Rapid Emerging Knowledge Deployment

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This paper describes how to manage technical knowledge that is transitioning faster than subject matter specialists, human resource analysis, and education deployment trainers can respond through traditional competencies. Radical learning techniques used by self-directed emerging technology study groups can serve as a management tool for gaining and leveraging the knowledge necessary to take advantage of rapidly emerging technology. Reduced education material costs, software licenses, and deployment costs are empowering individuals to drive the speed of technology change, teams to gain emerging technology, and managers to deploy knowledge as a strategic advantage.

Open-Sources Accelerate Change

You no longer need to be managing a sophisticated research lab for your people to be on the brink of technological change. Open-sources [1] are making a radical shift in the cost of emerging technology and, thereby, the cost of gaining rapidly emerging knowledge. Leading edge software advances like Java, Linux, and XML (eXtensible Markup Language) are being provided for only the cost of downloading them through the Internet. Special interest groups are providing no-charge open sources distributions consisting of software listings, compiled versions, and documentation. You can experience, modify, extend, and redistribute open sources for free. Individuals are fostering the transition:

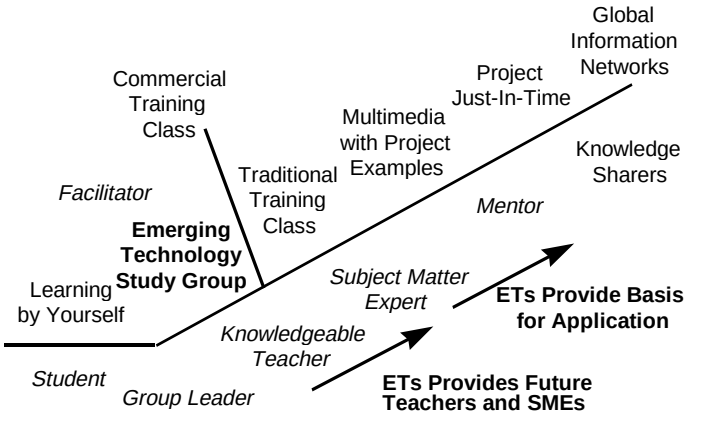
- Java happened during a long weekend hack by Patrick Naughton as a throw-away;
- PERL originated with Larry Wall to produce some reports from a Usenet news-like hierarchy of files for a bug-reporting system for the Net;
- tcl/tk was developed by Dr. John K. Ousterhout as a professor in the Department of Electrical Engineering and Computer Science at the University of California at Berkeley;
- Linux originated with Linus Torvalds in a project to explore the 386 chip and was copyrighted under the terms of the GNU's Not Unix (GNU) General Public License written by the Free Software Foundation.
- The World Wide Web (WWW) was invented by Tim Berners-Lee while working at the Centre Européenne pour la Recherche Nucléaire, the European Laboratory for Particle Physics. Berners-Lee originated the first WWW client, a browser-editor running under NeXTStep, and defined Uniform Resource Locator (URLs), HyperText Transfer Protocol (HTTP) and HyperText Markup Language (HTML).

Support is coming from companies eager to get attention on the Internet by giving software away; both major browsers are now free. The World Wide Web Consortium (W3C) was created using seed funding from the Defense Advanced Research Project Agency [2]. The vendor-neutral W3C provides the global community with internet standards for HTML, Standard Generalized Markup Language (SGML), and XML. SGML was the forerunner to HTML, which is used to format web pages, and XML, which is used to label knowledge assets. Through HTM, anyone can create a web page by hand and with XML one can create his/her own meta-data for sharing knowledge assets. While information remains costly to produce, reproduction has become inexpensive. For example, the cost of compact disc encyclopedias and phone books have dropped from an original asking price of around $2,000 to significantly less than $100 [3]. Internet-based dictionaries can be accessed for free.

Managers need to make the paradigm shift from the days when the only way to gain the latest technology was to attend user group conferences, since computer books were rare. Now vendors, interest groups, and individuals host Web sites that often hold more combined information than related publications. Books are published, often before the software releases. When someone asks for knowledge, the right question is, "Do you have Internet access?" Your on-line bookstore can monitor topics and send e-mail with advanced notice of pending publications.

