

Date Published 10-1-2004

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Frost, J., & Gantt, G. (2004). Common Forensic Authentication And Non-Repudiation Techniques To Deter Plagiarism. *Mountain Plains Journal of Business and Technology*, 5(1). Retrieved from <https://openspaces.unk.edu/mpjbt/vol5/iss1/6>

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COMMON FORENSIC AUTHENTICATION AND NON-REPUDIATION TECHNIQUES TO DETER PLAGIARISM

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ABSTRACT

The issue of academic integrity is a priority in any business school. Student education is one of the principal methods to deter plagiarism. Also, the instructor can direct students in paper preparation by requiring preliminary and final proposals, insisting on retention of source material and guiding the student to appropriate resources. Further, it is equally important for the instructor to use strong techniques to detect and confirm student plagiarism plus an active review of all submissions, not just selected “suspicious” student work. Finally, it is important to use computer forensic techniques to authenticate and avoid non-repudiation of student actions.

I. THE PROBLEM

Plagiarism is a component of academic dishonesty that continues to show a presence in student academic work with ready sources for entire papers, or major portions thereof, on the Internet. An oft-cited example of plagiarism from the University of Virginia is mentioned by Hoover (2002). “In April 2001, a physics professor, using a homemade computer program to detect similarities among term papers in his class, accused 122 students of plagiarism.” Problems like this are compounded given that the Internet, as an electronic medium, is now supplementing and may soon replace the traditional library as the primary source for research at all levels of education. The article “Of Course it’s true; I saw it on the Internet” in the May 2003 edition of *Communications of the ACM* (Graham, 2003) identified the reliance of college students on the Internet as an appropriate source for research. This article identified the ease of access (availability and speed) and the uncertain nature (reliability and integrity) of the medium. With these two related problems in mind, this work sets forth standards that professors may adopt to encourage accuracy in student research and to reduce plagiarism.

Previously, Frost and Gantt (2003) discussed the merits of various electronic agents as a method of detecting plagiarism. Clough (2000) also provides a good review of the multi-faceted review of plagiarism and tools available. These tools assist in detecting plagiarism from web-material (published in a hypertext markup format — html, shtml, xml, and other variants of markup languages). However, instructors that are investigating student papers for un-cited material must recognize that not all resources are investigated by electronic agents. There are numerous other sources on the web that are not in these formats that students may utilize in their academic efforts. These sources include information available for downloading in “.doc” and “.pdf” formats. Other information on the Internet is available to users in the traditional html

format but invisible to the electronic agents because the information is behind proprietary firewalls such as Wall Street Journal articles accessible only to subscribers to WSJ.com. There are also paper mill sites that are not accessible by electronic tools whose word processing documents must be downloaded in a text document format. Thus, while electronic agents may be useful tools in detecting instances of plagiarism, they should be supplemented by other procedures designed to discourage academic dishonesty.

A critical activity to discourage plagiarism is via education to create an awareness of the aspects of plagiarism and how proper citation honors the original author. This is comparable to an example of a city using a mobile unit that displays the motorist's current speed and the posted speed (FIGURE 1). Immediately, motorists are aware of their present speed in the zone compared to the posted speed. Although they can look at their own speedometer and the signs on the streets, this additional stimulus raises their awareness of the expectations placed upon them. Immediately, drivers are aware of the difference between their action and the



Speed Trailer – Figure 1

point of view of a controlling agent. Likewise, education and awareness of the instructor's intent to monitor for un-cited material is a deterrent to plagiarism. Universities are offering web-based instruction to assist students in avoiding plagiarism. An example is Purdue's On-line Writing laboratory at http://owl.english.purdue.edu/handouts/research/r_plagiar.html. Some prudent students use web search tools to investigate their own papers prior to submitting them. It is also important for instructors to prepare for the need of computer forensics of the data submitted in order to maintain the integrity of the instructor and of the data in the event that a submission is challenged or questioned.

Academic integrity should be emphasized at the university and college levels. Each college should create and publish to students and faculty the expectations for student conduct, both in the classroom and when students submit work. Student conduct expectations of the college may be above or beyond those published by the university. It is beneficial to develop a consistent brief summary of those expectations for inclusion in every instructor's syllabus and on individual faculty web pages. A united statement on the expectations of the college is critical to protect the college and the instructor when occurrences of possible plagiarism are uncovered. An example of the effect of such institutional support is offered by Burke (2004). At Hofstra University, matching material on papers submitted to Turnitin.com dropped from 34% to 12% after the university announced a zero-tolerance policy for plagiarism.

