Sustaining Excellence by Eliminating Plagiarism

Pj Radcliffe
RMIT University, Melbourne, Australia.
pjr@rmit.edu.au

Abstract*: plagiarism, particularly in university software subjects, has the potential to dramatically reduce the competence of a significant part of each class. If left unchecked this reduction in competence could cause employers and the community to question the credibility and relevance of a given university, and universities in general.*

An anti-plagiarism activity that focuses on a quick fix with anti-plagiarism tools will probably fail because the prevention of plagiarism is a complex cultural and systems issue not a mechanical process of using tools to catch the perpetrators. This paper argues that a better path is to analyze the big picture using a quality assurance method called How-How diagrams, work through a system design process, make adjustments to the curricula and work processes, and finally select and use anti-plagiarism tools.

Keywords*: plagiarism, quality assurance, How-How diagrams.*

Introduction

The introduction of fees has started a subtle opening up process of the tertiary education market. Students and employers are evaluating the costs and benefits of awards and providers in a way we have not seen before. This author has been bluntly told by an employer that if a potential employee had passed a CISCO and Microsoft accreditation course they are more useful than a university graduate.

Universities need to respond to this competition by communicating to employers, students, and the community at large, the advantages of a university education over other forms of education. The university system may also need to adapt in the face of competition and justify their costs.

> *Test*: do full fee paying graduates at your university say "I only paid X thousand dollars for my course and that was good value!". If they don't then competitors will be eyeing your market share.

In order to deliver on these big picture goals all Universities must be able to warrant that their product (a university education) is of good quality. A major blot on this warranty is the reality or belief of wide spread copying (plagiarism) that dilutes the quality of the product and the public's belief in it's value.

> *Newspaper articles and TV reports* have been quite damaging and have negatively effected public opinion. Consider the articles in the Melbourne Age by Milavanovic (2003) titled "RMIT student gets bond for cheating charge" and by Szego (2003) "Shock finding on uni cheating". The university's reportedly weak response to cheating has not helped the public image.

In the current environment plagiarism elimination is not simply some academic chase for purity or a quest for the "good old days when things were better" but a business imperative for any university that takes a long term view and values its reputation.

This paper does not attempt to solve the big picture problems rather one important issue that is more under the control of academics - the elimination of plagiarism. It reports on the response to the plagiarism problem by RMIT University's School of Electrical and Computer Engineering (ECE).

Not So Simple

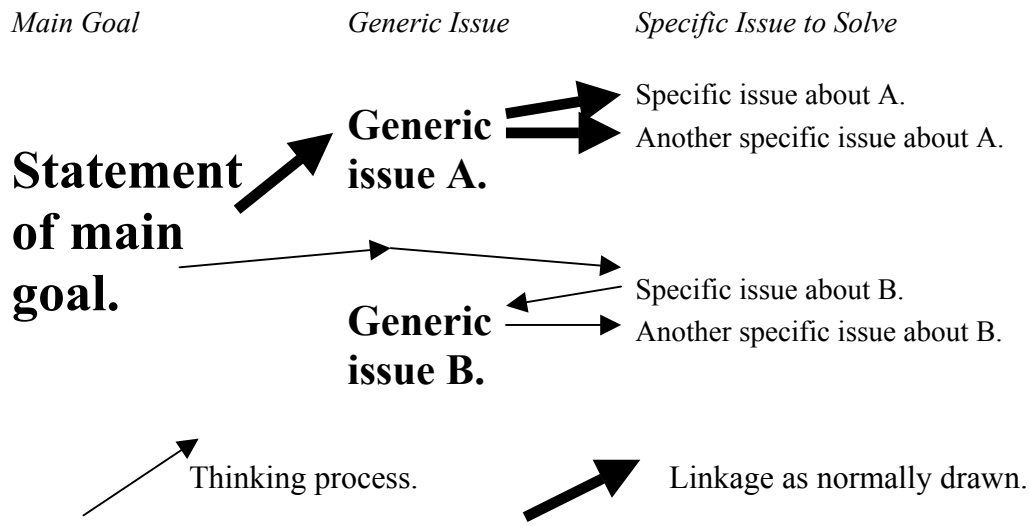
At first glance the plagiarism problem appeared to have a simple solution: the use of plagiarism detection tools should stop plagiarism because the risk of detection would deter students from cheating. Discussion and focus groups with staff and students in ECE quickly showed that plagiarism is a complex issue and that the thoughtless application of tools would not solve the problem and would most likely waste money, time and effort. Perhaps even worse a policing approach based on tools may develop undesirable attitudes and culture in the student body.

