

# OVERCOMING THE ROTE CLASSROOM PARADIGM THROUGH E-PROCESSES AND EXAMINATION OF CASE STUDIES

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## ABSTRACT

From journals to popular press, the perception that high school students are unprepared for either rigorous research or the accompanying writing is prevalent. E-processes such as e-research, e-collaboration, e-editing, e-mail, e-messaging, etc. provide new educational paradigms. An overview of the problem is presented followed by specific cases of successful high school research programs. Students gain skills using e-processes, giving them competitive access to professional conferences and publications.

## KEYWORDS

High school, research, publication, e-learning, internet

## 1. INTRODUCTION

Higher education brands high school preparation at research and writing as inadequate (Matthews, 2004; Jarman, 2006; Knudson, 1998; O'Donnell, 2002). Programs, such as the International Baccalaureate (IB), are demanding higher quality and lengthier assignments (Mathews, 2004). High schools that have involved students in research agendas, using a graduate school paradigm, have proven successful. These schools lean heavily on technology and the use of the Internet to gain acceptance into professional conferences and publications. E-processes in business are similar but not identical to educational e-processes. For the purpose of this paper, educational e-processes will be considered as those electronic mechanisms in place that

facilitate knowledge management, critical and rational decisions based on available information, and, more importantly, increase clarity and comprehension of communication (Pelz-Sharpe et. al. 2001).

## **2. BODY OF PAPER**

University faculty lament that students entering from high schools cannot write research papers (Jarman 2006; Knudson 1998; O'Donnell 2002). Motivation for exceptional research and concurrent exceptional writing does not flow from the high school student's peer group. There is no tenure, promotion, peer-group accolades, or monetary incentive associated with the high school student developing such skills. High school curricula focus on rote memorization of facts already established and standardized testing (Banks 2005) hindering the individual's growth preventing them from developing their own postulations and ideas (Westreich 2002).

What problems arise from this approach? Lack of conceptualization with focus maintained on the concrete level may reinforce feelings that student ideas and opinions are not valued (Wang et. al. 2001; Clump et. al. 2003; Thames et. al. 2003) and student disengagement from the analytical process occurs (Banks 2005; O'Donnell 2002). Teachers and students are not necessarily comfortable with the processes or subject matter (Certo et. al. 2004).

Today's high school students use the technology of the Internet for communication and entertainment (La Ferle et. al. 2000). High Schools may use the Internet for the gathering of information and call it research. However, the writing that follows is less than scholarly and the Internet usage sometimes profligates plagiarism (Aldred 2006).

Treating high school students like graduate school students may very well be the answer to this problem. As follows:

- a) Students become attached to an ongoing research agenda; and
- b) Students become mentored researchers with specific assignments; and
- c) Students are responsible for finding supporting corroborating evidence; and
- d) Students are mentored in a particular discipline's scholarly writing; and
- e) Students analyze professional forums as to submission suitability.

Where do e-processes come into play? It follows that if students use e-mail and e-messaging as their normal day-to-day modes of communication, they will be more comfortable in using this media in a research regimen. The ensuing communications can be saved and reread. E-mail and e-messaging allow students to reach and confer with experts in their research subject areas that could have been too slow, tedious or expensive when left to snail mail or telephone conversations. This form of e-communication extends itself to e-collaboration on conceptual discussions as well as text editing. The teacher-researcher is then able to mentor the student-researchers via such programs as BlackBoard, WebCT and others. Online copies of journals and papers through subscription services mitigate the lack of scholarly and professional journals.

Is there evidence that this paradigm can improve student research and writing and lead to publication or conference presentation? Case studies bear out this proposal.

Case 1: In the 1990's, a small, Midwestern, residential high school, students significantly became focused on forming a high school student chapter of the Association for Computing Machinery (ACM). The ACM is primarily an international association for CS professionals with chapters for university students. Two students and their teacher communicated via email proposing their ideas and traveled to the St. Louis ACM Conference for discussion. Over the following year, many e-mails attempted to make this chapter feasible.

