Ubiquitous Computing and Online Collaboration for Open Education

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ABSTRACT

This paper will first discuss ubiquitous computing at different levels of meaning, showing real-world applications in Japan, with a view to future ubiquitous learning (U-Learning). Then the author will cite and propose some ideals and principles of open education. Moreover, online collaboration is essential to educator development in the new fields of today's Internet-connected world. Thus, activities of the World Association for Online Education (WAOE) will be chronicled as a case of global online collaboration in practice. The conclusion will summarize how ubiquitous computing provides technological means, open education provides pedagogical goals, and online collaboration provides networking opportunities to achieve those goals. The paper aims to be of reference to educators in various fields who are interested in online education and are seeking professional development through easily accessible online technologies and networking opportunities.

Online Education as a New Academic Discipline

Online education in the broadest sense refers to all educational activities that leverage the affordances of the Internet, whether accessed by computers, mobile phones, or other Net-enabled digital appliances. Online education as a new field is pan-disciplinary and encourages interdisciplinary collaboration. It provides tools to expand access to education and opportunities to promote mutual understanding and cooperation between cultures. It makes no demands that cultures change, but it encourages international collaboration and intercultural understanding. That is, online education is adaptable to any culture with a modern IT infrastructure, provided people wish to take advantage of it. Even in regions like Africa where there is only mobile phone service, m-learning is possible. If they can access the Internet, mobile phone Websites can be created easily (McCarty, 2009b).

In a new field, not all areas are well developed into academic disciplines with a canon of

research literature, college majors, and so forth. When Internet access started to be widespread internationally, the call to turn online education into a new professional discipline (McCarty, 1998) was rapidly translated into a global virtual organization (WAOE), as will be demonstrated hereinafter. Many areas of online education have since developed, often focusing on learning management systems for online teaching, trying to simulate regular classes, but the full potential of online education remains to be developed in terms of pedagogy, educator development, digital literacy, socio-cultural issues, and global networking opportunities. Even the technologies need to go beyond replicating face-to-face classes to find models native to the new online environment.

Reflections on the IMETC2011 conference theme

The conference theme of the International Malaysian Educational Technology Convention held in Kuantan, Malaysia from 16-19 October 2011 is "Open Education: Towards a Ubiquitous Learning Environment." When we ask, "ubiquitous for whom?", open education gives ubiquity a new meaning. Openness means wider access for students and new learning opportunities for people in developing and emerging countries. It is educators who will make this happen, collaborating internationally through the same technologies for education that empower students and informal learners.

Ubiquitous Computing

The dictionary definition of ubiquitous is to be virtually everywhere, e.g., "Mobile phones are ubiquitous in most countries nowadays." Today the common-sense meaning of ubiquitous computing is being able to access the Internet or computer networks from virtually anywhere at any time, through digital devices like mobile phones, wireless-ready laptops, iPads, etc. Ubiquitous computing also has a technical meaning that is still evolving (see below). Ubiquitous computing can refer to the macro level, whereas at the micro level it manifests in many cases as embedded systems, software programs that control individual functions of everyday appliances (examples below). The hardware includes sensors like infra-red or barcode readers in mobile phones. An example (shown next) is QR codes, which are part of the *Internet of things*, providing a physical world-Internet interface.

Figure 1: QR code on a hand-made calling card

Ubiquitous computing includes devices that are usually operated offline, but are occasionally connected to the cloud or network through computers. This is needed for online content to go, like iPods, or for adding content to the cloud or network, e.g., by uploading digital video camera footage to YouTube, or recording a presentation for a podcast with a convenient hand-held MP3-format voice recorder.

Further to the technical meaning of ubiquitous computing, part of a recent definition is as follows:

> Ubiquitous computing (ubicomp) is a post-desktop model of human-computer interaction in which information processing has been thoroughly integrated into everyday objects and activities ... More formally Ubiquitous computing is defined as 'machines that fit the human environment instead of forcing humans to enter theirs.' (Wikipedia, 2011b)

The implied goal of ubiquitous computing is thus to serve people's needs without their having even to notice. Cloud computing is a similar aspect of ubiquitous computing that simplifies people's conscious tasks by storing and organizing information for users.
Another related concept is ubiquitous learning (U-Learning), applying the affordances of ubiquitous computing to education and informal or autonomous learning, at any time and from anywhere.