Each college of a university system should support the activities of its faculty by maintaining a central repository (perhaps monitored by an Asst. Dean) of the individuals found guilty of varying levels of academic dishonesty. The file on each student should contain the materials used to define their infraction and a statement from the instructor indicating the penalty levied. This central repository is valuable to identify repeat offenders. The college may desire to retain this data until the student graduates but should always honor all Family Educational Rights and Privacy Act (FERPA) requirements per University counsel guidelines.

II. CLASSROOM METHODS

It is equally important for the instructor to establish expectations for the research paper and research standards early in the semester. These expectations should be portrayed in lectures and in course syllabi. The instructor should review and explain clearly what is and is not plagiarism. The appropriate method for crediting the source of paraphrased material is an area that, in the experience of these authors, requires extra emphasis to educate many students of the need to properly cite the source of that material. This is in addition to proper citation of the sources of direct quotations contained in their written submissions for the class.

An investigation to determine student knowledge of citation methods is beneficial. It can be informative to have a class discussion where students present orally their understanding of the topic of plagiarism and how it may be avoided. During that discussion it is timely for the instructor to present a written copy of the university's policy on academic dishonesty and plagiarism, including a statement of the penalties that may be assessed for violations of the policy.

The faculty member's presentation during the above class discussion should include a clear statement of his or her expectations for the term papers to be required in the class. A useful list of practices that students should avoid is found in Stephen Wilhoit's article titled "Helping Students Avoid Plagiarism" (Wilhoit, 1994):

- Buying a paper for a research service or term paper mill.
- Turning in another student's work without that student's knowledge.
- Turning in a paper a peer has written for the student.
- Copying a paper from a source text without proper acknowledgment.
- Copying materials from a source text, supplying proper documentation, but leaving out quotation marks.
- Paraphrasing materials from a source text without appropriate documentation.
- Turning in a paper from a "free term paper" website.

Early in the term the instructor may require a very short, two-page trial research paper from the students to initiate the research and documentation process. This offers the instructor an opportunity to review each student's present knowledge and citation style. A short writing assignment also gives the instructor an opportunity to clarify any misunderstandings of the citation style requirements. Further, an early project establishes the student's writing style and word processor properties for later comparison. Another instructional method is to prepare a text and have the students create the needed citations and submit that assignment for credit. The choice of a citation style or adhering to every minute component of a specific style is not as critical as performing the required citation for sources. However, the student will need guidelines on the citation style selected. These are available on the Internet at numerous sites (identified by the instructor). The authors use Turabian/Chicago style citations with a reference on the Internet for students to review. (Hacker, 2003).

The requirement that a specific citation style be used for all student papers in a given class is a plagiarism deterrent. The selection of an acceptable citation style like Turabian and requiring footnotes may not be the type of citation contained in a paper mill paper. If the student's paper does not adhere to the specified citation style or uses a mix of styles, the suspicion of plagiarism is increased.

Classroom discussion on the development of a research paper should raise student awareness of the reliability of web sites, web search engines, proper citation techniques and avoidance of

advocacy sites. Students must recognize that a search engine is not a silver bullet. A year 2000 study reported that a single engine captures no more than 16% of the entire Internet while searching for the term (Introna, 2000). Moreover, less than half of the Internet is searched as all engines combined searched only 42% of the Internet, according to the same article (Introna, 2000). Faculty should insist on qualified sources for inclusion in student research papers. However, it is difficult to break students of the “convenient and good enough” mode of thinking due to what may have been their prior educational experience where any Internet source was accepted as satisfactory.

III. RESEARCH STANDARDS

The expectations for the term paper must be sufficiently specific to enforce and to set the standards by which the student submissions will be graded and analyzed. Specific standards also help to achieve grading uniformity and help to discourage plagiarism in that papers obtained from paper mill sites. A “patchwork quilt” paper composed by simply cutting and pasting from multiple web sites will not comply with the standards and expectations set by the instructor. Hence, deviations from the standards in terms of presentation and/or content may alert the instructor to conduct a more in-depth review of the student paper to ascertain if the student simply failed to follow instructions or if plagiarism may have occurred. Either event should warrant at least a reduction in grade, and in appropriate circumstances - additional sanctions. The standards we use include:

Table 1 – Research Standards and Initial Proposal

| Requirement | Reason |
|---------------------------|--|
| Age of reference | Last four years due to “time-fragile” aspect of topics |
| Paper quality/reliability | Refereed journals or recognized expert in the field |
| Opinions | No advocacy sites unless both ends of the spectrum are considered |
| Preliminary Proposal | Topic and central theme, |
| Final Proposal | Identifies if the student has the proper concept and is adhering to the first three requirements |
| Proposal Response | Approval to proceed or request for modifications |

1. TIME FRAME (AGE OF REFERENCE)

Limit the permissible time period for sources cited in the paper to a recent window of years (time consideration). The specific time frame will vary with the course and with the topics assigned. In “time-fragile” courses such as information technology, a recent period of four years or less is appropriate. Historic references may be important to confirm past judicial decisions, historic events, developments of influential people, and are acceptable if used sparingly. Papers containing only outdated references, or a majority of outdated/misdated references are indications of possible plagiarism.

