



Comparison of plagiarism rates between oncampus and offcampus engineering hydrology students

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1. INTRODUCTION

Plagiarism is a problem that has been described as being rampant within Universities and common across all disciplines including engineering [1]. Based on surveys, undergraduate engineering students admit to higher rates of plagiarism compared to most of their university counterparts [2], [3]. Cheating seems to be more prevalent in science, technology and engineering students relative to other disciplines [4]. Managing plagiarism is considered important as evidence suggests that student plagiarism is a strong predictor of unethical professional behaviour after graduation [5], [6].

This paper focuses on a specific type of plagiarism in the form of student copying of technical analysis. Our research question is “Do rates of plagiarism vary between oncampus and offcampus (distance) student cohorts?” Research in this area is limited but suggests that academic dishonesty is less common in online courses compared to courses delivered oncampus [7], [8] or at least is perceived to be similar [9].

A third-year engineering hydrology course offered by the University of Southern Queensland (USQ) is delivered to oncampus and offcampus students and thus presents a research opportunity to evaluate plagiarism differences between the two cohorts. Both student cohorts have submitted their assignments electronically in the form of Excel spreadsheets since 2010. Plagiarism rates will be examined retrospectively using the detection software Excel-Smash developed by Hellyer and Beadle [10] and conclusions drawn.

2. METHODS

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2.1 Description of the ENV3105 Hydrology course

USQ is a university with the main campus situated in the regional city of Toowoomba, Queensland, Australia. It offers, through the Faculty of Engineering and Surveying, engineering degree programs to students enrolled oncampus and offcampus via distance education. ENV3105 Hydrology is a third-year water engineering course offered to Bachelor of Engineering undergraduate degree students with agricultural, civil and environmental engineering majors. The course also attracts students enrolled in the three-year Bachelor of Engineering Technology and from a small number of postgraduate programs.

The offcampus students represent the majority (approx. 70%) of enrolments. All students have access to the USQ Learning Management System (USQStudyDesk) which contains course materials, assignments, tutorials and forums for students to interact and post questions. Oncampus students also receive weekly lectures and tutorial sessions delivered at the Toowoomba campus. Both student cohorts receive study resources (e.g. lecture materials, assignment updates) contemporaneously as the course progresses.

The course provides basic skills to carry out hydrologic analyses and designs that are frequently encountered in Australian engineering practice. It covers a range of techniques involving simulating floods for stormwater drainage, management of flooding and catchment water yield estimation.

Since 2010, course assessment has been based on the completion of two assignments (each 30%) and a 2 hour examination (40%). The assignment work is computational with students using Excel spreadsheets to undertake two main tasks 1) estimate design flood discharges at a gauged location by flood frequency analysis using annual and partial series [11] and 2) estimate peak flow reduction by reservoir routing and conduct a storage water balance analysis. These hydrological analyses utilise hydrometric data (rainfall, evaporation and streamflows) recorded over several years, so spreadsheets are the modelling tool of choice to complete the large amount of computations involved. From a technical perspective, the assignment tasks are basic and cover the fundamentals of engineering hydrology. The assignments in 2011 share the same aims as 2010, but made use of hydrological data measured at different locations.

For each assignment, students submitted a copy of their Excel spreadsheet and a written report (in pdf format) electronically onto USQStudyDesk. *Table 1* gives the numbers of assignments submitted by the two student cohorts.

Table 1. Number of assignments submitted by student cohort

Assignment	Offcampus	Campus
2010 Assignment 1	65	20
2010 Assignment 2	68	20
2011 Assignment 1	75	36
2011 Assignment 2	77	36
TOTAL	285	112

2.2 Marking of Assignments

Submitted assignments were downloaded from USQStudyDesk and distributed to three



markers for assessment in lots. One marker was an academic staff member and the other markers were external engineers engaged on short-term contracts. Each examiner was provided with a marking guide and instructions to advise the course examiner if there was any suspicion of plagiarism. No plagiarism detection software was used by the marking staff and they were thus reliant on recognising similarities between assignment work that may indicate incidents of student copying. Distribution of assignments was based on dividing the submitted assignments into three lots alphabetically by student name. Each marker was assigned a different lot grouping for Assignments 1 and 2 to limit marker bias.

2.3 Plagiarism detection by Excel-Smash

Spreadsheets provide a useful way to provide individualised assignments [12] and also can easily facilitate automatic grading using software such as Excel Grader [13]. In this paper, we are solely focusing on the systematic comparison of submitted spreadsheet files in order to detect cases of plagiarism.

USQStudyDesk archives all electronic submissions such as the Excel assignments and it was recognised that this provides a means to check the adequacy of the marker plagiarism checking and also address the research questions posed in this paper. During early 2012, all of the submitted assignments were analysed retrospectively using Excel Smash.

Excel-Smash is a Java application that detects similarities between Microsoft Excel assignments. Each submission is loaded in turn and a number of properties extracted – these properties include the name of the file creator, the name of the author who last saved the file and the file creation time and date. A representation of the text and formulas used within each assignment is also extracted. Excel-Smash compares the properties and content of each submission against every other submission. Where authors overlap or there is a high degree of similar content between submissions Excel-Smash prints a warning for a human marker to review.

