

MAKING A BRIDGE BETWEEN SCIENTISTS AND PUBLIC: PROVIDING A VENUE FOR LIVE-TALK FOR YOUNG AND UPCOMING SCIENTISTS

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Abstract

Traditional Science museums have focused on Public Understanding of Science which presents established science knowledge and examines applications of science in the past. Compared to PUS, Miraikan focuses on Public Understanding of Research which examines research into the unknown. PUR must be an on-going presentation following research as it develops. The future impact and applications of research are discussed, presenting the process, including negative and positive aspects, of research as it is happening. It enables the public to engage in a dialogue with the scientists, and to give feedback to the scientists. Miraikan assumes an important role as the basis for PUR activities in Japan. For instance, it organizes special 'like talk' events where young and upcoming scientists get a chance to talk about their work to undergraduates. We have applied the new learning theory in cognitive science to design activities in order to build and cultivate a community of practice in Miraikan.

Keywords: Acquisition model, Communication, Live-talk, Learning, Outreach, Participation, PUR

1. Traditional Schools and the Knowledge Acquisition Model

The traditional components of a school have been teachers, students, and general supporting staff. For generations, classroom teachers have stood in front of the blackboard, using standard style textbooks, and lecturing to their students. In this environment, intellectual work is thought to be an act of knowledge transfer. The human mind is seen as a container and learning is seen as the pouring of knowledge into it and saving it. With this view of knowledge acquisition, studying is considered as individual work. On the whole, teachers give importance only to the process of acquiring and saving information, and doing this effectively was the goal of education. Over the years, this has developed into the traditional style of formal education in Japan.

It is not only the conservative nature of humans in general that makes traditions hard to change, but the accompanying institutions and other cultural support that grow up around such traditions. For example, the tests that students need to take to enter universities in Japan support this view of learning as 'gathering up information.' All teachers in pre-college institutions from elementary school to high school feel pressure to prepare their students for this kind of exam. Furthermore, after university, in the usual exams given to enter graduate school or companies, or even the National Bar Exam or the hundred of other exams given to grant licenses for certificates (various teachers' licenses for example) students' ability to perform successfully is evaluated by the information and memories stored inside their heads.

But of course we know that in our real lives, whether as students, workers, parents, friends, we don't only depend on the remembered information we carry with us. In our daily lives, we solve problems not only with our personal pre-attained knowledge but more often with knowledge constructed through interacting with new situations and people. When we meet a new problem, we try to solve it by collecting information in various ways, such as consulting with others, doing research in some printed material or on the internet, or using tools or toys of some kind. Also, we need to recognize that solving problems is not just a means to gain knowledge. Human study is not 'knowledge acquisition' so much as it is an interpersonal activity which takes place in conversation and in communication, and is inseparable from situations or the context. Learning should be defined as the process of interaction which occurs in social relationships within a community containing a multitude of things beyond any single individual.

In the late 1980s, the knowledge acquisition model attracted criticism from many directions, especially cognitive science, the field that researches memory, understanding, and thought [1][2]. Lave and Wenger emphasize learning is not the process of acquiring knowledge but the process of participating the community of practice [3]. Based on this theory Sfard compares the traditional model of learning to new one by using a metaphor of acquisition and participation (Table 1) [4].

Table 1 The Metaphorical Mappings [4]

Acquisition metaphor		Participation metaphor
Individual enrichment	Goal of learning	Community building
Acquisition of something	Learning	Becoming a participant
Recipient (consumer), (re-)constructor	Student	Peripheral participant, apprentice
Provider, facilitator, mediator	Teacher	Expert participant, preserver of practice/discourse
Property, possession, commodity (individual, public)	Knowledge, concept	Aspect of practice/discourse/activity
Having, possessing	Knowing	Belonging, participating, communicating

2. Designing Our New Science Museum

The knowledge acquisition model has influenced everywhere in Japan, not only in schools but also science museums. Under such circumstances, the National Museum of Emerging Science and Innovation (Miraikan) has opened in July 2001 (Figure 1). It was born as a center for deepening the understanding of science and technology, and to fulfill Japan's aim of becoming a scientifically and technologically creative nation.

It was believed as a matter of extreme importance that Japan recognizes science and technology as the key for achieving further economic and social development and for sustaining or improving the quality of life in this country. In view of the short natural resources, rapidly ageing population and poor state of R&D environments, the only way for Japan to cope with ever-intensifying international economic competition and to sustain high industrial standards and quality of life is to create new industries through development of innovative and original advanced technologies.

In November 1995, the Basic Law on Science and Technology was enacted. It was enacted with the purpose of making a scientifically and technologically creative nation by promoting the advancement of science and technology. In July 1996 the Basic Plan for Science and Technology was formulated. Based on this, it was formulated to develop comprehensive and strategic plans. The Japan Science and Technology Corporation then decided to create a facility for providing scientific and technological information through exhibitions of the latest science and technology, development of exhibition techniques, exchanges among scientists and the like. The result is Miraikan.

Miraikan's mission is:

- Sharing scientific creativity and activities among people,
- Positioning science and technology as a part of culture, and
- Focusing on creating dialogue between scientists and the community.

To fulfill the mission, we are trying to let scientists get involved in our activities, such as developing new exhibits together, having science laboratory workshops, holding live-talk events, and operating research laboratory tours.

Recently scientists' outreach is recognized its importance in scientists themselves and the society. But most of their ways to reach to the public is 'pouring knowledge' from expert to novice. It is still in the knowledge acquisition model. We try to get out from the model and build a learning community with scientists and the public by providing different kinds of activities in Miraikan.