2. QUALITY AND RELIABILITY OF THE CITED MATERIAL

An insistence that most of the references used be refereed journal articles emphasizes the required scope of student research and often eliminates the ability to rely upon paper mills, other students, or work prepared previously for other courses. Our practice is to also accept references

from respectable periodicals that are appropriate to the course and the topic. One of these authors makes active classroom use of the Wall Street Journal, the New York Times, and wire service news reports as a selected set, not just any newspaper. Researching those sources is appropriate in that they often may spark the interest of the student and provide a hypothesis for the research paper. However, peer-reviewed journal articles (or actual court decisions in law-related courses) are needed for integrity and reliability in the paper. These requirements help to insure originality and individual efforts. Further, this exposes the novice researcher to respected resources that they will find readable and understandable.

3. OPINIONS/ADVOCACY SITES

We do not accept as adequate references, citations to web sites that are merely expressions of personal opinions (i.e., advocacy sites) unless critically evaluated by the student or unless opposite opinion web sites are included to show the diversity of opinions on the subject. It is important for the student to recognize the multiple opinions that are portrayed and develop critical thinking skills needed to arrive at his or her own decision or opinion whenever that is an element of the research assignment. Again, failure to express a required personal conclusion or the failure to justify that opinion with valid arguments when that has been a required part of the assignment may be an indication of plagiarism or of simply failing to follow instructions. Either are adequate grounds for a reduction in grade or possibly the imposition of more severe sanctions.

4. PRELIMINARY PROPOSAL

We also require students to submit (via e-mail or hardcopy) a preliminary written proposal of the research topic. The research requirements for the papers must clearly state that permission to proceed is not granted until the instructor provides confirmation by either e-mail or in a written response. The student proposal should consist of:

- Selection of a specific topic — what is the title of your research?
- A statement expressing the central idea or theme - what is the student intending to review and report?

5. FINAL PROPOSAL

Once approved, the next step in the process requires each student to submit:

- An outline of the paper — guided by the research conducted to that point, with two to three levels of outlining normally sufficing at this point.
- An initial list of works cited — the student should begin a bibliography of sources for the paper identifying sources utilized to-date.

Students at the outline stage may be focusing on a topic of interest instead of the research arena identified in their original proposals and approved by the instructor. Also, they may be trying to prepare a single paper for two different classes or class assignments (which is unacceptable for classes within our college). A review of the outline by the instructor can focus on:

- the match of the topic with the original proposal
- completeness of the outline

- adequacy of the references used to-date.

6. PROPOSAL RESPONSE

Students at this stage are notified of any deficiencies and provided an opportunity to address them early in the research/development phase period. The instructor then has several options:

- Accept the outline and direct the student to proceed as indicated.
- Accept the outline but request an expansion (enhance quality) of the content and/or sources.
- Accept the outline but offer specific suggestions for additional areas to strengthen the project.
- Reject the outline, stating specific reasons for the rejection, and request a resubmission.

Students must be advised of the importance of the proposal and of the outline. They should not be allowed to change an approved topic without the consent of the instructor. The submission of a term paper covering a topic, other than that approved in advance by the instructor, may be an indication of a possible paper mill paper or of possible plagiarism.

Table 2 – Submission (Paper) Requirements

| Requirement | Purpose |
|--|---|
| Hard and soft copy | Non-repudiation of submitted material and authenticity |
| Reference material | Retain all reference materials used during the research |
| Paper, source material or hyperlinks on CD-R | Assure validity of references cited |
| Paper length, font size, page formatting, citation style | Standardization for uniform expectations when grading |
| Writing lab review | Improvement of writing style of author |

7. REQUIREMENT

We require that the final paper be submitted in hard copy and on virus-free electronic format. The hard copy reduces the opportunity for students, if questioned, to declare that they e-mailed the wrong file while the electronic copy aids in establishing authenticity and non-repudiation. It is difficult to conduct simple forensics on a paper copy while the electronic copy expedites examination through electronic agents. Further, as explained later, the electronic copy can assist in establishing document ownership and the initial development date of the paper.

8. PURPOSE

A request for articles published in the last four years prevents many paper mill references as the sources used to prepare the paper mill product become out-dated. However, the instructor should be wary of students changing the dates or omitting the dates of reference material in less than subtle attempts to comply with the time constraints. Also, literature in business and information technology is quickly updated. The time-sensitive nature of information technology is an important concept for the students to embrace. Therefore, it is important to reference recent

articles to capture the current aspects of a research topic in that field. The students may view this as constrictive. However, it is an important practice to embrace.