The complexity of the plagiarism issue soon became too great for convenient representation in simple text and there was a concern that important issues may have been overlooked. We turned to How-How diagrams as a method to solve both these problems. First the general use of How-How diagrams will be explained and then they will be used to list the plagiarism issues we identified. These issues will then be discussed in detail.

How-How Diagrams

How-How diagrams are used extensively in Quality Assurance as a way to stimulate ideas, to foster group discussion, and as a way to organise and document ideas (Juran 1988). They also aid the problem solving process.

One particular feature of How-How diagrams is that they help identify both general issues and specific issues to be solved that may otherwise be missed. Consider the How-How diagram below. Given a problem statement the human mind will often leap to a specific solution (from "Statement of main goal" to "Specific issue about B"). The How-How diagram method simply requires us to look for a more generic statement of the specific issue (from "Specific issue about B" to "Generic issue B"). Armed with this new generic issue it may be possible to discover more specific issues to solve (see "Another specific issue about B").



The process of using How-How diagrams, either as an individual or a group, thus becomes-

- Agree on a main goal.
- Attempt to identify generic issues and specific issues.
- Group specific issues under generic issues; if there is no suitable generic issue create a new generic issue.
- Examine each generic issue to try and derive more specific issues.

How-How diagrams have many variants. They are commonly used to detail the issues related to a goal (as above), or to develop details how a goal can be achieved.

Plagiarism How-How

The plagiarism problem analysis in ECE use the following statement as a main goal-

"How to design a workable plagiarism elimination program".

The emphasis was on a system that works in practice and avoids the many pitfalls including political, organizational, practical, and technical issues. The diagram that follows shows the issues identified so far, though not the iterative development process as described above.

