Creating Rich Learning Environment with Computer Technology:

The Learning Model of "IDEA Center"

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The rapid changes our society is experiencing at the close of the 20th century ought to be reflected in our vision of education in the fast growing "knowledge society".

It is not easy to outline this vision: the number of relevant factors is so large, that it is impossible to consider all of them at once. One has to select a standpoint from which to embark on the task.

We in "IDEA Center" choose as our primary standpoint to raise the question of what are the needs of a young graduate, leaving school and going out into the world of tomorrow. A glance through any newspaper in any of the industrialized countries reveals what is expected of the educated young adult in most areas of employment. Most frequently, a person is expected *to be able to learn new subjects*, or *acquire new skills;* to be *familiar with some uses of* a *computer* along with a software or two; to be prepared for some *flexibility* in his or her professional job definition. In short, we expect the graduate of the near future to be a *skilled and willing learner* and, what is more important: a *self-regulated learner*.

Much emphasis has been put lately on the importance of *creative thinking*, perhaps the most advanced form of using that fabulous product of evolution, the human mind. Indeed, it is hard to imagine an independent, self-regulated learner, who has no ability for at least some extent of creative thinking. The reader may have noted that creative thinking is also a desirable qualification in many job definitions and it is an absolute necessity in all hi-tech professions. Add to this the fact that most workplaces expect their employees to *work in teams*, and you define another important qualification: the ability to *work in a team* and *learn with and from team members.* This involves of course being prepared for life long learning.

These are, in a nutshell, the qualifications of a member of an emerging knowledge society. And these are the needs that our system has to answer for, in educating the citizens of tomorrow.

The question is, does the educational system respond to the needs of this new type of society? Today's school surely needs to do more towards answering the needs of a young graduate in a developing knowledge society. Schools should begin to emphasize independent thinking, take into account the diversity of thinking modes, or learning styles; and encourage the learners to assume responsibility for their own learning. As long as learners are expected to go through predetermined steps, and arrive at predetermined end points, creative thinking has small chance of developing.

In recent years, we are pleased to note that computers are swiftly becoming a part of the learning environment; unfortunately it seems that all other aspects of the educational systems do not seem to renew themselves accordingly. As long as the traditional conception of teaching and learning persists, we cannot expect technology to bring about the needed transformation in education. Computers and technology can support change, but they cannot launch it.

These ideas and insights guide us at the "IDEA Center" in developing our technology rich learning model.

The underlying theoretical foundation of the model is that of the constructionist theory of learning. The basic principles derived from this theory apply to all areas of learning, and are not restricted to any specific discipline. Accordingly, the IDEA Model can be applied to any field of learning. However, the actual implementation is always content-dependent.

Figure 1. shows the basic structure of the model. There are two principal phases in the model: the ***exposure*** phase and the ***construction*** phase. These differ from each other mainly by the extent of the teacher's involvement and initiative in the learning activities.

Figure 1: The Learning Model of "IDEA Center"

In the exposure phase the teacher is the initiator, the person who outlines the goals, the contents, and the purposes of the various activities. At this stage, learners have a wide range of activities and interest to choose from, but the initiative lies mostly with the teacher.

At the construction phase, when teams of learners have decided upon their guiding themes, they are the initiators of learning activities. The teacher acts at this phase as a guide and a mentor, helps learners to define their needs and their goals, and helps them to monitor their learning and understanding. However, the responsibility for taking the initiative lies with the students.

In the exposure stage the teacher initiates sessions for peer learning, which later on become part of the routine: learners discover that they can be helped by peers, both in learning to use the technology, in obtaining materials and in exchanging ideas, solutions to problems, etc. An important asset of the self-regulated learner is the ability to improve his learning through *reflection*. Throughout the learning period, each student participates in reflective sessions. Students reflect on the various ways of thinking and learning they experience. With time they develop awareness to their modes of learning.

Computer technology is a central component of the learning model. But its role is defined by the educational outlook, not by the tributes of the technology. Only after having defined our educational outlook, can we introduce computers to the classroom and launch actual change in teaching and learning strategies. For example, we consider it of importance that our learner should be made aware of a variety of thinking modes, and that he should be able to employ various media for his learning processes. Having claimed that, we may use computers very efficiently to expose our learner to such a variety and assist him in experiencing various ways of learning.

Construction is also a major principle of our model. Learning in all of our environments is centered round the construction of some concrete product, which should be meaningful and relevant to the learner. In most instances the product is either a multimedia presentation or a computerized mechanical model. In some cases the product is a site on the WWW. Where computers are not available (it may still be the case in schools in Israel) the product may not computerized; but it is invariably a physical external product, that is constructed by teamwork, has obvious relevance and significance to its makers, and can be shared with peers.

On the basis of this general learning model we design learning environments where learners are encouraged to develop awareness to their own thinking modes, and learning styles and to assume responsibility for their learning activities. Our environments are open, dynamic and capable of change and they can be adapted to the use of new technologies as these turn up.

We wish to describe briefly two learning environments based on the "IDEA Center" learning model that have been developed and implemented at the "IDEA Center": **"Media+"** and **"Techno-Logic"**.

