

# **A REPORT ON A SOFTWARE PROTOTYPE WHICH UTILISES AN INNOVATIVE APPROACH TO REDUCING OPPORTUNITIES FOR PLAGAIRISM**

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# **A report on a software prototype which utilises an innovative approach to reducing opportunities for plagiarism.**

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## **Abstract**

There is increasing concern over student plagiarism in institutions of Higher Education and concomitant interest in appropriate ways to deal with it. Experience from the criminal justice domain suggests that to reduce the opportunity for crime to occur produces more success in crime reduction than does increased crime detection. Factors from dealing with crime prevention are examined and used to draw up a set of criteria by which to judge computerised assessment tools. A distinction is made between the prevention and avoidance of plagiarism and applied to the criteria. The paradigm offered by paper-based traditional assessment, the same assessment is taken by all students, is rejected as not appropriate for computer generated assessments aimed at avoiding plagiarism. It is argued that technology permits the dynamic production of unique instruments of assessment, at the point of assessment, for each individual student.

The software presented provides a tool which presents each student with a unique assessment. Examples of the software prototype screen shots are discussed and future developments outlined.

## **Introduction**

What is plagiarism? Osen (1997) characterises plagiarism as, “the bane of the academic world”, p.15, noting that it is not illegal, does not require intent, is defined as claiming the work of another as one’s own, and has not always been treated seriously. Crawford (2003) in a discussion of avoiding plagiarism in an on-line environment, offers five definitions of academic plagiarism: Ghostwriting – work written by someone else, increasing because of the

internet<sup>1</sup>; Patchwriting – sections or paragraphs which have been lightly changed, and then inserted in a student's own work; Inappropriate referencing, quoting and citing –that is, over-use of one author, attributing to the wrong author, and padding references; and finally, Contextual fraud, that is, changing the author's meaning by selective quoting. Crawford (2003) places plagiarism as an act of fraud, intentional or not.

There is increasing concern over plagiarism by students in institutions of Higher Education, in Scotland the SQA (Scottish Qualifications Authority) have run an on-line discussion group from 2003 in order to help formulate a policy, in the UK, the JISC Plagiarism Advisory Service has been developed (2002) in response to well found worry over possible consequences arising from plagiarism, for example, "Plagiarising student sues university for negligence" (Guardian Unlimited, May 27, 2004).

But how extensive is plagiarism? Is it a storm in teacup? In Scotland, Glasgow University's Computing science department discovered that 25% of first year computing science students plagiarised (Seenan 1999). Similarly, Edinburgh University's Computing Department reported that the work of 117 first year computing science students was being examined for plagiarism (BBC online network, July 1999; Seenan 1999). From Crawford's (2003) reporting on the work of Howard and Kelley, White, and Harris, plagiarism elsewhere is widespread: some of the plagiarism figures noted were: approximately 50% of MIT students and from 40% to 60% of all students whilst at university/college.

For the purposes of this paper, plagiarism is limited in meaning to the act of passing off another's work as one's own, intent is not inferred nor analysed.

The software discussed below is a work in progress developed to avoid this type of plagiarism.

## **Part A: What can we learn from the criminal justice domain?**

### **The rise of prevention as a tactic in dealing with crime**

The rise in crime prevention has been attributed to: increasing recorded crime (Shaftoe, 2001), 1.6 million in 1970 to 5.4 million in 1992; deterrent measures such as increasing penalties, legal powers and spending on police do not in themselves seem to reduce crime levels (Smith, 1996); detection rates are low: the British Crime Survey estimated the number of crimes in 2002 to 2003 at 12.3 million, as against just under 5.9 million crimes recorded by the police, (Simmons, 2003) and cannot function as an effective deterrent<sup>2</sup>; and lastly

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<sup>1</sup> Certainly internet based crime is rising: Riem, 2001, puts the proportion of 'cybercrimes' at 50% of all fraud, and web based fraud at 2/3 of all fraud cases investigated by the International Chamber of Commerce in 2000.

