

Software to detect collusion in academic institutions

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Abstract

This paper describes the development, implementation and evaluation of software designed to detect collusion and plagiarism in academic institutions. The software allows for inter-class and inter-semester comparisons with the added advantage of having an “in house” database of assignments over time. Students and staff at the institution where the software was tested were happy with its use. Advantages in the use of the software included significant time savings for staff over the previous methods of detection and a more objective method of analysis. Students considered that the software was fair and provided a level playing field for all concerned.

1. Introduction

This paper describes the development, implementation and evaluation of software designed to detect collusion and plagiarism in academic institutions. The software has been named the essay inspector and it is an online tool that has been developed to detect instances of student collusion. Students enrolled in designated courses electronically submit their work (essay, report or other plain text document) for analysis the software then compares documents with each other. This comparison process can be limited to fellow classmates or can be expanded to multiple classes and even multiple semesters of previously collected work. It can also be used to detect plagiarism if suspected.

The Essay Inspector has been in use for three years and the purpose of this paper is to describe and evaluate the system. This paper is structured in the following way.

Firstly we provide a literature review of the plagiarism and collusion problem. This is followed by a description of the software and the results of the evaluation of the software by both staff and students. The final section provides a discussion of the benefits and limitations as well as conclusions.

2. Review of the Literature on Collusion and Plagiarism

Academic dishonesty has been of increasing concern to educational institutions in recent years [1] with collaboration, and plagiarism in particular steadily increasing over the last 20 year period [1]. Cheating by students is expected to and is continuing to rise [2] with approximately 60% of students admitting to cheating at least once [2] and more recent findings indicating 75% [3]. In addition, 50% of students have admitted to collaborating on individual written assignments [2]. These figures are alarming considering the amount of plagiarism and academic dishonesty that goes undetected.

Plagiarism can be defined as “a major form of academic dishonesty involving the presentation of the work of another as one’s own” [4]. More specifically, it is “the unauthorized use or close imitation of the ideas and language/expression of someone else. It involves representing their work as your own. It is usually associated with little or no acknowledgement of the borrowing and the source” [5, p. 312]. DePaul Universities “Academic Integrity Policy” [4] states that plagiarism can come in many forms and can include explicitly copying or paraphrasing parts or complete pieces of work without correctly acknowledging the author of the material and submitting the

work of someone else as their own. The direct victim of plagiarism is the author of the misused work, however there are many other victims including journal editors and reviewers, and conference program chairs and reviewers to name a few [6]. Therefore, it is important to protect the intellectual property of others for intellectual, social, economic and moral reasons [5].

Due to the large amount of students who admit to academic dishonesty, many variables have been examined in order to explain what sorts of students are more likely to cheat. Several characteristics of students most likely to engage in academic dishonesty were found to be males [6], [7], [8], day students, and those who are young, single, part-time workers potentially with low GPA's [3]. In regards to collaboration, students are quite often confused by teachers who do permit working together and those who do not [2].

In addition, the reasons why students engage in academic dishonesty are plentiful. Empirical research on why students cheat within examinations has grouped situational factors in to two areas [3]. The first category is general environmental factors such as the size and composition of the class and proximity of surrounding students, the complexity of the exam and the level of monitoring by staff members [9], [10], [7]. Friends were also found to be a contributing factor, most likely because of peer pressure of which the authors argue is an increasing problem due to the increase in group work within learning activities [3] as was the student's lack of commitment and maturity [1]. The second category is the nature of the cheating episode where students may be more inclined to copy someone else's exam than resubmit an exam in

which students had changed the answers [3]. Stress, pressure to succeed academically and poor penalties are also determinants of academic dishonesty [6].

One significant area identified is the student's beliefs about what they are doing. [3] found that students will continue to cheat because they believe that it is worth the risk and believe that everyone else is doing the same. This is exemplified by the culture among students to protect those who cheat rather than expose them to punishment [6]. In addition, the ability to get away with cheating may increase the student's belief that they will get away with cheating in the future [11]. This is supported by [12] who found that students were less likely to plagiarise if they believed they may be caught. This belief is, in effect reinforced due to the low exposure of students who do offend because academic honesty is traditionally rectified on a personal basis between the student and teacher [6]. Another issue is student's beliefs regarding morals and the effect of dishonesty upon others which has been shown to affect dishonesty [3].

