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LTER Information Management and Collaborative Learning Environments

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# LTER Information Management and Collaborative Learning Environments

NSF International LTER Supplement 2009

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This report presents the concept of a virtual learning commons explored at an international workshop as one way of meeting the need of information managers for life-long, life-wide learning.

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# **ILTER Information Management and Collaborative Learning Environments**

## **1 Introduction**

The need for information management is growing in this age of digital data and information sharing. With growing expectations for data accessibility and needs for data organization, scientific networks face challenges unique to long-term, large-scale scientific endeavors including a recognized gap between skills in information management and the needs – both recognized and unrecognized. Amidst the diversity of tools and technologies available, there are changes in scientific practices to consider that add to the data work in individual investigator’s laboratories and the work involved in supporting collaborative project teams. There are even more profound cultural shifts involved as collaborative systems are developed at multiple, interdependent scales, moving from short-term, single site projects to longer-term, multi-site distributed networks (NSF, 2002, p.15).

To support creation and dissemination of knowledge about information management, an NSF supplement proposal was submitted in 2009 to the NSF LTER program office. The request was framed as follows: “We are requesting funds to bring together a group of specialists to 1) define a course of action and guidelines for creating a forum with educational materials on information management and 2) define the research questions we will pursue in a larger proposal.” The idea of initiating an education-oriented information management learning commons grew from collaboration among participants in two networks in the International Long Term Ecological Research Network (ILTER): the US Long Term Ecological Research Program (LTER) and the Finnish Long-Term Socio-Ecological Research (FinLTSER) Network. With Finnish expertise in relevant topics and data managers interested in the commons located at or near Oulu University, the meeting was planned for Oulu University and referred to as ‘the Oulu meeting’. Workshop participants from both networks recognized the need to consider development of some type of life-long, life-wide learning arrangements for information managers.

The US Long-Term Ecological Research Network began in 1980. Due to a fortuitous accumulation of insights developed from previous community efforts, of bold visions from charismatic well-placed leaders, of holistic perspectives inherent to ecological science, and of a deep understanding about data matters, data management emerged early on as a required role at each of the U.S. LTER sites. The inclusion of a data manager at a site’s inception can be recognized as a strategic, formative factor. Further, the understanding that ‘data matters’ and that there are new types of work is a message that currently travels informally among ILTER participants. The role and its responsibilities have evolved and broadened in the last decade as is evident in the name change within the US LTER from ‘data manager’ to ‘information manager’ (Baker et al., 2000; Baker and Millerand, 2010). The generation of effective resources to scaffold articulation of and learning about information management roles is, however, at an early stage.

This report summarizes start-up efforts in gathering and conceptualizing information about information management (IM) and collaborative learning environments such as a Virtual Learning Commons (VLC). Plans and products are discussed in Section 1; a timeline is given in Section 2 along with a description of initial events. The Oulu meeting activities are detailed in Section 3. Discussion and final thoughts are summarized in Sections 4 and 5, respectively. A list of abbreviations and online links is provided in Appendix 7.1 along with our 2009 proposal, the 2009 LTER All-Scientists Meeting Working Group Reports, and the Oulu meeting agenda.

## **1.1 Plans and Activities**

The brief timeline in Table 1 summarizes events associated with this project:

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Table 1. Timeline of Events

2009 LTER All Scientists' Meeting Working groups  
2009 Supplement Proposal Funded  
2010 Planning Meeting in Albuquerque  
2011 Meeting in Oulu

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Four working groups held at the 2009 LTER All Scientist's Meeting (ASM; 14-16 Sep 2009) at Estes Park served facilitated discussions that informed our work. Their titles are listed below:

Working Groups 1 & 2: Key Elements of Site-Based Long-Term Information Management: A Curriculum for Educating Ecological Information Managers (2 sessions)  
Organizers: Kristin Vanderbilt, Karen Baker, David Blankman, Helena Karasti, Inigo San Gil

Working Group 3: Virtual Learning Commons for LTER IM: Vision and Web 2.0 Support  
Organizers: Kristin Vanderbilt, Helena Karasti, Deana Pennington, Ann Zimmerman

Working Group 4: Assessing the IM Training Video Series: Viewer Feedback and Panel Discussion  
Organizer: Kristin Vanderbilt

Reports from these workshops are in Appendix 7.2. Further, during Working Groups 1&2, posters were generated by small groups of participants working together to outline the elements and categories of information management they thought important for an information management curriculum. Curriculum categories highlighted include: technical, data handling, management, communication with scientists and technologists, information management at a new site, and continuing learning for the information manager. The

technical category was inclusive of technical expertise such as database and systems design but also of knowledge about the science that the data supports and about the social and organizational dynamics. An analysis of these materials together with transcripts of the working groups was begun so as to inform subsequent efforts. A number of televideo conference calls were held prior and subsequent to a Planning Meeting held in Albuquerque in 2010. During these interactions, the Oulu University meeting was planned, proposal discussions held (led by Deana Pennington), and technological tools explored (led by Kevin Brady). In addition, the analysis of the Working Group materials was continued (Helena Karasti, Karen Baker, and Kristin Vanderbilt).

## **1.2 Products**

The working group identified five potential products as outcomes of the supplement:

- Conceptual insight
- A technical report
- An NSF proposal
- An Academy of Finland proposal
- A publication

A major thrust of this effort was to initiate development of a shared conceptual framework with respect to LTER information management as well as a digital learning commons. This includes 1) articulation of information management needs for learning by those at the local level. It also involves 2) developing strategies for how to meet these needs, 3) technical arrangements to support education over time, and 4) the framing of a long-term, community process. The second product is a technical report in order to record the needs, the goals and potential future directions identified during the project. The final products are two proposals and a publication that develop further some of the concepts and material in this report.

