Academic Dishonesty in a High-Tech Environment

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Overview

I.   The Problem
>   High-tech devices in the classroom
>   File theft
>   Plagiarism
>   Subcontracting an assignment

II. Fighting back
>   Plagiarism detection tools
>   Plagiarism detection services

III. False positives
IV. Causes and Effects
V.   Audience discussion

High-tech devices in the classroom

Image From:
www.cellular.ns.ca

Calculators

- Exploitable Features
  - Formula Storage
  - Text Storage - "Electronic Crib Sheet"
  - Algorithm/Program Storage and Execution
  - Graph Drawing
  - Infrared "Beaming" Capabilities

Cell Phones

- **Exploitable Features**
  - store/send text
  - store/send images/pictures
  - graphical display
  - Web surfing
  - send e-mail
  - "silent ring" mode ("vibrate")

Image From:
www.backslashtech.com

Electronic Communications

U-Md. Says Students Use Phones to Cheat

Text Messaging Delivers Test Answers

By Amy Argetsinger
Washington Post Staff Writer

The University of Maryland is investigating 12 students for allegedly using their cell phones to dial up all the right answers during fall exams.

The students are accused of using the "text messaging" functions on their phones or pagers to receive silent messages from friends who had access to answer keys for the tests, campus officials said yesterday.

It is the latest wrinkle in the continuing struggle between technology and academic integrity. Though quick to jump on the Web and embrace the laptop, schools across the country have been confronted with the problem of students using those very tools to plagiarize essays from the Internet. At Maryland, as at many other colleges, faculty members were stunned a few years ago to discover that some students were using the same high-end calculators required for many advanced math tests to retrieve stored information during exams.

But the use of cell phones "was a new one for us," said John Zacker, the university's director of student discipline.

The accusations prompted university administrators to send a memo to faculty members yesterday advising them to monitor the use of cell phones and other electronic devices during exams.

The incident also highlights an apparent generation gap in technology savvy on campus. While students by and large expressed no surprise that cell phones could be used for illicit purposes, Zacker said it simply had not occurred to most faculty.

Zacker said the accused students are suspected of exploiting a common practice at College Park, in which professors post answer

See CHEATING, B4, Col. 3

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Electronic Communications, 2

Text Messaging Delivers Test Answers to Students

keys outside their offices after giving an exam so that students can immediately calculate how they did.

Some professors, he said, have gotten in the habit of posting the keys while students are still taking the exam, assured that students would not be able to see the answers until they had turned in their tests and left the proctored classroom.

It is unclear exactly how the accused students may have cheated, Zacker said. But preliminary investigations suggest that they may have arranged to have friends outside the classroom consult the keys and call in the answers.

In some cases, professors had posted answer keys on their Web sites, and officials believe that students may have used cell phones equipped with Web browsers to look up the answers themselves, while still in the exam room.

The memo, from Provost William W. Destler, also advised faculty not to post answer keys until well after an exam is completed.

Zacker would not say which professors or departments had reported the recent accusations or whether all 12 cases came from the same course.

The University of Maryland has worked to bolster a culture of academic integrity in recent years, including the institution of a new honor pledge that students are urged to sign on their work. The student-run Honor Council will

rule on the cases in coming weeks. First-time offenders at Maryland generally receive a failing grade for the course with a marker on their transcripts indicating that cheating was involved, but additional offenses can merit suspension or expulsion.

Donald L. McCabe, a professor at Rutgers University who has studied academic dishonesty, said he had heard of other instances of students across the country using a cell phone to cheat.

Though technology has made it easier for students to cheat—and possibly harder for professors to detect it—McCabe does not believe that it has tempted more students to cheat. However, he said it may have increased "the frequency with which cheaters cheat."

"Ten years ago, you'd hear about students using hand signals or tapping with pencils on their desk," he said. "Things like this are displacing that. You don't have more cheaters, just more ways to cheat."