Some examples of embedded systems, often at the micro level of ubiquitous computing, are next presented. A vocational school in Japan writes about its training as follows:

> Embedded systems are computer systems embedded in various products. In our department we develop embedded computing software for TVs, microwave ovens,

digital cameras; mobile phones, PDAs, car navigation systems; office printers, copy machines, fax machines; and cars, vending machines, robots, satellites, and so forth. (Nihon Denshi Semmon Gakko, 2004 [translation by the author])

Another example of embedded systems and ubiquitous computing is found in the plastic wristbands used by some hospitals in Japan:

> Along with electronic charts, we offer in-patients safe medical care through wristbands. To avoid mistakes in intravenous therapy, injections, and etc., with the wristbands we can confirm the patient's name, sex, date of birth, blood type, and so forth. (Yamashiro Public Hospital, 2007 [translation by the author])

The way it works is that a barcode reader scans the barcode on the patient's wrist, which links to the patient's electronic chart in the hospital's database, calling up the file to the laptop computer that the nurse wheels around. The bar code represents the URL or unique address of the patient's file in the hospital's Intranet.

Furthermore, the national Kyoto Medical Center uses QR codes (introduced above) instead of supermarket-style barcodes on their wristbands. Since QR codes are usually read by the sensors in mobile phones that are so popular with young people, who also like bracelets, the wristbands would seem to enliven the modern ambience of the hospital with a subtle fashion statement.

Another example closer to education in Japan is attendance management systems, a subset of student information systems:

> A student info system is a software application for education establishments to manage student data. Student information systems provide capabilities for entering student test and other assessment scores through an electronic grade book, building student schedules, tracking student attendance, and managing many other student-related data needs in a school, college or university. (Wikipedia, 2011a)

Little information is available on student attendance management systems except from companies offering such systems in Japan and some universities in India. The author recommended such a system at his college before finding that such systems already existed, then the college solicited bids from companies. Students touch a sensor on the classroom wall, or hand-held by the teacher in some cases, with their ID cards, similar to a

train pass. They and the teacher can check their attendance status online, making it ubiquitous. Such attendance management systems increasingly add features of student information systems (defined above), and the providers explicitly use the analogy of electronic charts in hospitals (*denshi karute* in Japanese).

Another example of ubiquitous computing in Japan is location-based services, utilizing a GPS function in mobile phones. As illustrated below, mobile phone users turn on their GPS sensor, which contacts a satellite, establishing the user's exact location. That data is sent through the Internet to providers of various services, which then send location-specific information to the mobile phone user's screen. One of the examples of location-based services that was detailed in a paper by Hirano et al. (2007) was restaurant or store coupons, and the paper was published more than a year before Groupon started a similar service.
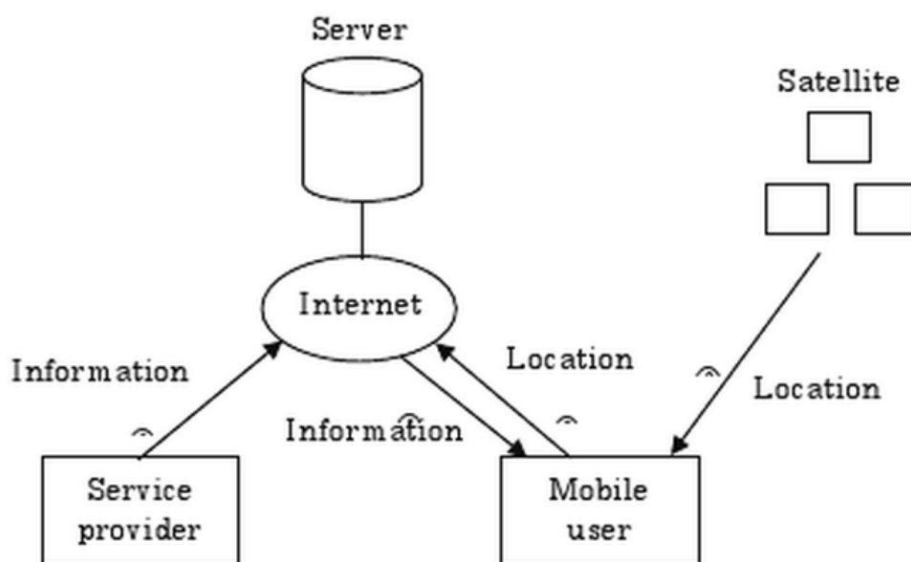