Several studies have shown that students undertaking business are more likely to engage in cheating than any other area [13], [14], [7]. Forms of cheating and plagiarism are common in both graduate and undergraduate students of business [15] with nearly 87% of business students admitting to cheating [6]. Students undertaking business were also found to have lower moral development and moral reasoning than students in other fields [16]. Whether academic dishonesty is most prevalent in all areas of business is yet to be examined with [3] being one of the first to identify the need to examine whether academic dishonesty differs among types of business majors.

Minimal research has been undertaken on differences in academic dishonesty between domestic students and international students with much of the existing research being very recent. This research has concluded that students from the U.S. are more likely to engage in academic dishonesty than students from the U.K. [17] and Hong Kong [14]. However, an examination of hospitality and tourism students from Hong Kong indicated that plagiarism and copying is not considered very shocking and they exhibit a relatively high tolerance of such behavior [18]. In addition to this is the finding that students from countries with high uncertainty avoidance are more likely to cheat, but are also more likely to respond to punishment [18]. This is due to the clash that occurs when many cultural differences from across the world join [5]. Because of this, [14] conclude that cheating on exams is of concern to students from individualist cultures where 'as out of class assignments are a concern to students from a collectivist culture.

Sims [19] argues that preventative measures for plagiarism have been suggested (see [20]; but their effectiveness has not yet been thoroughly examined and integrated into a model for implementation [20]. Yeung [18] recommends that students need to be educated about plagiarism and its potential penalties early in their study and reiterated throughout to encourage compliance. This is supported by [21] who argues that preventing plagiarism should be done proactively by requiring students to sit exams and submit assessments progressively and educate students in more depth about what is and is not acceptable. A formalized plagiarism prevention policy is beneficial in reducing incidents of plagiarism [19]. This supports similar findings showing some areas of improvement in copying, cheating notes, and giving and receiving exam assistance with the implementation of formal policies [1]. This policy, including

codes of academic conduct, should advise students as to what plagiarism is in its various forms, and the associated penalties [5]. However, governance mechanisms such as the existence of an ethics committee are not effective if it is the only initiative in place [27].

The increasing impact of technologies on academic dishonesty such as the internet has also become of large interest in recent years [22], [23]. Other methods include information systems such as various electronic sources, computers and word processing [12]. Many argue that the use of the internet will increase the quantity of plagiarism incidents over time [24] particularly in written assignments and is already claimed to be the number one factor contributing to plagiarism today [21]. This is primarily due to the mere nature of the internet which facilitates plagiarism through its ability to store, manipulate and reproduce ideas, its accessibility and the large amount of information that is available [24].

Because dishonesty has traditionally been rectified through better teaching and assessment methods, the amount of literature relating to the success of automated plagiarism detection is minimal [26], [12]. Of the research that is available, an automated detection system has been found to reduce incidences of plagiarism over time when students understand that they are more likely to be caught [12]. Furthermore, it requires minimal time by the teacher to operate once they become familiar with the package [12]. However, [12] also points out the use of an automated detection system in reducing plagiarism involves more than just operating the software. He states that unless it is implemented across all courses within a field, students may choose to take an alternative course where the chance of detection may

be less. In addition, its use must be accompanied by other proactive measures including discussing what plagiarism is and what penalties are associated with it.

3. Background to software development

The primary aim of the development of the automated system was to provide a clear message to students that the old manual system would be replaced and that the new system would detect collusion and that they will be caught if they attempt it. A secondary aim was to reduce the time needed to report plagiarism as the manual system was so labor intensive that it provided a disincentive for staff to report an incidence. An institution in Queensland, Australia adopted the essay inspector and staff and students from this institution were used in the study. Initially informal interviews with staff at the academic institution identified the following points regarding plagiarism:

- Students are, in some cases, unaware of both what constitutes plagiarism and the severity of the penalties associated with detection. This is especially the case with first year students (freshman student in the US) and international students.
- Students are inclined to seek assistance from fellow or former students in preparation of assessment pieces (collusion)
- When students do engage in copying of text from external sources such as textbooks and the internet, teaching staff members are confident that it will be picked up in the marking process due to a change in vocabulary etc.