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Electronic Communications, 3

Text Messaging Delivers Test Answers to Students

CHEATING, *From B1*

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Pagers

- Exploitable Features
  - Small (Easily Hidden)
  - Beaming/e-mail capabilities
  - Pre-store information
  - Silent Ring (Vibrate)

Image From:

www.cellularconcepts.ns.ca

Headphones

- Cassette, CDR/W, MP3
- Exploitable Features
  - Hold Large Amounts of (Recordable) Data
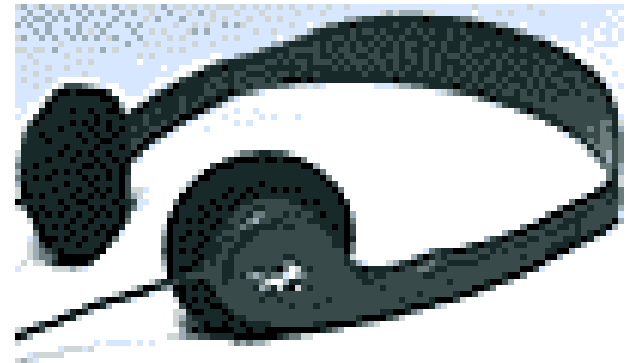 - Easy to Hide (MP3 Players)
  - Disguised as Music

Image From:
  www.armyradio.com

Personal Digital Assistants

- Exploitable Features
  - Text Storage (Massive)
  - Beaming/Messaging/Chat
  - Web Surfing
  - E-mail
  - Storing Hand Written Class Notes

take your life with you.

Zire

Image From
www.palm.com

Faculty Responses:

- "Our school had a request from the students to install **instant messaging** on the lab computers. There is some discussion now about what effect that will have on those who give online quizzes and exams."
  - *John Cigas*

- "We **do not permit** students to use calculators, electronic dictionaries, cell phones, pagers or mp3 players during any of our exams."
  - *Survey Respondent*

High Tech Meets Low Tech

- ## Can you read this?

"Crib sheet", printed in 4-pt font.
(easy to do with copier, high-resolution printer)

Exam Aids

Exam Aids

- On closer inspection…
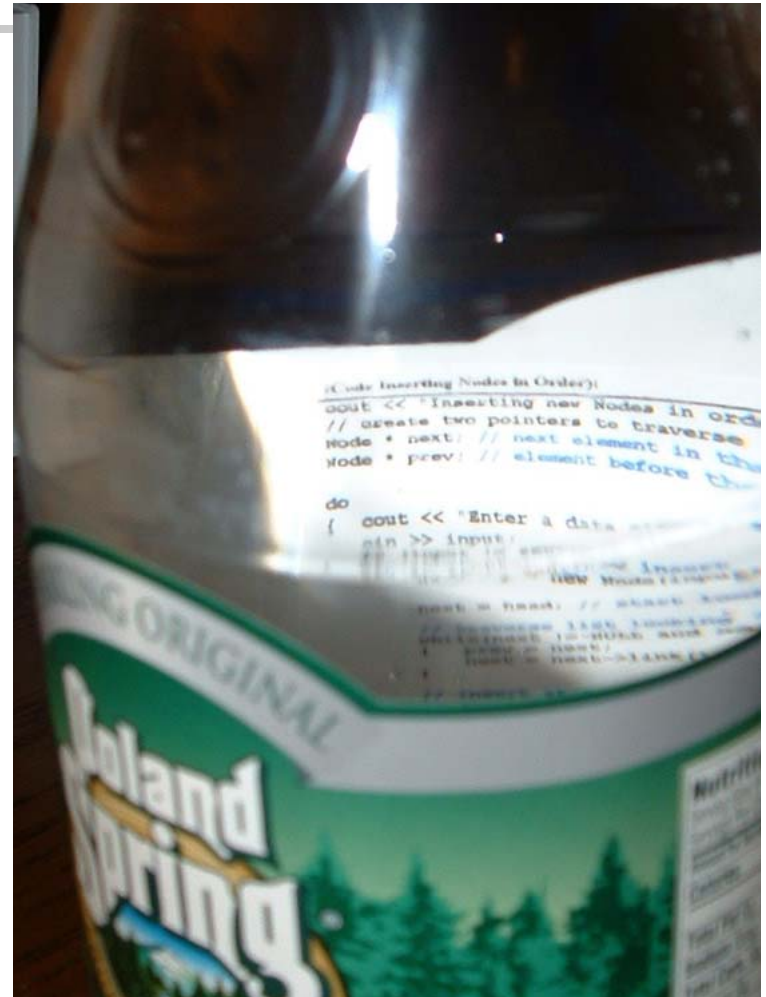
Exam Aids

- On closer inspection...

