marked. The students are then sent their scores from the Form including a summary of their homework. The teacher can supply comments that can be given for each question to all students, or just to an individual student. There is also the option to allow the students to see the correct answers. The results can then be used to generate a Google Sheets spreadsheet or be downloaded as a csv file.

The homework starts with an explanation of the language point covered. The first homework was exactly the same as that given in the paper-based homework. Later ones included some additional explanations and examples, taking advantage of the need to not be limited by a single sheet of paper. However, I kept the amount of extra material to a minimum, in part due to my inexperience and in part to keep the data comparable.

The first questions were multiple choice or cloze (gap fill) questions. These were followed by longer questions such as completing statements using hint words, word re-ordering, answering questions and similar guided writing. Finally, students were asked questions that required free writing, using the language they had

used in class and in the previous questions.

Another useful function of Google Forms is *Response Validation*, that allows specified inputs to be rejected or accepted, based on a choice of criteria. Failure to input the minimum or maximum number of characters, or the inclusion or exclusion of certain characters, will result in an error and a message or hint for the student directing them towards the desired answer. It can also be used to stop them from inputting Japanese characters, making sure they input the correct student number, email address, and so on.

Marking the questions was relatively easy. For the multiple choice there is usually only one correct answer, but for the cloze and structured writing questions, more answer options are possible. The Form can easily grade these without any problem. For example, "_ I borrow a pen?" could equally be answered with "May" or "Can". Questions where the student could write their own answers more freely had to be graded by each question. Google Forms allows for giving different questions different points, so a multiple choice question would be only 1 point, but a long form answer maybe 3 points; a student might lose a point for a missing or misspelt word.

The results were then downloaded as a csv file and copied into a prepared grading spreadsheet (which I had set up in Apple Numbers). This process took very little time when compared to marking paper-based homework, and drastically reduced the possibility of inputting results incorrectly. From the teacher's viewpoint, this is an efficient and clean approach to handling the homework. If one were to stay within the Google environment, this would be an even smoother and more seamless process.

2. 3 Weaknesses of the format

One of the initial and most obviously apparent weaknesses of the paperless format is that there is nothing physical to return to the students for them to use for further study. A pdf with comments covering the main issues in the homework were given to the students, but this is not nearly as useful as the personalised comments that can be given on a paper-based homework. The sight of red ink over a student's work can have a remarkable impact and work as an incentive for many students. It is also a useful study aid for preparing for tests and lets students know their strengths and weaknesses. Providing the same by email would be an extremely time consuming process and defeat an important objective of the process. Without anything physical to look at, the electronic-based classes were visibly less engaged than the paper-based classes with the follow-up homework review at the beginning of the following class.

2. 3. 1 Steps taken to improve the format

From homework assignment four (after the first homework test and the first survey), three measures were taken to improve the experience for the students.

Firstly, students were given a simple printout of the questions. This obviously went against the objective of paperless homework, but was a major issue for many of the students. It gave the students a physical format to interact with, and made the follow-up homework review much more meaningful. Theoretically, it also increased the amount of work the students had to do by requiring them to work both on the screen and on the page. At first, most of the students didn't complete the paper handout, but this changed a great deal with subsequent homework assignments.

Secondly, to make the forms more interactive for the students, some of the questions would give a 'hint' or feedback when an incorrect answer was entered, with the option of trying again or continuing on. However, I decided not to give too many hints that were not available to the paper-based homework.

Thirdly, the comments pdf was modified to include a personalised section, including the students name,

score and grade for the homework, plus a brief automated comment related to their performance. This was done using a useful free AppleScript app called *Pages Data Merge*. This in part makes up for the lack of red ink and teacher notes on the homework students are used to getting. For the last two homework assignments, these pdfs included the answers they gave for each question along side the correct answer.

3. Analysis

3. 1 Student Surveys

After three homework assignments, but before their first progress test, students were given an anonymised survey asking them what they thought of the paperless format, in particular in comparison to paper-based homework (S1). A second survey was given at the end of the course (S2). In the figures below, D1 indicates the lower ability class, D2 the higher ability class, so S1 D1 indicates the first survey results of the lower level class.

