

THE JOURNEY INSIDE

The ISTE newsletter of classroom ideas and hardware information.

US\$3.00

Cooking With Computers

Cooking? A very good question—but what else can I call it? As a consultant to teachers in Eugene, Oregon, I often end up in weird situations. But this one takes the cake. Helping to combine all the pieces necessary for the following event was particularly challenging. The experience was fun. It was educational. And I can hardly wait to repeat it. If you can come close to matching the list of ingredients, you may want to try this unique recipe yourself. Why take my word for it when you can produce a wonderful product for you and your class to enjoy?

Ingredients

- 1 class of third- and fourth-grade students who have enjoyed the Intel education program *The Journey Inside: The Computer* (substitutions: students just starting the program, students interested in computer hardware, students in other grade levels)
- 2 dead and useless computers (size, kind, and number not critical)
 - 1 monitor (quantity, type, and version not important)
 - 1 keyboard (version and vintage not critical)
- 1 pinch of some of the following: various hard drives, floppy disks, modem boards, memory

boards, chips, wafers, diodes, vacuum tubes, and transistors (vary the list to include whatever is available to you; be creative in your begging for donations)

- 1 assortment of tools, including screwdrivers, small wrenches, and pliers (carefully count these before and after; a quick customs search before students depart might be helpful)
- 1 adult (recipe improves if the adult shows minor symptoms of insanity—either before or after using the recipe; increase number if available)
- 1 school, tolerant of varied learning experiences (flexibility from other instructors and administration is helpful)
- 1 classroom (built to withstand an earthquake or worse)

Instructions

Excuse me. I've only just learned that a recipe has two parts—a list of ingredients *and* instructions. The cooking experience reported here was done without directions. However, for your benefit, a set of instructions was created afterwards. Please consult "The Lesson Plan" (page 6 of this newsletter) contributed by Kimberley Ketterer and Irene Smith.

— Continued on page 4 —

Oops!

Thank you to those who identified the error in the article "Beating the Binary Block" in Volume 1, Issue 4.



Your **editor goofed** and is totally responsible for the error. Yes, the first digit position should be 1s rather than 0s. Yes, we do know better and are very relieved to learn our readers are willing to help. ☺

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Workshop Schedule

Intel continues to provide workshops for teachers interested in using the program. These workshops provide ideas and suggestions for using *The Journey Inside: The Computer*. Teaching methods, activities, and reference materials are included in these presentations.

Florida Educational Technology Conference
Orange County Convention Center
Orlando, FL
February 16–18, 1996
Phone: 904-488-0980

Georgia Technology Conference
Atlanta, GA
March 14–15, 1996
Contact: Kathy Bailey
Phone: 404-377-3491

Pennsylvania Educational Technology Conference
Mountain Laurel Resort
White Haven, PA
March 18–21, 1996
Contact: Janet Szulanczyk
Phone: 717-560-4651

Northwest Council for Computer Education
Oregon Convention Center
Portland, OR
April 24–27, 1996
Contact: Paul Katz
Phone: 541-346-3537

Pending Confirmation

PDTCA:
Calgary, AB (February 28, 1996)
KACE:
Frankfurt, KY (March 1–4, 1996)
NECC:
Minneapolis, MN (June 11–15, 1996)

If you have any questions regarding the above-mentioned workshops, contact Irene Smith at ISTE, 480 Charnelton Street, Eugene, OR 97401-2626, 541-302-3776. □

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Please note: As of November 1, 1995, ISTE's area code changed from 503 to 541.

Career Profile—Mask Designer



*Mary Kamprath
Senior Mask Designer
Intel Corporation
Santa Clara, CA*

*Interview by:
Joyce Woodjetts, Intel Corporation*

Q: How long have you been designing masks?

A: For 11 years.

Q: Do you enjoy being a mask designer?

A: Mask designing is a very satisfying job. I get the same type of satisfaction from mask designing as I do from sewing or art because it is a creative process. It is a very artistic task to arrange all the transistors in the best way possible. A mask even looks like a piece of modern art. It is also satisfying to see the completed project and know that I played a major role in making a product work.

Q: Would you please describe your job?

A: I work primarily on memory chips. I am responsible for the physical design of a chip. I create the masks, or stencils, used to place the metal on a chip, build the transistors, and so on. I receive the schematics—drawings specifying the type and size of transistors needed—from a design engineer. The schematic does not state where to place the transistors. That is my responsibility. Using a computer, I decide where the transistors go, positioning them as close together as possible.

In order to fabricate an integrated circuit, I must follow process-specific rules that define the minimum width, space, and overlap for each mask layer. Each chip contains a great deal of information, so the space on silicon is very valuable. Software programs are available that can read schematics and determine where the transistors should go, but an experienced mask designer can condense the space more efficiently.

Q: When you were young, did you ever think that you would work with computers and electronics?

