A Principal Cognitive Precondition of Successful Child-Computer Interactions in the Information Society

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Abstract
A hypothesis about what is the principal cognitive precondition of successful systematic acquainting children with computers is put forward. For this, the notion of the Thought-Producing Self of the child is introduced. It is stated that the System of Emotional-Imaginative Teaching (EIT-system) based on the Theory of Dynamic Conceptual Mappings allows for realizing the Thought-Producing Self of each normal child between the ages of seven and nine. The EIT-system has been successfully implemented in Moscow at lessons of foreign languages (English and German for Russian children), literature and poetry in three languages: Russian, English, and German, communication culture, and the symbolic language of painting. The elaborated and well-tested syllabus covers eleven years of the continuing lessons of the kind. The total number of students taught in accordance with the EIT-system exceeds three hundred fifty, the age varies from four-and-half to nineteen. It is stated that the EIT-system also allows for introducing young children at the age of five and more into the complicated world of social relations (on the example of fairy-tales) in order to make easier their social adaptation. The idea of constructing new computer games (developing in young children the love to nature) is set forth.

Keywords
Thought-producing self of the child, Creativity, Social adaptation, System of emotional-imaginative teaching, Computer games

Introduction
Psychologists often ask children to draw a man. In most cases, children do it perfectly. But Leonardo da Vinci, a famous painter and scientist lived in the epoch of Renaissance, said that "a good painter is to paint two main things, namely, man and the working of man's mind; the first is easy, the second is difficult". While drawing, children don't think about the working of man's mind. The question is whether they should do it consciously. Young children often say: my legs are tired, my hands are tired, my eyes are sleepy, my hair is naughty, but they say nothing about their heads.

While studying painting, especially portrait painting, I ask children to tell me what it means: "the working of man's mind". And only after some hesitation and hints they come to the conclusion that it is thinking. Another question is what thinking is. Children immediately recall Pinocchio: when he started walking and talking, he was sure that he was a real boy, but the Blue Fairy said that he should know how to choose between the right and the wrong, and he had to think about and to answer the question: what was right and what was wrong. So Pinocchio started thinking consciously. So did my students.

One of the principal ideas considered below is that the systematic development of children's reasoning abilities, teaching children to appreciate the working of their own brains has much in common with successful (in the long-run perspective) acquainting children with computers. A hypothesis about what is the principal cognitive precondition for acquainting children with computers is put forward. For this, the notion of "Thought-Producing Self" of the child is introduced. It is stated that the System of Emotional-Imaginative Teaching based on the Theory of Dynamic Conceptual Mappings allows for realizing the Thought-Producing Self of each normal child between the ages of seven and nine.

This article is an extension and modification of the paper (Fomichova, 2000) presented at the First International Workshop "Developing Creativity and Large Mental Outlook in the Computer Age" (The University of Bergen, Norway, 14 - 18 August 2000).
A New Self-Concept and Child's Interaction with Computer

The development of the new information society raises a number of fundamental problems. One of them is to formulate and create optimal cognitive preconditions for successful children-computers interaction. This is a fundamental cognitive problem. The reason is the profound impact that the intrusion of intelligent computer and communications technology (ICCT) has had upon the education system, pupil cognition and the family as reflected in our language.

Indeed, a new word has emerged: "screenager" instead of "teenager". It is not simply just one additional word, it is the indicator of a new situation in the social structure of the family. Fifteen years ago a typical nuclear family consisted of a father, mother, and children. Now many children in economically well-developed countries spend so many hours alone in front of the computer screen that, in fact, we have a new non-nuclear family system: a father - mother and child/children - computer[s].

But the intrusion of computers may be regarded as a positive factor if, realising the extent of this intrusion as even reflected in the language, the experts responsible for the training of teachers can incorporate ICCT into the teacher training curriculum. The revision of the curriculum must reflect an understanding of the potential role of ICCT as opposed to the current system of education imbedded in the culture of a pre-ICCT age in both pre-school and school provision. Changing the system depends upon analysis of its problems, drawbacks and weak points.

In recent years, the problem of discovering and creating optimal cognitive preconditions that enable children to successfully interact with computers has acquired a high social and political significance. This is due to government policy in several economically well-developed countries (e.g., in Japan and U.S.A.) to acquaint primary school students with computers. They even recommend the use of complementary interactive Internet-based learning tools in the classrooms with children as young as 5-6. This paper presents a new constructive look at this problem, extending the ideas set forth earlier in (Fomichova & Fomichov, 1999a). For this, the concept of ‘Thought-Producing Self’ is introduced and analysed.

