AC 2011-2131: GAMING AGAINST PLAGIARISM: A PARTNERSHIP BETWEEN THE LIBRARY AND FACULTY

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Abstract

Instilling the values of research and professional ethics is one of the most important functions played by an academic institution. Holding students to a high level of academic integrity supplies the foundation for these values. As detailed in the March 2009 PRISM article "The Pull of Integrity," engineering colleges across the country are confronting the problem of plagiarism.[1] As a function of the library research support role, librarians should collaborate with departmental faculty to educate students about the ethics of research as outlined by national policies and by institutional honor codes. Examples of such policies include the National Science Foundation's America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act, or the America COMPETES Act. This Act, effective January 2010, requires that institutions applying for NSF funding must "provide appropriate training and oversight in the responsible and ethical conduct of research" to students and researchers.[2] To help meet these requirements, librarians can fill the role of educating today's researchers by teaching the ethical way to conduct research and cite sources to avoid plagiarism.

Introduction

This paper will discuss the rationale, recent activities, and future of the recently awarded National Science Foundation grant in which the University of Florida Libraries formed collaborative partnerships with other entities on campus to combat plagiarism. The goal of this grant is to create an online, self-directed, interactive game that will provide a role-adopting environment in which Science, Technology, Engineering, and Mathematics (STEM) graduate students will learn to recognize and avoid plagiarism.

At our university, the Marston Science Library (MSL) has played a steady role in plagiarism prevention on campus, albeit a latent one. These services consisted of:

- Purchasing and providing resources about plagiarism and plagiarism prevention for use by professors
- Advising students about proper citation styles
- Instructing students and professors using various bibliographic management software programs (e.g. RefWorks and EndNote).

In 2007, the MSL experienced an influx of requests for lectures on research ethics, academic integrity, or plagiarism prevention. In response, the library began to offer Avoiding Plagiarism for Science and Engineering Students workshops and created a subsequent web tutorial along

with accompanying assessments that could be incorporated into any instructor's course management system. This signified a need for STEM ethics education on campus.

An independent line of evidence of our University's plagiarism problem came from the Director of Student Conduct and Conflict Resolution, who reported an 85% increase in plagiarism cases between 2007 and 2009 (88 cases in 2007-08 vs. 163 in 2008-09). For the most current year (July 1, 2009 - February 15, 2010) 125 cases of academic dishonesty were reported, of which 64% (n=80) involved plagiarism. It is especially noteworthy that these data indicate (1) the majority of academic dishonesty cases reported on our campus involved plagiarism, and (2) the frequency was increasing.

In early 2009, the library learned of plans for the formation of a university-wide Academic Integrity Task Force. The charge of the committee was to determine if there was an issue with academic integrity on campus; ascertain if there were specific areas of campus prone to breaches in academic integrity or if it was a campus-wide epidemic; and make short and long-term recommendations for any issues that were discovered.[3]

Then in October 2009, the National Science Foundation released a revised Proposal and Award Policies and Procedures Guide that detailed the implementation of Section 7009 of the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (COMPETES) Act. COMPETES requires that "…each institution that applies for financial assistance from the Foundation for science and engineering research or education describe in its grant proposal a plan to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduate students, graduate students, and postdoctoral researchers participating in the proposed research project." The implementation of this directive took place in January 2010.[2]

All of these factors became the catalyst for submitting the *GAP: Gaming Against Plagiarism* grant proposal. The goal would be to create an online, self-directed, interactive game that would provide a role-adopting environment in which Science, Technology, Engineering, and Mathematics (STEM) graduate students would learn to recognize and avoid plagiarism. The game would be open source to allow adoption by any institution for its own use. The science librarians worked in close partnership with the University of Florida Libraries' grants manager to build the proposal. The grants manager facilitated partnerships with other groups on campus such as the Digital Worlds Institute [4] and the I^3 Program [5] and procured consultants outside of the University. In addition, faculty in engineering departments at seven other institutions were also recruited to beta test the product (listed in the project plan in the Recent Activities section). These partnerships would play a key role in the success of this grant.

Why plagiarism?