<sup>2</sup> The average number of crimes detected is, "just under 11 detections per officer per year", (page 1, Chapter 7, Simmons, 2003) and the detection rate for this period was 23.5%, (Simmons, 2003).

crime is expensive: the cost of crime in England and Wales for 1999/2000 was £60 billion (Brand and Price, 2000)

In the criminal justice system, avoidance and prevention have a high profile and low detection rates are recognised as fact.

### **Is crime prevention effective?**

In addition to, possibly, being cheaper, crime prevention does not generate the human costs of injury and loss that crime itself does. For example, Casteel and Peek-Asa (2000), report that crime prevention programs surveyed, showed a reduction in robberies of between 84% to 30% depending on the program: a significant reduction in human costs. High spending on crime prevention is attributed to the stability of crime rates in the retail industry (9<sup>th</sup> Retail Crime Survey, 2000/2001) and in the area of computer crime, prevention is seen as cost effective (Dhillon and Moores, 2001). It has been argued that the costs are often transferred to the neighbouring districts in that crime merely moves out but that holistic measures give lasting crime reductions (Shaftoe, 2001).

### **Factors in low crime rates**

Effective holistic measures articulating with reduced crime levels include social factors (Brown, Perkins and Brown 2004). Direct knowledge of peers' involvement in crime increases the likelihood of criminality (Falk and Fischbacher, 2002; Croydon Strategy 2002 – 2005), however, positive social recognition, social bonding and involvement have been found to reduce the risk of criminal behaviour by changing the individual's response to offending (Croydon 2002).

Perhaps the most important single feature is type of area, rural or urban. Rural dwellers experience less crime than those living in urban areas, feel people around them are helpful and have positive feeling about their neighbourhood (Aust and Simmons, 2002).

## **Part B: Plagiarism**

### **Detection**

Within the academic discussion of plagiarism, there has been an emphasis on detection, often via software, as in the Scottish Universities (above), JISC Plagiarism Advisory Service and Coulthard and Woolls (1999). In the Edinburgh example, more than half of the original 117 students were required to re-sit their exam (Cullen, 1999) but in the absence of anonymous crime reporting, it is difficult to assess what proportion of plagiarism had been detected at Edinburgh. Introna et al's (2003) findings for students at Lancaster University, indicate low levels of some forms of plagiarism in UK students,

with 19% reporting 'Once or more' to the action of Ghostwriting. Sidera-Sideri (2003), notes that there is evidence that plagiarism is increasing. The difference between the figures for Edinburgh and Lancaster may be due to a number of factors, for example, a possible different proportion of UK students in each student population. It is worth noting that knowing that plagiarism could be detected, did not deter students (Seenan, 1999).

The JISC monitoring service provides the following figures for February, March and April 2004.

Pages served for:

Advice and Guidance	562	627	502
Detection Service	1,038	1,074	1,038
Educational Material	325	378	281
Academic Practice	197	259	178

The ten most requested documents shows the technical review of detection software was top, 9.49% (of the total) followed by the Oxford Brookes Report, which gives advice on preventing plagiarism, at 6.9% of the total,. All perhaps indicating a greater interest in detection than prevention and/or avoidance, tho' there is no evidence on use to which the accessed pages are put.

The Helpdesk queries report by the monitoring service, February to April 2004, shows that queries re Detection were 23, 23, 20, whereas comparable figures for Other were: 10, 16, 17 and for Advice, 6, 3, 1. It may be that there were more helpdesk enquiries for the category Detection because using the software gave problems.