Graham and Metaxax (2003) point out the importance of students seeking qualified articles instead of accessing advocacy sites. Students are often initially unaware of the existence of advocacy sites or the intent of advocacy sites. Even when they are informed of the shortcomings of advocacy sites, some students are tempted to focus on the convenience of such sites, sadly ignoring the need for accuracy and integrity in their research. Government, business, and advocacy web sites are used and cited as if they were totally factual. This is not always the case.

Peer reviewed articles from reputable journals are now available by accessing the Internet. Students can find qualified information from those articles when they initiate their research in a timely fashion. Further, the student will recognize that these articles are usually understandable and not of cryptic fashion.

9. REQUIREMENT

We require hyperlinks to Internet materials used by the students in preparing their research papers be included in electronic format. When reference material does not exist in electronic format, evidence of the reference such as a photocopy of the title page of books and pages referenced are to be submitted in hard copy.

10. PURPOSE

The above requirement limits the use of paper mills and establishes good researcher habits by noting the original source of all references. Submissions of hyperlinks to electronic sources of reference materials when available, and hard copies when not, allow the instructor to double check students quoted materials and citations for accuracy (both time of articles and paraphrasing). Further, requiring hyperlinks to web-based resources reduces the opportunity for fictitious citations and allows the instructor the opportunity to review the quality of articles selected and insure their authenticity. The instructor can also verify any concerns relating to conclusions students may have cited from the material. Inclusion of links to the resources cited in the student research papers helps assure that the papers are the original work of the students. Further, broken hyperlinks (sites not available) indicate potential academic integrity issues.

11. REQUIREMENT

It is required that the student's original proposal, outline, and preliminary list of references be submitted to the instructor for approval or rejection to keep students on track. Submission of research materials also diminishes some of the convenient and easy aspects of plagiarism. We require students to submit copies of their papers on compact discs in read-only [recordable] format (CD-R). The ability to create a CD-R is commonly available at schools or on the student's personal computer. Some students may wish to use the capabilities of a compact disc-read/write (CD-RW) media to add materials to the CD-RW as the research proceeds and the paper is developed. However, the final submission should be on a CD-R disk rather than a CD-RW disk.

12. PURPOSE

The requirement that the final papers be submitted in both hard copy and virus-free electronic formats fulfills two objectives. The hard copy is used for manual grading. Further, the hard copy captures the concept of non-repudiation. As we move towards a paperless workplace, it is important to adopt working electronically. There are markup tools in word processors available to provide a rich environment of feedback and commentary on the electronic paper.

After submitting a hard and electronic copy, it is difficult for a student to allege that the wrong file was printed as well as included on the CD-R. Authenticity of the submitted electronic document's properties offer the instructor another confirmation technique that the materials were not developed by another author or at a previous date. Electronic submission is analyzed using electronic tools and compared to sources available on the Internet.

The requirement that the electronic research sources used by the students are submitted on a CD-R is new for us this year. Formerly we accepted e-mail attachments and/or zip or even floppy disks. Independent of reliability, e-mail, floppy disks and zip disks have their own problems. E-mail is sometimes lost, deleted, or corrupted and it may have virus attachments. Floppy disks and zip disks can fail or be corrupted. More importantly, if a segment of a research work is contested, the student may assert that what is being challenged is not what submitted by the student. In essence, it may be asserted that the paper was altered to portray a false case. The unalterable CD-R protects the faculty and the author from claims of alteration of data in the paper. While zip disks and floppy disks can indeed be altered, that is clearly less likely to be the case with a CD-R disk. Moreover, CD-R disks store more data than zip disks and they are less expensive than zip disks.

13. REQUIREMENT

A minimum paper length is required beyond the title page and bibliography. The paper setup is one-inch margins (which is not a MS Word default setting), Times New Roman 12 point, 1.5 space between lines, specific page numbering (bottom centered), and Turabian/Chicago footnotes. The specifications for the format of the paper could follow the typical submission guidelines for a professional paper at a conference.

14. PURPOSE

Uniform formatting increases consistency in grading and decreases the likelihood of unedited submission of work obtained from paper mills or other third-party sources.

15. REQUIREMENT

Finally, we require that student papers be reviewed by the university student writing lab at least one week prior to submission of the final report. The marked-up copy review is submitted with the final paper (both in hard copy) allowing the instructor to review any needed writing and grammatical changes identified by the writing lab. Our university's writing lab sends to the

instructor a confirmation of the student visit and provides a checklist of research paper issues addressed.

