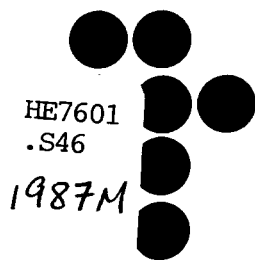# COMMUNICATIONS
FORUM

LEARNING MEDIA AND LEARNING
ENVIRONMENTS:
TECHNOLOGY AND COGNITION

November 12, 1987

Seminar Notes

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Seymour Papert
Media Technology, M.I.T.

Gavriel Salomon
Tel Aviv University;
on leave: University of Arizona

Roy Pea
New York University

Gail Kosloff
Student Rapporteur
MIT

This forum provided three distinguished researchers the opportunity to address several questions concerning learning and technology, including: How the impact of technology on learning and education should be studied? What does the future of educational media hold?

Seymour Papert, author of Mindstorms: Children, computers, and powerful ideas (1980), is a proponent of the Piaget tradition and prefers to focus on the development of practical education tools such as LEGO/Logo which employs plastic LEGO construction toys and the Logo programming language. The focus of his talk was around the question: Does technology do anything (in terms of making a difference in how children learn) or is it really culture that has the impact?

Papert went on to describe the work he and others at MIT have done at the Hennigan School in Boston with children who have been labelled "learning disabled" by the teachers and the school system. In one instance, the MIT team gave a young boy in this situation LEGO/Logo with which to work. According to Papert, the boy made amazing progress to the surprise of the teachers. Papert believes this child was able to "flourish" in the LEGO/Logo environment because he was able to escape from the "vicious circle" of failure. According to Dr. Papert, the child did not perceive LEGO/Logo as school and therefore did not respond to it with his typical responses to school and school-like things. The LEGO/Logo experience provided the child with an opportunity to accomplish something and know, without his teachers telling him so, that he had done well.

Papert views technology positively in the aforementioned case since its presence allowed the child to do something special. He would not question that the child achieved a high level of intellectual output with the LEGO/Logo experience. Yet he does point out that this achievement did not transfer to the child's regular classroom performance. In fact, the child's performance in the classroom got worse. Yet, Papert defends the technology saying that we would all perform the same way if given a taste of intellectual challenge and then thrown back into a Boston city public school second grade classroom.

While Papert sees the benefits of using technology in schools to help children perform better, he acknowledges the dificulty in measuring the true impact of introducing these technologies. He believes there is a need for a larger paradigm to aid in studying what is causing large, rather than small, changes of how technology impacts the way children learn. (Refer to the following article by Papert for more details: "Computer Criticism and Technocentric

Thinking," in the Information Technology and Education Column of Educational Researcher, January-February, 1987).

Papert questions whether this kind of envisionment of the future can be tested at all. In searching for a model he disregards the scientific models (controlled experiments) and states his preference for those models used in literary and social criticism. According to Papert "nothing like a controlled experiment could have explained a Picasso-like phenomena." In his opinion, these types of evaluations can be better dealt with looking at issues of "cultural movements."

Papert presented several examples of the development of cultural movements: He believes cinema did not arise as a combination of a new technology (e.g. a better camera) and an old art form, but as a new cultural movement. In the same vein, he believes the paperback book was really a new cultural movement. Papert views computers as a newer cultural movement not yet developed to their full potential.

According to Papert, the right way to look at the evolution of learning is to see it as an "intellectual movement." He cites examples in our society where certain issues have gained importance in the general culture and have then been reflected in the schools. For example, topics like sex education and new ways to teach genetics have become issues widely discussed in the culture at large and then adopted to be taught in the schools.

Papert also raised the issue of "empowerment" and believes that gaining a sense of empowerment is a value growing in our society. In this sense, people use new technologies, e.g. wordprocessing, because it adds to their sense of empowerment. He believes it is not the internalization of the wordprocessing technology that is important or significant, but the fact that using this technology adds to a person's sense of empowerment. The technology, according to Papert, is significant in that it makes the person feel better about himself.

The second speaker, Roy Pea has conducted a number of controlled experiments in media and learning. In general he believes that school learning relates quite poorly to learning outside this environment. His presentation focused on findings from a study he recently conducted with Elliot Soloway (Yale University) for the U.S. Congress Office of Technology Assessment. This research involved canvassing leading scientists in the field to get a feel for trends in educational media use.

In evaluating projects around the country they found more than print-based media being used, including 3-D graphics, desktop publishing, etc. They identified a trend toward using more integrated media, e.g. "seemless media," and "hypermedia." They also observed group's like MIT's Architecture Machine Group interested in local access to large information archives (optical

data). Finally, they noted the development of more powerful tolls for creating, transforming, and accessing information.

The next step in their study was to relate these media technology trends to project what will happen with technologies in schools. They acknowledged that making predictions is a very difficult task given the fickle nature of the educational marketplace. There is confusion in this environment about appropriate goals for education and questions about how school relates to life outside/beyond school.