### **Costs of plagiarism**

Seenan (1999) gives some idea on the sequence of events at Glasgow University following on from the initial assessment of 59 student's work as plagiarised. Seven were cleared, eleven received written warnings, the marks of twenty-five were reduced and sixteen were dealt with by the senate. Assuming two lecturers paid about £30,000 per year took an hour to process student work using detection software: cost = £38.00. A course board of, say, six lecturers and two senior lecturers (salary £34,000) took about 30 minutes to decide what to do: cost = £77. The senate comprised of, let's assume, ten professors (salary £60,000) spends one hour deciding what to do, cost = £380.00. In total, so far, the cost is just under £500 – but these are the figures for the first year Computing Science students, multiply by 10 for all the first year students, and add another 3 for students in the remaining years, gives possibly an annual £20,000, excluding any administration costs. This is tongue-in-cheek, but the point is, detecting and dealing with plagiarism has costs, including the social costs to students.

Anything less than this sum spent annually on prevention would represent a saving.

## **Prevention**

For all the apparent focus on detection, plagiarism is not cast as criminal, very little that could be described as judgmental is evident in the texts noted here. The effect of this has been to miss out on possible useful experience from the criminal justice domain. Can we read-off from crime prevention to reducing plagiarism? There must be caveats, but in as far as plagiarism has similarities with crime - it is deviant and it is a widespread social phenomenon - a trend towards prevention would be more effective in dealing with it than a reliance on detection. To achieve this a number of developments need to take place.

For example, a distinction between measures which we put in place to erect barriers to plagiarism (prevention) and those which are aimed at avoiding the issue altogether (avoidance). Prevention can be reserved for awareness schemes, encompassing: ensuring students know what constitutes plagiarism, teaching of citation, teaching summarising skills and so on (Crawford, 2003) and for encouraging social cohesion and a sense of responsible community, which have been established as important earlier. Avoidance would refer to those approaches which do not rely on the individual's ethics and culture but which make plagiarism impossible, at least in some forms.

Crawford (2003) gives a detailed exposition on both preventing and avoiding plagiarism, outlining what all the key players need to do. The emphasis is on creating a plagiarism free culture, as Crawford says, preventing plagiarism demands, "...a change in the culture – nothing less", (page 2, Crawford, 2003). The JISC site also contains much information on the prevention and avoidance of plagiarism. Neither source examine the role of technology in prevention and avoidance of plagiarism.

## **Part C: Implications for software used in CAA**

Prevention can be seen as aimed at firstly, preventing a first-time occurrence and secondly (when unsuccessful), preventing subsequent occurrences, (Yeboah, 2002), which necessitates keeping information and focussing. Further, technical and social aspects of prevention can be distinguished, with the social further divided into the informal and the formal (Dhillon and Moores, 2001).

Herd and Clark (2003) give the requirements of Computer Assisted Assessment, and the details of what would constitute an excellent e-assessment system have been clarified (Mackenzie, 2003) the list below can be seen as a supplement to both accounts, it covers those elements whose importance is derived from the discussion of the criminal justice sector and my experience with Virtual Learning Environments. The lack of richness in interaction, in general, between VLEs and users has been well set out (Mackenzie, 2003). A particularly tedious feature is repetition of entering, one at a time, the questions for students to answer, followed by, one at a time, the answers, not a method to encourage vast numbers of assessments. Another

is the impersonal interface: within an educational institution, that a specific student is vision impaired will be electronically known (recorded) but not acted upon, VLEs needs to be capable of accepting information about students and amending their interfaces accordingly. The electronic environments within which students find themselves are often proxies for lecturers, the standards we see as appropriate for our interaction with our students need to be manifested in the e-learning world.

*Criteria for CAA software that helps prevent and avoid plagiarism:*

#### I. Prevention

- Ensure users feel welcome – social cohesion and involvement, informal,
- Ensure all users in an institution have access – in order not to shift the plagiarism to other departments, formal social measures
- Ask users to make suggestions for improvements, and implement them - involvement, formal social measures, giving positive recognition
- Offer effective help – generate a sense of a helping community
- Keep definitions of plagiarism always visible – formal social, technical
- Keep a history of student progress, interests, learning styles and relevant educational information and tailor the interaction appropriately – social cohesion, community, technical
- Aid user enjoyment – involvement

#### II. Avoidance

- Ensure the production of assessment such a way that no student takes the same assessment as another - technical.
- Ensure that no student takes the same assessment twice - technical
- Ensure personal verification – technical

The relevant factors are associated with each criterion. In one sense, all criteria are related to technical factors, but only the most pertinent have been attached to each standard.