16. PURPOSE

A “qualified” review (writing lab) of the paper is beneficial to enhance student writing. Students are sometimes hesitant to use their own words to depict their comprehension of the subject and often feel each literary effort must be a new “War and Peace.” However, this is not the case. Most instructors expects an unpolished style in “new to the student” domains. In fact, it is often a hint of academic dishonesty if the text “just sounds too good” or too professional for the expected comprehension of the writer. Another goal of the instructor should be that the student avoids “patchworking” a paper with quote after quote laid into the paper to meet the page length specifications.

Figure 2 is adopted by these authors and consists of six phases in development of the research paper. Our students are encouraged to follow this developmental life cycle in preparing their research papers. We discuss the need for development of a topic for the paper and a review of the sources required for the research. One goal of the research paper component of our courses is that students begin to integrate and synthesize the materials into their and use that information to create their final reports.

DEVELOPMENT OF THE RESEARCH PAPER

Identification of Preliminary Topic

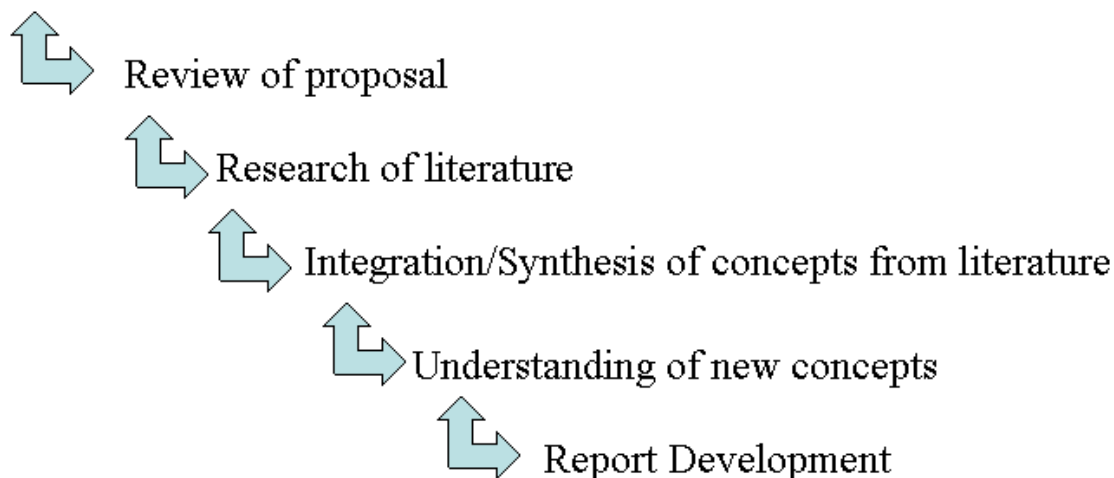


Figure 2 – Development of the Research Paper

IV. FORENSIC METHODS

Unfortunately, some students may view the Internet as a ready source of material to submit for class credit as their original work. The Internet is indeed an available resource that is extremely fast and convenient. It also offers opportunities, whether intentional or unintentional, for academic dishonesty via plagiarism. Such use should be discouraged.

There are two preliminary approaches for patrolling the field of paper submissions. Both techniques require advanced planning. Advanced planning consists of setting submission standards, acquiring electronic agents, and setting a submission date with enough lead-time to adequately perform the style of review selected. Two approaches to consider are:

- Investigate only those papers deemed to be “suspicious” by the instructor after visually reviewing them

OR

- Systematically review all papers via electronic tools (Frost & Gantt, 2003) coupled with an examination of the “Properties” component of the electronic version of each paper.

The choice constitutes an individual decision, although we prefer the later. The instructor may wish to browse the papers submitted and then decide which ones look too professional for the student writer, have other questionable attributes, or have problems with the resources used. This approach limits the number of papers scrutinized, and it may be necessary given faculty work loads. However, we feel it is best to review electronically all student papers and thus avoid the appearance of targeting specific students. A systematic review is favored and avoids claims of preferential treatment.