These points were noted and software developed to help in the detection of collusion.

3.1 The software

The was developed in order to facilitate the electronic collection of students submissions and to report on who has submitted, what time they submitted and how much, if any, of the submitted work matched those of other students.

Access to the system is secure for both students and staff and, in the case of students; the system is able to identify their current institutional credentials automatically and transparently. The object is for staff to manage the subsequent database (including collection times) either individually or as a group in the case of group assignments. In the case of group assignments, only the nominated group leader is asked to submit the assignment into the essay inspector. Staff is able to manage and control documents that are used in the collusion reporting system and can manage their personal details such as user identification and password.

3.2 Benefits

Based on initial conclusions and testing the following benefits of implementing and mandating the use of this system are:

- The system can clearly identify and assist teaching staff members in the detection of work produced in collusion
- The system will act as a deterrent to students who intend to act in a collusive manner

- The system, through the first two points, will indirectly aid in increasing the standard of work produced by students at the learning institution and conversely, identify areas of underperformance
- The learning institution can formally demonstrate their commitment to the educational process and associated standards by promoting their involvement in and use of the system
- The learning institution retains full control over collected data and therefore does not breach student rights in terms of privacy

3.3 How the System works

The system user creates a project, ostensibly attached to a specific course and allocates a collection starting and ending date.

Students who are asked to submit their assignment navigate to a page containing the project submission link and complete their submission by copying and pasting their text based data into the area provided. The students are then verified against the institutions authentication module.

The system user signs into the system to manage established projects. Dates and descriptions are modified to suit course constraints such as extending assignment deadlines.

The system user signs into the system to create and manage control documents. Control documents are created in a similar fashion to submissions. The system user

signs into the system to run a submission report. The report is run over a single project or a set of projects and displays submission times, submission word counts and also identifies where any submitter has submitted more than once.

The system user signs into the system to run a collusion report. The report is run over a single project, a set of projects or a number of projects or sets. The report also includes nominated archive projects and project sets, as well as nominated control documents. The report displays the target submissions along with total matching percent and top three matching submissions. The system user drills down into a specific submission's matches and views a side-by-side comparison document.

4. Initial testing and outcomes

In semester 2, 2005 a primary data set was collected from students at an academic institution in Queensland, Australia and analyzed. The outcomes of that process were:

- The system identified two clear cases of collusion with large sections of duplicated content
- The system identified that the level of collusion amongst students who completed submission was very low and below expectations
- A small number of students did not complete the submission

In subsequent semesters a number of points have been noted regarding submissions:

- The system identified submissions that copied work submitted from previous semesters, even though the project questions were not identical
- The system identified submissions that comprised of a number of different sources, where document matched small sections to a large number of other documents

e.g.

submission 1 matched submission 2 10%

submission 1 matched submission 3 15%

submission 1 matched other submissions in total 20%

5. Evaluation of the software by both staff and students

5.1 Materials and Methods

A mixture of qualitative and quantitative measures was used to determine the usefulness of the Essay Inspector. This involved separate questionnaires for students and staff and a series of unstructured interviews of academic and managerial staff from the institution.

Two questionnaires each containing attitudinal questions based on a 5 point likert scale and open ended questions were administered to staff and 232 students respectively. The results are shown in the results section of this paper

5.2 Results

The results are divided into student results and staff results.