The criteria delineate software which is to some extent, intelligent, and has some similarities with customer relationship management (CRM) software.

#### **A brief overview of two current CAA tools**

RoboProf (Daly and Horgan, 2004) generates and marks assessments, providing students with feedback and offering “tools to improve their [students] performance”,(page 10, Daly and Horgan, 2004). Roberts and Verbyla (2002)

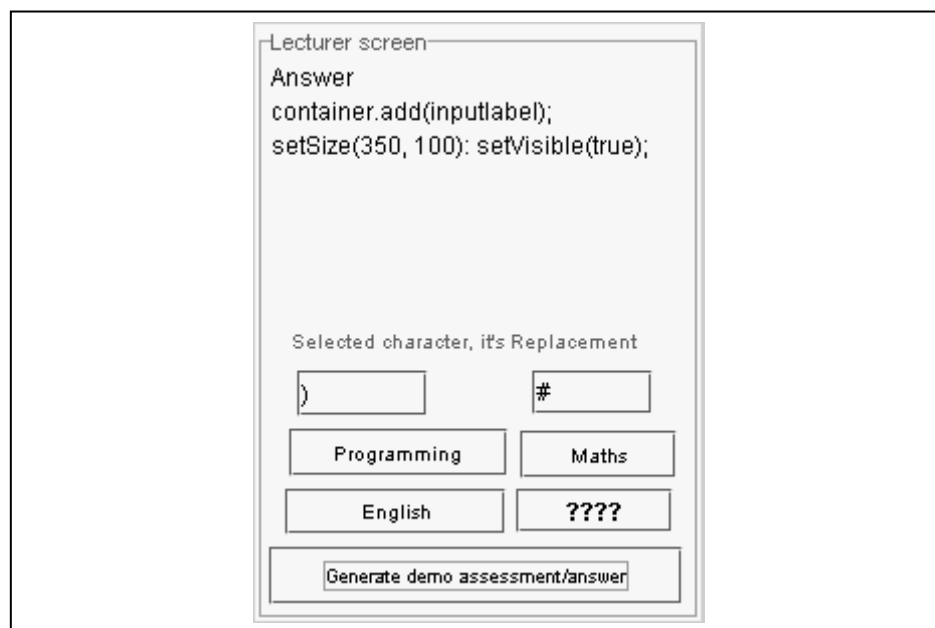


developed software which also generates assessments, tests (if computer programs) and marks them. Both are online tools assessing computer science, specifically programming.

