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Epistemology and Pedagogy



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Section 1. Introduction

The coming of information age was a buzz word already in 1970s. Some authors argued that the progress of information and communication technology (ICT) is analogous to the invention of printing press by Gutenberg some 500 years ago. Indeed before his invention, things had to be hand-written. Still today, the university community has not come to grasp the potential impact of the evolving ICT on the production and distribution of new knowledge. ICT is not about technology: it is about epistemology and pedagogy. In the following sections, the views expressed by selected authors are summarized; the development of an interactive multimedia browser is then introduced, with possible application at Chubu University.

Section 2. The Meaning of Knowledge Production: Selected Views

Alvin Tofler in his *Third Wave* wrote: "Second Wave civilization placed an extremely heavy emphasis on our ability to dismantle problems into their components; it rewarded us less often for the ability to put the pieces back together again. Most people are culturally more skilled as analysts than synthesisists. This is one reason why our images of the future (and of ourselves in that future) are so fragmentary, haphazard---and wrong. Our job here will be to think like generalists, not specialist. ... In all intellectual fields, from the hard sciences to sociology, psychology, and economics, we are likely to see a return to large-scale thinking, to general theory, to the putting of the pieces back together again. For it is beginning to dawn on us that our obsessive emphasis on quantified detail without context, on progressively finer and finer measurement of smaller and smaller problems, leaves us knowing more and more about less and less." "At the level of longer-term social policy we should also move rapidly toward 'telecommunity'. Those who wish community restored should concentrate attention on the socially fragmenting impact of communicating and high mobility. ... One of the key steps that can be taken toward building a sense of community into the Third Wave is the selective substitution of communication for transportation. The popular fear that computers and telecommunications will deprive us of face-to-face contact and make human relations more vicarious is naïve and simplistic. In fact, the reverse might very well be the case. ... Computers and communications can help us

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create community.”

Michael Gibbons and his coauthors in their *New Production of Knowledge* make the point that: “In Mode 1 problems are set and solved in a context governed by the, largely academic, interests of a specific community. By contrast, Mode 2 knowledge is carried out in a context of application. Mode 1 is disciplinary while Mode 2 is transdisciplinary. Mode 1 is characterized by homogeneity, Mode 2 by heterogeneity. Organisationally, Mode 1 is hierarchical and tends to preserve its form, while Mode 2 is more heterarchical and transient. Each employs a different type of quality control. In comparison to Mode 1, Mode 2 is more socially accountable and reflexive.” “Mode 2 knowledge production is ... marked by an increase in the number of potential sites where knowledge can be created; no longer only universities and colleges, but non-university institutes, research centres, government agencies, industrial laboratories, think-tanks, consultancies, in their interaction. ... In Mode 2, flexibility and response time are the crucial factors and because of this type of organizations used to tackle these problems may vary greatly. ... Characteristically, in Mode 2 research groups are less firmly institutionalized; people come together in temporary work teams and networks which dissolve when a problem is solved or redefined.”

New trend in software development is represented by Free Software Foundation when they wrote: “The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee you freedom to share and change free software---to make sure the software is free for all its users.” “When we speak of free software, we are referring to freedom, not price.” “Our General Public Licenses are designed to make sure that you

have the freedom to distribute copies of free software, that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free program, ...”. “If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors’ reputations.” “We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the programs proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone’s free use or not licensed at all.” “You may copy and distribute verbatim of the Program’s source code as you received it, ... provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty. ... You may modify your copy or copies of the Programs or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above.” The free software principle can apply not just to software, but also to contents that go along with the software. Thus, any contents can be also modified and distributed freely according to the principle analogous to free software: contents can be used as they are or can be altered by the knowledge users provided that the recipient of modified information are informed that what they have is not the original.

