# Initial Experiences of ALAN-K: An Advanced LeArning Network in Kyoto

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## Abstract

*This paper describes the start-up phase of the ALAN-K (Advanced LeArning Network in Kyoto) project, which is part of a major effort to create new learning environments for elementary, junior high and high school students in Kyoto, Japan. Our visions of digitally fluent and creative citizens are largely influenced by the visions, ideas, and experiences of Alan Kay and his colleagues. We view the Squeak system (Ingalls et al., 1997; Guzdial and Rose, 2002) as powerful learning tools and media for enabling both active independent learning and collaboration. A series of Squeak workshops were designed and conducted at two elementary schools, which will be the basis for designing further activities.*

## 1. Introduction

As we enter the age of "Knowledge Industries", the ability to create and use knowledge is increasingly important. In a society where computers provide critical tools and media for work, play and other activities, education should be reformed considering unique capabilities of various people.

We argue that a new educational system should aim at fostering creative citizens who are digitally fluent. To provide more elementary, junior high and high school students with learning opportunities to become digitally fluent and creative, Kyoto University, the city of Kyoto, the city's Board of Education, and Kyoto Software Applications, Inc. initiated the ALAN-K (Advanced LeArning Network in Kyoto) project.

### Digital Fluency and Creativity

As the cost of computing devices decreases, the importance of digital fluency[1] increases. In other words, *the "access gap" will shrink but a serious "fluency gap" could remain* (Resnick, 2002).

When people learn a foreign language, it is useful to remember some words or phrases so they can read a menu in a restaurant or ask directions to a train station. In order to be fluent in a foreign language, it is generally not sufficient to just remember words or phrases. To be fluent, one should be able to construct and articulate complex ideas, tell or write engaging stories using the language. Fluent people should be able to not only read and listen to existing ideas but also create and articulate new ideas and contribute to the body of knowledge in a society. Fischer (2002) discusses computational media that allow all of us to take on, or incrementally grow into a designer role.

When most people learn computers today, they learn how to use a word processor, a Web browser, or an E-mail application, which is equivalent to learning words and phrases in a foreign language. However, this is not sufficient in the future. Digital fluency, which includes the ability to digitally create and use knowledge, is increasingly important in our "knowledge society" where knowledge is often represented in digital forms. As you would have more opportunities to learn other things if you are fluent in a language, digital fluency will be important for lifelong learning and for participating meaningfully in a society.

### Independent Learning and Collaboration

Learning and teaching are both important. There are things that students can learn better by improving the ways teachers deliver instructional information to the students. There are also things that can be learned much better if students are given good things to do so that they can learn by doing. For example, a child making an animated picture on a computer would need to worry about mathematical descriptions of various shapes and movements. If the child were asked what he was doing, he would say that he was just making a picture, however, he would need to do real mathematics in order to accomplish what he wants to do.

Children can be given opportunities to actively and independently construct new understandings and ideas through exploring and experimenting with simulated worlds on computers. Computers can also provide

[1] CSTB (1999) uses the word *FITness* to refer to fluency with information technology

children with tools and media for connecting, communicating and collaborating.

People around learners can serve as consultants to the learners and facilitate their learning. However, it could be the case that the people around the learners, such as teachers, may not always be the world's best consultants for all the problems learners have. One argument is that teachers should collaborate, help with each other and keep learning new things to be as good teachers as possible. Another argument is that students, who know different things through their active and independent learning, should connect and help with each other. The ideas in these arguments cannot be successfully realized by merely developing some Internet communication tools. Such tools can be used to *amplify the learning experience* (Kay, 1991) but only within a good educational environment.

Active and independent learners need different consultants who understand the learners well and provide relevant advice. It is critical that learners, teachers, and mentors are provided with social as well as technical infrastructure that allows for easily connecting, communicating, and collaborating with one another over the network.

## 2. Local Issues

Six local schools collaborate with us. They include two elementary schools[2] (Gosho Minami Elementary School and Takakura Elementary School), two junior high schools[3] (Ryuchi Junior High School and Joson Junior High School[4]), and two High Schools[5] (Horikawa High School and Saikyo High School).

These schools have computer rooms, most of which are equipped with 20-40 desktop personal computers running the Windows 98 operating system. As of January 2003, some of the schools are connected to the Internet via dial-up. Faster always-on connectivity is available at the rest of the schools. In April 2003, there will be a major upgrade of the computer networks connecting the schools in Kyoto. We are expecting to see all schools in the city benefit from the always-on computer network environment.