"**Media+"** (Krumholtz, N. & Markuze-Haas, A., 1998), was designed as a holistic learning environment, not restricted to any specific discipline. We outline here some of its main features:

1. Learning is centered about the construction of a computerized multimedia presentation. Learning occurs before, during and after the construction of the product. The presentation is therefore not a summary, or a final project, but a learning product that is integrated in the learning process.

2. Learners choose a central guiding theme for their independent study within a given domain of knowledge.

3. Learners make their own decisions and choices when constructing the presentation, so that it reflects the insights and knowledge gained by them throughout the learning proces.

4. Learners achieve mastery of the multimedia tools as theproceed with their design and construction of their presentation. There is *no learning of software* tools *per se.*

5. Every activity of the students counts as learning: asking preliminary questions, forming a guiding theme, designing the presentation, participating in feedback sessions, as well as gathering, sorting and arranging relevant information, and various other activities.

6. Learners participate as equals with teachers in evaluating all facets of their learning. These include all activities related to construction and learning, participation in peer learning and team work - in short, anything and everything a learner does, that he wishes to evaluate. The evaluation is based on goals that the learners define together with the teacher.

7. Learners are encouraged to work in teams, to exchange interesting findings, to share ideas, and to discuss problems and possible solutions.

8. Teachers assume the role of mentors that guide and assist, and are taught to encourage their students to share responsibility for their learning.

"Techno-Logic" is a micro-world developed to facilitate the learning of both scientific concepts and their technological applications (Krumholtz N., 1998). It integrates creative construction of concrete machines and models with an introduction to computerized process control. In the **"Techno-Logic"** learning environment students invent, design and construct a product that has to perform some function, and provide an answer to some need in everyday life. Through the activities learners gain practical experience in planning, constructing and operating physical models that are computer controlled. The product is a mechanical model made of building blocks including motors, lights and sensors (i.e., LEGO-Technic, Fisher-Technic, K'nex, LASY or any other building blocks). After completing the machine model, the learner writes a program, using ***TechnoLogica*** control software (TechnoLogica Software, 1995), which controls the actions of the machine so that it can carry out its designed function. Finally, the students point out possible future developments that may improve the function of the present machine, or may be needed to answer new needs.

Students embark on learning, by dealing at first with questions concerning the meaning and role of technology in society. They consider concepts such as "needs" "function" "planning" "feasibility", etc. and decide for what need they wish to provide a technological solution. In this way, he or she learns, not only abstract scientific and technological principles, but scientific and technological processes as well. Through the suggested constructivist learning the student not only learns about science, but also practices science. The learner seeks solutions, asks questions, extrapolates, raises hypotheses, plans ways to verify them, and evaluates the results. In this environment most of the learning is in the domains of technology and physical science, but it also touches social issues. With appropriate guidance and direction, the Techno-Logic environment enables the learners to build their knowledge through varied, rich experience.

For a more detailed account of the learning environments the reader is referred to:

1. Krumholtz, N. & Markuze-Haas, A.: "Media+ - A Multimedia Environment for Constructivist Learning". *In: Proceedings book of the World Conference on Educational Multimedia and Hypermedia and World Conference on Educational Telecommunications (ED-MEDIA/ED-TELECOM 97),* Calgary, Alberta, Canada, June 1997.

2. Krumholtz, . N. & Markuze-Haas, A.: "Media+" - Constructionist Learning of Science". *In: Proceedings book of the 14th Int. Conference on Technology and Education (ICTE 97),* Oslo, Norway, August 1997.

3. Krumholtz, N & Abrahami, J.: "Media+Families" - Fun and Learning with Multimedia". *In: Proceedings book of the 14th Int. Conference on Technology and Education (ICTE 97)*, Oslo, Norway, August 1997.

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5. Krumholtz, N.: "LEGO-Logic: A Computer Learning Environment for Technology Education*". In: Proceedings book of the 8th Int. Conference on Society for Information Technology and Teacher Education (SITE 97),* Orlando, California, USA, April 1997.

6. Krumholtz, N.: "LEGO-Logic: A Computer Learning Environment for Technology Education". *In: Proceedings book of the World Conference on Educational Multimedia and Hypermedia and World Conference on Educational Telecommunications (ED-MEDIA / ED-TELECOM 97),* Calgary, Alberta, Canada, June 1997.

7. Krumholtz, N.: "LEGO-Logic: A Science and Technology Micro-World*". In: Proceedings book of the 14th Int. Conference on Technology and Education (ICTE 97),* Oslo, Norway, August 1997.

8. Krumholtz, N.: Techno-Logic: A Micro-World for Constructivist Science and Technology Learning. *In: Proceedings of the 6th Int. Conference on Computers in Education (ICCE98),* Beijing, China, October 1998.

9. Krumholtz, N.: "Simulating Technology Processes to Foster Learning*". The Journal of Technology Studies,* vol. XXIV, Nov. 1, Winter/Spring 1998.

10. TechnoLogica Software (1995). Phantom II production Ltd. Israel. Software available on the World Wide Web. (http://www.phantom2.com).
