

Digital Technologies and Dishonesty in Examinations and Tests

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Digital Technologies and Dishonesty in Examinations and Tests

1 Executive Summary

1.1 Context

This report is a review of our current state of knowledge about the impact of digital technologies on dishonest practice by students in examinations and tests. It was commissioned by the Qualifications and Curriculum Authority. Although the focus is on assessment within the United Kingdom school and further education sectors, where pertinent, evidence has been drawn from research into both supervised and non-supervised assessments from national and international sources and also from the higher education sector.

1.2 The Problem

- 1.2.1 Although there remains some debate on whether the incidence of academic malpractice is increasing, it is widely acknowledged that it is a very significant problem.
- 1.2.2 There is a strong causal relationship between attitudes to academic dishonesty, perceived opportunities to cheat and psychological variables such as self-control and risk taking.
- 1.2.3 While personality factors self-regulation and propensity to risk taking are likely to prove intractable; reducing the opportunities to cheat, developing environments where cheating is unacceptable and reducing the acceptability of cheating within any institution should be the foci of a programme to reduce malpractice.
- 1.2.4 Although much of the research has focused on the higher education sector, where school level data are available it suggests that the problem is more, not less, serious than within the tertiary sector.
- 1.2.5 While digital technologies may not have stimulated an increase in malpractice, they have added new ways in which cheating can occur.
- 1.2.6 Initial concerns about academic dishonesty and digital technologies centered on plagiaristic use of the Internet in coursework. The evidence of such misuse is substantial.
- 1.2.7 Technological convergence and the ubiquitous ownership of mobile digital technologies have been shown to facilitate the misuse of the Internet in supervised assessments.
- 1.2.8 In addition, digital technologies can act as electronic crib sheets and allow students to seek help from peers or others within and outside of the examination hall. The evidence of such misuse to date is growing but much of it is single case occurrences or anecdotal.

1.3 Potential Solutions

- 1.3.1 While technological solutions to malpractice prevention are available, they are unlikely to prove to be a complete solution and should be used in conjunction with more traditional methods of prevention and monitoring.
- 1.3.2 The first line of defence is to stimulate an environment where cheating is not acceptable though the use of honour codes to which both staff and students have allegiance. Such environments help students resist peer pressure to cheat.
- 1.3.3 The design of tests and examinations, and the organisational structures for delivering those assessments, should be designed to reduce potential collusion within or beyond the examination hall.
- 1.3.4 Encrypted tests and the use of biometrics to prevent impersonation might be of particular value for test centres where students are unknown to the invigilating staff.
- 1.3.5 Technological solutions such as signal jamming of communication devices although effective are currently illegal.
- 1.3.6 Technological monitoring is feasible only for digitally supplied material. Hence identifying plagiarism in examinations is more problematic than that for word-processed coursework.
- 1.3.7 Although it is possible to identify individual students who have cheated using a statistical detection program, such software is better used to identify centres with problems in order to help those centres strengthen their procedures rather than to bring cases against individual students.

1.4 Ways forward

- 1.4.1 Legal, social and cost barriers will severely restrict what technology can offer.
- 1.4.2 The solutions to misuse are still largely people led with technology as an important but not all-powerful tool in support.

Digital Technologies and Dishonesty in Examinations and Tests

2 Preamble

Whilst this document is concerned with the school and further education (FE) sectors within the United Kingdom (UK) the issue of academic dishonesty is a global phenomenon, which permeates all levels of education. The Joint Council for Qualifications (JCQ) (no date) reports that a rising incidence of plagiarism has been recorded by the relevant qualification awarding bodies and that this is also a major concern of the universities. Academic dishonesty calls into question the integrity of qualifications generally, especially those assessment components such as unsupervised coursework. As the University of California (no date) concludes, in line with other educational institutions and governing bodies, "Academic dishonesty is an assault upon the basic integrity and meaning of a University"; and indeed on the probity of the educational system in general.

The information presented in this report has been drawn from both the research literature and also a range of educational institutions policy documents. Those educational institutions, whose websites have been extensively used, are listed in appendix 1 along with that of the World Bank Group. Standard citing of material from many of these websites has proved difficult because of the degree of shared ideas and indeed terminology. However, this report does recognise the very valuable input of such sources.

3 Defining the problem

Before considering what steps can be taken to counter any malpractice, clear definitions of what this entails are necessary.

3.1 What Constitutes Dishonesty in Tests and Examinations?

- 3.1.1 *Cheating in tests and examinations:* Dishonest practice encompasses any action by an individual or group of students to gain an undue advantage in any form of assessment, be it coursework, test or examination. Such actions include:
- Looking at an examination paper or answer sheet of another student.
 - Actively colluding with another student within the examination hall either by signals or more direct electronic means (mobile phones etc.)
 - Obtaining information from a third party outside of the examination hall via digital technology (mobile phones etc.)