3. RESULTS AND DISCUSSION

The outcomes of the assignment plagiarism analysis over the two consecutive ENV3105 offerings are summarised in *Tables 2* and *3*. This shows the number of similar assignments detected: also expressed as a percentage of assignments submitted by each cohort. Student identifiers (letters A to L) have been added to aid interpretation and discussion. As an example ‘A & B’ denotes that two students A and B submitted assignments that were very similar to each other.

Table 2. Plagiarised assignments detected by human markers (showing number of assignments, (percentage of assignments) and student identity codes)

Assignment	Offcampus	Oncampus
2010 Assignment 1	0	0
2010 Assignment 2	2 (3%) A & B	4 (20%) C & D, E & F
2011 Assignment 1	0	0
2011 Assignment 2	0	0
TOTAL	2 (0.7%)	4 (3.6%)



Table 3. Plagiarised assignments detected by Excel-Smash (showing number of assignments, (percentage of assignments) and student identity codes)

Assignment	Offcampus	Oncampus
2010 Assignment 1	0	0
2010 Assignment 2	4 (6%) A & B, G & H	5 (25%) C & D, E & F & I
2011 Assignment 1	0	2 (5.5%) E & I
2011 Assignment 2	0	5 (14%) E & I & J, K & L
TOTAL	4 (1.4%)	12 (10.7%)

An inspection of the tabulated data indicates that the plagiarism detection rate using Excel-Smash is substantially greater than that achieved by the markers (total assignments =16, versus 6 for the markers). Excel-Smash detected the same set of assignments as the markers, plus additional sets of plagiarised assignments. There were no assignments detected by the markers that were undetected by Excel-Smash, and no detected cases of oncampus and offcampus students plagiarising each other.

The lower marker rate of plagiarism detection by human markers is considered not to be attributed to a lack of diligence by the marking team, but due to the way that the assignments are split into separate lots for marking. Individual markers encounter a one-third share of the submitted assignments so at best can only identify incidents of copying within that particular subset of assignments. As the assignments are grouped alphabetically by student name, the likelihood of two (or more) copied assignments being in the one group is limited. Excel-Smash has the distinct advantage of analysing and comparing all submitted assignments together as one entire group.

Both human markers and Excel-Smash found that oncampus rates of plagiarism were significantly higher than offcampus rates. Overall, Excel-Smash found 10.7% of assignments submitted by oncampus students were subject to plagiarism, compared to only 1.4% of the offcampus students. Oncampus students have substantive opportunities to interact on a regular, face-to-face basis (i.e. attend lectures, share oncampus accommodation etc). This greater degree of informal social networking may also increase the temptation for students to engage in plagiarism. In contrast, offcampus students have more formal and individualistic engagement as the majority of learning interaction is conducted remotely via USQStudyDesk. Copying of assignment work was generally contained to within small groups of two, occasionally three, students.

The plagiarism rate is inconsistent between assignments. All of the detected offcampus cases were associated with a single assignment (2010 Assignment 2). Detection rates per assignment for the oncampus students ranged from zero to 25%, with the maximum also coinciding with the 2010 Assignment 2. The social dynamics of why the different cohorts both exhibit the highest plagiarism rate for the same assignment is unclear. A statement warning students against academic misconduct, including sharing solutions for assessable work, was clearly displayed on USQStudyDesk for both the 2010 and 2011 course offerings. The 2010 semester was the first occasion that a fully renewed hydrology course, both in format and content, was offered also with a new examiner. It may have been the case that some of the students were 'testing the waters' in this new environment of course delivery.

Following the Faculty policy for academic misconduct, students detected by the course



markers had their submitted work reviewed by the Discipline Head, subsequently confirming that blatant copying had occurred. The students were issued with a formal warning and, as it was a first offense in all cases, marks were deducted for that piece of assessment. However, this was not a deterrent for some students (E and I) who were found to have submitted copied work for both Assignments 1 and 2 in repeating the course in 2011 even though the penalties for student plagiarism increase substantially after a first offense is recorded.

Given that there is evidence of repeat offenders (found retrospectively by Excel-Smash), the number of oncampus students detected for plagiarism is 14.3% of the student cohort compared to 2.8% of the offcampus students. The majority (75%) of the detected oncampus students were international students indicating more needs to be done discouraging this student group from engaging in plagiarism. Other research point to the problem that it cannot be assumed that international students share the same principles of academic scholarship as displayed in Western cultures and a whole series of intervention strategies are often required. These interventions could involve a staged program involving activities such as orientation to Western practices, providing online resources and scaffolding assignment work [14].

4. CONCLUSIONS AND RECOMMENDATIONS

By reflecting on the outcomes of the plagiarism analysis involving engineering hydrology students, several conclusions can be drawn:

- Excel-Smash is a rapid and useful tool to detect plagiarism cases using electronically submitted spreadsheets. The detection rate is higher compared to manual detection by course markers.
- Plagiarism amongst offcampus students is substantially less than what is occurring within the oncampus cohort and this may be related to the increased opportunity for informal social networking that is available oncampus. Copying of assignment work was generally contained to small groups of two, occasionally three, students.
- Given that there is a substantial difference between student cohorts, a more targeted approach with the management of course markers could be introduced. Instead of grouping students alphabetically, increased plagiarism detection may result if a single marker is assigned to the oncampus submissions. This represents approximately a third of the course student number, so has minimal implications to the assignment workload handled by each of the three markers.
- Repeat offences of assignment copying despite the threat of academic penalty and the high proportion of oncampus plagiarism cases involving international students are two focus areas that should be addressed by careful implementation of intervention strategies.

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