Exam Aids

- On closer inspection…

Exam Aids

- On closer inspection…

Ban Illicit Materials in Exams

File/Identity Theft Opportunities

- ## Viewing Files on Shared Disks
  - To find all occurrences of a given course name, file name, etc. on UNIX system:

    find / -name 'expression' –print

- ## Transmission Interception
  - Machines in same "collision domain" (hub) can sniff each others' incoming and outgoing packets.
  - System administrators have exceptional privileges – e.g., ability to sniff packets that "pass by" the machine

    Students hire on as P/T sys-admins

Identity "Borrowing" Opportunities

- Failure to logout when leaving lab

- Network outage when student logged in; still logged in after system restored

- "At our institution, students have attempted to use other student's accounts to send threatening emails to instructional staff."
  - *Survey Respondent*

Plagiarism Opportunities

- From students in the class or other sources
  - copying a written assignment

  - copying a computer program
    - complete copy
    - copying a portion of code

  - modifying a complete or partial copy:
    - renamed identifiers
    - modified comments
    - reordered subprograms/code blocks

Subcontracting an Assignment

- Electronic "Paper Mills"

  Offer papers on a variety of subjects. Most advise against fraudulent use.

  http://www.cheathouse.com

  http://www.termpapers-on-file.com

  http://www.cheater.com

  http://www.a1-termpaper.com

Subcontracting an Assignment

- Using legitimate Web services for hiring programmers to do small jobs
  - E.g., www.rentacoder.com:
    - Personal Project / Homework Help

- Submitting "naïve" questions to Usenet groups

- E-mailing questions to faculty at other schools

Subcontracting an Assignment

Other sites where "code for fee" can be negotiated
- http://netskool.com
- http://kasamba.com
- http://cstutoring.com

Find expert help in many areas (CS included)
- http://allexperts.com

Find free-lancer by typing "help me with my homework" in search engine, posting on Usenet, …

E-mail Solicitations

- "I have had a few (3 or 4) students ask for help on projects thru the Technical e-mail list I belong to. The list moderator shut the cases down quickly, and one time the list then discussed this problem. It was a well known problem of many members on the list who had been solicited before."
  - *Survey Respondent*

- "In a software engineering course for junior and senior majors, I had a former student send my class (and me by mistake), a solicitation to sell the students their former solution to the main project."
  - *Survey Respondent*

Tools for Fighting Back

- Awareness of possibilities
  - Stay abreast of technological innovations

- Plagiarism Detection Tools
  - Specific technical tools available for specialized areas, such as programming

- Plagiarism Detection Services
  - For a fee, offer assistance in tracking plagiarism locally and more globally

Detecting Text Plagiarism

- ## WCopyfind, Copyfind

  L. Bloomfield, University of Virginia

  http://plagiarism.phys.virginia.edu

- Free

- Compares submissions with each other

- Options:
  - Fewest number of matches
  - Length of the shortest phrase
  - Can ignore punctuation, letter case and numbers
  - Can specify *wordmap* (file of synonyms)

Detecting Text Plagiarism

- Compare files with existing material on Internet
- Software:
  - Eve (Essay Verification Engine)
    http://www.canexus.com/eve/index.shtml
  - Commercial Product, Free Trial

- Internet Service:
  - TurnItIn
    http://www.turnitin.com/
  - Commercial Service

Moss

- ## Moss (Measure of Software Similarity)
  Alex Aiken, University of California at Berkeley
  http://www.cs.berkeley.edu/~aiken/moss.html