## **2 Working Group Approach & Schedule**

The aim of the meeting at Oulu University was to set the stage for formulation of a larger research project, a virtual learning commons (VLC), incorporating principles of participatory design (Schuler and Namioka, 1993) and computer-supported collaborative learning (Stahl et al, 2006). Three US LTER researchers (Karen Baker, Kristin Vanderbilt, and Deana Pennington) made a five day visit to University of Oulu, Finland in 2011 for a planning and design meeting. The meeting was hosted by Helena Karasti, a researcher who has been working with participatory design since 1995 (Karasti, 2001) and studying information management and scientific collaboration within the LTER since 2002 (Karasti and Baker, 2004; Karasti et al, 2006). The agenda (Appendix 7.3) summarizes meetings with a variety of groups with expertise relating to

- **Online community tools:** for online access to educational resources  
Educational Technology Research Unit
- **Participatory design:** of information systems  
Department of Information Processing Science
- **Environmental issues:** for data work required to support ecology  
Thule Institute and FinLTSER participants

The first day started with discussions by the workshop coordinators followed by a meeting with FinLTER participants in order to initiate a dialogue on the concept of an education-oriented project. In addition, a video created earlier by an LTER information manager was played in order to see its reception first-hand. Discussions with this wide-range of experts brought forward a multiplicity of factors involved in creating a virtual learning commons and thereby raised awareness of the range of issues involved.

### 3 Working Group Sessions

#### 3.1 Learning Needs for Information Managers

*Initial Discussion Questions:*

- *What is your view and experience with information management?*
- *How do you envision a trajectory of information management?*
- *What would you like to see in a Virtual Learning Commons?*

We wish to move from the idea of information management as the putting together of lots of long-term datasets to considering the concept of information stewardship. Descriptions of information management typically outline explicit tasks: receiving, sharing, describing, and publishing data. But information management is more than just assembling files and carrying out detective work required to locate and rescue legacy data. Working groups at the LTER All Scientists' Meeting made evident that there is a great deal to information management that is not captured in standard operating procedures or online technical modules. There was a general recognition that local arrangements often depend upon one or more site-specific circumstances, such as an urgency with respect to legacy data, a new collections center, or an organization-wide geographic information system (GIS) program orientation.

There are a number of learning theories associated with particular researchers that are pertinent to a VLC project (e.g. Bransford, Lave, Wenger, Engeström, Hakkarainen). In terms of the design work of information managers, there is some design-based research in education, but the majority of research is in controlled settings rather than in the realities of a live setting. In both decision-making and sense-making, there are individual motivations, intentions, and attitudes to consider together with the sociopolitical forces and incentives of larger scale efforts.

At the meeting, the viewing of a video made by a US LTER information manager about information management at a local site provided a very useful introduction and segued into a discussion of alternative delivery arrangements and of potential educational materials to support the learning of information managers. From discussions with participants from FinLTSE emerged the following points to consider in creating an information management VLC:

### **1) Information management development in interactive phases**

*Develop and designate materials appropriate to differing phases of development of information management beginning with inventories.*

Discussions underscored the importance of developing the discourse about establishment of information management in terms of tasks performed in different stages or phases of development rather than as a single complex picture of a mature site. For instance, a new site might be in an initial phase of development and want to focus on producing not only datasets but also documentation in the form of guidelines, protocols, and best practices manuals. These will change frequently but provide materials that may be shared between researchers and information managers. Examples of these materials in document collections may be valuable to publish to the VLC. Locally, suggest adding IM materials, inventories, and bibliography.

Each may be revisited over time and developed from initial tasks at a new site to more sophisticated approaches developed over time. Data management at sites was described before the end of the first decade of LTER (Michener, 1986; Gurtz, 1986). Brunt (2003) sets the stage for the concept of iterative stages of development of information management by presenting 'start small and keep it simple' as one of the keys to success of data management. In our discussions, types of work or tasks performed in different combinations in the different phases of a site's development were identified as follows:

- Task 1 Data Survey;
- Task 2 Dataset Management;
- Task 3 Metadata Publication;
- Task 4 Data Publication;
- Task 5 Community Work.

In Task 1, surveys and inventories make visible the state of data. Discussion of data priorities serves as a guide to plans for aggregation of data into a central repository. Making data available in a new way impacts existing scientific data practices and frequently brings unanticipated changes. Dataset management in Task 2 involves data formatting and reviewing, making data more accessible through systems design, involves procedures for delivery data as well as creating metadata, developing data policy, and implementing data backups. Metadata publication in Task 3 enables data discovery and involves assisting with the data documentation process in order to make data findable to a wide range of individuals. Task 4 focuses on data publication in a selection of manners, e.g. web, marketing, and peer reviewed journals for credit. Beyond the first four tasks of information management work, is Task 5, community engagement, the work of contributing to projects



(e.g. project planning, identity-building), to a site (e.g. website management, serving on institutional committees) and to networks (e.g. publishing to archives, serving on community committees, participating in working groups). This type of work typically occurs concurrently with all the other tasks and in various phases of development.