As Figure 1.1 shows, initially the digital format was unpopular, but by the end of the course, this pattern had largely been reversed.

Fig. 1.1 Do you dislike (1) or like (5) using digital homework?
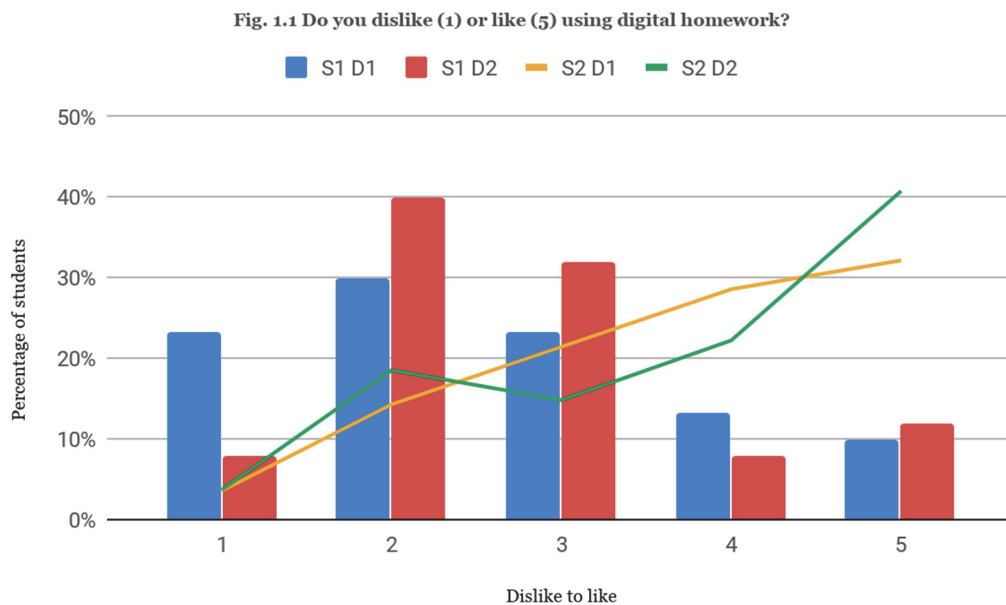
The second question asked how easy it was to recall the content of the homework when compared to paper-based homework. This is of course quite subjective, given that they did not have access to the paper version; it was asking them to recall their experience in the first year. As with the first question, the first survey clearly showed that students preferred paper-based homework; this pattern was somewhat changed by the end of the course.

Fig 1.2 How easy is digital compared to paper for remembering the content?

(1 difficult to remember, 5 easy to remember)

■ S1 D1　■ S1 D2　— S2 D1　— S2 D2
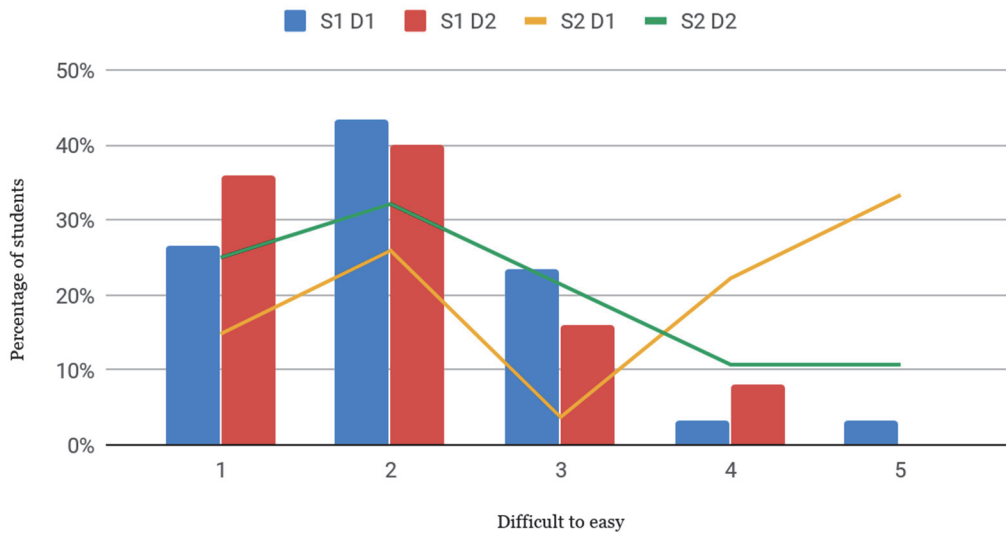
The third question was about how easy the digital homework was when compared with paper. As with the first two questions, the first survey was very much against the digital format, but in the second survey, this was somewhat reversed.