Web 2.0 “doesn’t have a hard boundary, but rather, a gravitational core”, according to Tim O’Reilly. The sense of Web 2.0 is illustrated by example by Tim O’Reilly, which is summarized as:

Web 1.0:

Britannica Online
personal websites
domain name speculation
screen scraping
publishing
directories (taxonomy)

Web 2.0:

Wikipedia
blogging
search engine optimization
web services
participation
tagging (“folksonomy”)

Citing Christopher Alexander, Web 2.0 design pattern is the summarized as:

1. The Long Tail: ... Narrow niches make up the bulk of the internet's possible applications. Therefore, ... reach out to the entire web, to the edges and not just the center, to the long tail and not just the head.
2. Data is the Next Intel Inside: Applications are increasingly data-driven. Therefore, for competitive advantage, seek to own a unique, hard-to-recreate source of data.
3. Users Add Value: The key to competitive advantage in internet applications is the extent to which users add their own data to that which you provide. Therefore, don't restrict your “architecture of participation” to software development. Involve your users both implicitly and explicitly in adding value to your application.
4. Network Effects by Default: Set inclusive defaults for aggregating user data as a side-effect of their use of the application.
5. Some Rights Reserved: Intellectual property protection limits re-use and prevents experimentation. Therefore, when benefits come from collective adoption, not private restriction, make sure that barriers to adoption are low.
6. The Perpetual Beta: When devices and programs are connect to the internet, applications are no longer software artifacts, they are ongoing services. ... Engage your users as real-time testers,

and instrument the service so that you know how people use the new features.

7. Cooperate, Don't Control: Offer web services interfaces and content syndication, and re-use the data services of others. Support lightweight programming models that allow for loosely-coupled systems.
8. Software Above the Level of a Single Device: Design your application from the get-go to integrate across handheld devices, PCs, and internet servers.

In all, “the richness of the shared data” is emphasized.

Section 3. Working Principles of a Browser: Collaborative, Multimedia, On-line, Field-based

Browser system is being development as the common information infrastructure as an attempt to respond to the new challenges and opportunities. The new challenge is sometimes represented by T-character. Each individuals need to develop “T-shaped” skills where vertical line representing specialized body of knowledge or skills while horizontal line representing the ability to collaborate as a team to tackle a common agenda. Analogously, when describing a collaborative team, one can visualize many vertical lines supporting a horizontal line. The opportunities is to fully take advantage of the progress of information and communication technology (ICT) in production, accumulation, dissemination and

use of new knowledge. A browser therefore is comprised of data/information collecting devices that are used in campus environment as well as in the fields, a group of application software for editing/visualizing various forms of information, and access to the internet.

The university community does not necessarily share the common starting point as the business world, although it is true that such a view can be challenged on the ground that universities cannot be immune to business practices which often reflect the best technological options and that universities provide piece-meal knowledge whereas the business world provide a workable system. And the practice may differ from one country/region to the other reflecting different legal framework about production and dissemination of knowledge. The last point for us is the starting point, whereas there are views that such differences represent barriers that need to be torn down.

There are proponents of open courseware, and it is true, from technological capability point of view, that it represents the best solution. In a multilingual, multicultural reality in Asia-Pacific, however, it takes another dimension, which is the question that open courseware offered in a single language, say, English, diminishes the role of universities in those regions as knowledge producers because knowledge distribution is conducted in a single language that presumably reflect single cultural background. It may end up endorsing the "winner-takes-all" rule in the academic community. This may not be a rule but very well become a reality, nevertheless. At the same time, copyright issue is in a sense a conflict that will never go away: traceability and transparency of authorship should not to be lost in scientific knowledge production and dissemination. Peer review of scientific articles is a well established practice and provides a transparent mechanism for quality

control: the process cannot be replaced by participatory knowledge production mode represented by, for example, Wikipedia. We are probably talking about very different types of knowledge products.