## **2) An information management strategy**

*Elaborate upon an information management strategy including a vision and a data policy.*

A multitude of ill-structured, conflicting issues arise in the real-world of information management, many of them demanding an immediate decision. Choices involve an understanding of not only the immediate research at hand but also the larger, longer-term socio-technical context with all its complexity. Since few information systems stand alone today, an IM strategy is required that addresses multiple levels of interconnectedness. A robust IM strategy includes a vision for discerning solutions and balancing actions that optimize for instance for both the short-term AND the long-term, for both the local AND the global. A view of IMs as data stewards recognizes the importance of this vision.

## **3) Data complexity**

*Recognize and articulate data complexity providing examples of types of data managed and standards used.*

The concepts that arose in meeting discussions included metadata description, ‘data policing’, data sharing, data policies, and data curation. There was little time to delve into any one of these sweeping topics. Also discussed were types and phases of data and metadata as well as of types of integration involving merging and synthesis for generation of derived products and meta-level knowledge. Throughout the discussion, unarticulated understandings of practices, infrastructure, and standards were evident. Additional tensions or dichotomies were recognized explicitly including need-based and archive-based, site-level and community-level, practice and theory, communication and delivery.

## **4) Information management community culture**

*Use multi-faceted materials and an array of techniques to capture the stories and activities of the community.*

Narrative – for the producer and for the audience – is a powerful learning technique. For example, stories may present the development of information management at a site or an example of social interactions involved in negotiating data work with a scientific investigator.

Multiple approaches are available for conveying information management to diverse audiences: use of metaphor to focus on growth over time; presentation of alternatives to convey choices such as high and low technological options; description of layered context to highlight multiple levels from local to global; and technical help to provide suggestions for a data manager or data curator.

## **5) Design as a learning tool, an engagement process, and a community education approach**

*Conceptualize a VLC as an infrastructural element that engages learners with differing backgrounds, eliciting and providing contextual information and concrete examples.*

Given how rapidly IT changes, strategic approaches are required in addressing how to scaffold the learning of information managers. The skills training and conceptual learning for rapidly changing professions were recognized as requiring a type of life-long, life-wide learning. This brought us to a critical discussion: readiness as a major factor and its relation to 'zones of proximal development' from the seminal work of Lev Vygotsky . In addition, distinguishing solution-based approaches from multi-perspective approaches is critical. Multi-perspective approaches can address learning and learning problems that are needed for a dynamic learning commons rather than a static list of training modules. A multi-faceted approach to engaging participants might include overviews, profiles, interviews, and assessments. Profiles may be informal participant contributions or more formal 'profile templates' used to collect information on local infrastructure, information systems, timelines, standards in use, and sampling arrangements.

Assessment of design and effectiveness of a learning commons is a complex issue. Surveys could help discern attitude and intentions but do not address the overwhelming number of positivistic rather than participatory methods used in design of a learning commons. One might consider how the effectiveness of the commons is linked to the design process.

### **3.2 Virtual Learning Commons/Community Concept and Associated Tools**

*Initial Discussion Questions:*

- *How can we create an international community of information managers so that we can all learn from each other?*
- *Given how rapidly technology changes, how can we know where we're positioned in the information landscape and understand our options?*

The Learning and Educational Technology research unit at Oulu University (LET) provided an overview of what the latest research says about quality learning. Though developed in the classroom settings rather than contemporary collaborative scientific arenas, four core learning principles were summarized (Rochelle & Teasley 1995):

- a. Learning is an active knowledge building process, not just about knowledge acquisition
- b. Learning is building on previous knowledge and skills in a timely manner
- c. Learning is situated, constructed within a context via grasping, transforming, creating, and expanding
- d. Learning is social, where collaboration can lead to deeper understandings among learners

Collaborative learning is supported by different technologies in web environments that are developed to promote collaborative knowledge building and shared problem solving. Collaborative learning poses new challenges for learners, who must be able to benefit from other learners. Instructors are challenged to create successful collaborative learning situations (Kirschner, Sweller and Clark 2006; Sweller 2006) that trigger social interaction and mechanisms such as questioning, explaining, arguing, and comparing perspectives.

Based on research in elementary schools, successful collaborative learning is a function of positive group processes (reciprocity, peer-tutoring) and the group itself must have heterogeneous, active participants who feel comfortable contributing in the group situation. Teachers facilitate the group interaction by helping with group dynamics and domain issues. Assigning learners to different roles (secretary, active participant) may foster collaboration by reducing the hierarchy in a group. Virtual learning spaces used in the elementary examples include Moodle, Second Life, Sloodle (Moodle + Second Life), and Qaiku, a micro-blogging and livestreaming service. Particular instructional approaches used include Jigsaw, a cooperative learning strategy that enables each student of a “home” group to specialize in one aspect of a learning unit that they then teach other members of their “home” group.

Technology, however, can change how we teach and interact in that

- Technologies are diverse and can be matched to needs
- Having options for choosing arrangements often improves motivation
- Support exists for both individual and community information transfer

Ideas about a LTER IM Virtual Learning Commons that arose during the discussion session included:

- a. Users must understand why it’s valuable to participate in the VLC
- b. Topics in the VLC should be a result of the brainstorming done by the community
- c. If a group approach is used, the group needs to formulate their problem themselves
- d. An IM FAQ would be valuable, as would a glossary of IM terms and a controlled vocabulary
- e. A help desk where people with expertise respond to users would be welcome
- f. Information management profiles may be useful to create as a start to the community

Discussion focused on how collaboration contributes to the quality of online learning. Key factors for successful collaborative learning supported by technology involve: group processes, course arrangements, learner orientations, tutoring, and a holistic learning environment. Two specific examples of factors arose in discussion: first, the need for establishing common ground in defining the goals, requirements, and needs; second, the naming and assignment of roles within a group (e.g. secretary, observer, technologist, pedagogy specialist, design expert).