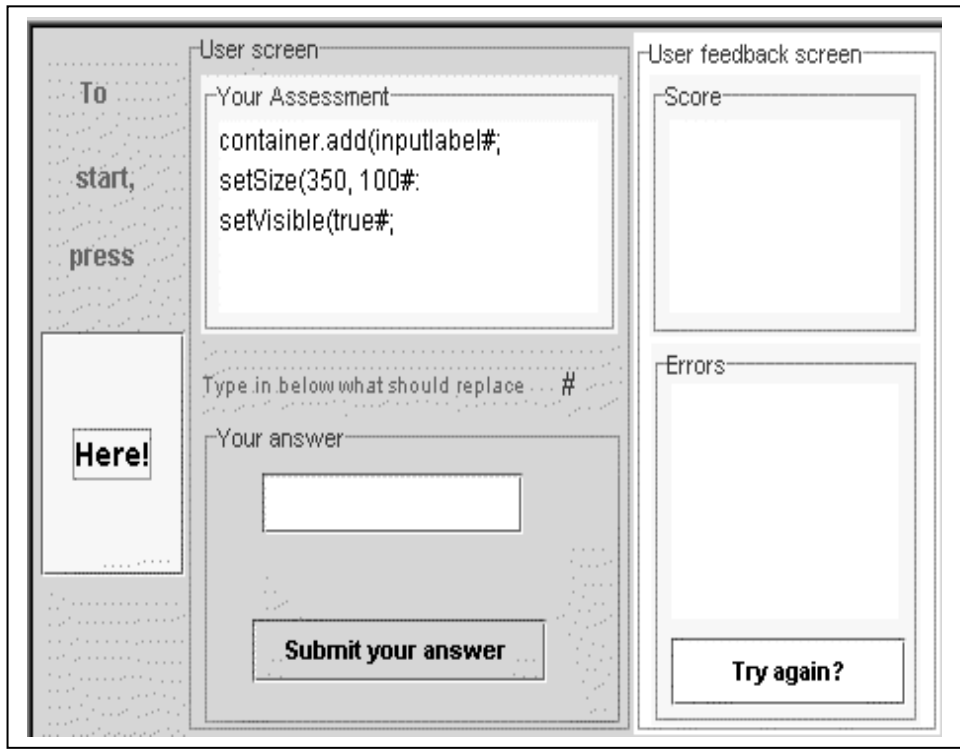
Both go some way to meeting the criteria for computerised assessment which would prevent plagiarism: feedback is available, help is offered and tracking of progress takes place. Neither meets the standard for avoiding plagiarism, which is not well developed in CAA. Randomising assessments as a way forward in plagiarism prevention is mentioned by Herd and Clark (2003) and Mackenzie (2003) but it is not developed by either.

### Avoiding plagiarism: the prototype

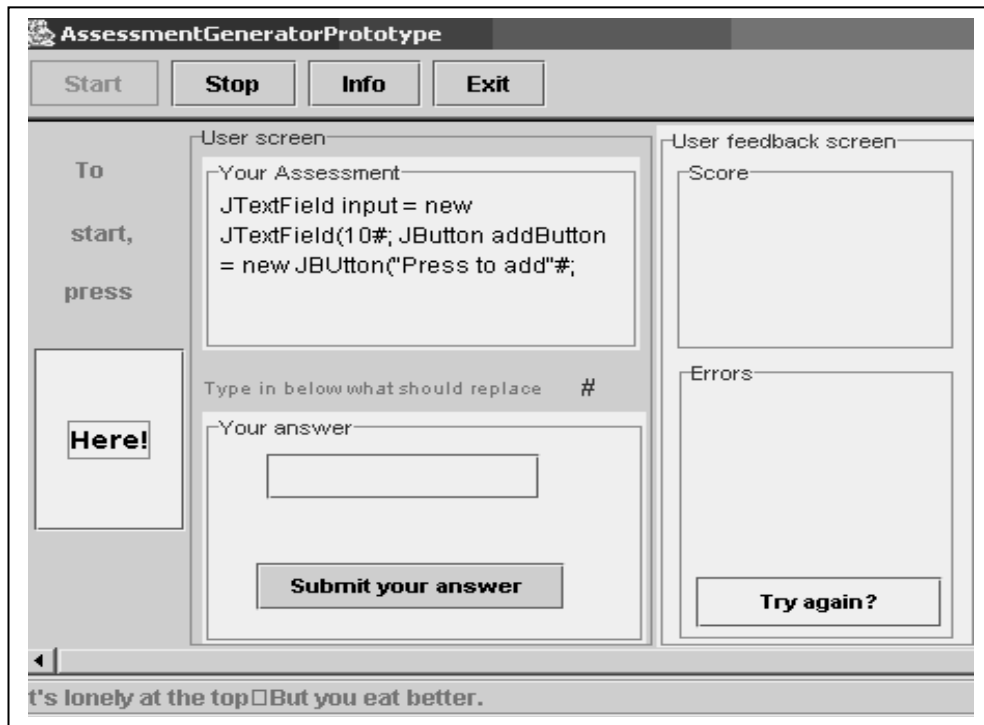
The prototype described uses random allocation to present different assessments at the point of delivery, meeting the avoidance requirement that students are given unique assessments. Different subject areas are under development; the default setting is java programming, but any programming language could be used, simple examples of English assessments are also generated. The format is replacement (a variation on completion exercises), students are given code and asked to replace incorrect symbols with the correct ones. The symbol to be replaced and its replacement can be set by the lecturer.