Figure 2: Architecture of location-based services, from Hirano et al. (2007)

Utilizing the same architecture of location-based services, public service announcements can also be prepared, which is useful in a country with frequent sudden disasters like Japan. An example of earthquake information for tourists who are in an area unfamiliar to them is illustrated as follows:

Disaster Information

An earthquake occurred in your nearby area around 1:00 P.M, January 22nd, 2007.

- Earthquake Disaster Information
- Guide to Hospital
- Water Supply Guide
- Meal Supply Guide
- Lifeline Information

(a) First notice

Guide to Hospital

The hospital in your area is the following:
- General Hospital
Number of patients acceptable: 300
TEL: 078-123-4567
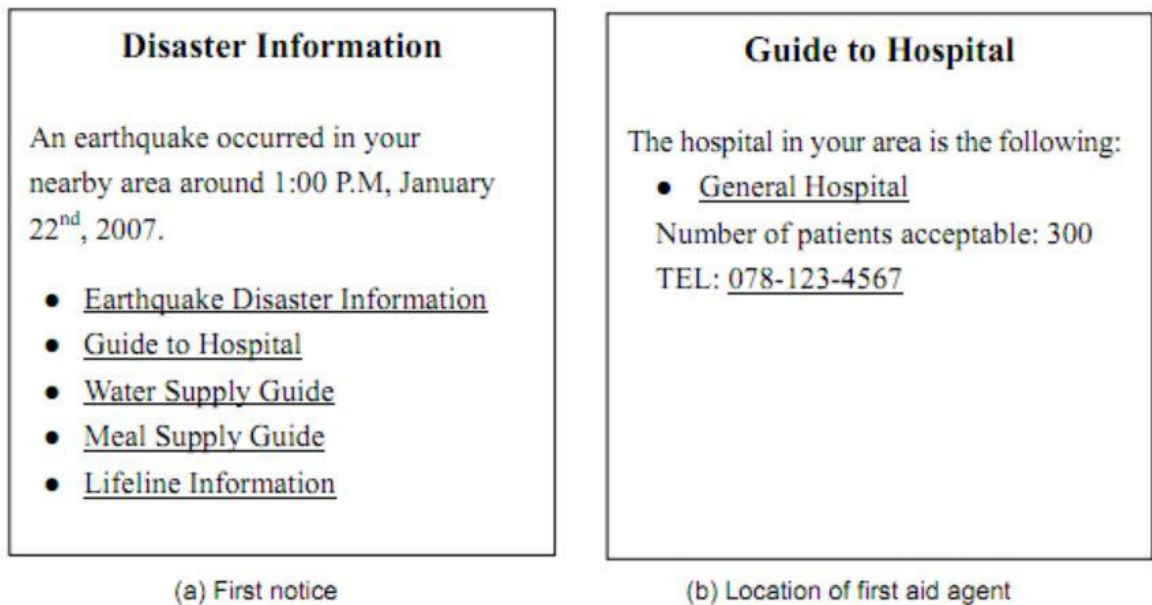
(b) Location of first aid agent

Figure 1.10   Emergency announcements with links in the case of an earthquake

Figure 3: Example illustration of mobile phone screens, from Hirano et al. (2007)

If the mobile phone user in the example clicked on "Guide to Hospital" on the left hand screen, the right hand screen would then appear. This approach was recommended to local governments, but other approaches could also be taken. Utilizing the QR code or infra-red sensors that are in most mobile phones in Japan, codes could be posted on any two-dimensional surfaces and surfaces rounded to an extent like telephone poles because of the fuzzy logic of the sensors. In the event of emergencies, users could quickly point their mobile phones at the nearest codes to access disaster information. Nearly everyone in Japan would be in a position to benefit from such emergency information services, because they or someone in their vicinity nearly always carries an Internet-enabled mobile phone in busy areas.

In light of these examples, the potential applications to education of ubiquitous computing or the Internet of things are limited only by the digital literacy and imagination of educators.

