Open Source Technologies in Science & Education: What's Your Geek IQ?

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The goal of education, whether public or private, K-12 or post-graduate, is fundamentally an altruistic one. Obviously, a well-educated public can better come to grips with both the environmental and technological issues that face today's societies. Knowledge empowers everyone, and free software (or Open Source) technologies such as GNU/Linux and BSD follow almost identical themes; by providing the same robust, standards-based capabilities to everyone, they not only foster education and cooperation, but also self-determination. By distributing the source, users have the freedom to fix bugs or add enhancements as their requirements dictate. Supporting and using open standards also helps ensure equality of access to these technologies for everyone. The GNU General Public License, among many other free software licenses, is intended to maintain these same rights and freedoms, by ensuring that no one individual or organization can take control. In this way, Open Source technologies are an ideal fit for many organizations, most especially those in a public education setting. The low overall life-cycle costs and flexibility are also a significant benefit to both public and private-sector organizations.

There are undoubtedly many such Open Source technologies, as well as in-house and commercial products, already supporting various requirements at your own institution; this paper will present a broad overview of the how's, why's, and what's of Linux and other open source technologies, focusing on specific examples of both instructional and research support in multiple settings. The Open Source roll-your-own approach is also contrasted with 3rd-party solutions, including internal and external resources.

Specific technologies covered include both basic web services and web applications, chat and conferencing, GIS and mapping tools, meteorological modeling, and high-performance computing. Examples include the apache web server for distributing documents and handouts (mostly html and pdf documents), the Zope web application server for group discussion and portal services, and Internet Relay Chat (IRC) as “virtual” office hours. Current plans include a dedicated web and real-time meteorological data server, on-line maps and data analysis, and more simulations. Example applications of the above technologies include classroom lecture/activities, homework/research assignments, group collaboration, and special projects. Classroom enhancements include the use of “smart” podium hardware, animations/simulations (eg, coriolis effect, adiabatic heating), live internet resources, and both traditional & digital video. On-line discussion forums and email are used for asynchronous communication, and the Freenode IRC network is used for real-time (synchronous) interaction with students.

Informal results over the last 5 years are encouraging on the whole, with most students participating in various on-line exercises at a high level, many enthusiastically (including low-income and ESL students). In fact, the ability to submit assignments via the web and email has been critical for some students to retain their grades, given international travel and other family commitments. However, a handful of students, regardless of the age group, are still somewhat hindered by a lack of experience and have a correspondingly low self-confidence or “comfort level” with the technology in general (relying on hard-copy or other workarounds for assignments).

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