Fig 1.3 Which is easier to use, paper or digital?

■ S1 D1　■ S1 D2　— S2 D1　— S2 D2
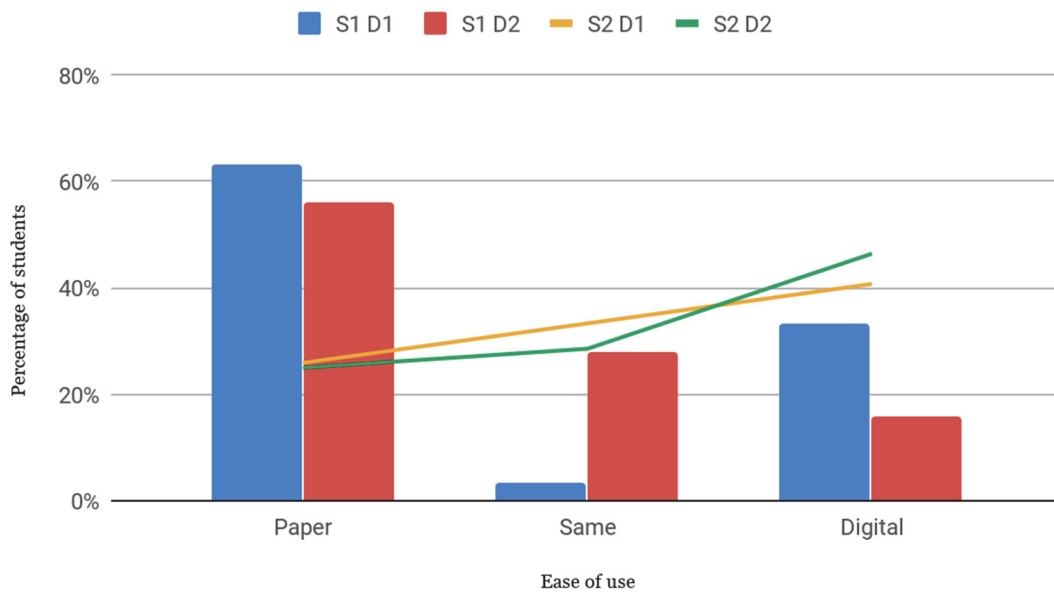
The reasons for these changes in opinion were probably due to the changes made in the homework and the emailed homework report. In the second survey, students were also asked about the homework reports and the response was overwhelmingly positive (90%+ giving a 4 or 5 out of 5 rating). The paper handout was also generally given a positive rating, but not enough students consistently used it to properly assess the impact (especially as there is no way to link the anonymous results to the test results, assessed below). Comments were also generally positive.

3. 1. 1 Completion Rates

One of the objectives of digitising the homework was to make it easier for students to complete the assignments, and to make it more difficult for them to avoid doing it, a particular concern with the lower ability classes. P refers to paper, D refers to digital, 1 to the lower ability classes, 2 to the higher ability classes. The higher classes had a 99% (D2) and 100% (P2) completion rate of all the assignments (the 1% in D2 was due to a student with health problems). The lower ability classes had a 7% (D1) and 8% (P1) incompletion rate. However, what these numbers do not show is the number of late submissions. Across all seven digital assignments, there were 31 late submissions. The number of late submissions for the paper-based one was much higher, but a record was not kept of the exact number.