### **3.3 Potentials, challenges and efficacy of a Virtual Learning Commons as a collaborative environment for learning and knowledge building in an international context**

*Initial Discussion Questions:*

- What are special considerations for creating a VLC in an international context?
- How will the issue of motivation be addressed?

The first presentation by Hanna Järvenoja was entitled “Motivation and Emotions in Self-Regulated Learning.” She discussed the gap between work life and education that may be altered by a lifelong learning perspective where education and work life go hand-in-hand. She described how learning (in collaboration) requires cognitive, but also motivational and socio-emotional skills. That is, “learning effectively by self-regulating the learning process is itself a skill powered by will, which is directed and regulated by motivation.” Self-regulation of cognition has been considered a significant predictor of academic achievement, and regulation of cognition entails understanding the task, planning and setting a goal for learning, applying strategies to achieve the goal, and reflecting. Motivation is a changing process that can be influenced. Emotions are part of learning, and influence motivation. Hanna described some tools that may be used for learners to document their emotions and motivation with the goal of better self-regulating their learning. Active engagement examples were mentioned including virtual tokens, virtual coffee breaks, and mentoring.

Pirkko Hyvönen presented about Edutool Master’s program to teach how to become an “adaptive expert” in learning and educational technology. Students learn expertise to adapt to changing situations, solve problems, create social innovations and integrate technologies in practices. The program requires understanding of other people, playfulness, creativity and insights, use of technologies, and constant learning. “Adaptive expertise” appears extremely pertinent to the role of Information Management.

This Master’s program helps students to understand their own processes of knowing and problem solving. Students learn a collaborative problem-solving method (Hyvönen et al. 2010) in order to find possible solutions by constructing new knowledge based on the learning sciences, but adapted to authentic work life. This might be an interesting model to use in a VLC for engaging members.

It was recognized that adaptive expertise involves three dimensions: knowledge construction, expert-like performance, and self-regulation. A community forum can help information managers develop their expertise both individually and collectively. For a virtual learning commons in an international context, there must also be awareness of

- a. the differing cultures (e.g. geographical, organizational, hierarchical, disciplinary, funding)
- b. data and information intellectual property rights and ethics that differ between countries and institutions

- c. reluctance of participants to leave their comfort zone (e.g. Finnish IMs may not want to contact US scientists because it may be challenging to communicate in English).

### **3.4 Community Building by using a VLC in an International Setting**

*Initial Discussion Questions:*

- *What are the characteristics of a successful international online community?*
- *What are the ways people can engage in a virtual learning community?*
- *Are there evolutionary stages in community building?*

There was time only to highlight briefly some approaches to engagement. There are a variety of reasons to contribute that must be taken into consideration during design:

- provides a sense of expertise
- gives professional recognition by having role names
- useful in adding role to CV
- self-learning is made visible
- promotes synthesis and packaging of information
- permits survey of activities in community
- enhances sense of knowing emotionally

It was recognized that the idea of community is complex, that there are more roles than just contributors and users, and that an international setting would involve additional considerations. There is a need for assessors able to define missing materials, for explainers and historians as well as content producers. Questions arose as to whether a gatekeeper was the only way to insure quality and how association with a professional society could be extremely valuable in terms of identity building upon existing infrastructure.

## **4 Discussion**

Four points and five outcomes resulted from this workshop. Important points included:

1) For a VLC, there are needs of at least three groups to consider: participants with interest in building expertise in information management; those with some expertise in information management who are looking for learning opportunities; and any participant looking for a community with a forum for collective sense making and vision making associated with information management.

2) In terms of what brings together the community for an LTER VLC, we have in common concerns with data work and with the care of scientific data. Introducing the concepts of 'data stewardship' and 'community' ensures a long-term frame to this care responsibility. Initiating such a project might involve surveying existing research on community

development since there are a number of existing fields of research to draw upon (e.g. Computer Supported Cooperative Work (CSCW), Computer Supported Cooperative Learning (CSCL), Community & Technology (C&T), Participatory Design (PD), Community Informatics).

3) It is a complex undertaking to engage people in their 'zone of proximal development' but there is a need to present the why of information management, the purpose of information management strategies, the phases of development, the relationships with technology, the dimensions of infrastructure, the concept of design, the ramification of scaling to whole communities with eScience, and the need for continuing learning.

4) Although it is up to a community to decide how to bring to life a virtual learning commons, the goals may be stated as creating a new dynamic learning environment that provides an information manager with the ability to stay on top of what they do. This requires an agile, engaging and perspective-building learning environment that encourages nimble thinking along with spritely design approaches supported by technology essential to distributed community building.

The working group outcomes include:

- A conceptual framework
- A technical report
- An NSF proposal
- An Academy of Finland research proposal
- A publication

Conceptual insight relevant to learning about information management and a virtual learning commons was developed. The technical report is this document. The NSF proposal is a CI Team Diffusion project led by D. Pennington: The Virtual Learning Commons: STEM Research Communities Learning about Data Management, Geospatial Informatics, and Scientific Visualization. An Academy of Finland research proposal led by H. Karasti is to be submitted October 2011 (the earliest date possible) to request funding for a comprehensive study of the use and distributed participatory design of the VLC. The Academy of Finland research proposal will provide a strong international dimension to the CI Team Diffusion project. Finally, discussions regarding a publication were initiated.