- ## Features:
  - Web based
  - Comparisons: Pairwise by submission (including multi-file submissions), line-by-line, and token-by-token
  - Can omit from consideration "common code supplied by instructor"
  - Can ignore match percentages below given

Moss Testimonials

"I have found Moss to be quite effective. … **any case that Moss detects has always been a true case of plagiarism**, and the students I've confronted in such situations have always confessed when confronted. Occasionally, when I've suspected that a student has copied code from a previous offering of the course, I've been **able to do a Moss comparison against previous students' code** and discover the collaboration.

-- *Jim Huggins*

Moss Reduces Cheating Rate

"We have been using MOSS for several semesters, and the **amount of cheating detected amongst students has declined dramatically**, from over 10-15% in the intro course (with an enrollment around 300 students per semester) when we started, **to virtually 0%**. We still have the occasional case, but the word seems to have gotten out to students that we are serious about this. **The default penalty is failure in the course.**"

-- *Carl G. Alphonce*

More Changes from Using Moss

"In CSC 214, the second-semester C++ programming class, we used Moss beginning in 1998. **For the first several semesters, we caught dozens of students in unauthorized sharing of code** (out of an enrollment of 150-400 per semester. It was very time consuming for the instructors to pursue all of these cases and get the reports signed by students. **After about three semesters of this, the cheating cases dropped off to almost 0. Everybody knew that if they cheated, they would be caught.**"

-- Edward F Gehringer

Sample Moss Results

- **Pairwise Matching of Submissions**

- **Degree of Match Provided for**
  - Tokens
  - Lines
  - Percentage

Moss Results

Sat Dec 15 14:45:03 PST 2001

Options -l cc -d -b SKEL/ -m 10

cs172 demo hw5

[Text Report | How to Read the Results | Tips | FAQ | Contact Moss | Submission Scripts | Credits]

File 1	File 2	Tokens Matched	Lines Matched
Student141 (77%)	Student12 (77%)	405	112
Student70 (63%)	Student141 (71%)	372	105
Student70 (63%)	Student12 (71%)	372	108
Student64 (61%)	Student111 (55%)	314	80
Student98 (71%)	Student1 (70%)	307	69
Student38 (60%)	Student112 (58%)	281	66
Student47 (81%)	Student126 (81%)	272	74
Student68 (69%)	Student55 (69%)	262	89
Student72 (69%)	Student45 (69%)	260	86
Student48 (39%)	Student136 (61%)	258	65
Student43 (54%)	Student19 (58%)	247	66
Student68 (64%)	Student103 (55%)	244	86
Student55 (64%)	Student103 (55%)	244	86
Student93 (45%)	Student84 (57%)	230	69
Student72 (59%)	Student68 (59%)	224	75
Student72 (59%)	Student55 (59%)	224	77
Student68 (59%)	Student45 (59%)	224	75

Moss Code Matching

- Side-by-Side Code Viewing

- Highlights Potential Infractions

- Can Ignore Instructor Supplied "Common Code"

Moss Checks Compilation

- Programs that do not compile are flagged

Student142 (10%)	Student107 (7%)	40	8
Student131 (7%)	Student120 (11%)	40	4
Student129 (9%)	Student119 (8%)	40	8
Student128 (9%)	Student125 (5%)	40	8
Student128 (9%)	Student110 (8%)	40	10
Student126 (11%)	Student124 (10%)	40	9
Student125 (5%)	Student119 (8%)	40	11
Student122 (4%)	Student119 (8%)	40	14
Student4 (8%)	Student16 (5%)	36	9

Any errors encountered during this query are listed below.

Warning: File Student114/WomanMain.cpp ended without closing function scope; this file has a syntax error. Results for Student114/WomanMain.cpp may be inaccurate. Last entered function scope on line 9.

Warning: File Student137/Woman.cpp ended without closing function scope; this file has a syntax error. Results for Student137/Woman.cpp may be inaccurate. Last entered function scope on line 47.