We are thinking about the opportunities for elementary, junior high, and high school students to connect with each other and collaborate across the Pacific Ocean. There is an interesting existing technological infrastructure that might be very useful for creating such opportunities: the high-speed network between Kyoto University and UCLA, which is currently used to connect students at both universities by video-casting a lecture at one university to the other.

Students use the computers that can handle the Japanese language. The Squeak system, which we use as the technological substrate for providing user interfaces and underlying mechanisms for students' learning, has been adapted to the Japanese language and multi-lingual environments by Japanese Squeak experts (Ohshima and Abe, 2003). Since the autumn of 2002, they closely work with the ALAN-K project and contributed significantly to improving the usability of the localized Squeak environment for Japanese children.

## 3. Squeak as Learning Media

The Squeak system has been used at various schools in the United States and elsewhere. Recently, Squeak workshops were held at several places in Japan including CAMP (Children's Art Museum and Park) and Science Museum Tokyo. They both successfully introduced Squeak to children, who quickly learned and created Squeak projects using only a short amount of time. Squeak was also used for undergraduate courses at some Japanese universities and colleges.

In the context of the ALAN-K project, we are looking forward to seeing the effect of Squeak-based learning throughout the 3 years of the project. We view Squeak as learning media that can be used to offer the following kinds of learning opportunities:

(1) *Opportunity for active and independent learning:* In order for children to actively and independently construct new understandings and ideas, learning environments should provide the children with tools for exploring and experimenting with simulated worlds on computers. Children should not just collect existing information and ideas (e.g., browse the Web to collect links to web pages that describe a method for creating animation) but use the information to contribute things and ideas for other children and even adults (e.g., create animation, come up with different methods for creating animation and create a web page explaining the discovered methods, or even improve tools for creating animation.). When using Squeak, the students are not just users of the technology but

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[2] Japanese elementary schools are for 1st to 6th graders; Ages 5/6 to 11/12.

[3] Japanese junior high schools are for 7th to 9th graders; Ages 12/13 to 14/15.

[4] These schools will merge to be a new school (Oike Junior High School) in April, 2003.

[5] Japanese high schools are for 10th to 12th graders; Ages 15/16 to 17/18.

become designers as they work through problems and express their own ideas. There are other educational technologies that are based on this "*students as designers*" framework. The Programmable Brick (Martin, 1996) is one of the examples of such technologies.

(2) *Opportunity for collaborative learning:* During our Squeak workshops at elementary schools, we have seen Squeak stimulate face-to-face communication and collaboration between children. Communication and collaboration can happen not only face-to-face but also across remote classes synchronously or asynchronously. The following table shows different kinds of communication and collaboration that are relevant to the ALAN-K project.

| | Same time | Different time (same semester) | Different semester |
|---|---|---|---|
| Same class | Face-to-face discussions with others; group projects | Asynchronous sharing of Squeak projects | Reviewing projects done in the past |
| Same school | Discussions; group work/play | Sharing projects across different classes; Connecting with others who share interests | Share projects done in relevant past classes; Connecting with possible mentors |
| Different school (within participating 6 schools) | Organized sessions and spontaneous communication possibly across different grades. | Sharing (any) projects across different schools; Connecting with others who share interests | Sharing (any) projects done in relevant past classes across different schools; Connecting with possible mentors |
| Different local schools in Kyoto | Spontaneous communication over relatively fast always-on computer networks | Sharing (selected) projects across different schools; Connecting with others who share interests | Sharing (selected) projects done in relevant past classes across different schools; Connecting with possible mentors |
| Different schools; nationally | Spontaneous communication | Connecting with others who share interests | Connecting with possible mentors |
| Different schools; internationally | Simulation and network games as possible means of language independent communication | Sharing (selected) projects as possible means of language independent communication | Sharing (selected) projects and ideas translated into native languages |

**Table 1.** Communication and collaboration by students

The Squeak system and related technologies such as Croquet (Smith et al., 2003) and NetMorph (Umezawa et al., 2003) provide advanced tools and mechanisms for communication and collaboration. In addition, Super Swiki (Rüger, 2003) allows for sharing of Squeak projects on the Internet.