Psychologists define a number of Selves, such as Ecological Self (it emerges as a result of interactions with the environment), Interpersonal Self (the self defines itself as a social being through social interactions), Self-Narrative (around the third year children become interested in the past and in the future and begin to acquire the memory skills on which narrative depends) and the Emotional Self (Snodgrass & Thompson, 1997).

But it appears that this definition does not include one of the most important Selves, the ‘Thought-Producing Self.’ The importance of it is now clear at the beginning of the XXI century - a century of the new information society, of screenagers, and of computers as integral members of the domestic family. The ‘Thought-Producing Self’ defines itself in the mirror of our appreciating ourselves. The child has to understand that his/her brain produces socially important thoughts and rationalisations. This moment is the beginning of defining himself/herself as a personality who is able to think, thinking that causes appreciation and praise. The child has to know that the work of his/her mind, thinking, is appreciated, acknowledged and respected.

It should be stressed that the Thought-Producing Self’ is defined here not as the ability of the child to understand that he/she can think. By definition, ‘Thought-Producing Self’ is realized in the child only if he/she is able to generate ideas that have a relatively high social significance. As such, they are greatly appreciated by other persons (usually, adults), because the ideas are, for example, nice, bright metaphoric descriptions of some situations or pictures or because they help to solve some practical problem. In all cases, the action of producing thoughts receives a positive response. This stimulates the child to continue to think in this way.

The intensive use of computers by the child before the realization of his/her thought-producing self may prevent the child from being able to develop as a creatively thinking personality. The unrestricted use of the computer in information processing can retard and restrain the child’s cognitive development, for example, as in the use of calculators in mathematics. That is why we put forward the hypothesis that realizing the ‘Thought-Producing Self’ of the child is the principal cognitive precondition for the successful, systematic involvement of the child with the computer.

Computers are a key element in the new information society. In order for computers to promote and not retard cognitive development, it is necessary to help the child to become a creatively thinking personality. Inventions like the bicycle, car, airplane are a natural extension of existing forms of transport. However, before each of us could benefit from these inventions, we had to master the previous mode of travel: feet. Similarly, with the
invention of the computer, before we use them we need to learn how to be autonomous, creative thinkers, i.e. how to use effectively one's own brain in terms of language, number, information processing, problem-solving and creative thinking.

Modern primary schools in many countries only engage pupils in relatively low-level intellectual activity. Often, they fail to realize the ‘Thought-Producing self’ of the young child. So the goal of constructing a new information society implies the following fundamental cognitive problem: what methods of teaching and upbringing can realise the ‘Thought-Producing Self’ of every normal child by the age of nine, the approximate age when different societies begin to systematically introduce ICCT in the educational system?

Central Ideas of Early Realizing the Thought-Producing Self of Each Normal Child

The essence of the scheme suggested by me and V.A.Fomichev was to enable children from the age of five to feel the joy of creative work and intellectual activity, to take delight in the beauty of a thought, to experience the birth of their own thoughts and the awareness of the idea that they themselves can generate their own new thoughts. These intelligent and lively ideas would be unlike those of both their teacher and other pupils. The consequence was that the children would appreciate the quality and strength of their own intellects.

When a young child has experienced these sensations, he/she makes rapid strides in cognitive development. This moment may be compared with the moments when a young tiger for the first time has experienced the strength of his/her muscles, and a young swan has understood the destination of his/her wings: the child will long for experiencing these feelings again and again. Then the child will come later to the computer as a shaped creative personality; he/she will consider computers only as useful assistants and will use their immense possibilities for enhancing this delight in creative activity. But he/she will never be satisfied by simple following what the computer offers.

We discovered that each normal child from five can have an education that enables the child to experience and realise its creative personality. It is through intense language activity that each child can acquire an excellent command of natural language (NL), at least of mother tongue (MT)). Our programme revealed that each normal young child can be taught "to paint with words". In particular, they internalised such forms of language activity as understanding poetical metaphors, describing landscapes, seascapes, and pictures of the nature around, inventing metaphors while describing the natural world, understanding the meanings of pictures, composing poems. All these helped realise the ‘Thought-Producing Self’.

Let's consider only two examples of metaphors composed by young students. Trying to make the partners of communication interested in the talk and to express their feelings and emotions clearly, children use their life experience. In particular, the idea of being drowsy at bedtime was expressed by one of young pupils in the following way: "The big yellow moon seen in the space that's made by curtains left undrawn resembled a stray red cat. It was stealing at dusk, creeping into my Nursery, searching for the saucer of milk".

