Detection and Prevention of Plagiarism in Electrical Engineering Education

Introduction

In recent times, plagiarism has attracted unprecedented attention in higher education. It is generally agreed that the advent of the Internet with the ease of access it provides to sources of information has contributed to the proliferation of the practice of plagiarism. Plagiarism has become a global problem, encouraging alliances of higher education institutions around the world, creating incentives for the development and use of highly specialised and costly software platforms in combating the phenomenon.

Until recently it would have been considered inconceivable for students of electrical engineering to resort to plagiarism. Yet, it seems hard to deny that there is a disturbing trend indicating that plagiarism is on the increase. Examples range from the use of circuit designs to adopting computational code without giving any credit whatsoever to the source.

What is plagiarism?

Plagiarism is variously defined as "a piece of writing that has been copied from someone else and is presented as being your own work" [1] . The on-line Encarta Dictionary: English (U.K.) unmistakably gives it as "***stealing somebody's work or idea:*** *the process of copying another person's idea or written work and claiming it as original*" [2] .

The University of South Australia defines plagiarism as "a specific form and serious act of academic misconduct". Acts constituting plagiarism are declared to include[3]:

- "direct copying of the work or data of other persons, from one or more sources, without clearly indicating the origin. This includes both paper-based and electronic sources of material from websites, books, articles, unpublished work such as theses, working papers, seminar and conference papers, internal reports, lecture notes or tapes, and visual materials such as photographs, drawings and designs;
- using very close paraphrasing of sentences or whole clauses without due acknowledgment in the form of reference to the original work;
- submitting another student's work in whole or in part, where such assistance is not expressly permitted in the course information booklet;
- use of another person's ideas, work or research data without acknowledgment;
- submitting work that has been written by someone else on the student's behalf;
- copying computer files, algorithms or computer code without clearly indicating their origin;
- submitting work that has been derived, in whole or in part, from another student's work by a process of mechanical transformation (eg changing variable names in computer programs)
- in any way appropriating or imitating another's ideas and manner of expressing them where such assistance is not expressly permitted in the course information booklet."

Reasons for plagiarism

The reasons given by those who have resorted to plagiarism are many and varied. Time pressure is one frequently quoted reason, particularly in the case of some mature age students with employment and family responsibilities. Another reason advanced in academic integrity hearings is that the student did not know what constituted plagiarism in the first instance. This position is taken particularly by international students from south-east Asia. In their case poor language skills is another factor. Then there is the knowledge gap problem: if the subject matter is hard to comprehend and knowledge is missing, plagiarism is resorted to as the way out. Fear of failure is another major factor. The extract below from an appeal letter by one student found guilty of plagiarism typifies some of these reasons (unedited text).

> "…I am writing a letter to express my sincere apologies for the mistakes that had occurred for my module EST 1 as this as caused me 2 fail the subject.
> Please allow me to explain my faults in this report that was submitted for this module. Firstly it was a similar title compared to the report done in my polytechnic days, as so I have extracted parts of it and some information regarding this from my previous well graded piece of report. I have least expected this as an outcome as I have only used my previous report as a main source of information for this present report. To add on to my mistakes i have left out the reference part at the end of the report. This has also been another essential part for my failure. This has caused me to be guilty of plagiarism in my recent work. I have learnt my lesson from this experience and promise not to repeat it in future.
> I would like to plead for another chance to rectify my unawareness. Kindly give me a chance to pass this module and not repeating the whole module once again. Pls forgive my mistakes and give me a lighter punishment than repeat the module itself. As I have targeted 2 years to complete this degree course and re taking this module would lead me to an extension of my course duration."

The following extract from the University of South Australia policy statement regarding academic misconduct acknowledges and outlines the extenuating circumstances which are taken into account when dealing with alleged plagiarism offences[3].

> "The University of South Australia recognises that academic misconduct can occur through lack of familiarity with academic conventions and therefore all issues of academic misconduct will be considered in the context of the following factors:
> a. the extent of the misconduct
> b. the student's intention and/or motivation"
> c. contextual factors such as:
>   (i) stage/level of program
>   (ii) number of previous offences
>   (iii) the student's learning background
> d. academic conventions within the relevant discipline
> e. the impact of a particular outcome on a student's progression
> f. information provided to the student about academic integrity as part of their course, and