The interactive multimedia browser is based on a set of working principles in an attempt to avoid controversial points and yet take advantage of the new ICT:

- (1) Contents are produced and disseminated carrying individual author's name;
- (2) Individual authors do not surrender copyright;
- (3) Contents can be viewed by the users but are not modifiable by the users;
- (4) Contents are made accessible over internet;
- (5) No original files are distributed; for this purpose an alternative system such as contents depository need to be provided.

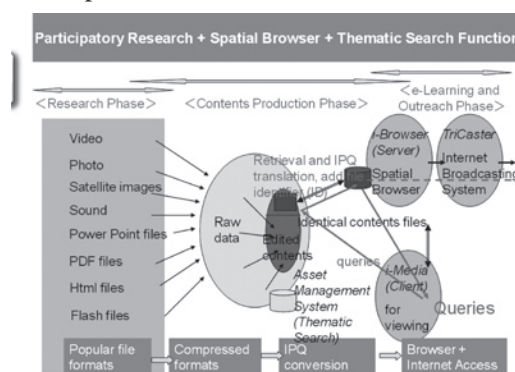


Figure 1.
Conceptual Framework of the Multimedia Browser

The interactive multimedia browser is being developed by the present author and associates in collaboration with an international NGO LEAD: Leadership for Environment and Development with the support by the United Nations University Institute of Advanced Studies in conjunction with the RCE (Regional Center of Expertise) whose function is to promote ESD:

Education for Sustainable Development. The Decade of ESD has started in 2005 as a step to implement the agreement reached at the WSSD in Johannesburg. LEAD Japan Program made a Type II (non-governmental) commitment at the WSSD consisting of three pillars: (1) field-based joint research related to sustainable development; (2) joint curriculum related to sustainable development, and (3) outreach to communities through internet.

Started in 2005, RCE has grown into a group of 55 by the time of the Third International Meeting in Barcelona in 2008 and many more are expected to follow in the near future. Next challenge for RCEs is to form a global network and to stimulate collaboration among them. For this purpose, the RCE Service Center was established in Yokohama whose role is that of a facilitator and information clearing house in the implementation of the DESD. RCEs pursue the ESD through vertical links within the hierarchy of formal education, from primary schools and secondary schools to universities, and through horizontal links among educational institutions and non-formal education institutions such as museums, local governments, NGOs, local community and business sector. In other words, formation of a participatory network for knowledge sharing is intended. Building upon the achievement of individual RCEs, it is hoped that the RCE Service Center will be the vehicle for information dissemination on sustainable development.

With this background, RCE Service Center Server consists of the following components.

- (1) Web-server
- (2) Interactive Multimedia Server
- (3) Multimedia Database

Web Server is the user entry point to the RCE Service Center Server through internet. It contains access buttons to several distinct clusters of contents providers. This page also provides titles of course modules

through which users can have access to an interlinked web site concerning environment and development. A prerequisite for such function is a site map providing links among various modules that can only be done by editor(s) of the site knowledgeable about environmental themes. In order to facilitate this process, individual contributors of the contents are asked to provide appropriate keywords. Thus, starting from a particular course module, users are guided through various other course modules that are related to a wide range of environmental themes that would shed light to the question at hand. The web server has a search function by keywords describing thematic topics. There is a box for this purpose. Using keyword(s), users can search through the contents within the RCE Web Server or the entire world wide web.



Figure 2.

The Web Page with Curriculum Modules and Keyword Search

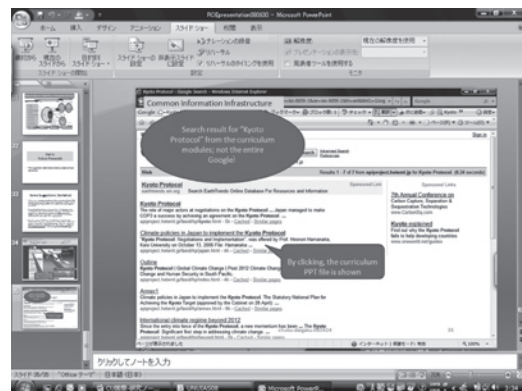


Figure 3. Search Result of "Kyoto Protocol"