Engineering colleges across the country are confronting the problem of plagiarism.[1] Plagiarism is described as the most critical and widespread misconduct issue facing beginning researchers from all disciplines.[6] In a 1997 study of 1,946 students from 31 U.S. academic institutions, 75% of Engineering students and 64% of Natural Science students admitted to some form of written cheating including: turning in copied material as their own work, fabricating or falsifying a bibliography or turning in work done by someone else.[7] A more recent and broader survey of 63,700 undergraduate students and 9,250 graduate students, revealed that cheating on written work occurs more frequently than cheating on examinations, and that 62% of undergraduates and 59% of graduate students had engaged in "cut and paste" plagiarism from either print or electronic sources at least once in the last three years.[6] Perhaps most disturbing, approximately half of the students surveyed in a 2003 study, who admitted to some form of plagiarism felt their actions were "trivial or not cheating at all."[8] This attitude could be attributed to a conclusion drawn by Whittington and Colwell [9] which states:

> Some students may not understand the rules of academic integrity. Some think that the product of their cutting-and-pasting expedition becomes "their" work because they put it all together and assembled it into one document. The concept of a 'mashup' is then applied to academic work, so that students may consider that a mix of items from various sources become a new work. Becoming aware of the types of ignorance may help instructors focus their actions in correcting misunderstandings or misinterpretation. (p. 4)

In order to facilitate change in student attitudes, Carrol notes that it is imperative to engage students in a nonthreatening, non-judgemental environment in which they can personally experience and grapple with the multiple dimensions of plagiarism.[10] This can be offered through education.

McCabe, Trevino, and Butterfield [11] state that "…cheating can be most effectively addressed at the institutional level…However, at an even broader level, academic institutions are advised to consider ways of creating an "ethical community" on their campuses – one that includes clear communication of rules and standards" (p. 228). Education as a method to reduce plagiarism is further supported by the work of Duff, Rogers, and Harris [12] and Belter and du Pré [13], who report significantly lower levels of plagiarism after students were given awareness training. McCuen [14] argues that:

> …education about plagiarism cannot wait until the student is starting to write the thesis or dissertation. The education should begin when the student begins his or her graduate program, if not before…and mentors should have high writing standards from the beginning, not waiting until the student is writing the final draft. (p. 155)

Why a game?

Gaming is universal among college-aged students. A 2003 Pew Institute study [15] of gaming technology on college campuses showed that 100% of participants had played a video or computer game, 70% played digital games "at least once in a while," and 65% were "regular or occasional game players. Gaming has become a part of daily life on college campuses: "students integrate gaming into their day, taking time between classes to play a game, play a game while visiting with friends or instant messaging, or play games as a brief distraction from writing papers or doing other work." [15] More recent research on teenagers (future college students) shows that not only is game playing universal, but that game playing facilitates social discussions and "can incorporate many aspects of civic and political life." [16]

According to the final report from the Summit on Educational Games [17]:

> "Educational games and simulations may be especially effective in developing higher-order skills — such as strategic thinking, interpretative analysis, problem solving, and decision-making. For example, in games, players are making decisions continually, in contrast to low levels of decision-making in traditional learning. Educational games and simulations may also be effective in developing complex aspects of expertise, not simply short-term memory of facts." (p. 43)

Gaming employs active learning on behalf of students. Players will have the flexibility to learn at their own pace and make decisions within the context of the virtual scenarios presented within the game. Teaching methods grounded in experiential approaches to learning will be emphasized in the instructional design of the GAP game. To scaffold players' development of expertise, this framework will emphasize experiential learning, immediate and meaningful feedback, identity-linked narrative engagement, and "just-in-time" delivery of information. In addition, the game will make use of strategies intended to influence students' ethical behavior, and it will explore the impact of peer behavior, institutional norms, and differing cultural practices on plagiarism. It will be collaboratively designed, tested, and evaluated through a multi-disciplinary iterative development process by recognized experts in graduate science education, gaming, academic integrity, intellectual property rights, and educational digital media production.