Pea went on to discuss the negative and positive signs in the adoption of technology in the school environment. On the negative side he identified the following issues which will continue, in his opinion, to widen the gap between school and society:

- o schools are highly conservative institutions;
- o knowledge is largely treated as static "stuff" to be delivered by media;
- o traditional assessments rarely tap reasoning and understanding (emphasis on rote learning);
- o multimedia education delivery--new dimensions for passive learning;
- o too much emphasis on traditional forms of accountability to justify costs (often achievement scores are used to justify purchase of new media); and
- o measurement mania whereby test scores are transmitted directly to central administration.

In contrast, Pea identified many positive signs that technology is being accepted by those in the educational arena, including:

- o a deep interest in Experiential Learning among educators and the R&D community;
- o greater concern for Situated Learning and Cognitive Practices outside school;
- o a trend towards "teachers as professionals";
- o the use of "Microworlds" may better engage intutition, prior knowledge;
- o more openness to Tool-aided Cognition in school;
- o trends toward students engaged in Collaborative Processes; and
- o projects in Apprenticeship Learning.

Pea voiced agreement with Seymour Papert that we should not hold such a "technocentric" view of technology in education. Pea believes we should include observations of social practices and how these practices might change with the use of new technologies in studying how technology will affect learning and thinking. Pea differs from Papert in that Pea believes cultural changes are amenable to scientific investigation and he believes in a plural approach to investigating the impact of new technologies. In

general, Pea is optimistic about the development of educational
media. Although, he is still uncertain about what will happen once
these technologies are introduced into the schools.

Finally, in regard to Papert's comments on "empowerment," Pea
raised the question of how one distinguishes between being empowered
and being manipulated. Pea believes it would be difficult to find a
school administrator that would say it is bad for students to be
"empowered" since they would likely be perceived as the bad guys.
In his opinion, this concept of empowerment needs a lot more
analysis.
(Refer to Pea's response to Papert's article "Computer Criticism and
Technocentric Thinking," Educational Researcher, January-February,
1987: "The Aims of Software Criticism: Reply to Professor Papert,"
Educational Researcher, 1987.)

The final speaker of the session, Gavriel Salomon, also believes
that it will not be an easy task to predict the future of media use
in the schools. However, he is optimistic that things will move in
this direction.

Salomon raised and addressed the question: Can humans simulate
computer intelligence? He noted that some issues may be left out of
research since they cannot be simulated on computers. For this
reason we should not, underestimate the influence of technical
developments on society, e.g. the clocks impact on the development
of western thought. In Salomon's opinion "sometimes a metaphor
becomes a cognitive tool." Furthermore, he alluded to Vygotsky's
work in making the point that tools used in communications can be
internalized and come to be used as cognitive tools. Lastly, based
on his own research on TV and symbol systems he has found some of
these symbols have been internalized, as if children could perform
"mental zooms" of ins and outs.

Salomon made the distinction between a tool and a machine.
While we can work with a tool, a machine works for us. He notes
that when speaking of computers there are a lot of hybrids.
However, items like STELLA, The Learning Tool (a blank sheet that
allows the learner to create spatial fields of concepts in
"windows") and the word processor are more generally tools or modes
of processing information.

Salomon is concerned that these learning tools should be in the
range of an individual's capabilities. He alluded to Vygotsky in
saying the tool should be in the "zone of proximal development"
such that it is within a child's range of ability if guidance is
provided. In light of a Vygotskian view, intelligent computer tools
can not only simulate human cognition but, given specific
conditions, humans can simulate computer's intelligence.

Salomon also noted that some tools are better candidates for
internalization than others, e.g. it may be easier to internalize an

explicit tool like STELLA than a spreadsheet that accomplishes most of its functions in hiding. Furthermore, according to Salomon, simply being exposed to a tool, except maybe over a lengthy period of time, does not lead to internalization. The individual must be mindful of the tool with which he or she is working.

Furthermore, Salomon described a study he and his colleagues have conducted showing that children are capable of internalizing the metacognitive guidance provided by a semi-intelligent Reading Aid. The study also revealed that children are capable of internalizing the tools "intelligence." This was manifested in improved reading comprehension, as well as improved essay writing.

In closing, he felt it was appropriate to raise some ethical questions such as--Are we going too far in imposing some kinds of logic on children that is not theirs? Are we imposing a way of thinking on children that is not natural? Salomon's belief is that using computers to perform a function we performed without them earlier (e.g. use of pencil and paper for writing) does not make it wrong. He believes that the distinction between the artifical and the natural is becoming more narrow.

Lastly, Salomon believes that people do argue with the issue of "empowerment." He sees a potential conflict arising in our schools, with the introduction of new technology for learning, since our culture believes in controlling children. He observed that PC (personal computer) tools, for example, may be confiscating power away from the teachers and, in fact, giving it to the students.

(For more details regarding the details of Salomon's talk refer to his paper entitled: "AI IN REVERSE: COMPUTER TOOLS THAT TURN COGNITIVE," Journal of Educational Computing Research, April 1988.)