Designing curriculums and learning environments with these cutting-edge technologies is a challenge. We believe that the design should aim at being idea-based, not technology-based. Kay (1995; 1996) even discusses that the best solutions are often found by thinking about how ideas could be learned with no supporting media at all.

## 4. First Squeak Workshops

Our first Squeak workshops were offered at two elementary schools in Kyoto on the 21st and the 22nd of November in 2002. We cooperated with a cognitive scientist in the United States, expert Squeak developers and others to prepare for the workshops and invited them to Japan to conduct these very first workshops in Kyoto. We served as assistants during the workshops, interacting with individual students.

| | *11/21* Takakura | *11/22* Gosho Minami | Total |
|---|---|---|---|
| 5th graders | 0 ( 0%) | 9 (47%) | 9 (23%) |
| 6th graders | 20 (100%) | 10 (53%) | 30 (77%) |
| Male | 16 (80%) | 11 (55%) | 27 (67%) |
| Female | 4 (20%) | 9 (45%) | 13 (33%) |
| ***Year using PC*** | | | |
| < 1 | 3 (15%) | 2 (10%) | 5 (13%) |
| 1—2 | 4 (20%) | 10 (50%) | 14 (35%) |
| 3—5 | 7 (35%) | 6 (30%) | 13 (32%) |
| > 5 | 6 (30%) | 2 (10%) | 8 (20%) |
| ***Frequency using PC*** | | | |
| Almost never | 1 ( 5%) | 7 (35%) | 8 (20%) |
| Once a month | 2 (10%) | 1 ( 5%) | 3 ( 8%) |
| Once a week | 7 (35%) | 6 (30%) | 13 (32%) |
| A few times/week | 3 (15%) | 4 (20%) | 7 (18%) |
| Daily | 7 (35%) | 2 (10%) | 9 (22%) |

**Table 2.** Statistical data of students at the first workshops

Participants of the workshops included 5th and 6th graders and teachers from the two local elementary schools (Gosho Minami and Takakura elementary schools). Table 2 shows statistical data of the student participants.

The first half of the workshops was a hands-on session of Squeak. Students created cars, steering wheels, driving courses, and 'drove' the cars using the steering wheel. Many adult participants and observers, most of who voluntarily served as consultants to the children, were impressed to see children learn Squeak rather quickly and all children create their first Squeak projects successfully.

The second half of the workshops was the presentation of the experiences in the U.S. including the introduction of the Squeak projects created by American students (see Figure 1). The presentation was given to both the students and the teachers on the 21st of November. Since some messages in the presentation were more interesting for the teachers and the other messages were more interesting for the students, two presentations were done in parallel for the teachers and the students on the 22nd, one presented for teachers by an American cognitive scientist and an English-to-Japanese translator and the other presented by a local graduate student in Japanese. Giving presentations in slightly different styles for different kinds of audience appeared to work very well.

Students on the 22nd were given more time to work individually on their own Squak projects than on the 21st. This created an opportunity to observe students communicate with each other. Some children were proud of what they created and called their friends to share the projects. Some traces of child-to-child communication were seen in their Squeak projects. For example, several children created different creatures that move as a school in a similar way.

The children were excited and had a lot of fun when they were introduced to what the American children created. We believe this and other methods of sharing Squeak projects will turn out to be something very useful for providing the children with meaningful learning experiences through communication and collaboration within and across the boundaries of languages and cultures. As the project proceeds further, we expect to experience a number of interesting things that will deepen our understanding of culturally independent and dependent aspects of learning.

The questionnaires answered by the students and the teachers have shown that the workshops created different levels of interests in the potential of the Squeak system in learning and playing. Many enjoyed the Squeak's ability to allow them to easily move pictures and play various sounds. Some children described some of their activities at the workshops as playing. Others said it was both hard and fun.

What the children want to create in the future includes animals, animations, adventures, baseball, guitarists, space travels, bicycles, kick boards, something

**Figure 1.** Kim Rose, Roxanne Maloney, and Yoshiki Ohshima introduce the Squeak projects created by American students to Japanese students and teachers. Takakura Elementary School, Kyoto.

that can be controlled, something that moves by itself, games, characters of a popular movie, and many others.

The teachers, who also experienced the Squeak hands-on during these workshops, gave us various comments. Most of them had fun with Squeak as the students did and are interested in Squeak at different levels. Many teachers thought Squeak would be useful for science, mathematics and "Sogo Gakushu" (integrated learning) classes. There were teachers who thought it would be useful for teaching/learning in social studies, music, Japanese, and art classes. Some teachers addressed the issue of tailoring education for each student and the issue of instructors. One teacher seemed to have kept thinking about differences of Squeak and other existing software systems.