When a student presses the start button the assessment becomes available to the student.

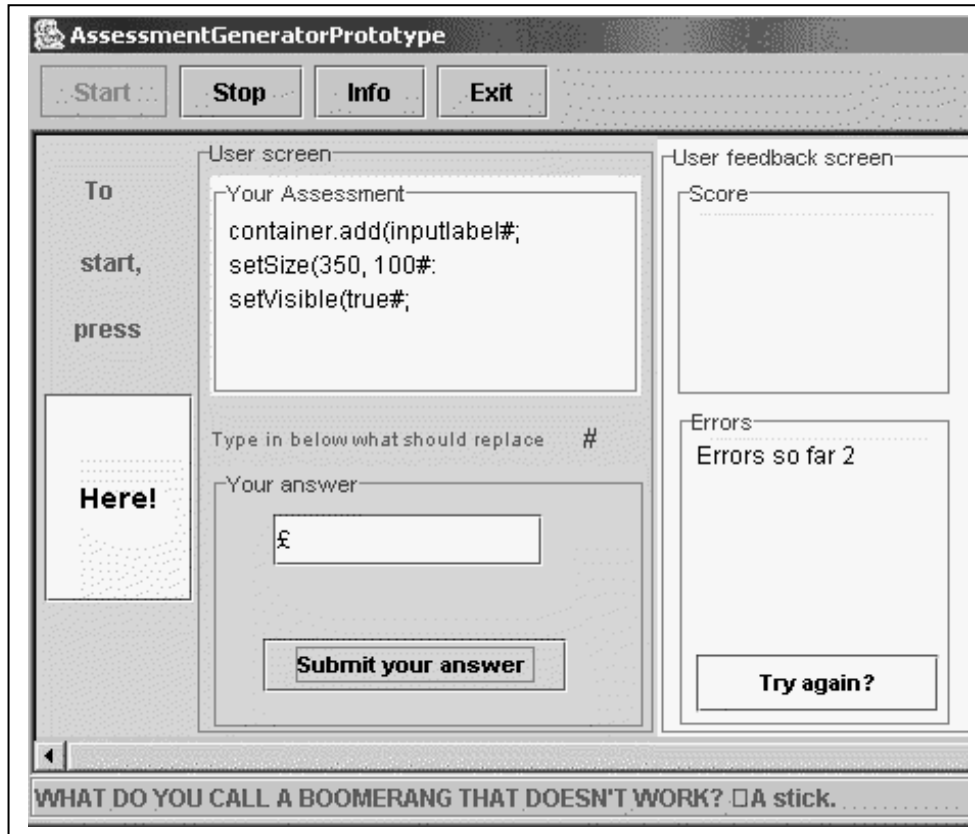


Any subsequent press of the 'try again' button generates a random code fragment, with the lecturer-set replacement, for the student to attempt.