g. where applicable, information about the student held in the academic misconduct database."
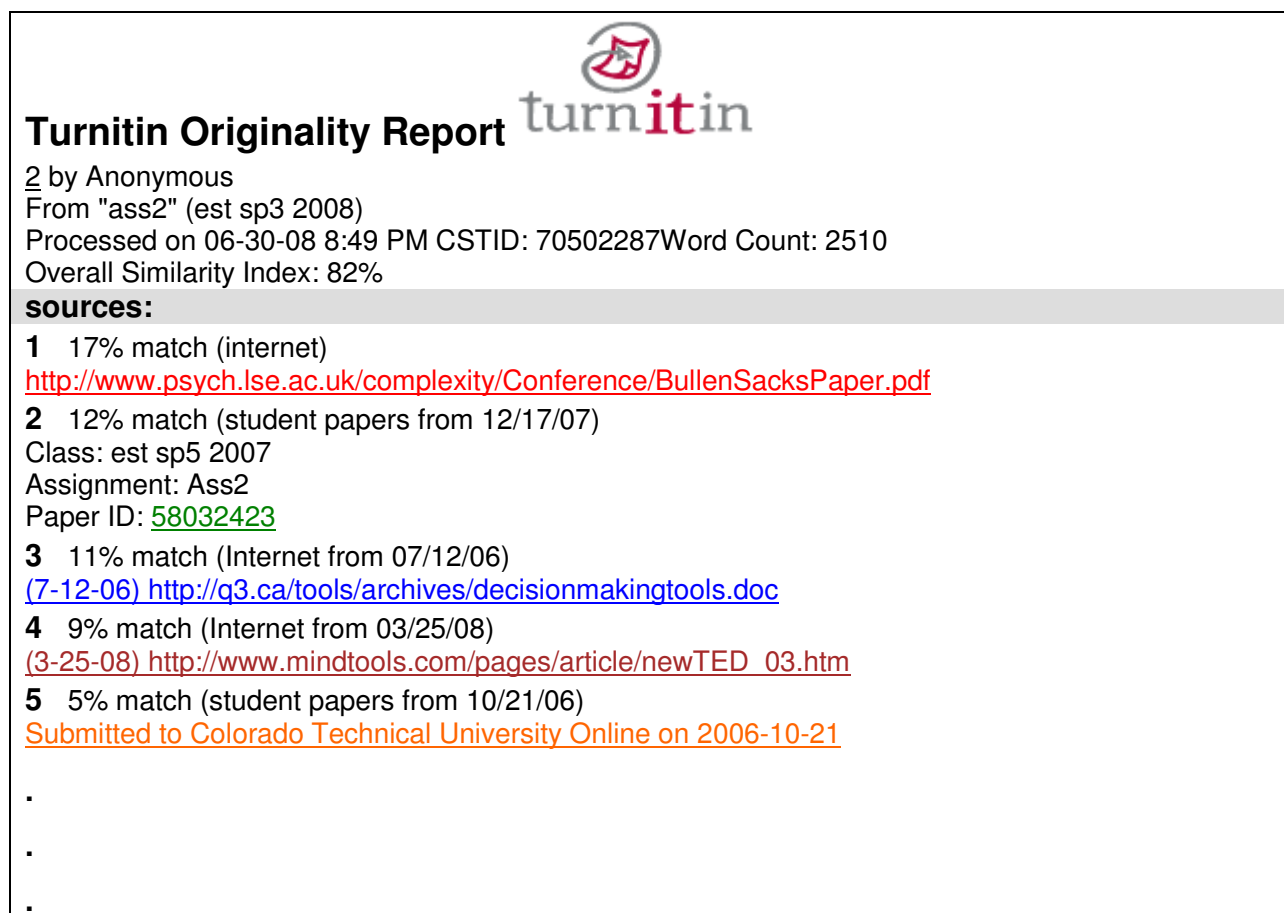
How to detect plagiarism?

There is a number of ways by which plagiarism can be detected. These vary from the intuitive to the sophisticated. In the case of text-based assessment tasks, such as assignments and reports, the style of writing may provide the basis for detection. For instance, if the text is written in immaculate English by and large, but contains passages with syntax and spelling errors, the assessor would not be wrong in suspecting a case of plagiarism. In such a case, suspicion could be tested by submitting samples of text to popular search engines on the Internet which may invariably yield the source from where the *perfect* passages may have been imported.

In cases of plagiarised computer algorithms or electronic circuits, academics assessing the work will have to bring their knowledge, experience and intuition to bear on the case in forming a judgement as to whether the submitted work is student's own work or not.

