Instilling the Necessity of Lifelong Learning using Article Reviews

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Abstract
ABET Criterion 3 requires students to demonstrate “a recognition of the need for, and an ability to engage in lifelong learning.” To successfully obtain this skill by graduation, it is imperative that students be allowed to practice these skills in all classes. This leads to a challenge: how can one effectively integrate and assess student’s lifelong learning skills in all classes in an efficient manner? One mechanism for addressing lifelong learning skills is the research paper. While the formal research paper provides the students with many important skills, especially for those who intend to go on to graduate school, the very nature of the research paper may diminish its effectiveness at promoting lifelong learning for the vast majority of students. Following the traditional format for a formal research paper also rules out the usage of podcasts and webinars, two evolving formats for information exchange.

This article presents a mechanism for helping students to learn about the importance of lifelong learning through the usage of short, non-intrusive “Article Summaries”. Article Summaries allow students, in a non-intrusive fashion, to learn in greater depth about the material which is being taught in a course as well as explore the differences in style between various media formats. Through student assessment data, article summaries are demonstrated to be a lightweight effective mechanism for increasing student engagement in a course as well as instilling an appreciation of the need to continually learn.

Introduction
In 1996, the ABET Board of directors adopted a new set of standards commonly referred to as Engineering Criteria 2000 (EC2000). EC2000 brought the concept of lifelong learning to the forefront of engineering education. In the past, engineering education focused principally on imparting knowledge on students through courses and curricular design. This fundamentally changed with EC2000, in that the goal of engineering education was to ensure that students had the tools and skills to be self-sufficient and innovative learners. Overall, the results of EC2000 have been positive, with students exhibiting, more active engagement in their own learning, more interaction with instructors, more instructor feedback on their work, more time spent studying abroad, more international travel, more involvement in engineering design competitions, and more emphasis in their programs on openness to diverse ideas and people.7 These changes, however, have continued to leave faculty members with a challenge: how can the academic environment continue to be modified to promote these skills, as continuous improvement is now expected of all programs?

Lifelong learning takes on two forms, formal education and informal education. Formal education includes continuing education programs, advanced degrees, and other directed programs.2,3 Informal education refers to all other forms. There is obviously a need for formal programs for future training. However, with the ever shortening relevancy of technical skills, to be successful in the workplace, students also must be strongly motivated self-learners.4,5
Many techniques have been tried to improve the ability of students to be self-directed learners. Mandatory attendance at professional society meetings, service functions, free-form lab activities, and project based learning all aid in this process\textsuperscript{6}. For these activities to be successful, however, students need to learn how to differentiate the quality of sources by being exposed to different forms of media. The Millennial Generation has grown up with the web, and is extremely fluent with its capabilities. They are also very savvy with technology. However, Millennial Generation members do not necessarily have the appropriate skills to appropriately harness this technology. When given a learning task, Millennial Generation students tend to proceed erratically through an information search process.\textsuperscript{5}

Traditionally, these tasks have been overcome through the usage of a formal research paper. In a formal research paper, students search through multiple sources to find material related to a specified topic. The student then submits the paper to the instructor for assessment. The formality of this approach, however, has significant drawbacks.

**Goals of the assignment**

While traditional research papers can aid in students learning, they suffer from several significant problems. First, because they are very formal, they are very time intensive for a student. A properly done research paper may take 15 to 20 hours of effort, making it impossible for an instructor to assign more than one or two papers per term if significant technical content is to be covered. This also means that research papers tend to have more depth than breadth. Second, as research papers are extensive, many student dread working on them, because they are often on a selected topic that may not be of direct interest or relevance to the student. Third, from a faculty member’s standpoint, properly grading and assessing research papers takes a significant amount of effort. A 10 to 20 page research paper requires 30 to 40 minutes to grade. Finally, because of the roles of protocol, faculty members tend to require the usage of conference or journal papers as sources, avoiding the very types of publications students will most likely read as practicing engineers.