The Interactive Multimedia browser is designed to handle multimedia data such as video clips, digital photos, Power Point files, maps and satellite images that are “heavy” for data storage and transmission over internet. The RCE Server is equipped with a software (trade name “i-Browser”) which converts the data format so that they could be handled “lightly” without losing the high resolution of the original data. It contains three categories of information, (1) MAP, (2) PHOTO (including video clips), and (3) INFORMATION (such as PPT files, PDF files, etc.) They all employ global view as the entry point in order to provide spatial dimension to the contents. In other words, the Browser is particularly suitable for intuitive visual search over the computer screen, without using language such as location names or keywords on environmental themes. MAP contains satellite images at three levels of resolution, NASA and NGA (National Geospatial-Intelligence Agency) GTOPO which provide data at 1 arc second (=30 meter resolution) and ETOPO (Global Digital Elevation Model Bathymetry providing 2 minutes by 2 minutes resolution) for global coverage of land and oceans; LANDSAT for wide regional view with 10 meter resolution; and IKONOS for detailed view of a specific site with 1 meter resolution (which will soon become 0.5 meter resolution). At the IKONOS level of resolution, satellite images can be easily related to photo/video images on the ground level. Thus the users can start from a global view and zoom in to a particular location anywhere on the earth. PHOTO contains digital photos and video clips, also accessible visually from satellite images. The browser software allows zooming in to photos so that details can be examined. INFORMATION is where users find Power Point files pertinent to a particular location. By zooming in, users have access to files that correspond to that

level of resolution, from global to local.

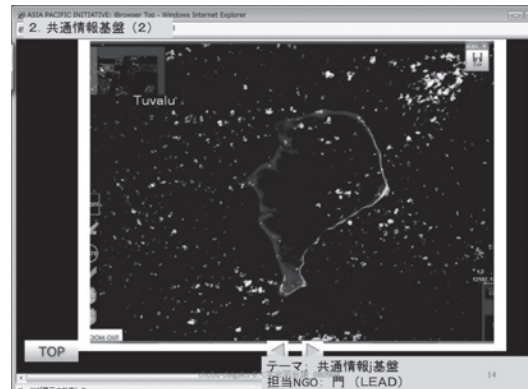


Figure 4. Spatial Search: IKONOS Photo of Tuvalu



Figure 5. PHOTO Layer: Tuvalu on the Ground

Multimedia Database, the third distinct part of the system, is the data storage and retrieval system for use by the contents developers only. It cannot be accessed openly.

A major development during 2007 to 2008 is the development of automatic uploading function which enables individual RCEs to upload locally-produced contents. Contents files such as graphics (JPG/BMP/TIFF, etc.) and PPT data can be uploaded to the ECE Server and can be automatically linked and shown at a designated area of the browser that represent particular geographic location of the RCE. “Distributed, autonomous, collaborative” principle will be realized with this additional capability. As for photos, it is possible to have up to 5

links, each containing 99 digital photos at maximum resolution (total number of photos are 5x99), that are accessible on PHOTO layer of the multimedia browser. Picture size of 1024*768 is recommended in order to preserve the quality of original data and to allow zooming-in for maximum details. As for Power Point files and PDF files, 30 links (i.e., 30 presentations) are allowed on INFORMATION layer. Limitation is that the contents can be placed only on designated layer, whereas with appropriate programming using XMMML (expanded multimedia markup language) it is possible to utilize several layers, each corresponding to the desired depth level.