The rate of change exceeds the time to develop subject matter experts, training courses, and human resource interventions. Given how much is free, employees are sometimes gaining more experience at home off the Internet. Managers need to create a learning environment at work that matches their team-based organizations. These teams need to be empowered to rapidly discover, gain ownership, and cross the learning curve.

Figure 1. *From individual to global learning.*



Rapid Response Knowledge Teams

As waves of technological change are upon us, we are shifting to team-based approaches; teams are struggling to paddle in front of the curl. At Raytheon Systems Co. in Garland, Texas, I have facilitated what I call emerging technology study groups (ETs). I have been sharing a vision that self-directed study groups can gain global advantage, Figure 1.

Object-oriented (OO) methods; Java, tcl/tk, and PERL languages have all moved up this model from individuals studying, through study groups, to formal classes and mentoring. The OO study groups started before UML and Java when there was only one thin Java book available. For organization, I adapted self-directed work teams [4]. They select their own leaders and set their own goals. This feeling of student ownership creates a lively, enthusiastic learning environment in which they train themselves. At times, there have been more active study groups than traditional training classes. The typical study group selects a book, reads a chapter a week, and has team members lead the discussions. Additionally, they were encouraged to select a higher team goal. The Linux study group helped each other install Linux on their home computers. A Java study group built a Java Learning Center, gained Internet access, wrote their own lesson plans, and led self-paced instruction. The successful study groups have used a radical schedule of meeting once or twice a week for an hour. In this way, they differ from cooperative learning, which occurs as part of classroom exercises, see Table 1. Managers can interject work assignments into the classroom as a substitute for cooperative exercises and into project schedules as just-in-time (JIT) study groups.

Employees are experiencing cooperative learning in school. They enter the work force with an expectation that they will be learning in teams, presenting their research findings, and earning part of their evaluations from team-based roles. The first emerging technology study groups were modeled on this expectation. As education is transforming for the Generation-X learner, they are enjoying the shift to interactive hypermedia learning environments. The Internet is becoming the environment for learning, with accompanying CD integration, and online broadcasts and discussion groups. Our study groups have used both our intranet and the Internet to host their materials.

Managing Rapid Learning Expectations

Learning expectations are transitioning from instruction to construction and discovery, from teacher-centered to learner-centered, from absorbing to navigating, from standardized to customized learning, and from teacher as transmitter to facilitator [6]. Training and human resource professionals are adapting radical approaches such as accelerated learning environments, adult learning techniques, alternative learning strategies, and knowledge sharing/reuse along with traditional Joint Application Design, Rapid Application Development, and JIT to enable faster learning and deployment. The management role is shifting from making requests of the training department to establishing team-based learning environments. It is deploying trailblazing teams that gain emerging knowledge, skills, and experience, and that facilitate technology dissemination.

Table 1. *Study group research and cooperative exercises.*

Study Group Research	Cooperative Exercises
Too new for training materials to be prepared	Part of an established training class' exercises
Time allowed between meetings for reading, practicing, and researching	Conducted during class with materials prepared by teacher ahead of time
Group size 10-12, max. 24	Group size 2-3, max. 5

Emerging Technology Study Group (ET)	Strategic Knowledge Team (SKT)
Voluntary self-directed study teams choose their own leaders	Appointed by the knowledge manager. Facilitates the formation of ETs.
Focus on skills desired by the team members	Focus on research assignments from the knowledge manager
Self-motivated	Job-position responsibilities
Based on employee's desire to gain competitive competence	Based on knowledge manager's goals

Table 2. *Self-directed and strategically aligned study groups.*

Knowledge managers are deploying Strategic Knowledge Teams. They differ from self-directed study groups in their motivation, see Table 2. Study groups are internally motivated; strategic teams, external. The key is that there is usually only one strategic team that can sponsor multiple study groups. Further, the study groups' organizational role can be defined as accountability for commitments to particular learning outcomes, not activities, creating an adaptive sense-and-response team both self-directed and strategically aligned [5].