Warning: File Student75/testMatriarch.cpp ended without closing function scope; this file has a syntax error. Results for Student75/testMatriarch.cpp may be inaccurate. Last entered function scope on line 17.

Document: Done (1.233 secs)

Moss Cliques

- Drexel DUPLEX Group Product

- Creates Clique Groupings from Moss Output

1 Student126
Student47:81% Student19:26% Student43:26% Student109:23% Student128:15%
Student124:11% Student30:11% Student63:11% Student97:11%
top

2 Student47
Student126:81% Student19:26% Student43:26% Student109:23% Student128:15%
Student30:12% Student63:12% Student124:11% Student143:11% Student97:11%
top

3 Student141
Student12:77% Student70:71%
top

4 Student12
Student141:77% Student70:71%
top

5 Student98
Student1:71% Student87:22% Student56:11% Student32:09%
top

6 Student1
Student98:70% Student87:22% Student56:11% Student32:09%
top

7 Student68
Student55:69% Student103:64% Student45:59% Student72:59% Student79:54%
Student91:38% Student81:32% Student26:31% Student39:30% Student5:27%
Student38:23% Student74:17% Student4:13% Student30:10% Student63:10%
top

8 Student72
Student45:69% Student55:59% Student68:59% Student103:48% Student79:44%
Student39:32% Student91:31% Student26:31% Student5:27%   Student81:24%
Student38:23% Student74:17% Student4:13% Student30:11% Student63:10%
top

9 Student55
Student68:69% Student103:64% Student45:59% Student72:59% Student79:54%
Student91:38% Student81:32% Student26:31% Student39:30% Student5:27%
Student38:23% Student74:17% Student4:13% Student30:10% Student63:10%
top

10 Student45
Student72:69% Student55:59% Student68:59% Student103:48% Student79:44%
Student39:32% Student91:31% Student26:31% Student5:27%   Student81:24%
Student38:23% Student74:17% Student4:13% Student30:11% Student63:10%
top

11 Student111

JPlag

- Developed by Guido Malpohl at the University of Karlsruhe
- http://www.jplag.de/
- Pair-wise comparisons for source code of programs and general text

student41	->	student49 (40.9%)	student86 (40.3%)	student2 (35.8%)	student73 (28.1%)	student151 (25.3%)	student88 (23.0%)
student86	->	student2 (36.0%)	student49 (34.1%)	student73 (28.5%)	student151 (24.5%)	student91 (22.5%)	
student22	->	student75 (30.1%)					
student2	->	student49 (29.5%)	student73 (25.4%)	student151 (24.3%)			
student49	->	student73 (24.9%)	student151 (21.7%)				
student87	->	student100 (22.3%)	student28 (21.4%)				
student101	->	student107 (21.6%)					

Issue of Concern: False Positives

- Given two decisions to make: cheating vs. not cheating
  - Can make correct decisions
  - Can make incorrect decisions
- Two types of errors possible
  - Incorrectly deducing cheating
    - False positive
  - Incorrectly deducing no cheating
    - False negative
- Often, one type of error is less desirable
  - Design procedure to minimize errors

Student Responses

- ## False negatives
  - Students may be angry that cheaters get good grades without doing the work
  - Demoralizes the group as a whole

- ## False positives
  - Accused may get angry
  - Parents may call University Dean/President

Faculty Strategies

- Faculty should not accuse students based solely on similarity scores

    - Ask for information about how such similarity may have occurred

    - Ask students to redo work in a controlled setting

    - Inform students their work will be examined closely in the future, looking for high-similarity cliques

JPlag False Positive?