A: When I was in junior high, computers were tools that only businesses used. They were big and took up an entire room, so I never thought of working with computers, let alone helping to design them. I didn't have an opportunity to work with a computer until I started teaching,

and even then there weren't very many computers around. It wasn't until I came to work at Intel that I started using computers on a daily basis.

Q: What is the most interesting aspect of your job?

A: My job is constantly changing, and there is a lot of variety. After 11 years I still don't know everything there is to know about mask design. I am always learning something new—there are new programs to learn and it is always a challenge to discover a better way to lay out a mask design. This job keeps me on my toes and never lets me get lazy.

Q: What do you like least about your job?

A: Because I work on big group projects, we are always under schedule pressures. Sometimes that means I put in long hours, and I need to find a way to balance all the different aspects of my life.

Q: What did you do to prepare for a job as a mask designer? What did you study in school?

A: I actually received my degree in education. During summer breaks I took classes at the local junior colleges. I started with some math classes and then tried drafting and programming. A mask design course was created, and one of my professors asked me if I would be interested in taking the class. The professor was an Intel employee, and he convinced me to give mask designing a try.

Q: What advice would you give to students to encourage them to become mask designers?

A: Stay in school and go to college. Learn as much as possible and don't be afraid to try new things. This is a point in your life where you can experiment and open up all sorts of possibilities for yourself.

You need to learn how to learn and do it efficiently. Throughout your entire life you will be learning new things, from school classes to changing careers, and the better you can be at learning, the easier it will be for you.

For skills specific to mask designing, it is important to take math classes, but it is also important to have strong verbal and written skills. You also need to learn how to work as a member of a team. In mask designing, you can be an excellent designer, but you also need to be able to communicate well with your teammates. After all, no one can design an entire chip by themselves. □

— Continued from page 1 —

The School

Students at the Yujin Gakuen Japanese Immersion School in Eugene, Oregon, receive instruction in English and Japanese. The school uses a thematic curriculum richly supported with computer technology. Classroom teachers use clusters of computers in their own rooms. In addition, a well-equipped computer lab provides specialized instruction for staff and students.



Kimberley Ketterer, teacher of the third- and fourth-grade students, works toward having every student and every teacher be a comfortable user of computer technology. Although Intel's *The Journey Inside: The Computer* does not target the third- and fourth-grade level, Kimberley wanted her students to share the experience. With careful preplanning and flexible teaching, she took her students through the entire set of lessons.

The Hardware

The hardware used in the recipe was rescued from an untimely end in a garbage bin. In exchange for providing technical network support, I acquired a number of obsolete computer components. In exchange for getting the network up and running, I became the proud owner of a carload of junk—two computers, two keyboards, one old monochrome monitor, various hard drives, and a few boards.

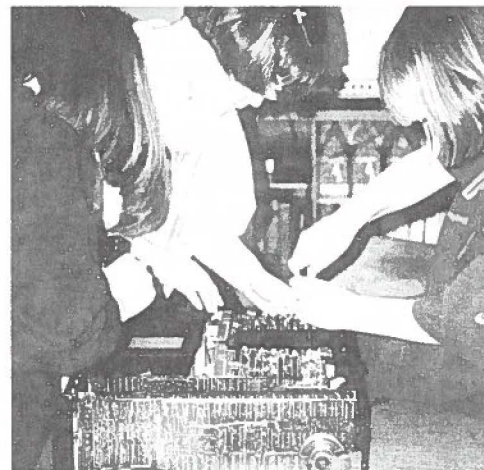
After carrying these items in my car for two weeks, I remembered Kimberley's class. Could she use them? Yes—but only if I was willing to come along and help with the activity. Never one to recognize the value of the word *no*, I agreed.

Doing the Cooking

I arrived at the school as the students in Kimberley's class were finishing their morning assignments. A group of willing assistants lugged

the pieces from my car to the classroom. The components were placed in five separate stations—monitor, keyboard, computer with two floppy drives, computer with one floppy drive and an internal hard drive, and a table covered with miscellaneous items. Kimberley soon had the class organized into several small groups with each group assigned to a station. Standing with our fingers crossed, Kimberley and I directed the students to find the tools they needed to take the items apart.

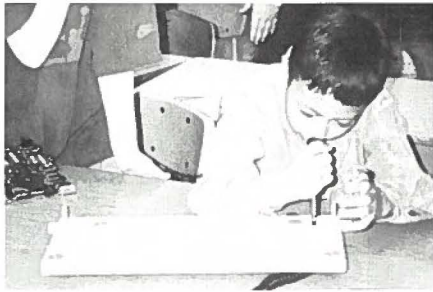
No one needed a second invitation. Soon there were excited conversations taking place in all parts of the room. Which screw was holding that piece in place? Was this screwdriver big enough to remove the screw? Was that the speaker in there? I can't see inside, will you tip it a little more so I can see?