Fig 2.Homework Completion rates
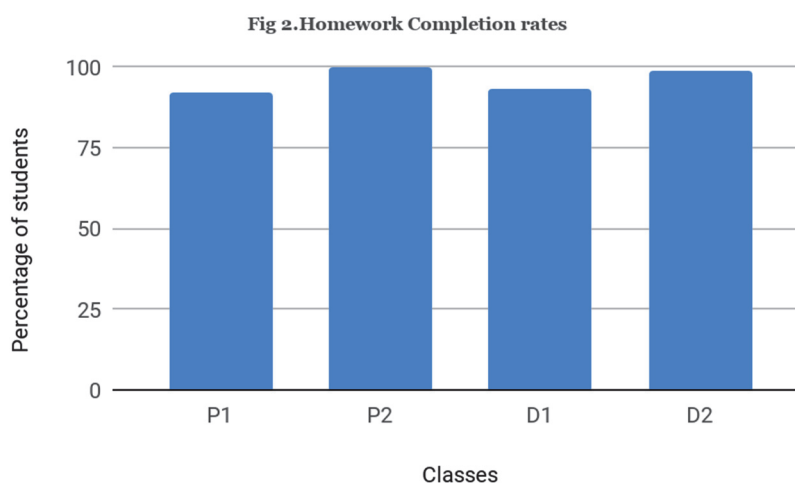
3. 2 Progress Test Results

All the students took the same tests in the same format. Comparing the scores of the students gives an objective view of the impact of the different formats. In addition to the tests in the second year, the scores for the Placement English Test (PET) taken at the beginning of their university career (thus acting as an assessment of their English knowledge on leaving high school) and the average score of their first year tests were used as a comparison. Although the two sets of tests are not directly comparable, as the PET and first year test examined a much broader but shallower range of language and grammar than the second year progress tests, the results at least provide a baseline. All the students took their second year tests using the *Socrative - Student* testing app on their phones. The students and their scores are grouped by their second year class.

The first second year test (2.1) was based on the first three homework assignments. Partly in order to increase the amount of data to analyse and partly in order to reduce the burden on the students, the second and third tests (2.2 and 2.3) were based on two sets of homework instead of three.

The test results (Fig 3.1) show a general upward trend. The first second year test generally showed a dip compared to their first year results, probably reflective of the students' long break from studying English conversation as well as the fact that it covered three homework assignments.

**Fig. 3.1 Test result comparison for all classes**
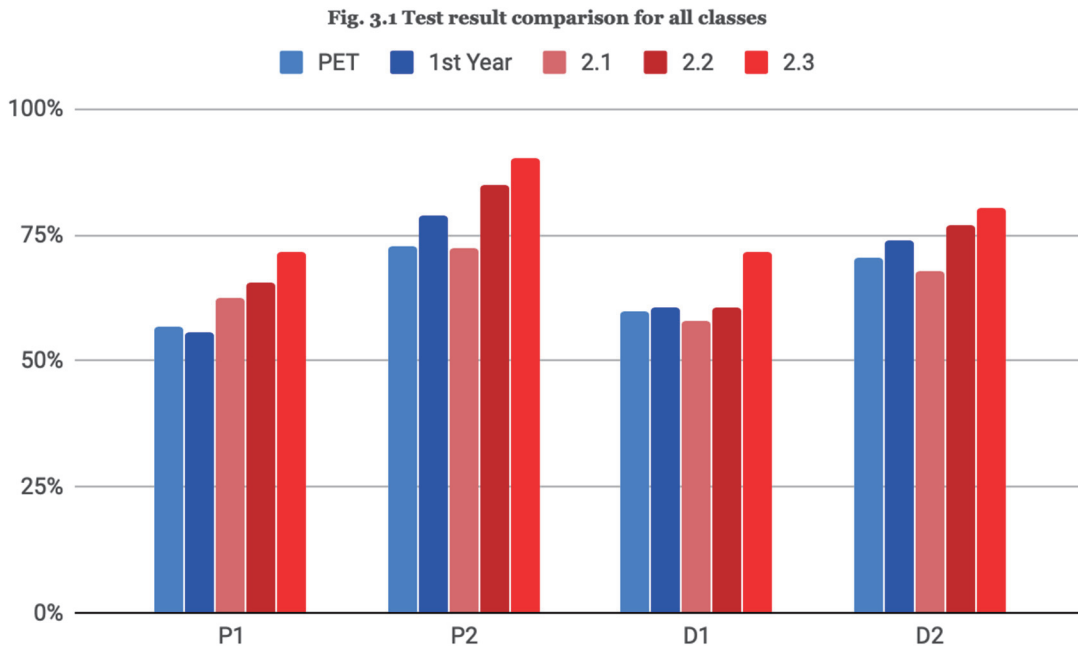
Overall, the two lower classes did not show much difference in their average grades. Although both higher classes improved their test score results from 2.1 to 2.2, P2 showed a greater rate of improvement than D2. In addition, in the third test ten students in P2 got 100% (37%) whereas only one student (3%) achieved the same in D2; one student in P1 also scored 100%. Over the course of the three tests, P2 showed a five percentage point improvement, whereas D2 showed a three percentage point increase. P1 had an 11 percentage point improvement, and D1 had an impressive 14 percentage point increase.