The prevalence of cases of plagiarism has led to the emergence of plagiarism detection software such as Turnitin, CopyCatch, EVE and WordCHECK along with many others, some of which are accessible at no charge[4]. In support of this development, it has been argued that sheer numbers of work submitted for assessment by large classes make it virtually impossible to detect plagiarism, unless computer-based techniques are deployed[5]. Of these, Turnitin[6] appears to have the greatest appeal if one can judge by the substantial number of Universities and other institutions of learning subscribing to it from around the globe. The University of South Australia is one of those corporate subscribers. The University encourages both its staff and students to make use of Turnitin toward stamping out plagiaristic practices in the interest of academic integrity. Although not used universally by all, academics employ it to *detect* plagiarism whereas students are encouraged to use it to test the integrity of their work before submission.

Turnitin places all work submitted to it on a gigantic database for comparison purposes. The work submitted is then compared with works stored previously, both student submissions and learned publications in electronic format. A *Turnitin Originality Report* is the outcome, which contains an *Overall Similarity Index*, identifying the sources which match the student's work and re-rendering the work in colour-coded text in boxes to show where the exact matches occur. Original work is shown in black without boxes. An excerpt from the front page of a Turnitin Originality Report is shown in Fig. 1. The usefulness of Turnitin is limited when used in electrical engineering education since it can not detect plagiarised images or computer code; it is a strictly text-based comparison platform. Graphical plagiarism – if any – can be substantiated by inspecting the sources where the textual plagiarism is established.

Despite its wide-ranging acceptance by many universities and other educational institutions, Turnitin has its outspoken critics[5,7].

Figure 1. Excerpt from a Turnitin Originality report

Examples of plagiarism

Examples of plagiarism abound. They vary from verbatim quoting to paraphrasing someone else's work, in the case of textual plagiarism, to using illustrative material such as drawings, graphs, pictures and photographs without identifying the source. In the case of electrical engineering programs, circuits, computer code and simulation software are frequent objects of plagiarism. Cases where different groups of students doing laboratory work submitting identical reports or individual students handing up a report written in a previous year by a group of students as their own work for assessment are not uncommon.

Figures 2 and 3 should illustrate this misdeed. Students, working in groups of three in computer hardware course were given the task to write an algorithm for bubble sorting. Surprisingly, both groups have submitted identical reports with identical algorithms and identical errors. The only difference was that one group had compiled a code whereas the other group submitted an *image* of the code!

B. 2. Bubble Sort Algorithm

The debugged program with test data in descending order:

```
                    ORG         $4000
NELES               EQU         10                                        Number of elements
UNSORTED    DC.W    18, 43, 2000, 72, 12, 2820,185,2300,35,880   Data to be sorted

START               BSR         SORT
                    MOVE.B      #9, D0
                    TRAP        #15


SORT                MOVE.W      #NELES, D1                    Number of data items
                    SUB.W       #1, D1
DOPASS              MOVE.W      D1, D4                        Init loop counter
                    MOVEA.L     #UNSORTED, A0                 Init data pointer
CHECK               MOVE.W      (A0), D2                      Get first element
                    MOVE.W      2(A0), D3                     Get second element
                    CMP.W       D2, D3                        Compare with second element
                    BCC         NOSWAP
                    MOVE.W      D2, 2(A0)                     swap elements
                    MOVE.W      D3, (A0)
NOSWAP              ADDA.L      #2, A0                        point to the next pair
                    SUB.W       #1, D4                        decrement loop counter
                    BNE         CHECK
                    SUB.W       #1, D1                        decrement pass counter
                    BNE         DOPASS
                    RTS
                    END         START
```

Figure 2: Bubble Sort Algorithm in practical report – Group A

B. 2. Bubble Sort Algorithm
The debugged program with test data in descending order:

```
            ORG       $4000
NELES       EQU       10                              Number of elements
UNSORTED    DC.W      18,43,2000,72,12,2820,185,2300,35,880   Data to be sorted

START       BSR       SORT
            MOVE.B    #9,D0
            TRAP      #15


SORT        MOVE.W    #NELES,D1                       Number of data items
            SUB.W     #1,D1
DOPASS      MOVE.W    D1,D4                           Init loop counter
            MOVEA.L   #UNSORTED,A0                    Init data pointer
CHECK       MOVE.W    (A0),D2                         Get first element
            MOVE.W    2(A0),D3                        Get second element
            CMP.W     D2,D3                           Compare with second elements
            BCC       NOSWAP
            MOVE.W    D2,2(A0)                        swap elements
            MOVE.W    D3,(A0)
NOSWAP      ADDA.L    #2,A0                           point to the next pair
            SUB.W     #1,D4                           decrement loop counter
            BNE       CHECK
            SUB.W     #1,D1                           decrement pass counter
            BNE       DOPASS
            RTS
            END       START
```

Figure 3: *Image* of Bubble Sort Algorithm in practical report – Group B

How to handle cases of plagiarism (Sanctions?)