- Impersonating or substituting, that is taking either the place of another student in an examination or undertaking an assessment on behalf of another or prevailing on another to substitute for oneself.
- Obtaining unauthorised information prior to the administration of a test or examination.
- Possessing or distributing a test or examination paper prior to its administration, without the express permission of an appropriate member of staff.
- Substitution involving the replacement of legitimate answer booklets during an examination with ones prepared outside the test centre.
- Using any unauthorised materials or equipment during an examination such as concealed notes or the Internet via a mobile phone. *This latter practice has moved plagiarism into the examination arena whereas it had been confined to non-monitored assessment previously.*

3.1.2 *Cheating in unsupervised assessments:* Such malpractice includes plagiarism, collusion and substitution:

- Plagiarism has many definitions but in essence it is taking someone else's intellectual endeavour and presenting it as one's own thought, ideas and work. In the *Guidelines for Dealing with Instances of Suspected Malpractice* of the JCQ plagiarism is defined as: "*The failure to acknowledge sources properly and/or the submission of another person's work as if it were the candidate's own.*" (www.jcq.org.uk). Plagiarism includes:
 - Copying from published materials whether in paper or digital form without appropriate acknowledgement of source. Such copying covers a range of material not just textual information.
 - Presenting another person's ideas or work as one's own, for example one student copying work from another student without the knowledge of the other student.
 - Submission of the same or very similar work for more than one course unless dispensation has been given (for a example a single candidate submitting a masters chapter in a doctoral thesis).
 - While wholesale paraphrasing is perceived as unacceptable within the University sector, the JCQ (no date) states that "Unless the candidate has submitted an extensive and unacknowledged paraphrase (amounting to more than 50% of the total) of another person's writings, the Awarding Bodies will not include paraphrasing under the definition of plagiarism." This difference in perception is indicative of the stage of intellectual development and skill of students as they progress

through the educational system. It should not be viewed as a lesser standard being applied to younger learners.

- Substitution within non-monitored assessment can be viewed as a special form of plagiarism where the student actively seeks a substitute document through swapping, buying existing material or purchasing a bespoke product or accessing electronically held material of other students without their knowledge.
- Collusion involves two or more students working together without authorisation and producing the same or very similar pieces of work both of which are then presented as the individual's own work and sole authorship. It also involves copying another student's work with their consent or at least knowledge.

3.1.3 *Cheating post the test or examinations:* Additional dishonest practices include attempts to alter official records or documents oneself or by changing one's answers on a returned examination and then requesting regrading of the script (see Yale University). These actions are interesting but lie outside the remit of this report.

3.1.4 Serious interference with the examination process by:

- Intimidation or bribing examination officials or markers.
- Deliberately placing candidates in centres under the supervision of corrupt officials.
- Setting up Ghost Centres, that is fictitious examination centres where candidates can complete the exam with the support of helpers and without supervision.

Again these behaviours are interesting but lie outside the remit of this report.

3.2 The Nature and Use of Digital Technologies

The range of digital technologies is increasing particularly in the area of small mobile digital technologies such as mobile (cell) phones and MP3 players (see Table 1). Two-way pagers and cellular phones can send text messages, up to 160 characters in length, by using a data transmission standard called short messaging service. Personal digital assistants (PDA), originally designed to store personal information, a calendar and contact information, now have expanded functionality due to increasing on-board memory, more powerful central processing units (CPU), and most significantly wireless network access, and can be used to create a database using keywords or short notes as well as messaging.

Mobile digital technologies are very familiar to the young. Haste (2005) highlights the ubiquitous nature of such technologies in her survey which shows that in the UK over 90% (N=1,058) of all 11 to 21 years olds have access to a mobile phone and that such phones are seen as "a vital tool for young people's social lives" (p.2) as illustrated by the fact that over than half of her national sample texted friends more than five times a day. Access to a personal computer was

marginally lower than for mobile phones but still high and the teenagers surveyed here used both their mobile phones and personal computers to surf the web and e-mail, although the personal computer rather than the mobile phone was the preferred tool for the post-sixteens when e-mailing and surfing.

The importance of these technological developments lies not in the number of digital technology devices currently available but in their ready take-up by the young and in the convergence of functionality of the technologies. This functional convergence means that modern desktop and laptop computers now incorporate the functionality of a communication device and communication devices such as mobile phones are taking on the functionality of a computer (Yoffie, 1997). The implications of this technological convergence are profound. Table 1 shows the exploitable functionalities of such technologies for the student who is seeking to gain a dishonest advantage in the examination room. For example, it is now possible to use mobile digital technologies to access the Internet or to collude with another person while in the examination hall. Umarji (2005) reports that in 2004 182 South Korean students were caught using text-messaging to cheat on the national college entry examinations and six students were similarly identified at the University of Maryland. The rise in such activity has also been highlighted in a recent report (2005) from the Qualifications and Curriculum Authority (QCA) which showed that over a thousand students were caught taking a mobile phone into an examination (0.06% of the total examination population).