Rapid learning techniques are available to the manager to deploy emerging technology as a part of their strategic initiatives and corporate knowledge assets. Global learning teams deployed through the Internet, private government and corporate intranets and extranets, based on open-standards, are facilitating and leveraging strategic alliances. ◆

About the Author

Kevin Marler is a Senior Knowledge Specialist at Raytheon Systems Co., Garland, Texas. He is a subject matter expert for the Raytheon Learning Institute, an internal ISO 9001 auditor, and teaches for Richland College, University of Texas at Austin, and Texas Tech University. He has a master's degree in business administration from the University of Phoenix and a bachelor of science degree from Brigham Young University. His competencies include object oriented, artificial intelligence, and knowledge management with experience leading emerging technology deployment in distributed networks, robotics, real-time graphics, and data warehousing. He spoke at STC '97, "A Use-Case Driven Requirements and Architecture Analysis Process for Systems Engineering," and STC '98, "Training Ourselves in the Global Holodeck, Emerging Technology Study Groups."

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Coming Events

20th IEEE Real-Time Systems Symposium (RTSS)

Dates: Nov. 30, 1999 — Pre-Conference Workshop
Dec. 1-3, 1999 — RTSS '99
Location: Phoenix, Ariz.
Sponsor: IEEE Computer Society
Internet: http://www.cs.tamu.edu/conferences/rtss/

24th Annual Software Engineering Workshop Call for Papers

Dates: Dec. 1-2, 1999
Location: Green Belt, Md.
Sponsor: NASA/Goddard Space Flight Center Software Engineering Laboratory, University of Maryland, and Computer Sciences Corporation.
Internet: http://sel.gsfc.nasa.gov/sew.htm

25th International Conference on Technology Management and Performance Evaluation of Enterprise-Wide Information Systems

Dates: Dec. 5-10, 1999
Location: Reno, Nev.
Sponsor: Computer Measurement Group
Focus: Better computing in the years beyond 2000. Every one of you has experiences and unique perspectives in managing enterprise technology assets.
Voice: 609-401-1700
Fax: 609-401-1708
Internet: http://www.cmg.org/cmg99/

17th ACM Symposium on Operating Systems Principles

Dates: Dec. 12-15, 1999
Location: Kiawah Island Resort http://www.kiawahresort.com/, near Charleston, S.C.
Sponsors: Association for Computing Machinery http://www.acm.org/, Special Interest Group on Operating Systems http://www.acm.org/sigops/
Internet: http://www.diku.dk/sosp99/

13th Conference on Software Engineering Education and Training (CSEEs&T)

Dates: March 6-8, 2000
Location: Austin, Texas
Theme: Software Engineering Coming of Age
Topic: Offering guidance, promoting innovation and collaboration, and stimulating new instructional approaches to education and training. For further details visit: http://www.se.cs.ttu.edu/CSEET2000
E-mail: mengel@ttu.edu
Voice: 806-742-3527
Fax: 806-742-3519
Internet: http://www.se.cs.ttu.edu/mengel

12th Annual Software Technology Conference

Theme: Software and Systems — Managing Risk, Complexity, Compatibility, and Change
Dates: April 30-May 4, 2000
Location: Salt Lake City, Utah
Co-Sponsors: U.S. Air Force, U.S. Army, U.S. Navy, U.S. Marine Corps, Defense Information Systems Agency, Utah State University Extension
Co-hosted by: Ogden Air Logistics Center/CC, Air Force Software Technology Support Center
Contact: Dana Dovenbarger
Voice: 801-777-7411
Fax: 801-775-4932
E-mail: dana.dovenbarger@hill.af.mil

23rd International Conference on Software Engineering

Dates: May 2001
Location: Toronto,Canada
Sponsors: IEEE Computer Society Technical Council on Software Engineering, Association for Computing Machinery, ACM Special Interest Group on Software Engineering (SIGSOFT)
E-mail: icse2001@csr.uvic.ca