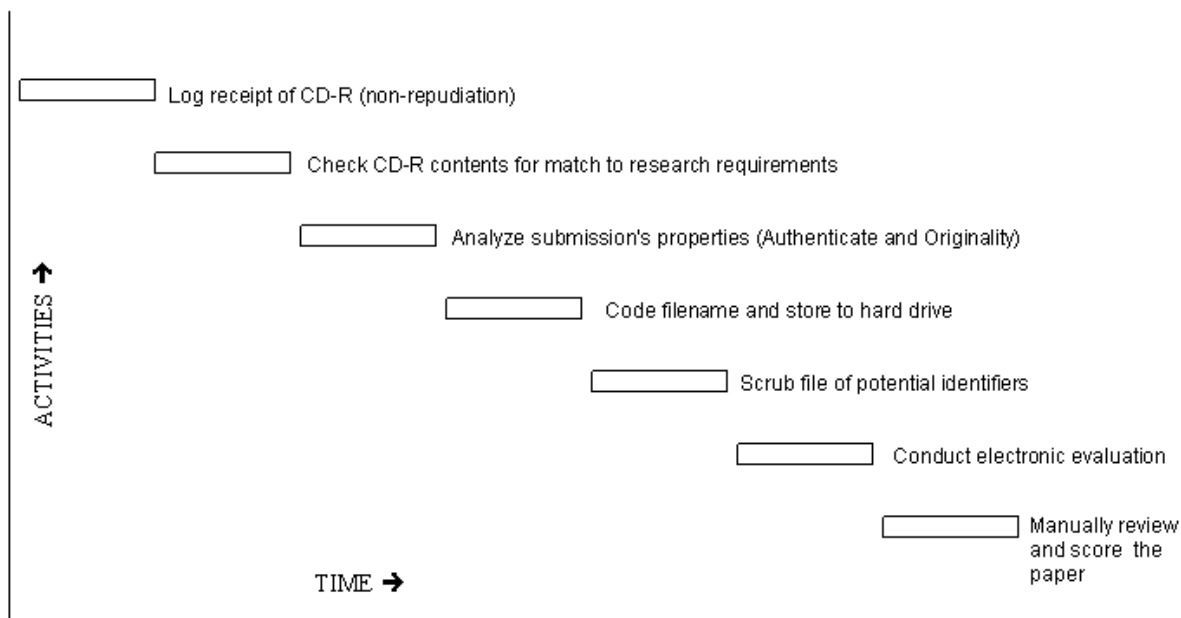
Another subtle, but revealing, forensic technique is to examine both file and document “properties” of submitted materials. The instructor can examine the “properties” of a file with Windows Explorer. When the instructor points to a specific file, without selecting it, an initial scrutiny of data on the file is displayed. This technique reveals file type, author, title (which is not the filename but the first line of text), date modified, and size if that data is available. Recently, an examined file indicated the author as xx@xx.com.uk. Further examination provided more data that the paper was from another author, in another country. Once the file is opened, the instructor can examine the document’s “properties.” Document “properties” are distinct from file “properties” and reveal additional forensic information. This data is accessed through File, Properties from the menu bar. These techniques are discussed in more detail with screen captures later in the document.

V. AUTHENTICATION AND NON-REPUDIATION

1. LOG RECEIPT OF CD-R AND INCLUDED MATERIALS

When students submit their documents (Figure 3) burned to a CD-R and in hard copy (paper) format, the instructor will have a permanent and unalterable record (the issue of authenticity) of what was originally submitted by each student. This assists in establishing a less challengeable audit trail (non-repudiation). We prefer a Word.doc over WordPerfect.wpd because of the additional information contained in the “properties” of a Word file and document. A “.doc” file contains additional information on the history of the file and document. This information is omitted from the properties of a “.wpd” file. If a student converts the file to rich text format from its original format, the properties and previous activities of the file’s creator are purged.

The document conversion from Word to .rtf resets the counter on revisions to zero, and establishes a new creation date and history log.



**GANTT CHART OF
STEPS FOR EVALUATION OF ELECTRONIC SUBMISSIONS**

Figure 3

2. CHECK CD-R TO MATCH TO RESEARCH REQUIREMENTS

The next step is to contrast the student submissions with the assignment's requirements. At this time, the instructor should take the opportunity to examine the "Properties" (accessed from File, Properties after selecting the file) of the original file. While the file is still on the CD-R, Windows Explorer (2000 or XP) can reveal additional information from the Properties tab of the document. As mentioned previously, this is an important method the instructor can use to authenticate the authorship (initial author) of the paper. Further, once ownership is established, the student is unable to repudiate the submission. The submission of student papers in hard copy format limits the opportunity to declare the wrong paper was submitted electronically. Moreover, the burned CD-R negates any accusation that the instructor modified the document in any manner. The CD-R is a permanent copy and not subject to alteration, thereby helps to authenticate the audit trail.