Table 1: Functionalities of Digital Devices (after Popyack *et al.*, no date)

Exploitable features	Storage	Processing	Sending	Accessing	Other
<i>Device</i>					
<i>Calculator</i>	Formulae Text (electronic crib sheet)	Algorithm, program storage and execution Graph drawing	Infrared beaming Capabilities		
<i>Mobile (Cell) Phones</i>	Text Images Pictures	Graphical display	Text Images Pictures e-mail	Web surfing	Increasingly small easily hidden Silent in vibrate mode
<i>Pagers</i>	Text		Beaming e-mail		Small easily hidden Silent in vibrate mode
<i>PDA's/cell phones</i>	Massive text storage Hand written notes Images Pictures		Beaming / messaging/ chat e-mail	Web surfing	Silent in vibrate mode
<i>MP3 Players</i>	Large amounts of recordable data				Small and easily hidden

Other examples of improper activity within examinations include those reported following a 'sting' operation by faculty members at the University of Maryland which showed 12 out of 400 accountancy students had accessed the Internet under supervised examination conditions (Read, 2004). Although in this case faculty were very positive about the 'sting', the director of the University's Student Legal Aid Office called into question the ethics and legality of such entrapment. This is not a case in isolation: the Seoul Metropolitan Police Agency, when reviewing text messages sent during the multiple choice College Scholastic Ability Test in 2004, found 550 suspect messages (Caveon Test Security, 2004).

Mobile technologies make plagiarism and associated activities possible in the examination hall. In small examination sites monitored by vigilant staff, students have limited opportunities to use mobile devices for cheating. However, in larger test centres with many students, mobile phones and PDAs facilitate student exchange of notes with other exam takers, the receipt of text messages from classmates outside the lecture hall, and searching the web.

It is apparent that the initial assumptions that the academic misuse of digital technology is centred on the use of the Internet and the World Wide Web as tools to plagiarise or to gain access to materials, whether off-the-shelf essays or bespoke products, presents only a partial picture. All those with a responsibility for protecting the integrity of the education system should be aware that while such activity may be the predominant malpractice, it is certainly not the only way students can or may cheat. Haste's (2005) survey highlighted the fact that the mobile phone was the preferred tool when young people chose to engage in less pleasant behaviour such as acts of malice and impersonation. While this does not provide direct evidence of a propensity to use the mobile phone to cheat, it does provide inferential evidence that this device is the most likely tool to be used should a student have a tendency to indulge in such practices. This inference is supported by Popyack *et al.*'s (no date) findings that students at Drexel University were fully aware of the potential of digital technologies for cheating. Of some concern is the further finding that the relevant teaching staff at Drexel were surprised when told that such activities could take place. Awareness of the potential problem is of course essential for any resolution.

4 Nature and Level of Dishonest Practice in Test and Examinations

4.1 Prevalence of Malpractice

There is currently very real concern surrounding the issue of academic cheating which is demonstrated not only by an extensive and expanding research literature on the problem (for example Connors, 1993; Larkham & Manns, 2002; Park, 2003; JCQ, 2006; Shepherd, 2006) but also, at higher education levels at least, by the proliferation of university policy documents for staff and students (see for example the University of California, McGill University, Lancaster University, the Robert Gordon University). Are these perceptions of academic

dishonesty practised through digital technologies borne out in reality? Is cheating as prevalent and as deeply damaging as many believe?

Although there is still a debate about the changes in the prevalence of academic dishonest acts by students, [see Brown and Emmett (2001) for a review of the evidence], Park (2003) asserts that there is an 'epidemic of cheating'. This is an assertion not supported by Vigue (1997) or Bricault (1998). Bricault, citing the work of Bowers and also of McCabe, has demonstrated that in the United States (US) cheating has been endemic for many years and pre-dates the digital revolution. The pre-digital origins of widespread cheating are attested to by Drake's (1941) report. However between Drake's (1941) study, which recorded 23% of college students admitting to cheating, and studies in the mid-nineties when self-reported instances of cheating showed 40-70% of students committing offences, there does appear to be a growing problem (Jensen *et al.*, 2002). Jensen and her colleagues' assertion that malpractice among the US equivalent of secondary, undergraduate and post graduate students is prevalent, is supported by a U.S. Department of Education report which describes levels of student malpractice as a "chronic problem" (Maramark & Maline, 1993, p. 4).

Much of the detailed research on the extent of malpractice has been undertaken in the post-nineteen tertiary sector and within the US, where the Centre for Academic Integrity (CAI) has been active for a number of years. The Centre records that between 40 and 70 percent of all American college students have reported cheating sometime during their academic career (Aiken, 1991; Davis, Grover, Becker, and McGregor, 1992). Recent surveys in the UK place the figures as between 4 and 7 percent of students admitting cheating (Shepherd, 2006) with about 40 percent of students stating they know someone that has cheated. Such low figures throw doubt on the applicability of US findings to the UK situation but Szabo and Underwood (2003) reported figures of 20% of undergraduates agreeing that they would definitely cheat to avoid failure with another 34% stating that they would actively consider this option. Only 46% of the students said they would not cheat under any circumstances. Further, Moon (1999) states that approximately 60% of US and UK higher education students confess to some sort of malpractice. These research findings suggest that there is some level of comparability between the US and UK situations and that, with a level of circumspection, one can draw on the extensive US data to inform UK policy and action.