## **5 Final Thoughts**

In retrospect, all activities that we have organized and engaged in during our collective journey to explore the notion of LTER IM VLC, including the working groups at US LTER ASM 2009, analyses of the sessions, and the meeting with various interest groups in Finland, have provided us with additional information and views as well richer understanding about the phenomena.

The work that a VLC must accomplish may be discerned from Monday's wrap-up session where the gap between new and experienced information managers was evident in summary statements. On one hand, new information managers were able to sum up the task of developing information management at a site with four terms: data, dataset availability, ongoing, and messiness. On the other hand, workshop coordinators summed up the work of information management with four phrases: 'scientific data practices', 'information management role', 'infrastructuring', and 'data stewardship'.

We end having gained an expanded view of potential resources and a deeper understanding of what is involved in creating an effective community VLC.

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## 7 Appendix Documents

### 7.1 Related Abbreviations and Links

Abbrev	Name	Link
ASM	All Scientists' meeting	<a href="http://asm.lternet.edu">http://asm.lternet.edu</a>
CCE LTER	California Current Ecosystem LTER	<a href="http://cce.lternet.edu">http://cce.lternet.edu</a>
FinLTSER	Finnish Long-Term Socio-Ecological Research Network	<a href="http://www.environment.fi/syke/lter;">http://www.environment.fi/syke/lter;</a> <a href="http://www.environment.fi/default.asp?contentid=247320&amp;lan=EN">http://www.environment.fi/default.asp?contentid=247320&amp;lan=EN</a>
Kuusamo	Northern LTSER Platform, Thule Institute, University of Oulu	<a href="http://www oulu.fi/oulanka/en_research.html;">http://www oulu.fi/oulanka/en_research.html;</a> <a href="http://www oulu.fi/oulanka/en_index.html">http://www oulu.fi/oulanka/en_index.html</a>
Kilpisjärvi	Northern LTSER Platform, Kilpisjärvi Biological Institute, University of Helsinki	<a href="http://www.helsinki.fi/kilpis/english/index.htm;">http://www.helsinki.fi/kilpis/english/index.htm;</a> <a href="http://www.helsinki.fi/kilpis/english/research/ltser_eng.htm">http://www.helsinki.fi/kilpis/english/research/ltser_eng.htm</a>
Kolari	Kolari Research Unit, Finnish Forest Research Institute	<a href="http://www.metla.fi/metsat/kolari/index-en.htm">http://www.metla.fi/metsat/kolari/index-en.htm</a>
LET	Learning and Technology Research Unit	<a href="http://let oulu.fi">http://let oulu.fi</a>
LTER	Long-Term Ecological Research	<a href="http://lternet.edu">http://lternet.edu</a>
LTER IMC Oulu	LTER Information Management Committee Oulu University	<a href="http://intranet.lternet.edu/committees/information_management/">http://intranet.lternet.edu/committees/information_management/</a>
SEV LTER	Sevietta LTER	<a href="http://www oulu.fi/english/">http://www oulu.fi/english/</a> <a href="http://sev.lternet.edu">http://sev.lternet.edu</a>
SIO	Scripps Institution of Oceanography	<a href="http://sio.ucsd.edu">http://sio.ucsd.edu</a>
UCSD	University of California, San Diego	<a href="http://ucsd.edu">http://ucsd.edu</a>
UNM	University of New Mexico	<a href="http://unm.edu">http://unm.edu</a>
UTEP	University of Texas, El Paso	<a href="http://utep.edu">http://utep.edu</a>
VLC	Virtual Learning Commons	-

## **7.2 LTER International Supplement Proposal 2009**

### **Part C: International Collaborative Supplement**

#### Growing Global Information Management Infrastructure and Collaborative Learning Environments

##### **Introduction**

We propose to initiate an education-oriented information management collaboration associated with two networks in the International Long Term Ecological Research Network(ILTER): the US Long Term Ecological Research Program (LTER) and the Finnish LTER Network (FinLTSER). In growing global, networks face challenges unique to long-term, large-scale scientific endeavors including a recognized gap between site level skills in information management and the diversity of available standards, tools and technologies. In addition, there are cultural shifts involved in moving from site research to multilevel collaborative systems (NSF,2002, p.15). At the ILTER's Coordinating Committee meeting in 2008, the ILTER country representatives identified information management training as the biggest need for advancing the goals of the network. Our proposal is timely because the success of data intensive e-Research efforts as recognized by the ILTER depends upon development of an information infrastructure that includes participants with an understanding of information management.

To support creation and dissemination of information management knowledge in the ILTER, the ILTER Information Management Committee has committed to developing a series of videos to be used by network members for information management training. Initial production of four videos led those of us who were contributors to consider more broadly the development of a collaborative learning forum and educational materials useful and accessible to a diverse international audience. We are requesting funds to bring together a group of specialists to 1) define a course of action and guidelines for creating a forum with educational materials on information management and 2) define the research questions we will pursue in a larger proposal.