Another key data point, especially for unmotivated and low level students, is the number of students who passed the test. The pass mark for all the tests was 60%. Fig 3.2 indicates that only a handful of students in P2 and D2 are failing the test. The students in P1 made a steady improvement over the course of the semester. Students in D1 had a very bad pass rate in the first two second year tests, but by the third test had a pass rate of 85%, 1 percentage point more than P1. This improvement may be a result of improvements made in the homework format discussed above in section 2.3.1

Fig 3.2 Students scoring over 60%
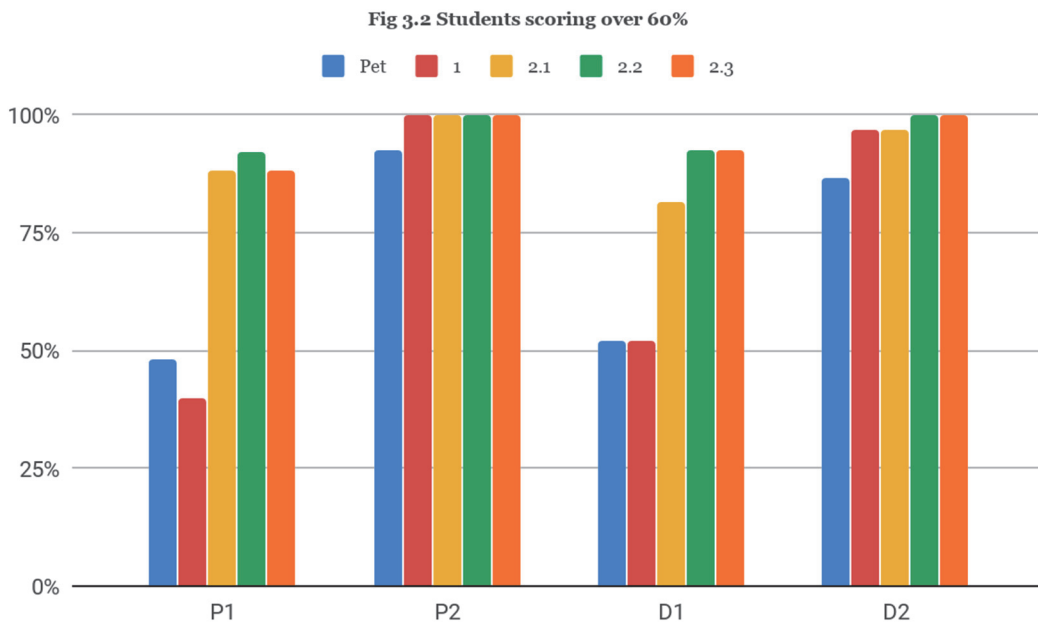
The test results show that all classes made an improvement during the course of the semester in relation to the PET and first year exam results. However, somewhat disappointingly for the project at hand, the paper-based classes made the bigger improvements. Although the improvement from the 2.1 to 2.3 was greater for D1 than P1 (the lower level classes) the improvement from the first year tests was much greater for the P1 group. In fact, both paper-based groups made a ten percentage point improvement over their digital peers.