The most recent CAI mass survey (released in June 2005) of the integrity of almost 50,000 undergraduates, on more than 60 campuses is genuinely disturbing. Seventy percent of students admitted to some form of cheating, with approximately 25% admitting to serious test cheating in the past year and 50% admitting to one or more instances of serious cheating on written assignments. Not all academic dishonesty is viewed in the same light. Lim and See (2001) showed that students perceived cheating in exam-related situations to be serious but plagiarism was viewed as a lesser sin. Whilst one might anticipate that rates of cheating would be higher in non-supervised exercises such as coursework as is the case for the CAI 2005 study, Whitley (1998) found only a small variation in levels of cheating between supervised (examinations) and non-supervised work.

The problem is not confined to the tertiary sector. In McCabe's 2001 study of some 4,500 US high schools:

- o 74% of students admitted to serious test cheating;
- o 72% admitted to serious cheating on written work;
- o 97% admitted to copying homework or to test copying;
- o 30% admitted to repetitive, serious cheating on tests/exams;
- o 15% had obtained a term (module) paper from the Internet;
- o 52% had copied a few sentences from a website without citing the source.

Interestingly, 90% of the students using the Internet to plagiarise had also plagiarised from written sources. Underwood and Szabo (2005) confirm this link between cheating off and on-line.

While the debate on the extent and rates of change over time of malpractice remains active, there is an increasing consensus that the mode of cheating has changed (Vigue, 1997), that is the Internet has changed the dynamics of dishonest academic practice. There are of course significant examples of cheating in which technology is not involved, for example events that lead to the quashing of Kenya's national secondary level examination results (Obonyo, 2005). However, digital technologies have brought equity to cheating. Access is no longer for the knowing few but is there for the majority (Underwood & Szabo, 2005).

4.2 Factors Influencing the Propensity to Cheat

Cizek (1999) and Whitley (1998) provide substantial reviews of the research into the motivation to cheat. Some key demographic, situational and psychological factors that correlate with academic dishonesty include:

4.2.1 Situational factors

- o Size of institution – cheating is:
 - More prevalent in large institutions rather than small (Davis, 1993 cited in Bricault, 1998).
- o Educational sector - cheating is:
 - More prevalent among school students than undergraduates (Davis, *et al.* 1992; Jensen *et al.*, 2002);
 - More prevalent among first year rather than third year undergraduates in educational systems such as that of the UK, which is a dual or multiple entry system allowing a second chance or recovery from failure (Cochran *et al.*, 1998; Graham *et al.*, 1994; Underwood & Szabo, 2005; Culwin, 2006; Forster, 2006);
 - More prevalent among final year rather than first year undergraduates in educational systems such

- as that of France, which is mostly a single entry system where failure can have lifetime implications in terms of access to high-earning or high-status employment (Forster, 2006);
- Acknowledged to be unacceptable by high school (secondary) students and teachers but there are diverging views on what such practice encompasses (Evans & Craig, 1990).
- Educational environment – cheating is:
 - More prevalent in educational environments which students perceive as inequitable or excessively demanding.
- or
 - More prevalent in educational environments where the teaching staff are perceived as uncaring or indifferent to their own teaching or to their students' learning (Popyack *et al.*, no date).
- Relevance of the subject – Gerdeman (2000) found that subject areas perceived as being of low relevance are more susceptible to cheating behaviour because of lack of motivation to study. However, this is at odds with the findings of Forster (2006) who has shown examinations with lifelong implications attract malpractice.
- Perceptions of lax attitudes on the part of staff to malpractice that lowers the risks of being found out in students' eyes (Simon, 2003; Park, 2004; McCabe, 2005; Underwood & Szabo, 2005). McCabe's (2005) survey of some 10,000 staff shows that 44% of those who were aware of student cheating have not reported the incident.
- The social milieu - the context within which the students find themselves has profound effects on students' behaviours as they seek social approval; respond to peer pressure to support a friend; and work within the perceived contextual norms including the perceived frequency of cheating within the institution (McCabe & Trevino, 1997).
- Performance and time pressures – when good grades are critical and competition is high some students bow to the pressure to achieve (Pellegrino, 1991 cited in Bricault, 1998; Straw, 2002; Park, 2003; Bolin, 2004). High status vocational subjects such as Law and Business Studies are particularly vulnerable (Hendershott *et al.*, 2000).

4.2.2 Student factors

- Sex – Males are more likely to cheat than females (Jensen *et al.* 2002; Underwood & Szabo, 2005) although Whitley (1998) has pointed out that sex differences are particularly strong in survey studies where participants provide self-reports. The figures

should therefore be viewed with some caution they the distinction may not be in behaviour but in the willingness to admit to malpractice.

- Ability – students with lower grade points scores are more likely to cheat (Graham et al., 1998). This is not an absolute: bright students in high performing situations may cheat to emulate more talented peers (Pellegrino, 1991 cited in Bricault, 1998; Shepherd, 2006).
- Lack of self-control or overall propensity to deviant behaviour or risk taking may lead to impulsive cheating (Underwood, 2003; Underwood & Szabo, 2005). Individuals who score highly on mild social deviance scales are as likely to cheat in examinations as they are, for example, to avoid paying their bus fares or cheat on their income tax returns.
- High self-control may lead to deliberate election to cheat if the student assesses the risk of detection as low and the rewards are high (Bolin, 2004; Szabo & Underwood, 2005).
- A diminishing sense of academic integrity and ethical values among students; that is cheating behaviour is more common among students who evaluate cheating leniently. (McCabe & Trevino, 1997; Lim & See (2001); Underwood & Szabo, 2005).