The Federation of American Scientists [18] indicates well-designed games offer best practice pedagogical features. The features that will be incorporated in the GAP gameplay design include:

- Experiential Learning – giving students real-world decision making practice;
- Problem-based Learning – skills sets are developed through hierarchical problem solving scenarios;
- Immediate Feedback – increases persistence in problem solving;
- Learner-Centered Learning – student is the focus of and controls the learning process;
- Problem Solving in Complex Systems – successful problem solving is dependent on understanding core concepts of the system, e.g., in GAP, solving complex plagiarism scenarios will depend on understanding basic plagiarism issues;

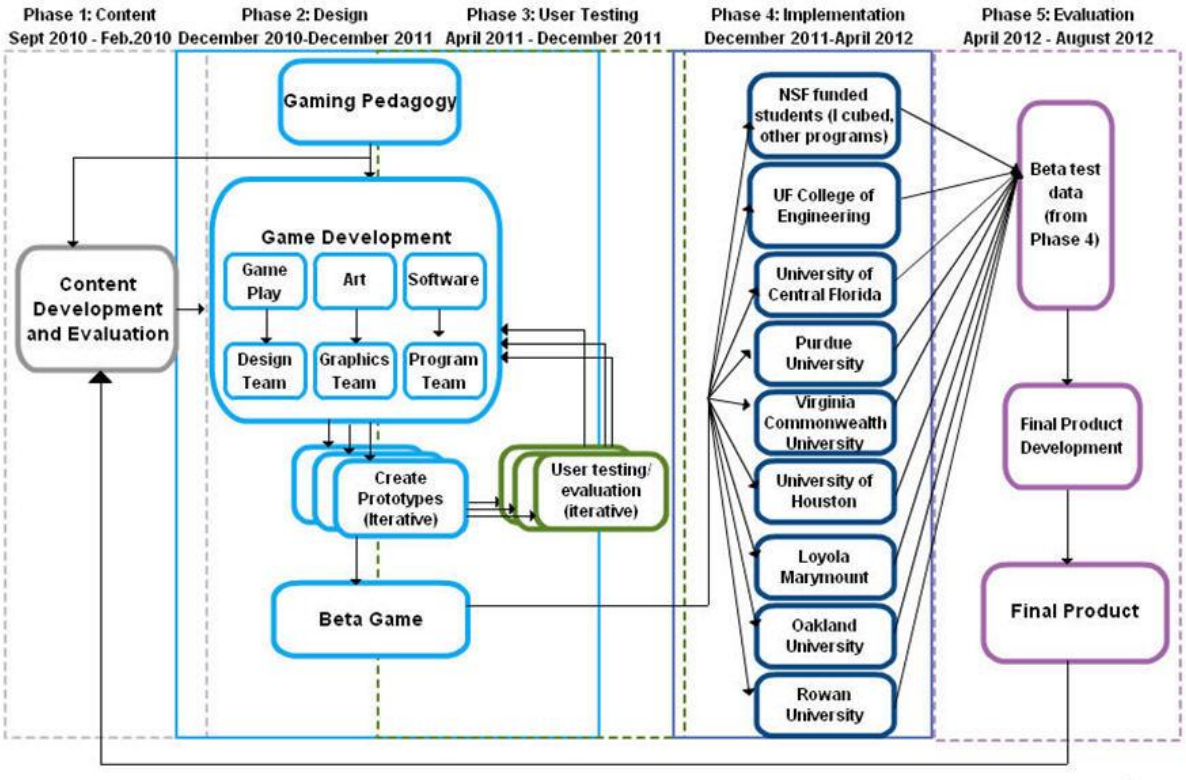
- Social Relationships – social skills development is intrinsic to success, e.g., in GAP, understanding cultural perceptions of plagiarism will be integrated into the scenario; and,
- Prioritization Among Competing Objectives – alternative choices lead to shifting game outcomes and game scenarios.