We request support for four US LTER researchers for a four day visit to University of Oulu, Finland in 2009 for a planning and design meeting. During the visit we will meet with Helena Karasti, a researcher who has been studying technologically mediated work within the LTER. We will also meet with other scientists focusing on participatory design of information systems at UOulu (Department of Information Processing Science), on environmental issues (Thule Institute), and on educational technology research (Educational Technology Research Unit). We will participate in a FinLTSER information management group meeting to discuss an education-oriented project and to see first-hand reception to the initial videos (<http://www.ilternet.edu/training/training-online-resources-collection>). Based on discussions with researchers at UOulu and the experience with the FinLTSER IM group, a larger research project incorporating principles of participatory design (Schuler and Namioka, 1993) and computer-supported collaborative learning (Stahl et al, 2006) will be formulated. Support is also requested for two domestic

trips for face-to-face follow-up work within the US and that would include a group televideo conference with colleagues in Finland.

### **A Forum for Collaborative Learning**

The geographic distribution of ILTER networks and short-term support of education projects challenges coordination; e-Learning addresses these challenges through use of computer networks for distribution of materials. We will draw upon insights of computer-supported collaborative learning to create relationships among learners, promoting interaction and reflection. We envision not just a structure for knowledge transfer from more experienced networks to those less experienced but rather a process for engagement of participants network-wide to contribute their local innovations, tools, best practices, etc. (Twidale and Floyd, 2008; Karasti and Baker, 2008b). Our potential audience is the wide range of participants involved in data handling from field technicians and information management personnel to research scientists. The project goal is to create an open collaborative learning forum as a joint activity in which all participants can interact by learning from, teaching with, and contributing to the forum.

There are a number of approaches to education and learning that we would like to investigate and incorporate in order to improve the quality and accessibility of information management know-how. In addition to working with an understanding of the principles of information systems, we will focus on co-participation and the interdependence of design and learning. We come from the perspective that the work of information management consists of situated activities and that a network enables situated learning (Lave, 1991). Materials will go beyond traditional framing arguments and discussion; dialogue will be highlighted and diverse, local participants included. Participatory design is an approach to design that actively involves participants and users in the design process. The initial videos used 'slidecasting', a combination of text, narrative, and storytelling able to be prepared locally and delivered as Internet videos. Though the original videos were not developed with a broad vision of communication and learning in mind, we plan development of such educational materials as more than a uni-directional set of lessons. Rather, they represent (1) a prompt for a new way of knowing information management issues; (2) an articulation device that creates knowledge; (3) a communication mechanism that contributes to joint meaning making; (4) an intervention that empowers participants as learners, teachers, and mediators; (5) a cross-comparative assessment opportunity, and (6) a medium stimulating reflection. We plan to work with computer-supported multimodal approaches to create a collaborative learning environment where learners are challenged as they listen to different perspectives and prompted to articulate and contribute their ideas and experiences. In so doing, they begin to create their own conceptual framework.

An aim emerged with production of the initial educational videos: to catalyze the understanding of information management within the networks. Our approach will include 'showing instead of telling' (Baecker, 2002) such as by blending visual and narrative, 'learning by experience' (Dewey, 1938) such as by including commentary on implementation of standards, 'design by doing' (Greenbaum and Kyng, 1991) such as by presenting development of an application or architecture, 'continuing design in use' (Henderson and Kyng, 1991) such as by describing the evolution of a software module over

time, and 'PD in the Wild' (Dittrich et al, 2002) by presenting a wide range of local experiences. Two strengths of our participatory approach are first that it takes practice seriously - where "practice is both 'doing' and 'understanding' that enables doing" (Wynn, 1991) - and second that it incorporates the culture of the existing workplaces. Such an approach would initiate a unique, open-ended process integrating e-Learning and e-Research within the ILTER Network.

## **Participants**

Our five-member team combines expertise and access to ecological networks that enables us to make a significant contribution to development of an understanding of information management. Members of the team are largely junior researchers enthusiastic about collaborative research opportunities. Karen Baker, an information manager for the California Current Ecosystem US LTER and the Palmer Station, Antarctic sites, co-directs the Ocean Informatics team taking sociotechnical approaches to implementation of information systems and information infrastructure (Baker et al, 2000; Baker and Chandler, 2008). Vanderbilt, information manager for the Sevilleta US LTER and chair of the international LTER (ILTER) Information Management Committee, is keenly aware of the need for learning endeavors that recognize and serve the cultural and linguistic diversity of the ILTER community (Vanderbilt et al, 2008). San Gil's position at the LTER Network Office is jointly funded by the US Geological Survey's National Biological Information Infrastructure (NBII) and the US LTER. Focusing on data sharing across multiple levels of organizations, he brings to the project extensive technical expertise regarding metadata and a strong interest in issues relating to translation from one language and culture to another. Zimmerman, an expert on the practices and information needs of environmental scientists in general and LTER in particular, has worked with the NSF-funded Science of Collaboratories (SOC) project investigating large-scale collaborations across many disciplines (Zimmerman, 2003, 2007). Helena Karasti has worked closely with US LTER network and sites (Karasti et al, 2006; Karasti and Baker, 2008a). She now co-leads the FinLTSE Information Management Group, is a member of the LTER Europe Expert Panel on Information Management, and European representative for ILTER Information Management Committee. Added synergies are that several of us are located at institutions with students involved in e-Research collaborative learning projects. In addition, both the Palmer LTER site and Thule Institute are both involved in International Polar Year activities.