The teachers' ideas about using Squeak in classes include using it for storytelling, presentations, experiments, recordkeeping, and art.

Overall, these first workshops provided a learning experience for both children and adults and made us believe that many interesting things can be done as the project goes further.

## 5. Workshop Series

One of the most important things on our agenda was to give children more time to get used to the Squeak system and play/learn on their own. This is difficult with a single workshop that needs to be finished in a couple of hours or so. We decided to offer a series of four Squeak workshops in January 2003.

| | |
|---|---|
| 5th graders | 9 (33%) |
| 6th graders | 18 (67%) |
| Male | 14 (52%) |
| Female | 13 (48%) |
| Squeak | |
| First-timer | 18 (67%) |
| Non first-timer | 9 (33%) |
| ***Year using PC*** | |
| Never | 1 ( 4%) |
| < 1 | 5 (19%) |
| 1—2 | 6 (22%) |
| 3—5 | 10 (37%) |
| > 5 | 5 (19%) |
| ***Frequency using PC*** | |
| Almost never | 5 (19%) |
| Once a month | 4 (15%) |
| Once a week | 12 (44%) |
| A few times/week | 4 (15%) |
| Daily | 2 ( 7%) |

**Table 3.** Statistical data of students at the series

Our colleagues at Kyoto University and we conducted this series of workshops. Sixteen students from Gosho Minami Elementary School and eleven students from Takakura Elementary school (twenty seven children in total) got together four times in the computer room at one of the schools. Table 3 shows statistical data of the participants.

**Figure 2.** Children creating a car that is controlled by a steering wheel. At the first workshop in the series on January 10, 2003. Gosho Minami Elementary Schoool, Kyoto.

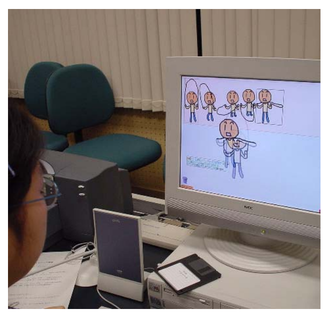

**Figure 3.** Child creating an animation of a person jumping a rope. At the third workshop in the series, on January 20, 2003. Gosho Minami Elementary School, Kyoto.

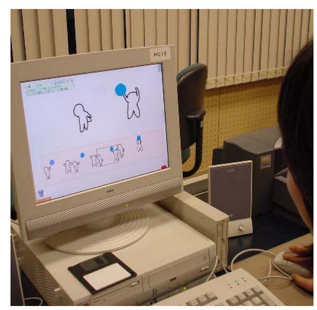

**Figure 4.** Child creating an animation of people throwing and catching a ball. At the third workshop in the series, on January 20, 2003. Gosho Minami Elementary School, Kyoto.

Each workshop was for an hour, which gave students the total of four hours of using Squeak in two weeks. The first workshop in the series, which was offered on the 10th of January provided the students an opportunity to do a "car and steering wheel" project that is similar to what the participants of the first workshops in November did. Non first-timers of Squeak, some of whom participated the workshops in November, tended to finish each step quickly. These non first-timers could have used their extra time for guided exploration and experimentation with various things in Squeak if we have had more adult "Squeak consultants" at the workshop. Another idea that would be worthwhile to talk about is to design a workshop so that non first-timers can act as mentors for first timers. The first workshop was concluded by demonstrating a game of garbage-collecting cars, which was created by extending the “car and steering wheel” project.

The second workshop in the series that was offered on the 17th of January provided the students an opportunity to create robot cars that can move along a driving course. This workshop was concluded by showing a race of two robot cars, one having only one sensor and the other having two sensors. A few students started talking about building and experimenting with a car with three sensors. One student accidentally created a car that moves backwards along the driving course successfully. This initiated discussions among students on the positions of sensors.

The third workshop in the series that was offered on the 20th of January provided the students an opportunity to create animations of various kinds. This workshop was started and concluded by showing sample animations created by American students. In-between, there were step-by-step instructions for creating an animated crab. But students were free to choose whatever they wanted to animate such as octopuses, squids, cats, clocks, birds, people, Packman-like games, worms, jelly fish, rabbits, insects, etc.