4.3 In Summary

- 4.3.1 The problems of academic dishonesty may be less well researched in the school system than in the tertiary education sector, but all the evidence points to the problem being both real and on a significant and growing scale.
- 4.3.2 There is a strong causal relationship between attitudes to academic dishonesty, perceived opportunities to cheat and psychological variables such as self-control and risk taking.
- 4.3.3 While personality factors self-regulation and propensity to risk taking are likely to prove intractable, reducing the opportunities to cheat, developing environments where cheating is unacceptable and reducing the acceptability of cheating within any institution should be the foci of a programme to reduce malpractice.

5 Options for the regulator with regard to non-ICT and ICT solutions

The QCA's objective in commissioning this report is to seek ways of reducing the incidence of dishonest practice in examinations and tests both supervised and unsupervised.

Although the focus of the report is challenges caused by digital technology and possible solutions, in essence it is not feasible to separate activity which

is non-technology, low-technology or high-technology driven. Such activities form a complex web of behaviour and require multiple-approaches to achieve solutions. As Simon and his colleagues point out, while it is important to describe and map the extent of academic dishonesty and determine methods for combating the problem, it is equally important to understand the perspectives of staff and the organisation as a whole: "The new realities of academic dishonesty mean that administrators and professional academics must work together to maintain a healthy learning environment, which requires a level of trust between classroom teachers and organisational elites, that is the administration" (Simon *et al.*, 2003, p 194).

Hinman's (2000) three-pronged approach to cheating and plagiarism provides a good model for effective practice. These three approaches are:

1. The Virtues Approach:
 - Develop students who do not want to cheat
2. The Prevention Approach:
 - Eliminate or reduce the opportunities to cheat
 - Reduce the pressure to cheat
3. The Policeman Approach
 - Catch and educate those who cheat
 - Catch and punish those who do cheat
 - Monitor the custodians

(after Hinman, 2000)

These might be summed up as the three "Es": Ethics, Engineering and Enforcement. Such terminology is widely used in other areas of social activity such as the regulation of road traffic behaviour.

5.1 The Virtues Approach (Ethics)

This approach should always be the first line of defence against dishonest practice.

5.1.1 *Codes of practice:* It includes making explicit the definitions of and code of practices in operation in relation to plagiarism and other forms of cheating to students and to staff. This has been the first line of defence of both the JCQ and QCA in their dealing with institutions and individual students and staff. Statements of code of practice, while meeting legal requirements, have proved insufficient deterrent to much of the malpractice within the student body however. The next step is developing and cultivating an environment where cheating does not prosper and it is easier for students to say no to peer and other pressures. Brown and Howell (2001) have shown that institutional policy statements on cheating and plagiarism can influence student perceptions.

5.1.2 *Honour Codes:* Hinman (2000) reports that in the US academic honour codes (e.g. the Academic Integrity and Kansas State University Websites) have been shown to reduce cheating, for example serious test cheating on campuses with such a code in operation have been shown to be 25% to 50% lower than in institutions that do not have such honour codes both within the secondary and tertiary sectors. Overt codes of practice are a mark of an institution's commitment to good academic behaviour and

when students perceive their tutors or teachers to be so committed, levels of malpractice decrease (Underwood & Szabo, 2004).

5.2 The Prevention Approach (Engineering)

The need to make explicit what is deemed as malpractice seems obvious but Park (2003, p. 473) points out that the act of plagiarism, while deemed malpractice by some, is dismissed as 'poor practice' by others: incompetence rather than intent; a lapse rather than a crime. There is little disparity in the interpretation of malpractice as far as test and examination cheating are concerned however (Lim & See, 2001). Many actions to reduce the potential of cheating are non-digital and include such common sense actions as maintaining security of examination papers and mark books both before and after the examinations. In addition cheating can be reduced by:

- 5.2.1 Modifying the test and examinations. This might include moving towards more process-orientated rather than product-orientated assessments; reduced recycling of previous test papers; and, producing multiple forms of the examination so that no one is seated in juxtaposition to a student with the same version of the exam.
 - o In Psychology at Nottingham Trent University, on-line multiple-choice examinations present each student with a selection of questions randomly selected from the test bank. No two students are presented with an identical paper. This approach severely limits collusion within the examination hall.
 - o Students (N=1,672) in Hollinger and Lanza-Kaduce's (1996) survey rated scrambling tests, authorised use of study sheets, multiple forms of tests and more invigilators as key to the reduction of cheating. Cheat hot-lines or similar moves to get students to police the situation for themselves were not deemed useful and this was confirmed by Underwood (2003).
- 5.2.2 Modifying the seating plans within the examination hall, as students seated next to strangers are less likely to cheat. It is essential to record where students are seated. Students should sign in, indicating their name, ID, signature, and seat number. Without a seating plan, suspected cases of cheating identified by any statistical detection program (see the example of the Acinonyx software below) cannot be followed up. The World Bank Group (no date) has argued for spiral seating plans with more than one version of the examination.
- 5.2.3 Cross checking of answers by candidates to ensure that substitution has not occurred. For example, disparity between a well-structured and error free answer alongside work that appears rushed and error-riddled is suggestive of substitution..
- 5.2.4 Severely limiting the material students can bring into an examination. This includes banning all mobile technological

devices. The State of California has taken this approach throughout the school system and not just in the examination hall.