## **Proposed Planning and Design Meeting Discussion Topics**

- *Developing a conceptual framework for LTER information management with long-term and global e-Research perspectives*
- *Considering the role of information management at a site*
- *Considering the role of information management across multiple network levels*
- *Initiating collaborative learning and growth of information infrastructures*
- *Creating new approaches to communicating and learning within a scientific network*
- *Articulating cross-cultural challenges to communicating data practices*

## **Anticipated Outcomes**

The working group will produce a summary of the discussions to be disseminated within

the communities. Major outcomes are three-fold in terms of first steps toward: 1) a conceptual framework for LTER information management; 2) technological supports for collaboratively designed multimodal educational materials that persist and grow over time; and 3) framing for a larger education research project that will include other members of the ILTER Network.

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### **7.3 Working Group Final Reports; LTER ASM September 2009**

#### *Workgroups 1 & 2*

Key Elements of Site-Based Long-Term Information Management: A Curriculum for Educating Ecological Information Managers

Organizers: Kristin Vanderbilt, Karen Baker, David Blankman, Helena Karasti, Inigo San Gil

The goals of this working group were to initiate discussion of the role of information management (IM) and define a set of categories describing the work of information management in different work arenas. The process of developing a shared understanding of IM ensures that a number of perspectives will be represented in the development of educational materials. The inspiration for the meeting grew out of the 2008 ILTER Coordinating Committee meeting in Slovakia, where the committee identified IM training as the most critical need of the ILTER. IM participants interested in the education of information managers as well as all those engaged with data in general created a few informal videos in various formats to explore the concepts of communicating information management. Initial feedback from participants and viewers confirmed the need for a more comprehensive approach. The workshop allowed us to elicit and capture community views of information management as well as to illustrate the diversity of needs and understandings about information management. Considering curriculum categories as part of an integrative framework for topics that emerged at the workshop initiates development of an organizational framework for the projects.

Participants were asked to consider the question “What does an LTER Information Manager need to know?” Working in small groups of 2-3 participants, each group prepared and posted a list prior to reporting to the whole group. During the second block of the workgroup, topics were reviewed and an initial set of categories identified:

1. Technical Topics Relevant to IM
2. Data Handling
3. Management Strategy
4. Multiple Interfaces for IM work
5. Roles of Information Management and Information Managers
6. New IM Discovery Process
7. Learning for IMs

In discussion, other elements pertinent to working group interests were identified. The value of investigating the following will be considered: gathering information on existing programs and resources, considering contributions made by cross-domain or cross-community partnerships, developing mentorship within and between organizations, and investigating the role of information management by assessing strengths of those who are information managers,

Next Steps: This workgroup complements another workgroup held the following day at ASM entitled “Virtual Learning Commons for LTER IM: Vision and Web 2.0 Support.” Organizers of these workgroups are preparing for an international meeting next year in Finland supported by an LTER International Supplement to PAL. Dialogue with European information managers, researchers, and educators is planned. The possibility will be discussed of preparing a proposal for submission to NSF and funding agencies in other LTER countries (e.g. Finland) that would include the implementation of a virtual environment that employs Web 2.0 tools to support communication and education of personnel interested in information management. There may be value in a follow-up meeting to the ASM workgroup that would include selected researchers and educators to provide further breadth and background from the US for such a proposal.

### *Workgroup 3*

Virtual Learning Commons for LTER IM: Vision and Web 2.0 Support

Organizers: Kristin Vanderbilt, Helena Karasti, Deana Pennington, Ann Zimmerman

Report prepared by: Kristin Vanderbilt and other organizers

This workshop complemented an earlier ASM workgroup entitled “Key Elements of Site-Based Long-Term Information Management: A Curriculum for Educating Ecological Information Managers.” The aim of the working group was to learn from the participants “What would a Virtual Learning Commons consist of if it met your needs as an LTER Information Manager optimally?”

Towards this goal, the participants were asked to work in groups of 2-3 people and address the questions: “What are the learning situations that information managers face? In what situations do information managers feel a need to learn?” Situations identified were diverse, including everything from how to negotiate interactions at the site and network levels to learning what software and hardware are good solutions to particular problems. Participants stressed the importance of learning from the rest of the community. Situations could be categorized as 1) Technical Concepts, 2) Business Workflows, 3) Community Interactions, and 4) Understanding Data Content. Based on these categories, the group brainstormed about how Web 2.0 tools could facilitate learning in each situation. There are many, many ways in which wikis, blogs, web forums and other Web 2.0 functions could be effective learning tools. The discussion underscored how information managers must constantly be learning to stay up-to-date in a rapidly changing field and how a virtual community might best facilitate this process because of its immediacy.

Next steps: Armed with the understanding of the diversity of information management learning needs generated during this working group and the IM Curriculum working group, the four organizers will discuss preparing a proposal on the topic of a Virtual Learning Commons for Information Management to submit to the NSF program solicitation “Research and Evaluation on Education in Science and Engineering (REESE)”. Conversations from this working group will also inform an international meeting next year in Finland supported by an LTER International supplement to PAL. After meeting with



information managers, educators, and researchers from the ILTER, the organizers expect to write proposals for parallel funding from Finland, the US and possibly other ILTER countries on the topic of a Virtual Learning Commons for LTER Information Management.

