Preparing undergraduates for the future of scientific collaboration: Benefits, challenges and technological solutions in distributed REU sites

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Distributed Research Experiences for Undergraduates (REU) Sites

- They seek to attract, nurture, and retain students in the Science, Technology, Engineering, and Mathematics (STEM) career pipeline. This is accomplished through:
  - o mentoring focused on enhancing student learning,
  - o opportunities for students to interact with their peers to the extent that they choose,
  - o experience with current equipment, procedures and approaches, and
  - o the production of a research product (e.g. oral or poster presentations, journal article, etc).
- Some or all participants are geographically separated (Figure 1). The exact arrangement of participants varies depending on their needs and preferences.

Leverage Information and Communications Technology (ICT) and specialized programming to develop "cohorts" or peer networks for short-term collaboration and support, as well as longer-term assistance navigating the STEM pipeline.

Connecting Distributed Interns

- Programing
  - Purpose
  - Technology

Virtual ice-breaker before the summer
- Establish a social presence among the group, formally assess virtual interactions
- Facebook & Course management system (CMS)

Orientation
- Establish a social presence, provide ICT training, learn/scientific computing programming concepts & skills
- In person

On-going, virtual interactions
- Maintain social cohort
- Blogs
- Facebook Virtual rented

Close experience, present research results, re-great and strengthen cohort
- In person

Final meeting
- End-of-summer symposium or scientific conference

Past summer interactions (e.g. Alumni/mentor conference "meet-up"
- Re-establish and maintain connections

Table 1 (right). Framework for fostering social and academic connections (Table 1).

Figure 4. Number of interns (2006-2012) who felt like they connected to other students at their mentor's institution (green) and other IRIS interns (blue) in a beneficial way.

Figure 6. Basic components of QuakeQuest. Left - Icons for browsing poster archives – students select and print in Portable, Center - Private conversations to set up poster and discuss with peers. Right - VDP control window.

Virtual World - QuakeQuest
- Virtual Poster Session to share research results and critique posters before final research symposium
- Email

Key Features
- Opportunities for voice and written feedback
- Create clusters of posters for mini poster sessions

Student Response
- QuakeQuest was in beta phase. Students expected production level software and were frustrated with bugs. This has been abandoned.

Figure 5. Facebook, introduced to the program in 2010, has positively impacted the percentage of interns who agreed or strongly agreed that they were connected to the cohort in a beneficial way.

Table 1 (right). Framework for fostering social and academic connections (Table 1).

Technological Solutions

- Course Management System
  - Functionality Used
    - Page – Advertise the program and connect with alumni
    - Announcements – Send news, requests, and updates to participants
    - File Organization – Folders organize files containing forms, guidelines, templates and presentations students use
    - Discussion Board – Encourage conversation via email and/or smartphone
    - Course Management System
  - Key Features
    - Supports synchronous and asynchronous communication
    - Enables and encourages conversation via email and/or smartphone
    - Learning management system
  - Performance
    - Increase in frequency and quantity of group communication
    - Ease of use
    - Flexibility
    - Learning management system

Key Features
- Supports synchronous and asynchronous communication
- Flexible and private (password protected)
- Well designed structure for organizing information.

Student Response
- Students generally content with use of a course management system
- Students don’t fully understand the benefit of critiquing each other’s work and tend to look at the online critique function used

Comments
- Virtual cohorts can be constructed using a collection of Information and Communications Technology when combined with programming designed to foster shared experiences and purpose.
- Building a successful virtual cohort is achievable. It takes planning and the on-going commitment of a centralized mentor to monitor and encourage communication.
- Fostering common purposes, though challenging when students are working on different projects, may strengthen the virtual community.
- Ensuring that plans have opportunities to develop both social and academic connections with the cohort is important.
- Students in distributed REU sites develop connections with both their virtual cohort and students at their summer placements.
- Virtual connections and in-person connections may offer slightly different elements of support to the participants, though the virtual may never be as strong.
- Facebook is a powerful tool for developing a social cohort among the interns, but not for communicating program details, logistics, deadlines for assignments, etc. Other tools such as a course management system may be better suited for this.
- Asynchronous communication is essential, as time zones and fieldwork make synchronous communication difficult to schedule.

This work was funded by the National Science Foundation; BHR-1156739 &