3. ANALYZE THE SUBMISSION'S FILE AND DOCUMENT PROPERTIES

File Properties. In Windows 2000 and XP, pointing to a file icon with the pointer provides an initial peek at the sources of the document (for authenticity purposes). Figure 4 shows the

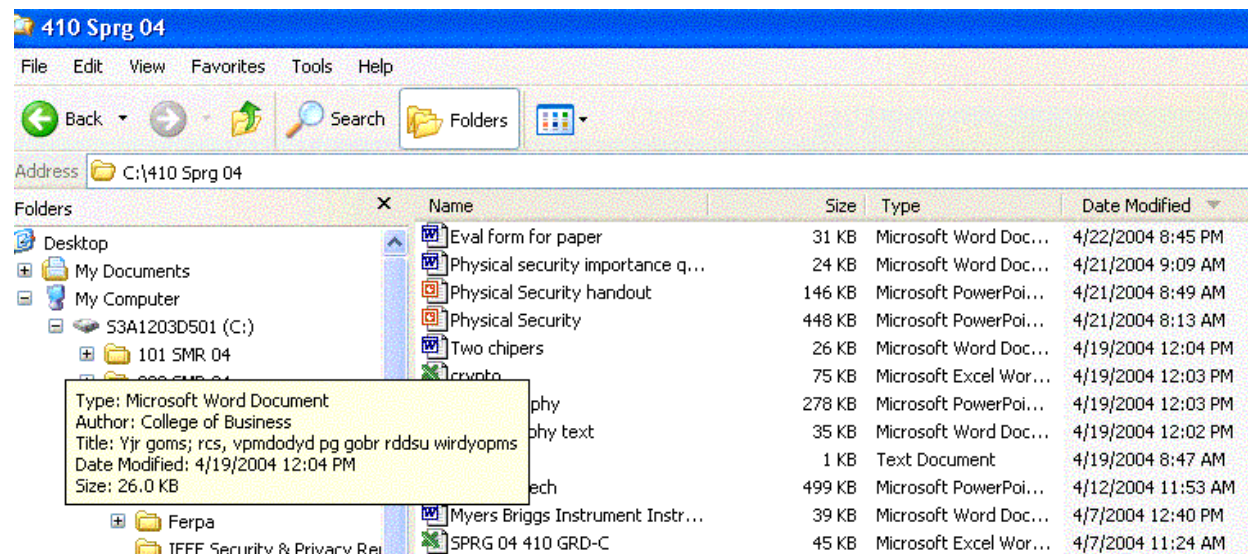


Figure 4 - File Properties Showing File Type, Author, Title, Date and Size

information provided by a selecting (highlighting) a file in Microsoft Windows Explorer. Further, the instructor can access additional data by right-clicking the file on the storage media and selecting Properties (in Microsoft Windows 2000 and XP). Since this data is stored on permanent media (CD-R), the instructor can open the file without changing the basic Properties data. This is the start of the authentication process for a paper. Does the authorship indicate a unique e-mail address or a name totally different than the student? This is usually the first alert of a potential problem with the author of the paper if “things look strange, too.”

The author is identified, and date of modification is revealed. Much more is disclosed as the investigator accesses File, Properties to check the author, creation date, number of revisions, last modification date, and the date you are presently accessing it. When accessed from the CD-R, there are no modifications to the original (creation) data. This is a major reason for shifting to the requirement that electronic versions of the papers and hyperlinks to source documents submitted by students be in CD-R format rather than on zip disks or as e-mail. Likewise, for this reason, the medium should be a CD-R disk and not the more expensive rewriteable CD-RW format where the authenticity may be challenged.

Examining files based on Properties can provide false - positive indications. If the student purchased a used computer with a word processor installed by a different individual, the previous owner's name may appear in the Properties. Likewise, the student may be using a neighbor's or friend's computer or a computer at work to complete the assignment. This may be confirmed by analyzing past assignments submitted by the student, asking the student questions that would be familiar to the author of the paper or in extreme cases, asking the student to submit the computer for detailed forensic examination.

4. DOCUMENT PROPERTIES

Figure 5 (Document Properties) shows more of the details that help in determining the author of the paper, its original creation date, how many revisions occurred, and the last time the paper

was accessed. The properties of a file include data indicating its creation date, registered author, time the file was open, word count, and other document information. More valuable information is displayed under the General and Statistics (Figure 6) tab of Properties once the file is opened with a word processor. It is important to note that the creation date of the General tab is not the original creation date. The instructor must access the Statistics tab (Figure 6 – Statistics Tab) to uncover that the paper used in our example had roots two years previously. The date shown in the Documents - General tab of Properties (Figure 5 – same document) thus did not reveal the true creation date of the document.

It is also interesting to note the number of revisions (times the paper is saved) identified under the Statistics tab. Apparently, the author in this example saved the paper every four minutes during the document's creation (total editing time divided by revision number: $1105/268=4.12$ minutes per revision). A paper with no revisions or with an excessive number of revisions may raise suspicions, but that alone is not conclusive.