- 5.2.5 Bans have not proved that successful, so a more secure but currently illegal and socially contentious approach is to jam signal-emitting devices. Ofcom (no date) defines jammers as “devices which are intended to prevent radio equipment from receiving and transmitting the signals relevant to their function. Use of such devices therefore constitutes the specific offence of causing deliberate interference.” Such ‘jammers’ have to be sophisticated and strong enough to block phone signals without interfering with other devices such as electric doors or leaking out of the zone, in this case the examination hall. The tendency is to have a reduced signal so that student at the edges of the hall might still be able to make contact with the outside world. Such devices remain illegal in the US, the UK [see Electromagnetic Compatibility Regulations 1992 (SI 1992/2372)] and the European Union but they are widely used in Asia, the Middle East and Latin America.
- 5.2.6 A potentially less expensive, but legally untested, alternative to signal jamming is blanket cloaking of an examination hall using a basic Faraday cage. New types of mobile phone blocking paint, based on nanotechnology, could become available in the future which could deflect radio signals when required and be activated and deactivated at will. The flexibility of this technology could mean that unwanted signals can be filtered out while allowing certain transmissions to proceed as normal. The status of such techniques is questionable. They do not ‘jam’, that is interfere with the signal, but they do prevent signals getting through, that is they cause ‘shadows’ or radio wave blind spots.
- 5.2.7 There are also detection devices that will indicate whether a mobile device is being operated within an examination hall.
- 5.2.8 Where electronic equipment is needed in an examination as in the case of calculators, centre-provided rather than personal equipment will reduce problems. This is again costly.
- 5.2.9 Biometric identification verification methods installed on the user’s computer can determine whether the named student or an impersonator is sitting an examination (e.g. The Ergotest system). Biometric identification is seen as a way forward for examining distance learning courses or students sitting in centres where they are unlikely to be known by the invigilators.
- 5.2.10 The World Bank Group (no date) argues that publicising the fact that students have been found cheating and have been duly dealt with is fundamental in convincing students that the risk is too high.

5.3 The Police Approach (Enforcement)

Although strategies designed to reduce or prevent the incidence of malpractice do reduce cheating, they do not eliminate the problem, hence monitoring is essential.

5.3.1 Tests and examinations that are conducted electronically are relatively easy to monitor even where plagiarism is involved. If the student can use digital technologies to access material the same technology can be used to monitor malpractice, whether through the use of search engines such as Google (at no cost) or plagiarism detection software such as Turnitin UK software (paid license by JISC in the UK). The latter is used widely in the UK tertiary sector. See Appendix 3 for further examples of such software.

5.3.2 At McGill University all substantial multiple-choice examinations (more than 29 questions and 24 students) are subjected to the Exam Security Computer Monitoring Program. In the UK McManus *et al.* (2005) have developed a similar program Acinonyx to investigate cheating in medical examinations. Such programs operate by analysing patterns of response by pairs of candidates and identifying the degree of pattern match. In the McManus case (2005) 13 potential cases of cheating out of eleven and a half thousand examinees were identified. These cases were further scrutinised using data on seating plans, notes in question booklets, changed answers and information from invigilators, which finally confirmed two students had colluded on a number of examinations.

There are two goals in using these pattern analysis programs. The first is to support charges of academic dishonesty against one or more students, as in the McManus case, and the second is to investigate the security of examination centre itself. The first use has proved to be controversial. It is only applicable when used in conjunction with other data, such as those outlined above; this approach may still prove unacceptable as there is a risk of false positives (Chaffin, 1979). However the use of such software to assess the procedures of a test centre with a view to helping such a centre improve its practice would be a positive way forward.

5.3.3 Signal detection devices to identify mobile phones that are active do not have the legal question marks of jamming and blocking. There are now very inexpensive devices (circa £100) which can silently detect mobile technology devices as they are switched on or off and when in use. These devices have a limited range so would need to be walked round an examination hall. They will also identify signals outside of the hall. One limitation would be that such a device will not identify any mobile phone which is being used as an electronic crib sheet only, that is if no active connection is made (reference 5.2.7).