The fourth workshop in the series was offered two days after the third workshop. The first 20 minutes of the workshop provided the students with an opportunity to share what other students created at the previous workshops (Figure 5). Then the students spent the rest of the time (40 minutes) to create anything they like.

Most students said they liked creating animations better than creating robot cars. This can be partially because of the way the question was asked: most students probably did not think that they could create robots with different costumes other than cars.

**Figure 5.** Students sharing their projects presented on a large screen. At the fourth workshop in the series on January 22, 2003. Takakura Elementary School, Kyoto.

Many of the animation lovers seemed to be aware that interesting things could be done to their animated objects using the technique for making robot cars. For example, a 5th grader created an octopus that “sees” rocks and starts to climb up on them. A 6th grader tried to create a game where a dog collects a number of newspapers in the neighborhood, using multiple objects with different scripts.

A few students were thinking hard to make their objects to move faster. One was working on a robot car that runs as fast as possible in a driving course. He modified the car’s sensors and also modified the driving course to match the ability of the robot car. Another student wanted to achieve very high frame rate with his animation.

After the workshop was finished, one of the 6th graders, who created a game where a monster eats houses, asked if he could create a Packman-like game with a main character and a number of moving enemy characters. He reacted with “aha” shortly after he was introduced to the idea of random numbers and how they can be used to successfully create the kind of games he wanted to create.

Finally, the workshop series was more than just giving children a larger amount of time to get used to the Squeak system. It also gave them an opportunity to learn and use various techniques and concepts to construct something personally meaningful for them. They had fun and were motivated to solve challenges relevant to their tasks at hand. During the workshops we saw a lot of children communicating spontaneously with friends.

## 6. Future Plans

The ALAN-K project started 4 months ago and there still is a long, fun and challenging way to go. This paper we hope will serve as one of the snapshots of relevant ideas and initial experiences, which someone can take a look at a later point in time.

At this writing, we have not yet experimented with different collaborative learning settings. We did have workshops with children from different elementary schools and these children had opportunities to share Squeak projects with others. One of the next steps could be to aim at fostering *Squeak learning communities* (Steinmetz, 2002). In the near future, there will be abundant opportunities for exploring collaborative learning because:

(1) *There will be more students.* Soon, there will be a workshop with junior high school kids and also a workshop with both elementary school kids and high school kids. The number of relevant people and organizations is increasing. So, it is increasingly

important to foster communities and organize volunteers.

(2) *There will be advanced networking infrastructures and collaboration technologies for children.* As mentioned earlier, faster computer networks are coming to the schools in Kyoto in April, 2003. Also, collaboration technologies such as Croquet and NetMorph keep evolving. Another infrastructure worth mentioning here would be the high-speed network between Kyoto University and UCLA. These are all useful for designing environments for children to connect, communicate and collaborate with others over the network.

(3) *New classes will start.* We talked with some teachers and administrators about the use of Squeak in (mostly after-class) classes. Such classes will create various opportunities of asynchronous collaboration as well as synchronous collaboration.

Repositories of educational contents are also important for collaborative learning environments. Technologies such as ubiquitous video cameras and microphones, interactive whiteboards, personal digital assistants (PDAs) and various sensors create opportunities for blending learning in physical environments and computational environments. Such technologies also allow for capturing and recording of varieties of data that could be used in the future. Kambayashi et al. (2000) discuss useful mechanisms for retrieving captured data in a distance education setting.

Along the lines of these ideas, we did a very preliminary experiment in cooperation with a few researchers at Kyoto University. A Squeak workshop was digitally captured using several omni-directional sensors that provide 360-degree-view image around the sensor.

Finally, it will be both very interesting and very challenging to provide a learning environment where children in different countries can collaborate. We are also very interested in pursuing this idea in the context of the project.

## Acknowledgements

We would like to thank Yahiko Kambayashi for creating the environment for the project to start and continue. Kim Rose, Roxanne Maloney and Yoshiki Ohshima led the first Squeak workshops in Kyoto. Kentaro Yoshimasa together with one of the authors led a workshop in January. Akira Okada, Takeshi Fujioka, Chisa Sumitomo, Tesuo Ogino, Sdenka Salas, Kazuhiro Abe and Satoshi Nishihara closely collaborated with us to make each Squeak workshop a success. Many thanks to the Squeak community for the Squeak system, which we used at every workshop.

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