Recent activities

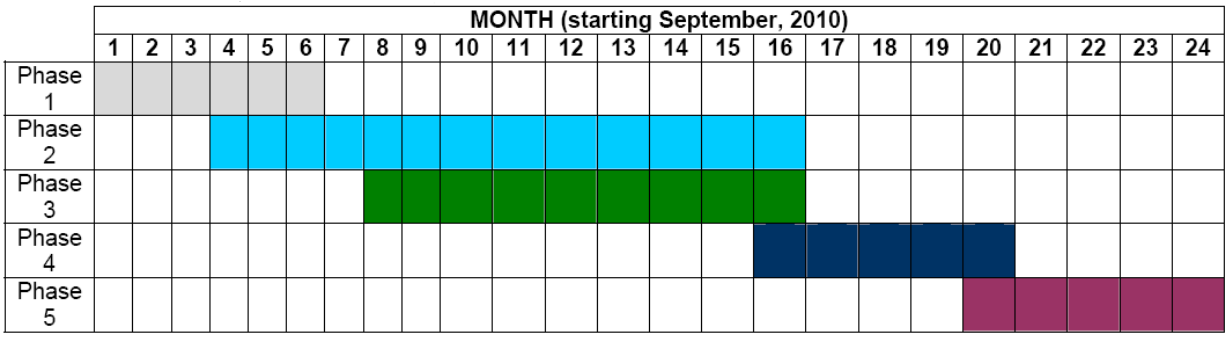
The grant was awarded to Libraries and its partners in September 2010. Due to the two-year funding period and the level of workload for this grant, a detailed project management plan was constructed to facilitate the tracking of activities. The plan loosely follows the ADDIE model which is often used in the field of instructional design. [19]
This model consists of five distinct steps:

Analysis - Identify the problem & establish goals for the project
Design - Determine content & establish prototypes
Development - Create the product
Implementation - Place the product into practice
Evaluation - Assess the product

The GAP team used the Creately diagramming software to construct the overall project plan. [20]



In addition, to track the project on a more granular level, a month by month plan was produced along with the goal and key activities that would occur during each phase. [20]



Phase 1. Content Development (Pre-production visualization)

- Goal: Develop scenarios and content for game
- Key Activities:
  - Collect samples from STEM disciplines
  - Sample validation against NSF Codes of Conduct
  - Research global scientific ethics approaches and issues
  - Develop narratives appropriate for game play

Phase 2. Game Development

- Goal: Develop beta version of game
- Key Activities:
  - Develop prototypes of animated and progressively more complex game modules, through iterative design processes
  - Include pedagogical aspects of the game design

Phase 3. User Testing

- Goal: Test game interface with users/ gather feedback to inform development
- Key Activities:
  - Develop testing protocols
  - Recruit STEM graduate students for tests
  - Analyze testing data
  - Use feedback to inform further prototypes for beta version

Phase 4. Implementation

- Goal: Distribute game to internal/external programs
- Key Activities:
  - Distribute beta version with pre- and post-tests to graduate students on our campus
  - Distribute beta version with pre- and post-tests to partnering universities
  - Conduct beta test with 200 local students and various partner organizations
  - Collect feedback from the pre- and post-tests for evaluation

Phase 5. Evaluation

- Goal: Evaluate and develop final game
- Key Activities:
  - Evaluate the game's success as a learning tool
  - Evaluate overall project

- Compile best practices to inform development of future modules
- Develop final game

Building the content

The GAP content team, comprised of the science librarians, set to work immediately to define the essential content to be included in the game. The content was informed by findings from the literature; a survey regarding perceptions of plagiarism administered to all STEM graduate students on the University of Florida campus; and collective past experience of the team. The content was then divided into three levels. These levels where then mapped to the six specific learning objectives detailed in the grant proposal:

1. Identify major types of contemporary plagiarism, including unique aspects of science/technology publishing (e.g., charts, tables, and diagrams).
2. List the basic rules to avoid plagiarism in research activities.
3. Demonstrate ability to apply the rules in increasingly complex scenarios.
4. Explain copyright, fair use and author's rights (i.e., intellectual property rights).
5. Explain the potential consequences of plagiarism academically and professionally.
6. Recognize and acknowledge differences in cultural approaches to plagiarism.

As the team assessed the completeness of the content document, they reviewed the Office of Research Integrity's definition of research misconduct [21] and determined that other issues surrounding research ethics should be included. This scope revision led to the development of content, definitions, and case studies based on data falsification and data fabrication. Furthermore the inclusion of data fabrication and data falsification ensured that the GAP game would comply with the America COMPETES Act. In addition, the content team decided to remove their original learning objective pertaining to intellectual property rights due to time constraints and the complexity of the topic.