5.2.1 Results for students

The Cronbach's Alpha for reliability for the student survey questionnaire was 0.735 and this is over the 0.7 considered acceptable in social science research. Table one

provides an overview of the average responses by students to the five questions asked, namely;

- V1. I think Collusion (cheating from other students) is a problem at [the institution]
- V2. I find the rules about Collusion (cheating from other students) easy to understand?
- V3. I fully understand the rules about Cheating at [the institution]
- V4. I find the Essay Inspector easy to use?
- V5. I think the use of the Essay Inspector is fair for students 1=strongly disagree 5=strongly agree

Table One Mean responses to the student questionnaire (1=strongly disagree 5=strongly agree)

	V1	V2	V3	V4	V5
Number of responses	231	231	232	232	232
Mean	3.05	3.55	3.82	3.72	3.70
Median	3.00	4.00	4.00	4.00	4.00
Std. Deviation	1.080	.976	1.054	1.114	1.170

Collusion was not considered a problem at the institution by students with a rating of 3.05 out of 5. The students appeared to fully understand the collusion rules at the institution (3.82) and also found these same rules easy to understand with a rating of 3.55 out of 5. There was also a strong indication that students found the essay inspector easy to use (3.73) and that it was fair for students (3.70). Many students provided additional information in the open ended question section of the questionnaire. A large majority of students had positive things to say about the software and these included statements such as “it is fair to all students”, “it is good for detecting collusion”, “it improves academic skills” and “it encourages students to do their own work”. One unexpected advantage provided by students was that the system provided a date stamp and proof of submission before the deadline.

5.2.2 Results for Staff

A total of 12 staff completed the questionnaire and the questions are shown below.

- V1. Is collusion a problem in the specific course/s you teach?
- V2. Is collusion a problem at your institution in general?
- V3. How would you rate The Essay Inspector as a method of collusion detection?
- V4. How would you rate the ease of use of The Essay Inspector?
- V5. In relation to your previous and/or current methods of detecting collusion, how much of an improvement is The Essay Inspector?
- V6. Do you think The Essay Inspector saves you time?
- V7. How well would you rate the student's acceptance of The Essay Inspector?
- V8. How well would you rate your acceptance of The Essay Inspector?

Table Two Mean responses to the staff questionnaire (1=strongly disagree 5=strongly agree)

	N	Minimum	Maximum	Mean	Std. Deviation
V1	12	1	5	3.75	.965
V2	12	1	5	3.75	1.055
V3	12	3	5	4.17	.577
V4	12	2	5	3.42	.900
V5	12	3	5	4.42	.669
V6	12	1	5	3.33	1.557
V7	12	2	5	3.58	1.240
V8	12	2	5	3.92	1.165

Staff rated all aspects of the Essay Inspector very highly. In particular it was highly rated as a method of collusion detection (4.17) and as a superior method to previous approaches (4.42).

Staff also provided additional information in the open ended question section of the questionnaire. Some of the positive aspects included statements such as “time saving and transparency and objectivity”, “enables [the analysis of] suspected incidences of collusion across classes and previous semesters”. Negative aspects revolved around the extra work required as more incidents being detected, however the long term advantage of greater detection was acknowledged.

6. Discussion and Conclusions

One benefit of Essay Inspector is its ability to compare student answers over past semesters. An advantage of this would be that staff can set the same assignment over many semesters secure in the knowledge that inter-semester copying will be detected. The institution in question has a high number of international students from Asia. These students come from a collective culture and collective cultures appear to encourage collaboration which in some cases can be confused with collusion by the authorities.

Previous approaches to plagiarism at this institution have been problematic as the onus was always on the busy academic staff member to identify and prove the existence of collusion or plagiarism. This became a major disincentive as excerpts of suspected plagiarized material had to be cut and pasted into a document, a comparison document produced and the relevant sections highlighted. These highlighted sections then had to be shown to the student and if proven guilty, sent to the relevant academic supervisor who usually decided the punishment. The amount of work required for this to be effective was prohibitive and for all practical purposes meant that suspected plagiarism was never reported. This approach automates the procedure and allows non-academics to interview students about suspected collusion with the full report displayed in front of the students involved. The amount of duplication is shown as a percentage and it is up to the academic to decide if it is a case of plagiarism or collusion and this decision will depend on the discipline.

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