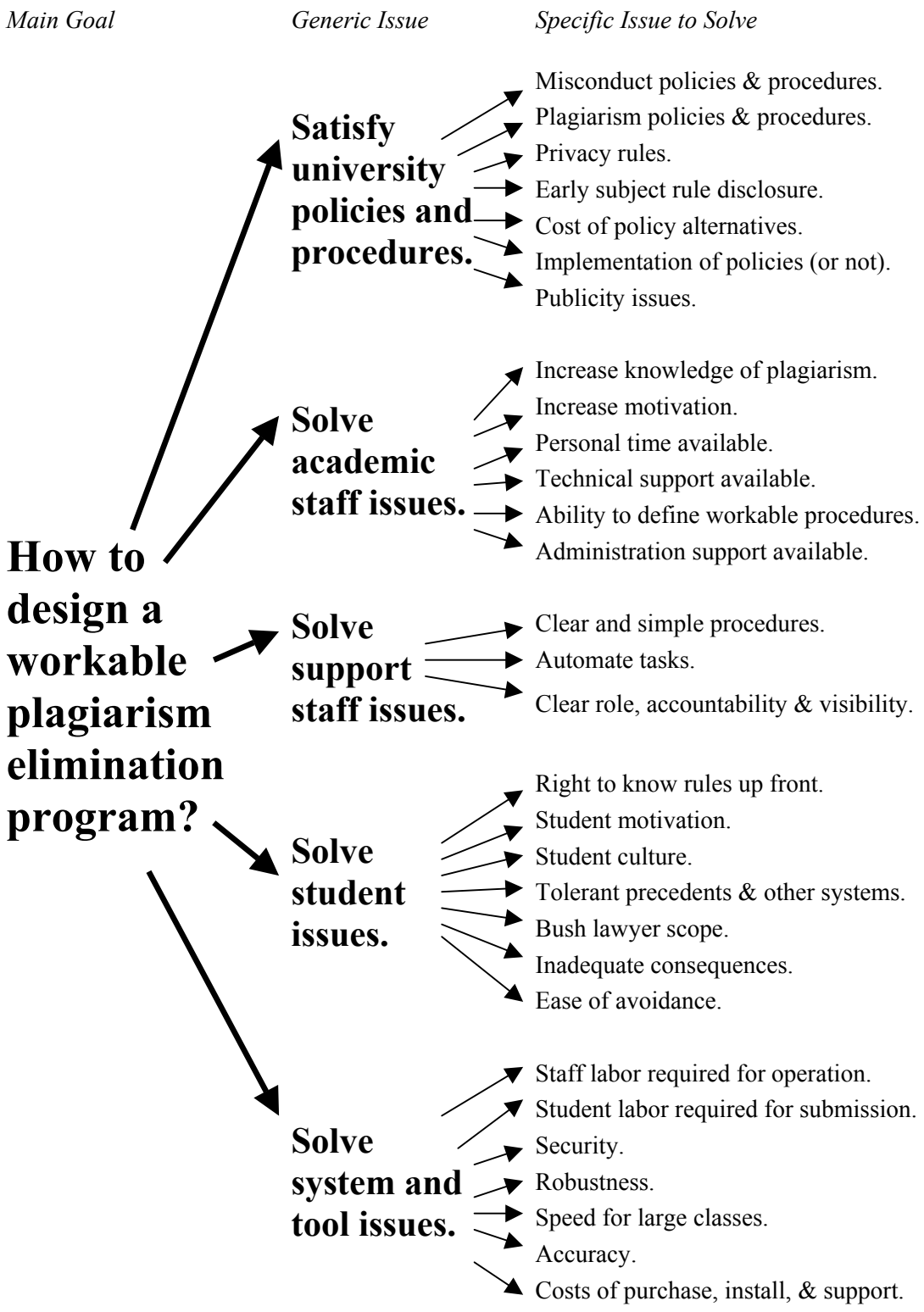


Figure 1 : Issues to resolve before tools are decided.

The following sections discuss key issues identified on this diagram, and possible solutions.

University Policy and Procedure Issues

A key activity for an anti-plagiarism activity is to discover relevant policies from all sources and how they might affect an anti-plagiarism program.

The university has an important role in defining enterprise wide standards. All decisions by departments and schools must fit within these guidelines and any activity that violates these guidelines will eventually be called to account and ruled invalid. Most universities place their rules on the web. Local policies at the faculty, department or school level are often a problem as such policies are seldom visible on the web and may not even be written down. Local policies tend to be more volatile and change more quickly with time. There is certainly legal opinion that if policies are not written down and available to everyone then they do not have any weight.

In general the execution of policies at the university level is a time consuming, drawn out affair that may become political. Quite often any deviation from official procedures by the university results in all charges or penalties being dropped on any appeal by the student. Such deviations are quite common, particularly with local undocumented processes. This can be incredibly frustrating and demotivating for staff and engenders disrespect from the student body toward the university.

In order to avoid the waste of time and frustration it is best to devise a system where penalties are immediate, local, and difficult to reverse so that University processes need not be brought into play. The system must fall within policy guidelines or it will be easily challenged and beaten.

Academic Staff Issues

It is difficult to ask staff to do more in a general atmosphere of funding cuts, higher workloads, and in some cases a depressing work environment. An anti-plagiarism program will fail unless staff feel motivated to make it work. Motivation must be nurtured starting with education about the degree of plagiarism, the consequences for a department's and individual's reputation, and the nature of anti-plagiarism tools. Many other factors come into play -

- Active management support.
- Availability of tools and resources.
- Lack of bureaucracy in the response to plagiarism. Excessive process can soak up inordinate amounts of staff time and given current staff workloads this is untenable.
- A local champion can help overcome teething problems and show how a simple yet effective system can be implemented.

Support Staff Issues

Many anti-plagiarism programs will require some use of support staff ranging from office staff who accept project work to technical staff who maintain the network. These people cannot be expected to be enthusiastic about the program and so what they need to do must be well defined with clear written requirements and procedures, and ample warning of what is needed from them by what time.

Student Issues

Students expound many good reasons why universities should be tolerant of plagiarism and unless academics specifically address these issues then student culture will remain unchanged, and will remain tolerant, even supportive, of plagiarism. In some cases the student's arguments are quite valid and academics need consider driving changes both at the work process level and the curricula level. In other cases the student's perception or attitude is causing a negative learning outcome and the academic needs to take a leadership role in engaging the student body and adjusting the student culture.