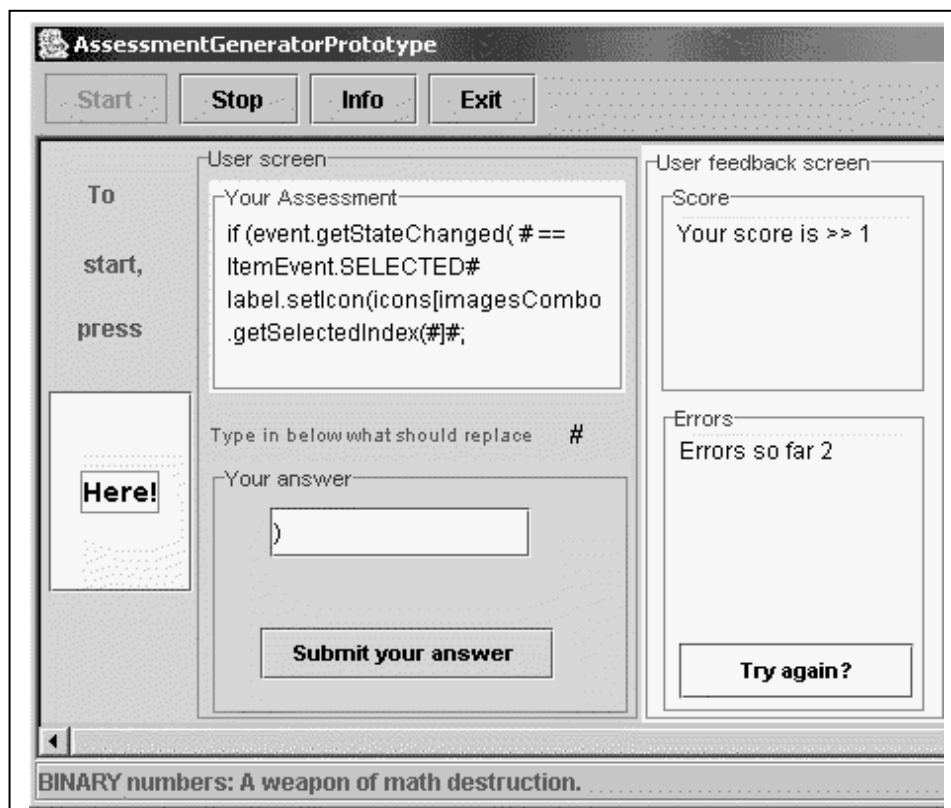


In order to engage students' attention, work from another project (Sampson, 2004) resulted in jokes along the status bar (a start at socialising the tool).

Feedback is given as the student provides answers.



The student has generated another assessment, and this time is successful.



The assessment may be generated at one of two points: by the student clicking a button or by an assessor. The choice of symbols (at the moment) is with the assessor.

The benefits of the assessment generator are that: it can be linked to strings generated from example programs (computing lecturers have numerous instances of these) and randomly allocated for elements to be replaced; the elements can be randomly selected from a list, as can their replacements and it can be generalised to a number of assessment types and subjects. Example assessment types are: matching exercises, words or sections could be removed and the removed elements presented as a list, the student would choose an item from the list which was to be re-inserted correctly; removed sections are left blank and students provide the fillers: this last is more difficult to implement and would require either a program of greater complexity, or more lecturer input than at present. Such exercises have wide applicability, for example, any language based subject, including the restricted language of maths. All this can be automatic and provide unique assessments for different students, with minimum additional work by a lecturer (one of the main reasons why I started down this path).

'Humanising' the student interface, even with simple humorous statements demands attention to cultural issues and sensitivity to social ones.

The software was designed using UML with Together and is currently implemented in java.

### **Future developments:**

Where is the prototype going? I am developing it to meet rest of the criteria: the additional subjects and 'word' facilities are important; work on 'humanising' it needs to be taken further, the welcoming and tracking functions need to be designed and implemented.

Collaboration and suggestions are most welcome.

### **Part D: Conclusions**

In essence, this paper argues there are grounds for transference of the cost of detecting and dealing with detected plagiarism to the production of software, the purpose of which is to avoid and prevent plagiarism. The characteristics of such software as informed by the experience of the criminal justice domain with crime prevention and shortfalls in VLEs are put forward. A software prototype which addresses what is arguably one of the most important requirements in plagiarism avoidance, that of creating unique assessments, is described. The use of variations on completion as a mode of assessment provides a powerful and widely applicable technique for assessment generation. Future developments to meet more of the criteria are outlined. Using a dynamic way of assessing student knowledge has potential to reduce

opportunities for at least one kind of plagiarism, that of passing off another's work as one's own.

The approach represents a significant paradigm shift in e-assessment and the use of technology in education: one that is over-due.

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