5.3.4 Have a clear, consistent and public available list of legal sanctions for malpractice.

5.4 In Summary

- 5.4.1 While technological solutions to malpractice prevention are available, they will not prove to be a complete solution and of necessity should be used in conjunction with more traditional methods of prevention and monitoring.
- 5.4.2 The first line of defence is to stimulate an environment where cheating is not acceptable though the use of honour codes to which both staff and students have allegiance. Such environments help students resist peer pressure to cheat. The establishment of such an environment, coupled with a clear message of the risks of malpractice, has been shown to reduce although not eliminate incidence of cheating.
- 5.4.3 The design of tests and examinations, and the organisational structures for delivering those assessments, should be designed to reduce potential collusion within or beyond the examination hall.
- 5.4.4 Technological solutions such as encrypted tests, airport-style detectors and the use of biometrics to prevent impersonation may be of particular value for test centres where students are unknown to the invigilating staff.
- 5.4.5 Technologies such as signal jamming and creation of radio wave blind spots are highly effective but raise legal and cost questions.
- 5.4.6 Cheap signal detection devices are available and may prove to be a useful way forward in the fight against the use of mobile communications in the examination hall.
- 5.4.7 Technological monitoring is feasible only for digitally supplied material. Hence identifying plagiarism in examinations is more problematic than that for word-processed coursework. If parts of papers or full papers are converted to digital form, as is happening on a trial basis, then they too will be available for scrutiny.
- 5.4.8 Although it is possible to identify individual students who have cheated using a statistical detection program, such software is better used to identify centres with problems in order to help those centres strengthen their procedures rather than to bring cases against individual students.

6 Identification of areas of activity that remain problematic

In reviewing the current state of knowledge on academic dishonesty it is clear that a major problem exists. That this is important is attested to by the fact that the more important an examination is to the student then the more likely cheating will ensue. While technical solutions are most effective against digitally stored data, the use of small mobile devices in examination halls is blurring this distinction. Both technical and non-technical solutions

to the problem are available but there are barriers to their implementation. Such barriers include:

6.1 Human barriers

- 6.1.1 There needs to be clear and transparent rules and regulations governing academic dishonesty.
- 6.1.2 Policies should be fair but also workable. Overly bureaucratic procedures will deter staff from taking action.
- 6.1.3 All interested parties need to have an agreed perception of what constitutes cheating. This agreement should not be just between teaching staff and students but also between tutors and the executive at all levels.
- 6.1.4 Staff willingness to treat academic dishonesty as a serious but resolvable problem is key to successful implementation of any policy.

6.2 Legal barriers

- 6.2.1 The burden of proof is necessarily high when dealing with individual student cases.
- 6.2.2 Operating policies at the centre level, with a view to raising standards in centres, is less contentious than operating at an individual level.
- 6.2.3 The use of technological solutions such as statistical analysis packages is untried in UK courts. McManus (personal communication) points out that examination boards have proved reluctant to test this case in court. Probabilistic analyses on their own are not enough to prove two students have colluded and even with additional data on opportunity, for example, may be challenged by the student or his or her advisor.
- 6.2.4 A number of technically feasible solutions such as the use of an individual student's biometrics and signal jamming devices raise civil liberty questions which have yet to be resolved and in the latter case are illegal.

6.3 Cost barriers

- 6.3.1 The installation of technical devices is not cost free although in the case of signal detection hardware the costs are low. The probability of individual examination centres willingly bearing this cost is low.

7 In Summary: The Way Forward

JISC, in its plagiarism roadmap, maintains that the way forward is a holistic approach using both technical and non-technical solutions. While technological solutions can and do support more conventional approaches to reducing academic dishonesty they are not a total solution, not least because the use of some technologies is currently illegal. Ofcom, in

discussing signal jamming devices, advocates an “alternative, legal way to do this is by education and publicity in informing users to keep mobile phones switched off when requested to do so.” The solutions to misuse are still largely people led and this should not surprise us. When the three ‘Es’; ethics, engineering and enforcement were brought to bear on a parallel mal-behaviour, that of drink driving, while technological enforcement via the breathalyser had a significant impact, the core change in behaviour came when the majority of society no longer perceived drink-driving as acceptable. A tipping point occurred when society in general came to an ethical standpoint. This sea-change will be necessary to combat academic dishonesty also.

8 Recommendations

The regulator may wish to consider the following recommendations:

- 8.1 The regulators should restate the list of prohibited activities within an examination hall in the light of the new mobile technologies.
- 8.2 In conjunction with the examination authorities, require some form of status identity and seat plan for all examinations. If this is too draconian a measure, at least consider such a measure for test centres where invigilators are unlikely to have personal knowledge of the candidates, as these are the more vulnerable units.
- 8.3 In conjunction with the examination authorities, investigate the legal status of potentially useful technologies for reducing and detecting various forms of malpractice.
- 8.4 In conjunction with the examination authorities, conduct field trials of the use of signal blocking and signal detection technologies.
- 8.5 In conjunction with the examination authorities and for electronic examinations such as multiple-choice test, conduct field trials of response analysis programs to test the vulnerability of any centre. This should be seen as a centre-support monitoring exercise rather than a punitive exercise and at this time should be confined to centre level analysis rather than the identification of individual candidates.

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Appendix 1: Institutional Websites Central to this Report

- Academic Integrity Website http://www.academicintegrity.org/samp_honor_codes.asp
- Kansas State University www.ksu.edu/honor
- Lancaster University <http://www.lancs.ac.uk/users/celt/plagiarism/plagiarism>
- McGill University (no date) Prevention of cheating on multiple-choice and midterm examinations. <http://www.mcgill.ca/integrity/strategies/midterms/>
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Appendix 2: An Example of Staff Awareness of Dishonest Practice

Some 60% of staff with Bricault's surveyed staff were unaware of any malpractice. Where malpractice was identified some 50% of the activity was related to plagiarism although cheating in supervised assessments (class examinations) was at a non-trivial level.