This author has run several small focus groups of third and fourth year students in the ECE course at RMIT and has interviewed many students who have been caught plagiarizing. The results are similar to those reported by other academics (e.g. Ryan, 1988). The most common pro-plagiarism arguments, stated from the student perspective, include-

- "I think this subject is poorly thought out and far too much work. Group work (plagiarism) is the only viable solution."
- "I want to specialize so I will pair up with someone who loves another subject and we will swap work."
- "I need to work to pay HECS fees or other reasons, copying is the only way I can survive."
- "I am forced to do subjects I hate that are totally irrelevant to my career."
- "I can't cope because of poor teaching in previous years, lack of tutorials, and poor resources."
- "In industry you copy everything you can so why do it differently here?"
- "It happens everywhere so why target me?"
- "This is the only subject I have trouble with."

The Quality Assurance guru Edward Demings made a very pertinent comment on worker performance (Juran, 1988)-

> "To call the attention of a worker to a careless act, in a climate of general carelessness, is a waste of time and will only generate hard feelings, because the condition of carelessness belongs to everybody and is the fault of management, not of any one worker, nor of all workers."

In short, it is the responsibility of academics to engage the student body and foster a positive change in the student culture.

There are a whole range of things that can be said that will change student culture (AUTC, 2003). These are best explained in the first lecture of a subject-

- Admit the relativity of marking "In reality there is always an element of relative marking, if you do well and others do badly then that will help your mark".
- Remind students of the collegiate value of a degree, "The reputation of your degree depends largely on the quality of other graduates. Do not endanger that reputation by helping people to graduate with inferior skills."
- Give students a clear definition of plagiarism and how to avoid it (Carroll, 2000)
- Explain how giving answers is not helping the recipient, "By giving solutions you discourage people from improving their skills. In later years they will most likely be caught out, so don't give solutions and so help people get better.".
- Acknowledge and perhaps accept the industry approach of copying everything, "The only time it is wrong to copy in industry is when you get sued. Re-inventing the

wheel is a waste of time and money. In this university we must measure your skills as an individual, so copy all you like but you must acknowledge the source of everything you copy."
- Remind students the main goal is to become skilled, "your main goal is to improve your skills and get that first job, employers are harder to fool than academics."
- Publicize anti-copying strategies and tools.
- Clearly articulate university policy.
- Draw attention to detection methods and punishments.

The design of assessment items and student work processes can also minimize plagiarism (AUTC, 2003). Examples include-

- Give students randomized problems, for example different cutoff frequencies in an electronic filter design.
- Use of innovative marking schemes that discourage copying. For example tell students "You will be rewarded for innovation and novelty so keep your good ideas secret."
- Change assignments, labs, and projects from year to year to stop plagiarism between years.
- Place minimal marks on assignments but then base a significant part of the exam on the assignment.
- Develop a level of competition by having a variety of small prizes for the major project in the subject.
- Develop marking guidelines that encourage competition, such as class list marking or the military standard bell shaped distribution for class results. These approaches violate the policies of some universities.
- Require weekly submission of code into CVS repositories and check the weekly differences between versions. This would detect major, sudden, last minute developments which are characteristic of plagiarism.

System & Tool Issues

Anti-plagiarism systems are indeed systems and must be analyzed and designed from a systems perspective. Mistakes at the detail level can result in an unworkable system that frustrates everyone and will delay by years the introduction of a working system. Typical system design tasks include-

- Proposing a complete workflow process, probably using block diagrams or Data Flow Diagrams.
- Estimate the labor time for staff and students for each process.
- Carefully examine the effect of class size on labor time.
- Look at ways in which labor can be minimized.
  Identify opportunities for automation, especially if tools may already exist.
- Consider the skills of staff and students to use any automated systems.
- Identify scope for abuse and fooling of the system.
- Run a pilot program to prove the system before general use is encouraged.

Labor costs can rise dramatically with class sizes. Consider a simple task such as taking floppy disks from an assignment pigeon hole, and sorting them into a box for each subject. Realistically this may take 30 seconds a disk and with a class of 240 students this represents two hours labor just for one subject. Administrative staff may simply not have that time free.