## **7.4 Working Group Meeting Agenda; Oulu University January 24-28, 2011**

### **Virtual Learning Commons for Long-Term Ecological Research (LTER) Information Management (LTER IM VLC)**

January 24-28 2011, University of Oulu, Finland

Organized with support from US National Science Foundation and Academy of Finland

#### **PROGRAM**

##### **Monday 24 January**

###### **9-12 (IT226)**

Session for working group members

Working group members:

Karen Baker (PAL & CCE, Scripps Institution of Oceanography, Univ. of California, San Diego),

Helena Karasti (Dept of Information Processing Science, Univ. of Oulu & Luleå Technical University)

Deana Pennington (CyberShARE Center of Excellence, Univ. of Texas, El Paso))

Kristin Vanderbilt (SEV, Univ. of New Mexico)

###### **12-17 (IT223)**

*Theme: Learning needs for information managers*

Coordinator: Karen Baker (PAL & CCE, SIO, UCSD)

11:30 – 12:30 Lunch (together)

12:30 – 13:00 Kuusamo LTSE platform and its information management (Riku Paavola)  
Presentation and discussion

13:00 – 13:30 Watching together a video: 'Ecological Information Management at the Virginia Coast Reserve Long-Term Ecological Research Project' by John Porter

13:30 – 14:00 Video discussion + start a poster

14:00 – 14:30 Coffee (Tuomas will arrive)

14:30 – 15:15 Review poster

Kilpisjärvi LTSE platform and its information management (Tuomas Heikkilä)  
Presentation and discussion

15:15 – 16:30 Group discussion

16:30 – 17:00 Wrap-up

Participants:

Tuomas Heikkilä (Kilpisjärvi LTSER, Northern LTSER, Univ. of Helsinki)

Riku Paavola (Kuusamo LTSER, Northern LTSER,

Katja Sippola (Finnish Forest Research Institute (Metla), Kolari)

Working group members

## **Tuesday 25 January**

### **9-14 (IT223)**

*Theme: Virtual Learning Commons/Community concept and associated tools*

Coordinator: Kristin Vanderbilt (SEV, UNM)

9:00 – 9:30

Welcome and introduction of to theme and ways of working

Brief introductions

Kristin Vanderbilt: Introduction to Long-Term Ecological Research (LTER) and LTER Information Management (IM)

9:30 – 11:30

Essi Vuopala & Miisa Brännfors: Quality learning supported by technology - Research-based perspectives and case examples

Presentation (about 50-60 min) and discussion

Participants:

Tuomas Heikkilä (Kilpisjärvi LTSER, Northern LTSER, Univ. of Helsinki)

Riku Paavola (Kuusamo LTSER, Northern LTSER, Univ. of Oulu)

Katja Sippola (Finnish Forest Research Institute (Metla), Kolari)

Essi Vuopala (Learning & Educational Technology Research Unit (LET), Univ. of Oulu)

Miisa Brännfors (LET, Univ. of Oulu)

Working group members

11:30 – 12:15 Lunch

### **12:15 – 14:00 (IT223)**

Kristin Vanderbilt: Examples of VLCs and tools

Participants:

Tuomas Heikkilä (Kilpisjärvi LTSER, Northern LTSER, Univ. of Helsinki)

Riku Paavola (Kuusamo LTSER, Northern LTSER, Univ. of Oulu)

Katja Sippola (Finnish Forest Research Institute (Metla), Kolari)

Working group members

### **14-17 (IT226)**

Session for working group members

Participants:

Working group members

### **Wednesday 26 January**

#### **9-14 (IT223)**

*Theme: Potentials, challenges and efficacy of a Virtual Learning Commons as a collaborative environment for learning and knowledge building in an international context*

Coordinator: Kristin Vanderbilt

9:00 – 9:30

Kristin Vanderbilt: Welcome, Introduction to theme, Introduction to LTER IM, Brief summary of two previous days' outcome & LTER ASM 2009 working groups

9:30 – 10:00

Essi Vuopala & Miisa Brännfors: Quality learning supported by technology - Research-based perspectives and case examples

Brief summary of Tuesday's presentation (about 15 min) and discussion

10:00 – 11:00

Hanna Järvenoja: Motivation and emotions in self-regulated learning

Presentation (about 20 min) and discussion

11:00 – 12:00

Jonna Malmberg: Strategies and self-regulated learning in technology-enhanced contexts

Presentation (about 20 min) and discussion

12.00 – 13:00 Lunch

13:00 – 14:00

Pirkko Hyvönen & Niina Impiö: Learning to become an adaptive expert in learning and educational technology: Edutool master's program (120 ects)

Presentation (about 20 min) and discussion

Participants:

Essi Vuopala (Learning & Educational Technology Research Unit (LET), Univ. of Oulu)

Miisa Brännfors (LET, Univ. of Oulu)

Hanna Järvenoja (LET, Univ. of Oulu)

Jonna Malmberg (LET, Univ. of Oulu)

Pirkko Hyvönen (LET, Univ. of Oulu)

Niina Impiö (LET, Univ. of Oulu)

Kari Liukkonen (Dept of Info Processing Science, Univ. of Oulu)

Working group members

**14-17 (IT226)**

Session for working group members

Participants:

Working group members

**Thursday 27 January**

**9-12 (IT223)**

Theme: Community building by using a VLC in an international setting

Coordinator: Deana Pennington (UTEP)

Participants:

Lisa-Lena Opas-Hänninen (English Philology, Univ. of Oulu)

Suvi Pihkala (Women's & Gender Studies, Univ. of Oulu)

Leena Kopperoinen (Finnish Environment Institute, SYKE)

Kirsi Latola (Thule Institute, Univ. of Oulu)

Kari Liukkonen (Dept of Info Proc Science, Univ. of Oulu)

Outi Klintrup (Tellus Library, Univ. of Oulu)

Working group members

**14-17 (IT226)**

Session for working group members

Participants:

Working group members

**Friday 28 January**

**9-17 (IT226)**

Session for working group members

Participants:

Working group members