I listened to a conversation between Kimberley and two of the students. They wanted to make sure Kimberley was aware that one of the younger girls was *standing on the table and yelling*. They weren't upset—merely astounded. No one had ever seen this particular girl doing anything like this before. She was always the quiet one in the class, industriously doing whatever task had been assigned. The girl was standing on the table with the computer case between her legs, a screwdriver in each hand, arguing with her classmates about which screw should come out next. Kimberley and I were as amazed as the students

Several boys were fascinated with the keyboard. Although part of their personal goal appeared to be to create as many pieces as possible, I heard their heated discussion about how the keys actually worked. Each boy took a turn explaining their theory to the others and illustrating it with the pieces they had in front of them. They all realized that the mechanical and electrical components worked together to input their data from the

keyboard to the computer itself. Once they had the circuit board uncovered, they came to me with



their questions. Also, they asked permission to remove the keyboard chip so they could see how large it was.



One boy asked several times if he could take some of the pieces home. I hope he doesn't lose his enthusiasm before I can find both an artifact and a specific challenge that he can work on at home. Hopefully, he can learn some new things to share with the rest of his class. And yes, I think this needs to be done soon. Who knows what he might do with the home computer in his quest to see and do more?

Unlike Kimberley, I'm not used to the level of noise, enthusiasm, and action that was going on around me. To provide some "quiet" time, I asked Kimberley to bring the entire group together. A review of terminology led to locating specific parts in the hardware pieces. Students were challenged to think about what they were seeing in relation to what they had learned from *The Journey Inside: The Computer* and other computer experiences. Soon, each group went back to work at a different station. I doubt that the noise level dropped, but at least I felt like I had had a short break and could once again provide assistance when asked.

The last 30 minutes of the available time was used for reports from each group about what the students had seen and learned. Every student had

gained at least one piece of information to share with the others and was able to make a connection



between at least one component from the computer pieces and a concept he or she had previously learned.



Reflections

I'm still not sure what to call the outcome of the cooking class, but one thing is for sure—I can hardly wait to do it again. I'm leaving now to scrounge around for anything else that students can use. Just because the hardware item has been declared inoperable doesn't make it useless. Be brave. Let your students touch, feel, tear apart, destroy, and above all, learn. I survived. You will too. □

Irene E. Smith

IMAX Film via Video

Intel's IMAX film *The Journey Inside: A Learning Adventure in High Technology* is available on video. The video is in VHS format, full color, stereo sound, closed-captioned, and is 40 minutes long.

To order call 1-800-591-5005. Request item number 253561TH—educator price \$10.95, plus postage and handling (local sales tax may apply). *Credit card orders only, please.* Order by phone or mail to Hermann Marketing, Attn: The Journey Inside Merchandise Program, 1220 North Price Road, St. Louis, MO 63132, USA. □

The Lesson Plan

Objectives:

To become familiar, through “hands-on” discovery, with the internal and external parts of the computer.

To develop questions and statements through discovery and “aha” experiences.

Grade Levels:

3–9 (adjust to grade level)

Materials Checklist:

- Computers and computer components that can be taken completely apart
- Tools, including a variety of screwdrivers, pliers, tweezers, and chip pullers
- Note cards

Time Required:

Two one-hour class periods

Prerequisite Student Skills:

Cooperative and collaboration work-group skills

Introductory Vocabulary:

floppy drive	hard drive	resistor
motherboard	battery	daughter board
mouse	CPU	microprocessor
keyboard	circuit board	screwdriver
floppy disk	crystal	transistor
power supply	diode	pliers

Guideline—Adjust the list to the needs of your particular class. If you do this activity after the class has done the entire *The Journey Inside: The Computer* program, the list will be longer than if you use this lesson as an introduction to computer hardware.

Activities and Procedures:

Class Period One

1. Divide the class into groups of 3–4 students.
2. Distribute to each group a part of the computer to disassemble and a collection of necessary tools.

Station One: keyboard

Station Two: monitor

Station Three: computer case containing various boards and components

Station Four: collection of smaller items, such as floppy drives, hard drives, floppy disks, microprocessors from Intel kit, wafers, diodes, or bulbs.

Other Stations: Create additional stations for as much equipment as you have. Have enough stations to keep all students working at once. If you cannot create enough stations, add some *discussion stations*. The student groups can rotate from a hardware station to a discussion station and back. Have students use the discussion stations to share what they have already seen, formulate further questions, and plan their next steps.

Guideline—students must work with the computer part assigned to his or her group and everyone in the group must have an opportunity to handle the tools.

3. Rotate through the stations, helping if needed.

Class Period Two

1. Re-form same groups from last session.
2. Distribute index cards to each group.

Assignment: Come up with a question or statement stemming from your explorations. Be ready to share these discoveries with the class.