Finally, I looked at the sex of the student and their test results. There were 70 men and 39 women in the course. Two thirds of P2 were women, the rest were roughly 50-50. As Fig 3.3 shows, there was very little difference in test results between the sexes. However, the women made bigger improvements than the men.

Fig 3.3 Test averages by sex
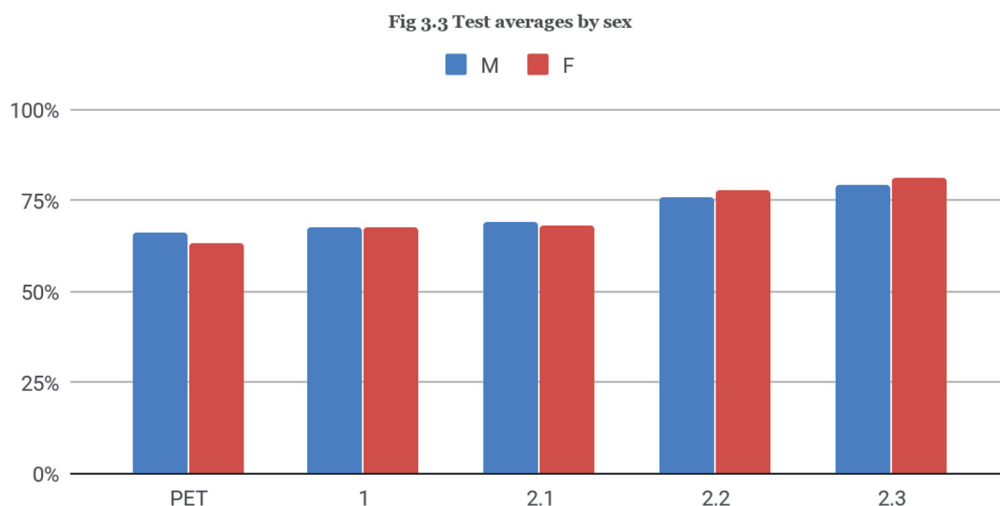
4.　Conclusions

The strongest initial sentiment from the surveys was that the students do not want to abandon the paper-based format. By the end of the semester, a majority of the students were accepting of the digital format. This suggests that, properly presented, students will be willing and able to study primarily on their phones.

The test results are far from conclusive, but strongly suggest that although it is possible to abandon paper, more is needed to be done. Students doing the paper-based homework on average did better in their tests than those doing digital-based homework (although the three students who dropped out were all from P1, and would have brought down the average for that group). This may be due to bad framing of the questions, not enough follow up, or the students reluctance to engage with the material in a digital format. Clearly, further work in this area is required.

From the teacher's point of view, there were several advantages. As mentioned above, digital homework greatly reduced paperwork and the drudge work of inputting results into a spreadsheet, as well as greatly reducing the chances of making an inputting mistake. Data was easily compiled and analysed, allowing the teacher to quickly know the strengths and weaknesses of the students. Another useful advantage, not mentioned above, is that typos or other errors can be quickly corrected without the need to throw away large amounts of paper or require students to write the correction on already distributed handouts. Although quite a bit of work has to be put into the process (making the forms, putting together spreadsheets, setting up the data merge process), once done the system works with only a little tweaking and some copying and pasting. This gives the teacher a lot more time for preparing materials and classes and data to help address the problems that come up in the homework.

Future improvements to the format will include providing a unique and directed learning experience for the student, by expanding and improving the hint provided to the students, providing more questions for students weak in a certain area and skipping repetitive, easy questions for the more able students. The ability of Google Forms to choose the next section based on a particular answer will, to a limited extent, allow for this, but will require a great deal of careful planning on the part of the teacher. The ability to give the students a broader and deeper explanation and many more questions, should increase the students understanding of the assignment, assuming they are willing to put in the work. Combined with other digital study options, this experiment was a tentative first step towards a paperless classroom. The next steps include a fully digital, phone-based textbook that integrates with the wider digital environment, such as Quizlet and group and pair work activities using Google Forms. Going forward, more research and development of the process is needed.

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