Another example is connected with their life experience in the summer time. While trying to explain her emotions evoked by the hot day, one of young students said: "The weather was hot, and white clouds were floating in the blue sky. It seemed to me that the weather was so hot that white clouds like ice-cream were melting".

Three principal ideas underlie this way of developing children's creativity and cognitive skills, of realizing the ‘Thought-Producing Self’ of each normal child:

1. A common, symbolic information processing approach to teaching young children (aged five or older) and teenagers how to understand NL texts, poetical metaphors, and the language of painting. Children are taught that the words of NL, MT or a foreign language (FL), poetical metaphors, and pictures are symbolic expressions, and the task is to decode them in order to penetrate the ideas and feelings encoded in them by their authors.
2. Children are explicitly taught that NL is a means of representing and conveying information, and they are explicitly and systematically taught to fulfill various operations of conceptual processing NL texts.
3. The principal precondition of children’s knowledge acquisition is the creation by a teacher of an appropriate cognitive-emotional context for effective “inscribing” that piece of knowledge into the conceptual systems of the child.
It means much more than simply maintaining a friendly, warm positive atmosphere in lessons. The preliminary explanations, questions, examples given by a teacher must contribute to the pupils conceptual processing and understanding of the material and related tasks in the context of some required cognitive-emotional space (Fomichova & Fomichov, 1999a, 1999b).

These general ideas of supporting and developing children’s creativity and symbolic information processing skills are provided and concretized by the Theory of Dynamic Conceptual Mappings (DCM-theory) and System of Emotional-Imaginative Teaching (EIT-system), represented in over thirty publications in English (see, e.g., Fomichov, 2000; Fomichov & Fomichova, 1997 - 1998b; Fomichova and Fomichov, 1999a, 1999b). The central component of the DCM-theory is an original conception of the early positive development of children’s reasoning abilities, imagination, and mental outlook. The EIT-system effectively develops children’s intelligence at lessons of mother tongue, foreign languages (English and German), literature, poetry, and art.

The methods forming the EIT-system have been successfully used during 11 years in teaching English and German as foreign languages, literature, poetry, communication culture, the theory of painting. The total number of students exceeds 360, the age varies from 4 to 19. The elaborated rich teaching materials (covering 11 years of continuing lessons) may be directly used in English-speaking countries for developing children’s intelligence in lessons taught in the mother tongue.

It should be stressed that 7-8-year-old Russian students (3rd year of studies in experimental groups) are able to read fluently and to discuss in FL (English) unadapted “Alice’s Adventures in Wonder Land” by Lewis Carroll and to describe spontaneously landscapes in a FL. It results in a much higher level of FL competence than that achieved through modern text-books for children under ten; e.g., the popular textbook (Scott & Ytreberg, 1994). This shows that the recommended method for developing children’s thinking is highly effective. EIT-methods allow for the ‘Thought-Producing Self’ of each normal child to develop between seven and nine where the starting age of extra-scholastic studies is five or four-and-half.

The principal reason for the programme’s success is the connection between Artificial Intelligence theories of language processing and development and Education. In addition, some ideas were drawn from the philosophy of language, semiotics, the “soft stream” in modern cybernetics, cognitive linguistics, and cognitive psychology [semantics of emotions] (Fomichov, 2000; Fomichov & Fomichova, 1997, 1998a -1998b).

**Importance of the new approach for making easier social adaptation of the child**

Our goal is to help children to become successful members of the new information society. That is why we have to keep in mind the ideas set forth by J.Searle (Searle, 1995) concerning the construction of social reality. He said that social reality is based on a complicated system of symbols, that is conventions, various agreements accepted by the society. Natural Language (NL) is a particular tool that helps to create these agreements, on one hand, and helps to explain them to children while teaching children how to behave in the human society and not to destroy the anticipations of people being partners of communication (in order to escape misunderstanding).

One of additional precious features of the elaborated method of realizing the Thought-Producing Self (TPS) of the child is early introducing children to the complicated world of social agreements.

For instance, while discussing a well-known fairy tale about Sleeping Beauty, it is possible to stress that the King, who was responsible for the Christening Party, was not sure whether all fairies had received his invitations and had accepted them. The oldest fairy was not found, and she might have been insulted that she hadn't been invited.

Another example can be taken from the American fairy tale about the Little Angel with Silver Hair who had to work hard especially at Christmas time to make people on Earth happy. But she didn’t do it and was sent down to the Earth to have a look and realize that people needed her help, especially at Christmas time. So she broke the conventions existing in her society and was taught a lesson.