Consequently, Level One content includes basic definitions of plagiarism together with a discussion of intentional versus unintentional, data falsification, and data fabrication; examples of the 5 major types of plagiarism (stealing, patch writing, misquoting, self-plagiarism, and insufficient paraphrasing) and data falsification and fabrication; and simple tips to avoid plagiarism. Level Two content describes the potential consequences of plagiarizing in both the academic or professional arena. Level Three content utilizes real life examples to illustrate the concepts introduced in levels One and Two and allows students to apply their knowledge.

The completed content document outlines learning outcomes for students and provides the foundation for the game developers to design a learning environment that will support the content.

Building the game

The design and development team started analyzing its target audience of graduate students in STEM disciplines by beginning a series of exploratory focus groups [22] to determine attitudes toward potential design metaphors, prototypes and play styles. Focus groups, when conducted correctly, have the capacity to encourage participants to express and discuss their opinions of tools and topics. Focus groups often decrease the presence, power and role of the researcher in data collection while encouraging participants to participate in discussions in a quasi-naturalistic social context.[23]

The first of the series of focus groups was conducted in October of 2010, with two focus groups with seven participants each. The results presented the team with interesting, but varied, findings. First, participants had different preferences when it came to "at home" game play, as participants varyingly expressed a dislike for games or expressed an interest for a diverse selection of game genres. Still, participants for the most part expressed an enthusiasm for social games, browser-based games or mini-games when asked to select a genre in which they would like to play the game. The research team then decided to adopt the design metaphor of a series of linked mini-games.

To support accessibility, the team made an early overall commitment to building a game that would be portable across a variety of different computer operating systems, would not have significant hardware requirements and would require not much technological support from staff. Because of this commitment to portability and the enthusiasm for browser-based games on the part of focus group participants, the design and development team decided that the web browser would be the best platform from which to launch or run the game.

The design and development team then began evaluating a number of different development platforms on which to build a browser-based game. The development team reviewed and evaluated development platforms that used purely native browser scripts (e.g HTML5, CSS and Javascript), Java platforms for developing browser applets, and Flash platform. Because support standards for native browser scripts like HTML5 are currently conflicting and erratic across the major browsers, and Java applets often place significant demands on the resources of older computers, the design and development team tentatively decided to use the Adobe Flash framework for development. Flash uses the Adobe Flash Player, a freely-available and easy-to-install browser plug-in that is installed on some 99% of Internet-enabled desktops. [24]

The design and development team reviewed a number of two-dimensional (2D), isometric (ISO), and three-dimensional Flash-based game engines. The design and development team has provisionally selected the Pushbutton engine for 2D game development, the AS3 ISO Lib for ISO development, and either the Away3D or Alternativa engines for 3D development.

Future activities

Once the production phase of the game begins, a rapid prototyping technique will be utilized to create the game. This iterative approach consists of three stages:

1. Game design and development team develops a prototype informed by content team and gaming pedagogy consultants.
2. Librarians conduct usability testing with student players.
3. Pedagogy consultants and librarians analyze feedback, which is used in subsequent prototypes

The librarians will evaluate the content and development process through usability testing of each prototype with various STEM graduate students using the Libraries' User Experience Lab. The results will provide insight into playability and content validity that can then be modified for the next iteration. In addition, the GAP Team will construct assessments to test the pedagogical effectiveness of the game through the consultation with an outside expert in the use of games in education. These assessments will be administered in the form of pre and post-tests or embedded within the game itself.

Once the rapid prototyping phase has reached completion and a beta product is finished, the product will be distributed to the seven partner institutions for testing. Data from these institutions will be compiled, analyzed, and incorporated into revisions for the final game.

Conclusion

Through collaboration with academic faculty both on campus and at other institutions, the University of Florida Libraries are now playing a key role in the fight against plagiarism. The *GAP: Gaming Against Plagiarism* project will create an online, self-directed, interactive game that will provide a role-adopting environment in which Science, Technology, Engineering, and Mathematics (STEM) graduate students will learn to recognize and avoid plagiarism. Increasing graduate students' awareness will help move these new researchers in the right direction.

Note: This paper is based on the recently awarded National Science Foundation Grant, "GAP: Gaming Against Plagiarism" http://ufdc.ufl.edu/UF00098766/, 2010.

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