Our Experience

- Students respond to feedback that similarities are noted

- No punitive approach needed
  - The knowledge that detection is highly probable quickly limits copying

- Caution: some students react negatively to atmosphere of constant suspicion

Plagiarism Detection Information

- Metrics Based Plagiarism Monitoring
  - Edward L. Jones, Florida A&M University

    CCSC 2001

- VAST - Visualization and Analysis of Similarity Tool: Towards an error free plagiarism detection process
  - Thomas Lancaster and Fintan Culwin, South Bank University, London

    ITiCSE 2001: http://doi.acm.org/10.1145/377435.377473

- Fully Automatic Assessment of Programming Exercises
  - Riku Saikkonen, Lauri Malmi, Ari Korhonen

    Helsinki University of Technology, Finland

    ITiCSE 2001: http://doi.acm.org/10.1145/377435.377666

Unintended Consequences

- "As faculty we must begin by setting a good example … impressing on students why academic honesty is important to them (every instance of cheating potentially diminishes the value of [their] degree …), making sure detected cases of cheating are dealt with in an appropriate manner (**simply awarding zero on an assignment for cheating can actually *encourage* cheating: if someone has the choice of not doing an assignment or cheating to get it done, there is *no penalty* for cheating and getting caught, but there is a definite advantage to cheating and not getting caught** …) …, and also taking preventative measures to ensure that cheating is just too much effort to be worth it."

    -- Carl G. Alphonce

One Approach to Combat Cheating

- "**Give hard exams**, and vary them every year. Only those who truly studied the material can succeed, and there is no benefit in getting help from someone not currently enrolled."

    --- http://www.psu.edu/celt/largeclass/faqexams.html#4

How a Student Might Respond

- "**Give hard exams**, and vary them every year. Only those who truly studied the material can succeed, and there is no benefit in getting help from someone not currently enrolled."

    --- http://www.psu.edu/celt/largeclass/faqexams.html#4

- "**Yes, cheating is right! What else can I do? They put very difficult questions, and if I don't cheat I'll fail. They force us to cheat!** If they make their exam questions more solvable, I promise not to cheat again!" says M.R., 19.

    --- http://www.teenstuffonline.com/tfd200005-02.htm

Student Perceptions

- **"I believe there are two kinds of cheating, one is bad and real cheating, whereas the other is not really cheating, or acceptable cheating, something we all do**. Bad cheating is when you try to cheat off the person sitting next to you, maybe a friend, without him seeing or knowing this. But when you've got a really hard exam on a very long subject, you're likely to be confused and need some help. You ask your friend who's sitting in front of you, and he can either tell you or refuse to answer you back, so you won't be forcing him to do anything."

--- http://www.teenstuffonline.com/tfd200005-02.htm

Why Students Cheat

- Class is Too Hard or "Unreasonable"
- Grades are the Most Important Thing
- Coursework is "Meaningless Busywork" or Waste of Time
- Cheating is "Part of the System"
- Loyalty to Friends is Higher Morality
- External Demands leave no Time for Studying

Blaming The Instructor

- Student's Job is to Cheat: Instructor's Job is to catch Cheaters
  - Instructor is too Lazy/Inept to Stop Cheating
  - Instructor Doesn't Care

- Instructor isn't Respected by Students
  - Course is Designed to Fail Students
  - Instructor is a Jerk (Doesn't Respect Students)

The Moral High Ground

- GENDER. **The most significant differentiating factor among high school students is gender.**

- SPORTS. In most cases it was not a differentiating factor with one significant exception: **varsity athletes were more likely to cheat on exams.**

- RELIGIOUS SCHOOLS. Those who attend private religious schools do not behave or think much differently from others... **They did steal less but they cheated and lied more to teachers and parents.**

- RELIGIOUS CONVICTIONS. Students who said that their religion was essential or very important to them (regardless of the kind of school they attended) ... **tended to have more positive attitudes about the importance of ethics.**

- COLLEGE AND HONORS CLASSES. Generally, those who intended to go to college and attended honors or advanced placement classes **said they cheated, stole and lied less than others.**