In the Spring of 1993, two students from this high school submitted a paper in a blind review to the ACM undergraduate/graduate research symposia in Indianapolis, IN and presented (Gardiner et. al. 1993). This quickly derailed the theory that high school students were not up-to-par with university students on either the undergraduate or the graduate level. If not for such e-processes as e-mail, file transfer protocol (FTP) and analysis of local area network (LAN) logs, these students would not have been able to compete at the university level. Paper reviewers were university professors in the field of computer science. This group,

recognized between keynote speakers, became the first high school chapter of the ACM. This has resulted in an increased number of high school student chapters of the ACM globally.

Over a period of years, they used the Internet as an e-collaboration tool, an e-communication tool, an e-research tool, and analyzed the use of the Internet in their residential school as an available research topic. Four papers were accepted and delivered to the undergraduate/graduate research symposia, ACM conference in Phoenix, 1994. As well, the students hosted a professional panel session at the joint Special Interest Group Computers in Science Education (SIGCSE) attended by a host of CS educators interested in the newly proposed ACM CS curricula (Sheets et. al. 1994; Ford et. al. 1994; Vance et. al. 1994; Brown et. al. 1994). The panel involved collaboration with a Phoenix high school coordinated via e-mail and use of the Internet to develop the panel's premise. Given the schools' distance, methods such as conventional mail would have made such correspondence inconvenient and costly.

In the first four years of this process a curriculum entitled Computer Science Seminar emerged. High school students collaboratively coauthored with faculty multiple times in the Journal of Computer Science Education (Gardiner et. al. 1992; Strange et. al. 1993). The Internet and Intranet became indispensable for dividing work, co-editing, online consultation and collaboration as well as gathering supporting evidence.

Case 2: In 2003, the same paradigm, using e-processes at a secondary, residential school in the Northern United States, seriously engaged students in examining doable and interesting research questions. Delivering their first conference paper in New York City (Davis et. al. 2004) was followed-up in the next school year with another (Barter et. al. 2004). The latter acceptance was a blind review for an international conference having a 15% acceptance rate. Doctoral students at the conference were amazed at high school students "doing something they had not yet accomplished". Genuine appreciation came from the attending audience applauding the sophistication, maturity, and professionalism of the paper presentation.

In both cases, the students act much like college graduate students. They learn the process by doing, mentoring, collaborating with each other, and learning to govern their time and efforts for the reward of a conference presentation. Both time and efforts, mitigated by the use of e-materials, e-tools, and implicit e-processes, required that students learn to use the Internet and e-processes as viable and indispensable tools. Traditional research requires a significant investment in professional research material. However, high school students do not have access to such resources. Using the internet, high school students can find copies of professional, peer-reviewed journal articles available online. E-research techniques act to lower barriers to the professional arena, allowing high school students access to the professional world of research. Such tools include online, digital libraries, databases and student response surveys. If such resources were not available the research process would have been inconvenient and time consuming, if not impossible.

Case 3: High School scholars, who may not find the mentorship expertise in the secondary school, have been successful in competitions such as the Intel Science Talent Search (ISTS) by attending summer research programs in universities and local scientific laboratories (INTEL Corporation 2006). This requires that the students attach themselves to a college researcher and become a part of their research agenda. The last two years of the ISTS competitions produced winners of first place through third from this paradigm. Continued collaboration using Internet technologies is advantageous for the student to collaborate with their mentors prior to submission to ISTS. Other competitive presentation forums of this nature may occur locally, regionally, nationally, or internationally. Competitions of this nature, organized around a research paper followed by a poster presentation, resemble the format of a science fair presentation. The audience and adjudicators are mobile and contestants prepare themselves for questions on an ad hoc basis.

### **3. CONCLUSION**

Based on the above case studies and the results of high school research competitions, high school students are capable of rigorous research and the requisite writing required from professional conferences and journals. Internet technologies and electronic tools have become a necessity for fostering and maintaining the collaboration, communication, requisite rigor and quality expected this level of scholarship. On-going research agendas and resultant mentoring necessitate Internet technologies allowing both synchronous and asynchronous communication.

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