In the computing fields, the ACM and IEEE Computer Society technical societies have been extremely progressive in presenting quality technical material in non-traditional formats. The ACM has sponsored the Computer Science Teachers Association Snipits Podcasts (http://csta.acm.org/Communications/sub/Podcasts.html) and the IEEE Computer Society has sponsored Software Engineering Radio (http://www.se-radio.net/) and the Silver Bullet Security Podcast (http://www.cigital.com/silver-bullet/). These efforts, while geared at practicing professionals, offer an opportunity to enhance students’ independent learning.

The goals of the assignments are simple. First and foremost, it is desirable that students understand the different purposes and audiences for publications. Educators are very familiar with the differences between trade publications, conference publications, and journal publications, but students often do not understand the differences because they have not been exposed to them. Second, it is desirable in any class for students to be able to go further in depth than is possible with standard lecture coverage. By having students complete an assignment such as this, students can explore their areas of interest. Last, the assignments must not intrude into the normal classroom environment. The courses which use these assignments are already
difficult classes with a full set of technical topics, and the goal is not to overwhelm students but rather to provide supplemental material.

With these goals being set, an assignment of the form given in Figure 1 is provided to students early on in the quarter. Interim deliverable dates are given to the students, but the exact scope and order of their articles is left up to them.

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**SE4930 Current Topic Research Assignments**  
**Dr. Walter Schilling**  
**Winter, 2011-2012**

**1 Introduction**  
In lieu of a formal research paper, SE4930 will rely upon a set of article reviews and podcast summaries. In short, over the course of this quarter, you will be tasked with selecting 2 articles and one podcast from a set of online sources. You will then be responsible for reading the article and preparing an article summary. The article summaries will be submitted via the course website.

**2 Summary Content**  
The summaries should be approximately one and one half pages, and should highlight the material contained within the article or podcast. In specific, you should address what was discussed in the article or podcast, what you learned from the article or podcast, how this material will help you in your software development, and what questions you may have developed from reading this article or listening to this podcast.

In addition to the written text, the summary shall clearly delineate the name of the article or podcast, its date, and other relevant bibliographic information.

**3 Details**  
Overall, you are required to summarize four artifacts. Two artifacts are to be articles, one artifact is to be a podcast, and one artifact is left up to you. The materials are to come from three different sources.

One article must be from IEEE Security and Privacy Magazine (http://www.computer.org/portal/web/security/home). The IEEE Security and Privacy magazine is one of the leading authorities on the topic of secure software development, and has many articles that are applicable to this topic. You must select one article from this publication to review and summarize.

In addition to current security trends, it is also important to read on some of the experimental aspects of software security. To fulfill this obligation, one article being reviewed must come from a conference proceeding. One of the oldest and most highly regarded conferences in the area of security is the IEEE Symposium on Security and Privacy (http://www.ieee-security.org/TC/SP-Index.html). Conference articles from this publication are available through our library subscription to the IEEE digital library. You must select one article from one of the conferences to review and summarize.

In addition to formal articles, it is also important to be able to listen and comprehend audio information. To this end, you will be required to summarize one of the podcasts from the The Silver Bullet Security Podcast (http://www.cigital.com/silverbullet/). This is a series of online podcasts presented by IEEE Security and Privacy and Cigital which address assorted security needs.

**4 Due Dates**  
Overall, four submissions must be made. Three are predefined for you (one must be a Magazine Article, one must be a conference article, and one must be a podcast), while the fourth may be chosen from any of these three sources. To avoid all reviews being completed in week 10, the following interim due dates have been assigned:

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Time</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>December 14</td>
<td>23:00</td>
<td>The first article or podcast review</td>
</tr>
<tr>
<td>5</td>
<td>January 11, 2012</td>
<td>23:00</td>
<td>The second article or podcast review</td>
</tr>
<tr>
<td>6</td>
<td>January 25, 2012</td>
<td>23:00</td>
<td>The third article or podcast review</td>
</tr>
<tr>
<td>9</td>
<td>February 8, 2012</td>
<td>23:00</td>
<td>The fourth article or podcast review</td>
</tr>
</tbody>
</table>

The specific sequence and order of articles and podcasts up to you. However, once an article has been reviewed, it is no longer available for a second person to review the article or podcast. Thus, it might be to your advantage to start early if there are articles that you are really interested in. You may want to do the podcast first or the conference article. And, it is certainly permitted to turn in articles early.