5. CODE FILENAME, SCRUB IDENTIFYING DATA AND STORE TO HARD DRIVE

Once the properties, general information, and statistics of a document are examined, the .doc file is converted to text (.txt) file. The instructor can convert it to “plain text” and store a copy of the electronic version of the student paper (presently on CD-R) to an anonymous (but coded) text file. This coded filename is recorded in a spreadsheet along with other inserted “comments” of interest about the file. The text file is stripped of any identifying comments and used for comparison to similar materials on the Internet through the use of an electronic agent. The instructor should scan and remove references to the student or the class/instructor. Removal of identifying information lessens the chance of inadvertent FERPA violations while using electronic agents to examine the papers.

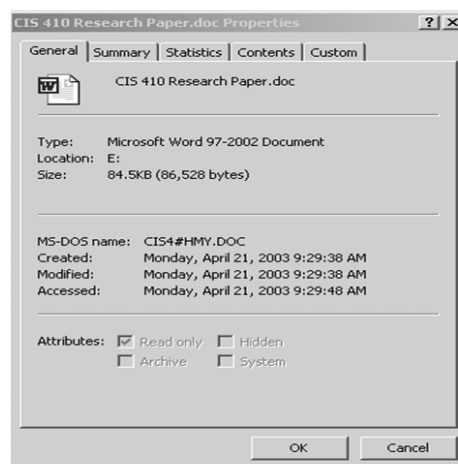


Figure 5 - Showing the Five Tabs of Document Data After Accessing File/Documents for the Document

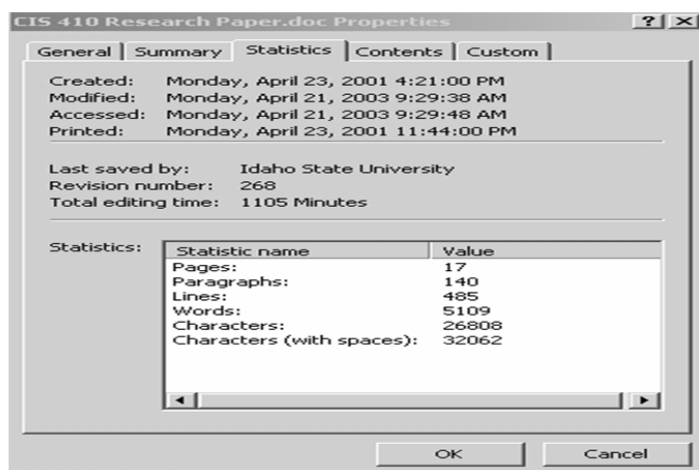


Figure 6 - Statistics Tab of Document Properties Showing Created Date v. Modified Date

6. CONDUCT ELECTRONIC EVALUATION

We support evaluation for all submissions to avoid claims of bias. There are several electronic agents available to provide comparisons between submitted text files and material available on the internet. A list of potential agents or services is:

WCopyfind
MyDropBox
WordCheck
Eve
Turnitin
Scholar from SurfWax

These agents or services examine the Internet for matches to phrases, sentences and paragraphs. The reports produced provide links to internet sites and materials that match portions or all of the phrase, sentence, and paragraph. It is then the responsibility of the instructor to scour the report for positives that may represent plagiarism. With this analysis, the instructor can counsel students and penalize those using inadequate citations or poor paraphrasing. The founder of Turnitin.com, John Barrie, states, "It's typically 30 percent of all the papers submitted have significant levels of plagiarism (Gibson, 2004)." Mr. Barrie did not indicate what determined "significant levels" of plagiarism.

VI. SUMMARY AND CONCLUSIONS

It is desirable to stress the importance of academic honesty to our students as many will soon enter the business profession. Development of safeguards to provide faculty with more confidence in student paper sources is necessary to avoid rewarding nonperforming students. A combination of increased student awareness of plagiarism and mastery by the professoriate of a variety of forensics tools can help to develop those safeguards. The former will expand student knowledge in the domain of ethical academic behaviors while the latter is important to confirm that student activities in preparing their term papers are acceptable. Over time and acting together individuals teaching at the university level, have the opportunity to raise student performance and to reduce the number of instances of less desirable practices.

We believe that education should be the main tool used. Making plagiarism more difficult to accomplish will reduce the need to resort to punitive sanctions as a last line of defense. When students are taught to know better, and when it takes more effort to act badly than to act in accordance with expectations, we anticipate a corresponding decrease in all forms of plagiarism - be it intentional or unintentional. Activities such as using non-cited materials from the Internet or using submissions obtained from paper mill sites can be diminished with proactive faculty efforts. However, faculty must provide more than mere lip service to their efforts as they stress academic integrity. Forensic techniques used to ensure authentication and non-repudiation of student papers are additional important exercises. And those efforts need not always necessitate invoking formal academic dishonesty proceedings that may in turn result in undesirable administrative decisions to blame the messenger.

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