Consider the labor of using a program that compares two documents and gives a single figure of merit for document similarity. The number of comparisons that must be made for a class of size n is ${}^{n}C_2$ or n(n-1)/2, approximately $n^2/2$. In a class of 10 this comes to 45 comparisons, given a class of 240 this comes to 28,680 comparisons and if each comparison took only ten seconds the total comparison time would be about 80 hours not including ranking or follow up.

Students can be mischievous and any system weakness will be punished. Some students will make claims that the system is faulty to hide their own shortcomings. The system design must identify possible abuse scenarios and develop mechanisms to avoid abuse. There is often a tradeoff between system robustness, usability and cost.

- Student claim "I am absolutely certain I handed it in, you have lost it!"

  Solution 1: in a web based submission system give the student a receipt number that encodes the student number and date. It is the student's responsibility to record this number. If the student does not have a valid receipt number then their claim is not accepted.

  Solution 2: in a paper based submission system the student gets a signed or stamped receipt from office staff. No receipt means the claim is not accepted. Bar code based systems can help reduce staff labor and track assignments through the system.

- Systems can be stressed for example by submitting huge files that clog the file system.

- Systems that lack password protection can be spoofed easily. Students can put in bogus submissions for other students and the whole system descends into chaos.

- Web based systems can have HTML or PHP commands placed in data entry fields that then damage or discredit the system. Some knowledge of network security and abuse methods can save severe embarrassment later.
  (In one of our early web prototypes anonymous students posted comments that included .gif files of staff member faces atop other bodies...)

- Assignment return systems can also be abused. Unsecured returns are pilfered by lower year students who will copy the solutions next year.
  (This author has heard students comment they must have got a good mark because their assignment was taken by someone else.)

Current Status

The author's main application is with software assignments in the School of Electrical and Computer Engineering at RMIT. The How-How approach has helped to avoid a variety of problems and has certainly saved time, effort, and possibly embarrassment.

The issue of university policies is crucial and must be given early attention. If the policy issues are not resolvable then it is not worth the effort of running an anti-plagiarism program as the risk of university rejection of the scheme is too high.

From our experience the issue of student motivation is probably the biggest single issue. This places a responsibility on the academics to clearly communicate the issues and change student culture.

The current status in the School of Electrical and Computer Engineering is-

- RMIT policies support anti-plagiarism activities. Student rights are extensive and must be respected.
- Staff are worried by plagiarism and there is a will to eliminate it. Many subjects use organizational and motivational innovations to limit plagiarism.
- A number of staff clearly expound the anti-plagiarism message but this could be more wide spread.
- Penalties for plagiarism are spelt out in many subject guides so staff have a "legal" basis for enforcing penalties. These penalties are local and immediate.
- No tools currently exist that cope well with our large class sizes and project types (classes in excess of 300 students and multi-file projects).
- No funds are available for tools or labor thus we are limited to GPL tools and what we develop ourselves or with projects from our better students.
- Academic staff time is at a premium thus the system must be as fully automated as possible.
- This paper deliberately did not dwell on the technology of plagiarism detection but after searching the literature and small scale trials we have decided on a detection algorithm and system design. We hope to have anti-plagiarism tools completed for use in late 2003 or early 2004.

Conclusion

Plagiarism is indeed a complex issue with significant cultural and systems issues. Any attempt to use anti-plagiarism tools without considering these issues is probably doomed to failure. This paper has identified many issues and all appear soluble though this may be difficult given an environment of tight staff and monetary restraints.

University policies and procedures must be an early consideration as these are usually immutable and can effect the viability of proposed solutions. Academics have many responsibilities and tasks including student consultation, proper curriculum development and leadership in the area of work place culture. Support staff issues are a major consideration in a climate of restraint and the need for such staff must be minimized.

The student body and individual students should be seen as the major beneficiaries of an anti-plagiarism program. The benefits may include a better and modified curriculum structure, a better work culture, a better learning outcome, and a better respect for the degree title.

At RMIT School of Electrical and Computer Engineering we have done the initial planning of an anti-plagiarism program and hope to introduce it in the near future.

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Acknowledgements

To most students who work hard, don't copy, and so graduate with skills and knowledge of which they can be proud.