3. Allow 15 minutes for question/statement formulation.
4. Bring students together as a class. Have all groups show their computer pieces and talk about their discoveries.
5. Arrange part of the classroom for display of computer parts and cards.
6. Invite other students in the school to observe the class’s discoveries.

Sample Questions/Statements:

1. Floppy Drive Group:

“You can see the read/write head move into position to read the disk.”

“You can see the action of the drive as it moves to hold the floppy disk tight as you are inserting the disk into place.”

2. Motherboard Group:

“Can you find the speaker, power source, and an LED?”

3. Daughter Board Group:

“This daughter board runs the floppy-disk drive.”

“Can you find the way this board actually connects to the motherboard?”

4. Computer Case Group:

“The large board on the bottom of the case holds the microprocessor.”

“The power box contains a fan and a switch. Can you find them?”

“Are there any transistors visible on the board at the bottom of the case?”

5. Hard Drive Group:

“The very tiny black piece on the cover holds the actual read/write head. This drive has three other platters below the visible one. They look like small records or CDs. They are made of aluminum or glass.”

6. Keyboard Group:

“Can you put a key back in place after you remove it?”

“Notice the circuits of wires on the green circuit board that sits under the keys in the keyboard.”

“Did you notice where the special keyboard chip is located?”

Follow-Up Activity:

View the Intel Corporation video *The Journey Inside: A Learning Adventure in High Technology* filmed in IMAX, or complete the lessons from *The Journey Inside: The Computer*. □

Kimberley Ketterer
Irene E. Smith, PhD

Warning: Fragile

There is a silicon wafer in your kit. The wafer's plastic packaging was designed to protect the wafer, but this item is still extremely fragile. If the wafer does break, the pieces will be quite sharp. Please handle the wafer with care.

In addition, the two microprocessors packaged in the small plastic bag are somewhat fragile. To lengthen their life span, try placing the chips in a clear plastic *bug box*. These small boxes are available in science supply catalogs. This will protect the chips and, since the top of the bug box is a small magnifying glass, will provide an even *closer* look at the chips. □

Journey to the Middle of the Hard Drive

We took a hard drive apart. It was like going into another world. On the top of the hard drive was a solid surrounding of metal that we ripped off. The next layer was a copper sheet that was so hard to get off we had to get a pair of pliers to help us rip it off. The third layer was some kind of plate with a green star on it. On the starpoints it had metal wires wrapped around it.



The fourth layer was fun but hard. What we found was really neat! It was like a record player. When we tore the record player off we were amazed. It looked like a silicon CD. It was really a reader and it had an arm that went over the reader. The fifth layer had a lot of screws. It was like a tunnel that we had to dig ourselves out of. We went past metal and copper. We finally got it out and felt triumphant. It was fun. So, when you have an old hard drive, take it apart. You will be glad you did. □

Casy Piquet
Spenser True

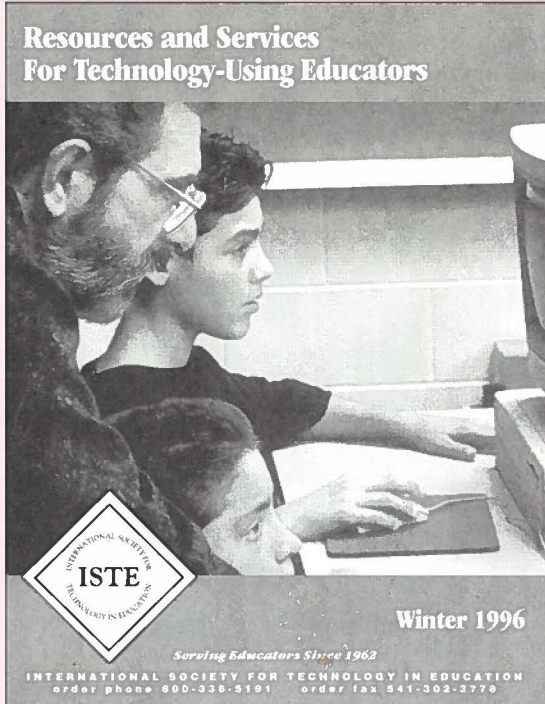
Dominic Tringali

Grade 4, Yujin Gakuen Japanese Immersion School

Comments From Kimberley Ketterer

The written comments by these three boys gives you an insight into their enjoyment of the activity. In addition, I would like to add some comments in support of this kind of activity. Hands-on types of activities like this help my students gain self-confidence with hardware and in using computers. Students show greater interest in hardware and certainly show a tremendous improvement in understanding the process of input to output. The demystification of computers is accelerated, and vocabulary is validated. The contents of the *The Journey Inside* video and activities are tied together, and the concepts become more real to students. Without a doubt, the student conversations that occur in my classroom are more in-depth and reflect an increased level of understanding technology. □

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