Ideals and Principles of Open Education

This section will review an e-book on open learning, report on the meaning of "open" in open universities, and present the author's view of open education. The following ideals and principles could add pedagogy and conscience to the use of technology, while serving as goals of both ubiquitous computing and online collaboration.

Downes (2011) envisions a society where "knowledge and learning are public goods, freely created and shared, not hoarded or withheld in order to extract wealth or influence" (p. 3). He advocates "open source, open content, and open learning from the point of view of the person desiring *access* to these things, rather than from the point of view of the provider" (p. 6). Around 1995, "when the internet arrived it gave people a whole new set of capacities" (p. 37) or affordances, giving the user an active role in the content, and a potentially global audience (p. 38). But traditional media and traditional services view this new development, quite rightly, as a threat" (p. 38).

> … right now the control, the mechanisms of the production of this new media, especially in the case of learning, is in the hands of the traditional content publishers. It's the broadcast model. And the reason why we need to move to the conversation model is because: nobody can learn only by listening, nobody can teach only by talking. (Downes, 2011, p. 45)

Regarding Open Educational Resources (OER), Downes (2011) writes: "For authors, open publication grants access to the widest possible audience. Studies show that their articles are cited more frequently … For readers, open access grants access to an entire body of literature" (p. 63). "And universities obtain increased visibility for their scholarship" (p. 63).

Audience, citations, and access to a body of literature are among the key issues for a scholar, and the stakes are especially high for a new discipline, because the relative openness or availability of research findings, experimentation, and scholarly communication affects the pace and extent of development of a new field into certain disciplines.

Among other models of Open Educational Resources, Downes cites a concise perspective on OER initiatives by Hylan (2005), as follows:

> By Open Educational Resources (OER) initiatives, we understand:
> 1) Open courseware and content;
> 2) Open software tools (e.g. learning management systems);
> 3) Open material for e-learning capacity building of faculty staff;
> 4) Repositories of learning objects; and
> 5) Free educational courses. (p. 63)

Those are some important elements of open education in practice, reflecting the ideals of

maximum and equitable access to education.

Another manifestation of open education is open universities, which serve millions of learners in Asia and elsewhere who might otherwise be excluded from opportunities for educational credentials. On the author's behalf, Dr. Ramesh Sharma asked Prof. Polu Satyanarayana, the last living founder of the Indira Gandhi National Open University (IGNOU), "what is 'open' in open universities?" The e-mail reply was as follows:

> The first chancellor of UKOU late Lord Crowther, after receiving Royal Charter in 1969 in his address said that the UKOU would be open, not only as to entry, but as to places, as to method and as to ideas. His address is often quoted by [Sir] John Daniel, whenever he lectures on ODL [open and distance learning].
>
> [At IGNOU] the word open in open university reflects
> - ❖ openness with regard to place and pace of study
> - ❖ openness with regard to choice of courses
> - ❖ openness with regard to completion of studies
> - ❖ openness with regard to admission criteria (as cited in Sharma, 2011)

The IGNOU Website specifies their pedagogical approach further as follows: "The 'People's University' follows a learner-centric approach and has successfully adopted a policy of openness and flexibility in entry qualifications, time taken for completion of a programme, and place of study" (IGNOU, 2011).

These points about open universities provide insight into the meaning of openness in education and shed light on the pedagogical principles and egalitarian values underlying open education.

In the view of this author, open education today involves utilizing the Internet and online education in the broadest sense, while upholding the value of openness and related convictions about the active role of an educator in society. A theory of open education could therefore be approached in terms of constitutive principles such as these:

- ❖ *ICT affordances* – leveraging information and communication technologies for learning, teaching, student empowerment, educator development, and networking; utilizing the open Web, mailing lists, learning management systems, social media and other Web 2.0 technologies that are affordable if not free, easy to use, with user needs and feedback influencing future services.

❖ *Open access* – open educational resources (OER), as cited above, open access journals and other online publications, online conferences or online participation in f2f conferences, open enrollment or free educational opportunities.

❖ *Openness* – open-mindedness, inclusiveness, honesty, voluntarily sharing one's wealth of knowledge and institutional resources, mentoring, and endeavoring to open the minds of administrators and teaching colleagues as well as students.