Figure 1: Frequency with which Staff reported Academic Dishonesty (Bricault, 1998)

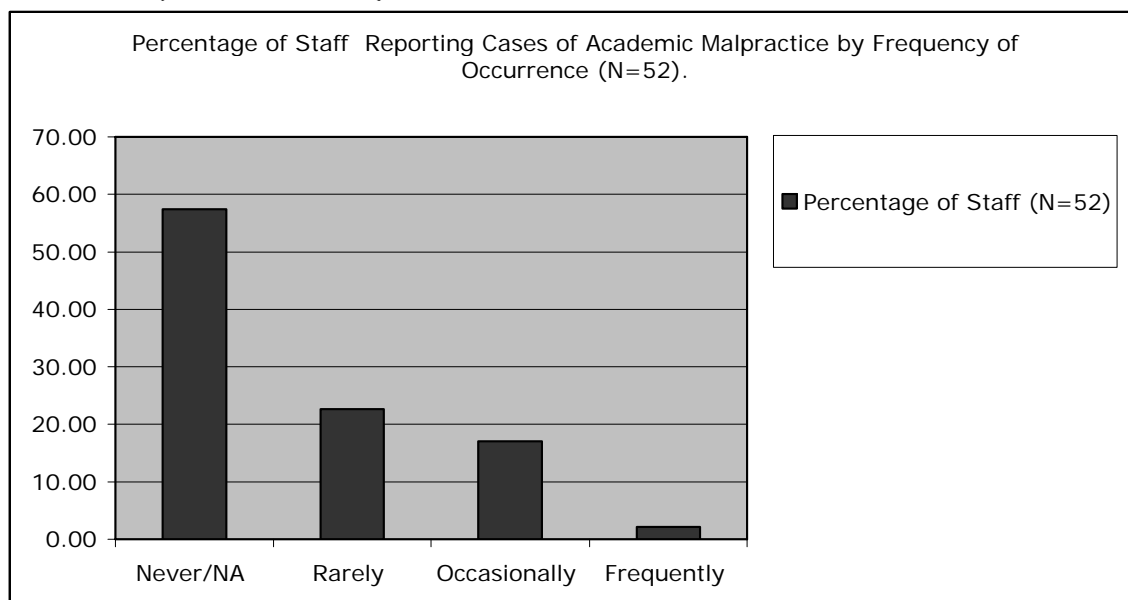
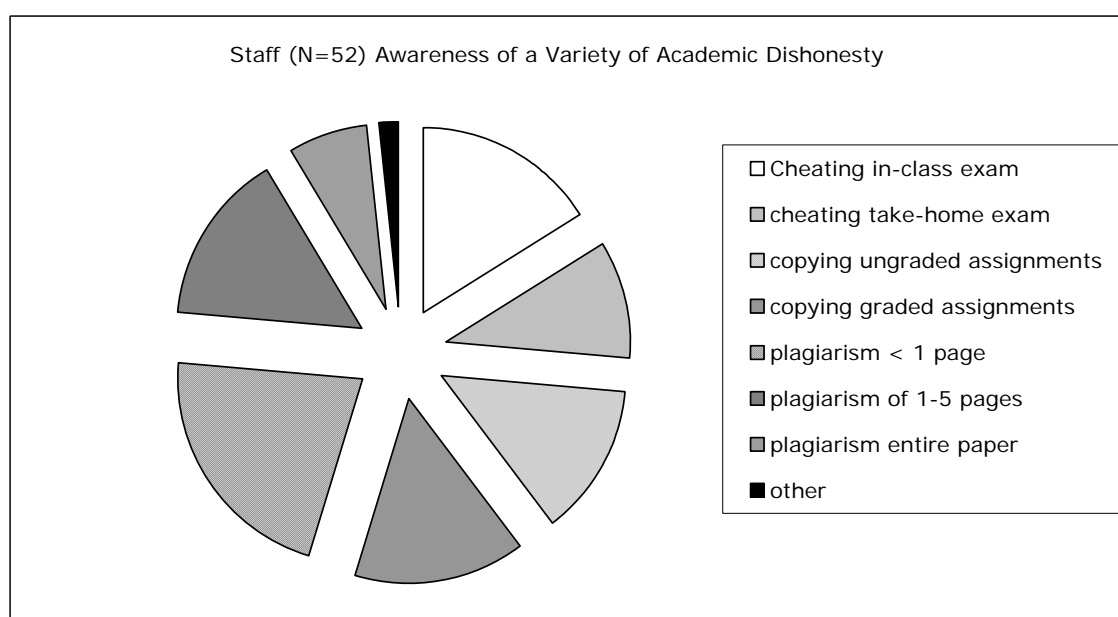


Figure 2: Staff Awareness of Academic Dishonesty (Bricault, 1998)



Appendix 3: Technical Review of Free Text Detection Tools

Bull & Collins (2001) technical review of products showed that:

- Turnitin (iParadigms), Findsame (Digital Integrity), Eve - all identified cut and paste from the Internet
- Turnitin, Copycatch, Wordcheck successful compared textual data stored in databases