Figure 1. National Museum of Emerging Science and Innovation (Miraikan)

3. Designing Live-Talk Event

'Science Edge' is one of new challenge programs [5]. Science Edge is a live-talk event which we hold six times a year. Topics we cover are: brain science, molecular biology, nano-science, planetary science and so on. We purposely select young upcoming scientists as guests. Because we want to change a typical image of a scientist: white lab coat, messed up hair and thick eyeglasses. We select 'hot' and 'cool' scientists from post-doc or doctoral course students. Hot means passionate, enthusiastic on their research topic and cool means smart, fashionable, up-to-date young scientists. We like to introduce the scientists as they are real people to the public. Also we like to provide young scientists opportunities to talk in a public.

Target participants are not general public but science and technology major undergraduates. Compared to general public, it is easier to start with the undergraduates for young scientists. We try to promote the communication instead of one-way lecture.

We have designed a new learning environment which values learning without walls and attempts to remove various barriers between 'teachers' and 'students' or 'speakers' and 'audiences.' Speakers have traditionally stood on a raised surface, 'delivering' lectures to audiences, who were expected to listen passively. Taking away these platforms and having completely open talking areas is our way of creating open style environments which will make interactions among participants and between speakers and participants very natural (Figure 3).

With these open spaces, visitors and museum staff walking by an interesting live-talk event might think, "Hey! What's going on in there?" Or "Wow! That looks interesting. I'll just walk in and join them." Such an open atmosphere would be unthinkable in most schools or universities in Japan where both psychological and physical doors are kept tightly shut. Our open physical and emotional spaces will promote stimulating human activities which will we lead to deep, meaningful learning [6].



Figure 3. Open Atmosphere for Live-Talk Event

The role of the host is important in this event (figure 4). The host is a science communicator in Miraikan who is a Ph.D. holder or who has equivalent knowledge and skills. She or he does;

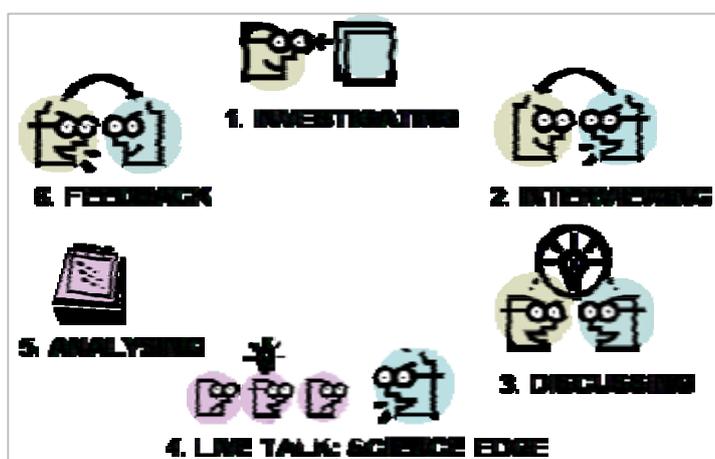


Figure 4. The Role of the Host at Science Edge

1. Investigating in most recent academic journals such as 'Science' or 'Nature' to select a guest scientist,
2. Interviewing the scientist to understand their passion, and
3. Discussing a theme and logistics for Science Edge event.
The key is
4. Having a talk with the scientist, the host, and undergraduates, and after a talk
5. Distributing & collecting questionnaire sheets from participants and analyzing the result.
Then we provide
6. Feedbacks to 'the guest scientist' to improve their communication skills.

4. Prospect for Miraikan as a Learning Community

Communication ability - the ability to listen to others and express ourselves - is very important for self-development and self-realization. One of the important aims of Miraikan is to help scientists see the value of research and presentation in their personal and professional lives, and to begin to develop their confidence as communicators in a wide range of situations, utilizing a wide range of media. Working in laboratories, homes for the aged or handicapped, on newspapers/radio/TV and even street performances are ways we will enter into dialogue about the arts, science and technology with the local community.

Furthermore, we are greatly aware of the lack of women in the sciences and have taken it on ourselves to change this situation. Although the number of female students in science majors in Japan is increasing, it is still very low, so Miraikan will search for ways to encourage young women scientists to join us at every possible turn, and our goal is to accept half men and half women as scientists.

By taking part in a respectful dialogue with a diversity of learners, we will begin to see a wide range of styles and intelligences. Different study styles, learning styles, presentation styles; different kinds of intelligences - for problem solving, for thinking creatively, for social interaction, for artistic or dramatic expression - each person will feel his/her own power both individually and as a part of the learning community of Miraikan. We have even created different kinds of event in our museum where learners of all ages, from all sectors of society, with all styles of learning, can interact and share their visions.

In traditional school education, 'passing' knowledge through using standard textbooks and then evaluating solely based on what knowledge has been memorized is the standard approach. This style created the mistaken view that meaningful study activity is closed, individual work inside schools. It is different from what experts do in real society. Scientists' activities include searching for meaningful issues, generating hypotheses, and finding ways to verify them. In contrast to this, education including scientists' outreach today focuses on memorizing propositions and formulas, or on proving an issue already known. Classes tend toward a drill and practice mentality so that so-called 'basic knowledge' will be deeply instilled.

Objectifying knowledge in this way removes all the mystery, surprise and relevancy of learning. It accelerates passive learning and increases disengaged learners. In order to change the situation, at Miraikan by giving visitors a chance to communicate with real scientists, we want them to become engaged in the joyful aspects of meaning-making and finding a place for themselves in today's and tomorrow's world.

Providing the learning surroundings described above, Miraikan intends to redefine 'community' to include our visitors, scientists and museum staff, people in Tokyo and neighboring towns, and expanding throughout Japan and the world, offering learning opportunities to everyone within physical or digital reach. As Wenger et al. indicate the importance of 'cultivating communities of practice' [7]. We want to redefine humans as lifelong learners through our sharing of meaningful learning and living experiences.

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