❖ *Digital literacy education* – computer training, national and local e-learning initiatives, and efforts to overcome the digital divide, so that learners worldwide can have equal opportunities to make use of ICT affordances for their education.

❖ *Collaboration* – as openly as possible, cooperation between nations, educational institutions, and individual scholars, interdisciplinary research, and academic associations, including online or virtual organizations.

A number of broader principles may also help clarify the dynamics, ideals and goals of open education:

❖ *Disintermediation* – cutting out the middle man in economic systems, a process of connecting people including educators with learning and networking opportunities directly, opening up alternatives to exclusive schools and gate-keepers as well as to sources of information such as textbooks and journals for those who cannot afford them.

❖ *Multilingualism* – like biodiversity, recognizing the value of maintaining diverse perspectives and indigenous knowledge, encouraging foreign language education, facilitating the use of multiple languages technologically, while recognizing the right to native language education.

❖ *Intercultural reconciliation* – cultural differences will always exist, but educators can show how respect toward different cultures benefits their own society, and minimize intercultural conflicts due to prejudice, by encouraging intercultural sensitivity and collaboration on mutually beneficial and sustainable projects.

❖ *Universal humanism* – while recognizing the diversity of cultures and the free will of individuals, upholding universal human rights and other United Nations agreements, regarding all people as deserving of suitable and high-quality education insofar as possible.

Sharing the above affordances, ideals and principles could expand the participation in open education to as many people as possible throughout the world, among whom future educators would also emerge. While there may be institutional limitations for educators, any movement towards the ideal of open education will be helpful. Valuing the local

context and the agency of practitioners, teachers "reading between and behind the lines" of government educational policies can open up "spaces for transformative pedagogical interventions" (Ramanathan and Morgan, 2007, p. 448). Open education has to be based on opening the minds of all involved in teaching and learning.

Ideally, open means available to each individual, accessible and affordable if not free. However, it is inevitable in an economic system that wealth confers advantages to families, and that providers of educational goods and services must pay their employees. Thus, in order to receive the best guidance available, those who can afford face-to-face classes and buy publications can still support publishers and brick-and-mortar institutions. The less fortunate economically, although missing such face-to-face guidance, might still find answers to their needs for information on the Internet, and for instance follow mentors through social media like Twitter or Facebook. Of course a wealth of information is available to those who are able to get online, for example from Wikipedia, YouTube, and academic sites on the open Web (as opposed to password-protected or paid subscriber sites). But more efforts are needed to get the remaining majority of world citizens online, if the latter so wish, as well as for established educators to support open education initiatives.

Since mobile phones have become more common than computers globally, especially in regions like Africa, there is a great need for m-learning (Banks, 2008) or Websites for mobile phones (McCarty, 2009b). Regarding priorities for Africa, Afele (2003) argues that it is not a matter of choosing either food or information technology (IT), but rather access to IT is urgently needed to add global knowledge to indigenous knowledge in order to gain greater self-sufficiency.

Open education ultimately means access to online education, not just meaning online or blended courses but in the broadest sense of all the ways that the Internet can serve educational purposes and connect people to exchange information. This would include digital literacy education (Watters, 2011), learning to critically distinguish the academic reliability of online information, in order to study autonomously, another kind of self-sufficiency for lifelong education.

Open education prefers the open Web over proprietary silos, including walled-off social networking sites (Berners-Lee, 2010), that cannot be spidered for Web searches, although enrollees-only or other password protected sites like open source learning management systems may be necessary at times to protect students' privacy. Yet an aspect of Web 2.0 technologies with pedagogical potential is that students encounter real people and

situations on the open Web, which is more like the real world and thus, given sufficient guidance, potentially educational in a practical sense. Wheeler (2010) makes a similar point in arguing for personal learning environments or open architecture cloud learning environments over institutional virtual learning environments. On the Web students also use technologies that will be useful for their future in the working world.

In this view, a theory of open education would involve the myriad affordances of the Internet and the new discipline of online education, but the pedagogical principles and other values that determine how technologies will be applied are also essential to clarify, as the full implications of open education present a challenge to surpass previous notions of education.