    --- Josephson Institute of Ethics, 2002 survey
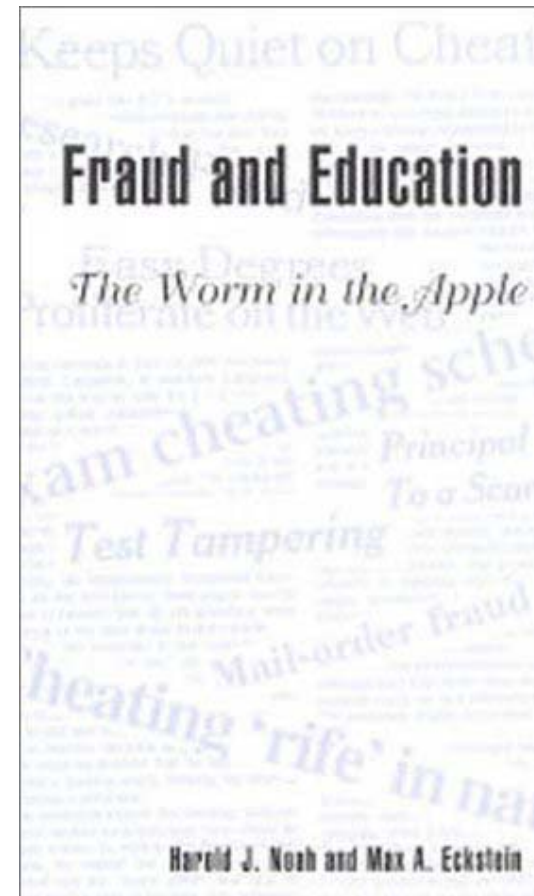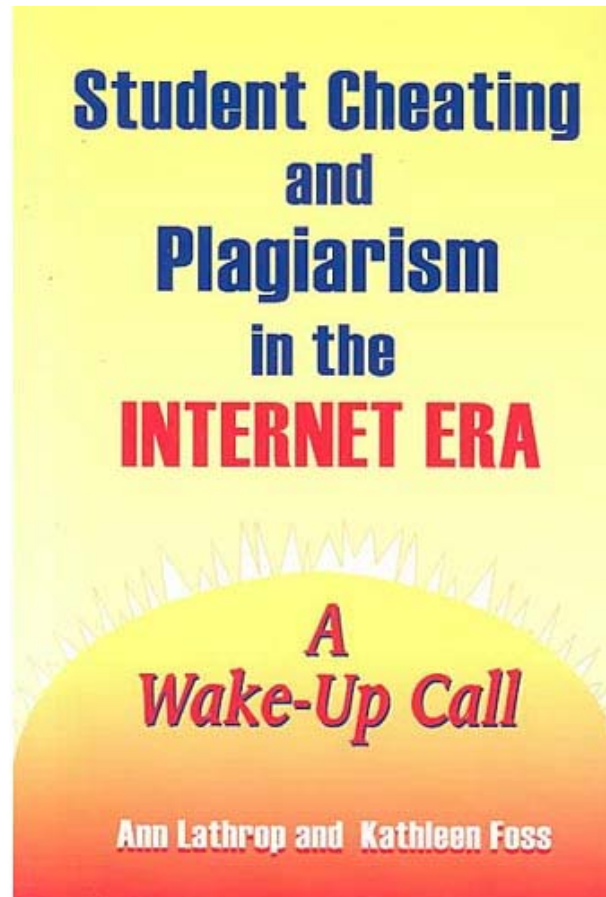
Combating Cheating:

- "**Warning students not to plagiarize, even in the strongest terms, appears not to have had any effect whatsoever**. Revealing the use of plagiarism-detection software to the students prior to completion of an assignment, on the other hand, proved to be a remarkably strong (though still not absolutely perfect) deterrent."

    --- Actions do speak louder than words: Deterring plagiarism with the use of plagiarism-detection software
    PS, Political Science & Politics; Washington; Dec 2001; Bear F Braumoeller; Brian J Gaines;

Recommended Reading

Student Cheating and Plagiarism in the INTERNET ERA

A Wake-Up Call

Ann Lathrop and Kathleen Foss

Fraud and Education

The Worm in the Apple

Harold J. Noah and Max A. Eckstein

SIGCSE Survey Contributors

- Jesse M. Heines , Univ. Massachussetts, Lowell
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