Article reviews are to be uploaded to the course website.

Ungraded reviews will also be placed on the course website in a matrix so that it is possible to determine if an article has already been reviewed or may have relevance to another article.

Figure 1 Sample Article Summary Assignment.
Student Perceptions

Overall, student response to article reviews has been very positive. From the student’s standpoint, article reviews provide students with the opportunity to explore different subject areas that are related to the course material. Furthermore, whereas a formal research paper requires extensive effort on the part of the student, article reviews are not as extensive, allowing them to be used without impacting the overall coverage of the course.

To assess students impressions of article reviews, students were asked two related questions in end of course assessment surveys. Assessments were based upon a 5 point Likert scale. Overall, as is shown in Figure 2, students tended to agree with the sentiment that they learned material which they would not otherwise have been exposed to, and that they learned more by doing article reviews than if they had completed a formal research paper. This sentiment was also supported by student written comments, which are included in Figure 3.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I felt that the paper reviews helped me to independently learn new material that I would not have learned otherwise.</td>
<td>Year 1 30%</td>
<td>35%</td>
<td>20%</td>
<td>15%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Year 2 20%</td>
<td>60%</td>
<td>20%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>I learned more by doing paper reviews than if I had done a formal research paper, and I have more interest in reading extra articles than if I had done a full research paper.</td>
<td>Year 1 80%</td>
<td>15%</td>
<td>0%</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Year 2 30%</td>
<td>20%</td>
<td>40%</td>
<td>10%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Figure 2 Assessment data from students on article reviews.

- Research papers are too formal to enjoy and learn when you read the sources.
- Most were very high level or specific to a particular company.
- Shorter than a full research paper is good.
- IMO smaller papers are easier to write and between all of them contain a variety of topics.
- I would choose to agree with this since I don't read about security often.
- I really liked these. They really showed how the topics related to the real world.
- The smaller reviews helped give a broader view of security as a whole.
- A research paper would have been more effective in my opinion.
- Article review assignments allowed me to read about a broader range of topics.
- IEEE articles were too long and tough to read, felt like masters level reading.
- The articles were very interesting to summarize.
- They were interesting. Better than a research paper.
- I learned quite a bit from a wide range of subjects.
- Articles were interesting to read.
- I really liked this switch. Covering multiple articles meant getting more overall information. Additionally, the fact that they weren't formal papers took away most of the stress / pressure and I was able to concentrate on just learning something.

Figure 3 Sample student comments on article reviews.
Faculty Perceptions
From a faculty member’s standpoint, article reviews represent an interesting dichotomy. Students need to be able to write formally and to perform the equivalent of a literature survey. It is imperative for students going onto graduate school as well as many positions in industry. Thus, from this aspect, article reviews appear to offer a reduction in coverage versus a more formal research paper.

However, there are many distinct advantages to article summaries versus a formal research paper. Because the article summaries are somewhat less formal in their presentation, the grading and assessment required by the faculty member is reduced. In a formal research paper, the faculty member is expecting a high degree of perfection from the students, assessing technical communications, formatting guidelines, technical relevancy, and other aspects. Given the informal nature of article reviews, the faculty member can focus more clearly on the learning aspect of the article review: did the student comprehend the article, and did the student effectively communicate that comprehension. This reduces grading fatigue.

Article summaries also allow for a more effective dialog between the student and the instructor, placing the instructor into more of a mentorship role. In writing article summaries, each student is requested to ask any questions that they encountered when reading the article. This can lead to a very effective student – instructor dialog, as well as proving a route for further discussion of topics, either before or after class than would be possible with a formal research paper.

The format also allows for easier scaling than is possible with a formal research paper. In the particular class from which the data of Figure 1 was obtained, 4 articles or podcasts were summarized. This can easily be increased or decreased to fit allowable class structure and schedules.

Summary
This article has presented a mechanism for instilling the desire for lifelong learning in students. It is scalable, in that it can easily be adapted to the available time for any class, and it is not intrusive into the classroom environment. Students in general have been supportive of the mechanism in class, and it has been found to offer distinct advantages for the faculty member.

Bibliography