Global Online Collaboration

Online collaboration has been discussed by Beaufait et al. (2008) in the disciplinary context of cooperative vs. collaborative learning among students in online classes, whereas this chapter focuses on collaboration among educators, who are also learners, at a distance. Since the issue is largely remote communication in both cases, there is some overlap between collaborative learning and collaborative educator development in the online education field. Thus, relevant to this paper, Beaufait et al. cite Daradoumis and Xhafa (2005) as follows: "A culture of collaboration must be based on relationships characterized by trust, motivation, encouragement, mutual support, and openness" (2008, p. 450). Such a culture is not a given condition when individuals from all over the world form an organization, whether offline or virtual. Acculturation can be more difficult when the relations between the nations of members are strained. For example, foreign language learners find it more difficult to become bilingual and bicultural when the cultural attitudes of the target language community are exclusive, or the target culture is at odds with the learner's culture. Fortunately, the collegiality among the world community of scholars, sharing similar academic standards and ethics, makes educators among the best equipped profession to overcome exclusive cultural allegiances such as nationalism and to, indeed, collaborate towards intercultural reconciliation as well as the advancement of knowledge.

A case in point is the World Association for Online Education (WAOE), representing participants from all populated continents and major world religions. The foregoing discussion of open education was not just hypothetical or about future goals, but the principles have been put into practice to some degree by online collaboration in a global virtual organization.

Some global ideals of open education were expressed in the final three of the WAOE's 22 founding objectives:

- ❖ to maintain a global perspective as a world organization, supporting multilingualism and multiculturalism in online education, preserving human rights to diversity and mutual respect despite differences, and encouraging intercultural sensitivity and world reconciliation through intercultural communication among global citizens,
- ❖ to be as inclusive as possible in scope, serving the aspirations of all members and working for equitable access to online education and to membership, and,
- ❖ as world civilizations become digitized, to create an organization that can function entirely with digital technologies and thus provide worldwide access to its activities, research, and support." (World Association for Online Education, 1998)

The second to last objective in particular parallels the goals of open universities outlined earlier, except that here it is educators, understood to be lifelong learners, needing inclusive access to professional development in successive educational technologies. One of the articles introducing the WAOE alluded to educators being isolated or divided into different disciplines and online venues such as mailing lists (McCarty, 2009a), which are still useful today. The article, as it were, sought to bring the disparate *ronin* interested in online education together through the WAOE:

> Educators concerned with online education in the broadest sense see their institutions cutting deals and their scholarly judgment over the curriculum undercut. Web-literate educators have their regional and disciplinary organizations, but when they reach out to the wider world through the Internet, they sense that the new medium holds great promise, but also that essentials are lacking in comparison to the face-to-face medium. Wandering from list to list, Website to Website, like so many nomadic masterless samurai, what online educators have been missing is a real organization. (McCarty, 1999)

For the first time a fairly complete chronology of milestones in WAOE history is presented below, with the important exception that there were many other cases of WAOE members collaborating on publications and projects. Some of the items reflect the requirements of a non-profit organization (NPO), so the annual meetings are only mentioned once, or

represent renovations of the main Website, which are important to an organization. But most of the items are meant to be seen retrospectively in terms of global online collaboration among educators concerned with online education. That being said, actions tended to arise naturally out of the overall vision of sharing expertise, without a deliberate rationale or calculation of gains, so actions are presented for reflection without commentary. Still, readers may see most of these milestones as expressions of online collaboration during an era of reconstituting academia in cyberspace, as the virtual organization format allowed active members to turn ideals into reality:

- ❖ 1998, April: Teaching in the Community Colleges (TCC) Online Conference keynote address and downloadable video proposed a year-round organization to turn online education into a professional discipline.
- ❖ Mailing list discussions continued after the conference, then a Constitutional Convention held in a BBS drafted WAOE formative documents and a system for online parliamentary procedures.
- ❖ Further meetings were held in a Web Board and using mailing lists hosted at American universities.
- ❖ Domain <waoe.org> acquired.
- ❖ Affiliated *Journal of Online Education* at New York University.
- ❖ WAOE recognized in educational technology sites, directories, and publications such as the *Chronicle of Higher Education*.
- ❖ WAOE registered as a non-profit public benefit organization (NPO) in the State of California with Articles of Incorporation and Bylaws.
- ❖ 1999: A Special Members' Meeting ratified the NPO Bylaws and elected members of the Board of Directors from various countries.
- ❖ Inaugural Members' Meeting and Board of Directors' Meeting, annual NPO requirements, were held, with the State of California interested in WAOE's online voting.
- ❖ Different mailing lists were developed for member discussions, organizational announcements, and officers' discussions.
- ❖ Besides the elected officers, appointed officers included the Cyber-Parliamentarian and a Coordinating Ring of officers from many countries.
- ❖ Online newsletter *WAOE Electronic Bulletin (WEB)* started.
- ❖ A World Cultural Festival was held online, then a summer festival in collaboration with Child Research Net, a Tokyo, Japan NPO.
- ❖ A WAOE Online Educators' Course utilized the Blackboard LMS.
- ❖ 2000: The WAOE membership had been approaching a thousand participants from over 50 countries until a small membership fee was introduced, which regrettably