The University of South Australia has policies and procedures governing the issue of plagiarism. These are embedded in the so-called Assessment Policies and Procedures Manual. A network of so-called *Academic Integrity Officers* (AIO) are entrusted with the responsibility of guarding academic integrity within the University.

If an academic detects a case of plagiarism the matter is reported to the relevant AIO. The AIO then invites the student or students to an academic integrity hearing. The purpose of the meeting is to explain what the charge is, present the evidence and seek an explanation from the accused. The AIO may invite the academic initiating the procedure and the accused is advised that he may be accompanied by another person, who may be a member of the student union or even another academic. After the hearing, upon further consultation with the academic and in the light of the matters presented during hearing the AIO formulates recommendations. If the charges are substantiated punitive measures are adopted, which are communicated to the student. The punitive measures may vary from a reduced mark for that part of the assessment in which the student is found guilty of academic misconduct to suspension from the University, depending on the severity of the misconduct. At any rate, the incident is recorded on the *academic misconduct database* of the University. This is a confidential database which is only consulted by authorized persons such as the AIOs, with no access by external bodies. To combat this, we have developed a range of counter measures which range from institutional initiatives to individual action. These include the use of propriety software for plagiarism detection and common sense measures. We have also addressed issues related to the setting of assessment tasks which may inadvertently encourage plagiarism.

Measures for countering plagiarism (preventive measures)

Plagiarism is multi-faceted issue. It involves ethical and cultural factors, but is also open to interpretation - particularly if the intellectual tasks are formulated fuzzily so as to encourage plagiarism.

It stands to reason that the combating plagiarism must start with academic integrity education. This must be the theme throughout the entire educational process. Principles of academic honesty, fairness, morality and rightness must be inculcated into the students' minds. Directing and coaching students to learn ways of avoiding plagiarism should bear fruit if done in an appealing and motivating manner. Of course, the academic teachers need to be ever vigilant to guard academic integrity without appearing to be constantly suspecting their students.

The formulation of assessment tasks has a major significance in encountering plagiarism. It has been variously observed that the students could be driven toward plagiarism if they perceive their task to have been reduced to mere compilation of facts, statistics and *pretty* pictures to satisfy the assessment criteria for a poorly set task. McKenzie[8] observes that "it is reckless and irresponsible to continue requiring topical "go find out about" research projects in this new electronic context. To do so extends an invitation (perhaps even a demand) to "binge" on information."

Tasks requiring original thinking to be able to draw conclusions are far more valuable as learning tools than those which merely demand a compilation of facts. Fact finding missions may naturally drive students to "cut and paste" with an ease unheard of until most recently.

At the University of South Australia, no effort is spared to stem the scourge of plagiarism. Regular face-to-face workshops are scheduled for student attendance in addition to the on-line workshops which students are encouraged to undertake. Also, there is provision for course-specific workshops to be conducted on demand. Considerable resources are available for academic staff members, providing guidance in developing assessment strategies, which discourage plagiarism[9]. Vividly presenting examples of previous cases of plagiarism, coupled with the deterrent effect of the use of plagiarism detection software are touted as further possible ways of combating plagiarism.

How effective are preventive measures?

In the case of electrical engineering programs at the University of South Australia, we have observed a reduction in plagiarism incidents over a period of the last three years between 2006 and 2008. The reduction has been substantial in a number of courses which had been suffering from regular plagiarism. In some cases, incidents reported have been reduced by more than 80%. The reduction is thought to be mainly attributable to exposing students to the principles of academic integrity early in the course, sustaining the exposure throughout the course, introducing variation into the design of assessment tasks from year to year and rewarding initiative and motivation on the part of students.

Conclusion

Plagiarism threatens to undermine education at large, both at the university level and elsewhere. Although seemingly improbable, electrical engineering education is no exception. However it is possible to avert the threat by adopting educational approaches which are designed to discourage plagiarism by cultivating inquisitive attitudes in learners and creative approaches to course format.

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