Figure 6. RCE Service Center Browser

Step-6

1. Click "Select" and you select the uploading file.
2. Input link title in Title dialog.
3. Click "Upload" button.

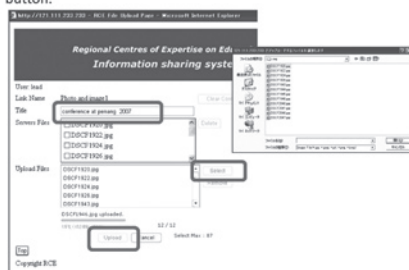


Figure 7. Steps for Automatic Uploading of Contents

The automatic uploading, allowed only for the system managers, can be achieved by following several steps.

- Step 1: Access the RCE Server with internet explorer (<http://rce-browser.com>)
- Step 2: Click the "Member Login" button on the top page.
- Step 3: Enter the user name and password.
- Step 4: Select "PHOTO" or "POWER POINT" tabs and upload jpg/bmp/tiff to PHOTO area and ppt/pdf to POWER POINT area.
- Step 5: Select link title (5 links for PHOTO and 30 links for POWER POINT).
- Step 6: Click "Select" and select the files for uploading.
- Step 7: Click "Next" button; click "Entry" button on the next page.
- Step 8: When all processing are finished successfully, confirm by clicking "OK" as prompted by the system.
- Step 9: The uploaded contents can be viewed at the appropriate geographic location of the i-Browser.

Section 4. Browser Development at Chubu University

Starting in 2008, Chubu University will carry out a three-year project aimed at capacity building of environmental leaders in Asia Pacific backed up by the Ministry of Environment of the Japanese government. There are 6 universities throughout Japan that were selected through a competitive process. There are similar projects that are to be carried out by 4 other universities sponsored by the Ministry of Education (MEX). Chubu University is in a unique position of being a member of the RCE network and developer of the RCE Service Center Browser through an international NGO LEAD Japan. Concurrently, there are two additional plans under the scheme: (1)

formulate a consortium with private business entities, local governments, and NGOs, and (2) formulate a network of universities in Asia Pacific to promote sustainable development.

The Chubu University project is entitled “Curriculum Development and Implementation for Environment and Development based on Participatory Network of NGOs and Universities”. Chubu University, with its founding principle “Be Trustworthy”, contributes by education related to ESD, such as sustainability science, global environmental governance, energy and resource studies, material flows, biodiversity, urban environment, field-based studies, international studies, and geographic information system. The development of an interactive multimedia browser is also the responsibility of the university. Taken together, it is hoped to formulate a building block in the university curriculum in the near future.

LEAD as an international NGO is

expected to contribute to the project by its skill in compiling workbook suitable for field-work, both within Japan and overseas. It has programs in 13 countries and regions of the world: there are programs in China, Indonesia, India, Pakistan, and Japan. Russia and Mexico are also represented. Since Chubu University faculty members are also active in field-work, in the region as well as overseas, collaboration between the two organization will lead to leadership training that excels in field-work component.

The expected outcomes of the project are: Leadership training through fieldwork, resulting in trustworthy manpower; Specialization with collaborative skills, leading to “T” shaped knowledge base; Communication skills over diverse cultures, realizing global-local seamless linkage; and Common information infrastructure, providing common platform for contents development and dissemination.



Figure 8.
Outline of Chubu University Project, 2008-2010

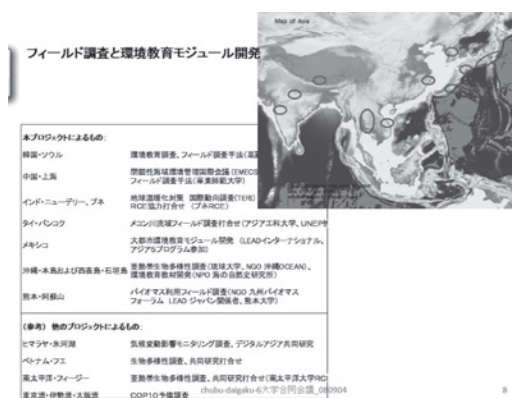


Figure 9.
Field Survey Sites of the Chubu University Project,
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