- discouraged the less privileged.
- After gathering initial membership fees, receiving donations, and transferring honoraria to WAOE from collaboration with Child Research Net, membership dues were abolished.
- WAOE online greeting card for the year 2000 in 20 languages.
- The Multilingual WAOE Project resulted in WAOE commissioned Websites, discussion groups, or membership information available in Spanish, French, Malay, Turkish, Italian, Portuguese, Hindi, German, Russian, Chinese, and Japanese.
- A policy for affiliating with other organizations was developed.
- 2000-2001: Online Educator Development Practicum with the MetaCollege LMS.
- 2001: WAOE collaborated with e-learning conferences in Malaysia and Mexico.
- A WAOE membership badge was made available online, but while only individuals can belong to WAOE, some groups have abused the badge or WAOE's logo to falsely imply a sort of accreditation.
- An interactive world map of WAOE officers was offered along with other interesting items in java by Prof. Roberto Mueller in Brazil.
- 2002: Started donating WAOE server space, hosting the International Program for Africa and a Russian initiative.
- WAOE co-sponsored Future of Universities event held in a MOO.
- 2003: WAOE donated $900 to an NGO in Estonia for Baltic region online education for minority Russian language users.
- WAOE blog "Intercultural Literacy" started.
- Main WAOE Website and mailing lists hosted at Portland State University by Chief Technology Officer Prof. Maggie McVay Lynch.
- Mentoring Project of WAOE expert volunteers to help educators develop plans for online education projects.
- WAOE mentors in several countries added a blended element to a graduate course on Online Education at a national university in Japan with audioconferences, voice board, the WebCT LMS, etc.
- Four officers met face-to-face for the first time, giving a group presentation at a conference held at the University of Sussex, UK.
- 2005: Spoken Libraries Project, whereby several WAOE members developed podcasting blogs.
- 2006: WAOE moved Websites and e-mail accounts to a private ISP as the CTO retired, with mailing lists moved to Google Groups
- Resolution announced to clarify that WAOE is an academic organization for individuals, not accrediting groups using our logo.
- WAOE members in six countries collaborated on two chapters in *The International*

Handbook of Virtual Learning Environments.

❖ 2007-present: New Board of Directors: President Nick Bowskill (UK), Begum Ibrahim (Malaysia), Mike Holmwood (Canada), Eileen Dittmar (US), and Ramesh Sharma (India), with Steve McCarty (Japan) appointed President Emeritus, also serving as Webmaster.

❖ 2008: WAOE live 3D event with Capella University in Second Life.

❖ 2010: WAOE's main site was redesigned.

❖ From 2010: WAOE hosts a Moodle LMS site as a voluntary contribution to the distance education section of the national University of Guyana in South America.

❖ 2010-2011: Board meeting to consider changing from an NPO to an informal international NGO.

❖ 2011: WAOE contributed about $1,400 to a children's hospital in Bangladesh.

❖ Some WAOE members able to meet f2f at the 5th International Malaysian Educational Technology Convention.

Those are some of the ways that the WAOE as a virtual organization has practiced global online collaboration and has worked for open education, while the story continues today.

Conclusion

In summation, **ubiquitous computing** provides the *means* for ubiquitous learning (U-Learning) or the fullest potential of open education *technologically*, **open education** provides the *ideals and goals pedagogically*, while a virtual organization like the WAOE provides a *vehicle* to bring educators together for global **online collaboration** in order *to achieve the goals of open education*.

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