The third example of this section emerged as a result of discussing with children "The Alice's Adventures in Wonder Land" by Lewis Carroll. Children are easily involved into the relationships between Alice and a mouse. When Alice was swimming in the pool of tears being greatly upset and distressed, feeling herself lonely, and speaking to a mouse splashing in the same pool, she mentioned her cat Dina, who was the capital one for
catching mice. The mouse was offended, even insulted, bristled all over, and quivered all over with fright. That made Alice understood that she had hurt the poor animal's feelings.

 Practically, Alice and Mouse are the representatives of different communities: they have different cultures, different conceptual pictures of the world. There is also a great number of other examples of the kind.

 The social reality that we are having now, on one hand, is as follows: the human society is transforming in the informational society. This new society can be characterized, in particular, by the following features: (a) strong flood of information, (b) emergence of virtual reality, (c) the possibility of using computers for processing the information and helping to take a decision or just finding a hint to a decision.

 One of the principal peculiarities of communication in the new information society is also the intense, every-day interaction between people belonging to different cultures. This interaction is realized, first of all, by means of e-mail and the World Wide Web (WWW). That is why children are to be taught what to say, how to express their ideas, keeping in mind the peculiarities of thinking and different conceptual pictures of the world of the communication partners belonging to different cultures. Otherwise it may lead to misunderstanding.

 On the other hand, interaction, communication, collaboration between people is still defined by the complicated conventions accepted by the society and created with the help of natural language (NL). That it is why it appears to be very important to start acquainting children with this role of NL rather early, at the age of five - six, when the consciousness of the child is ready to absorb a lot of new knowledge. My eleven-year experience of personal teaching young children at that age convincingly shows that the elaborated method of realizing the TPS of the child provides broad new possibilities for making easier social adaptation of the child in the world.

 Analyzing the books while reading them to our children or together with them, we can form one of the cognitive-emotional subspaces of the child's conceptual picture of the world. This subspace is responsible for understanding the existence of different ways of behavior in one and the same situation, depending on the difference between social and cultural realities in which people are brought up.

 This cognitive-emotional subspace will help children to be ready to look for the information of the kind, to process it, to behave in the right way, and to better understand people belonging to different cultures. This idea well correlates with the idea of Dr. Federico Mayor, former Director-General of UNESCO, about a Culture of Peace (Mayor, 1995).

 **Computer games for creating cognitive preconditions of sustainable development**

 One of the discoveries made by the Theory of Dynamic Conceptual Mappings (the DCM-theory) is a great role of the impressions from the pictures of the nature and of expressing these impressions in the development, the ripening of the young child's consciousness (Fomichov & Fomichova, 1997, 1998a). It appears that it is possible and expedient to construct the computer games of a new class: those supporting and developing in children the love to the nature, the understanding of the nature, the desire to communicate with the nature.

 Very often, the first acquaintance of the child with computer is caused by a new computer game for young children or by an educational program helping children to learn letters, rules of reading, etc. If a child is carried away with a new game and a new toy (because she/he regards computer as a toy) then she/he spends much of his/her time playing. As a result, she/he gets accustomed to quick decisions: computer stimulates immediate reaction to the circumstances; computer games don't mean pondering, on the contrary, they mean action, choice, reaction, speed.

 The globalization of the world starts with the lack of knowledge about the smallest representatives of flora and fauna, with the lack of emotions caused by their representatives. Knowing a lot about the world in general, we shouldn't forget about the so-called "trifles" as the elements of the world.

 Following the logic offered by computer, children start loosing their interest towards pondering, they stop noticing graceful butterflies, fragrant tiny field flowers. The whispering sea sharing its secrets with children and babbling rills don't attract their attention, though they need it for their successful upbringing and even for their living. They can't do without environment. And environment should be manifested in particular things so dear and clear to people since their childhood. Otherwise they'll easily sacrifice the woods and the water, the air and
the mountains for an imaginary or virtual project or progress or just for "the good of the nation" and destroy the harmony of the world or even universe.

Such kind of estrangement from the reality will mislead people to a wrong understanding or exaggerating their rights while taking a decision concerning the environment.

To prevent people from such kind of estrangement, the computer games for young children (under twelve) should stimulate acquiring knowledge about so called "trifles" such as forget-me-nots, sea-shells, pebbles, drops of dew, chipmunks, etc. I mean the tiniest things requiring some efforts on the part of kids to be noticed and studied. The games may not only provide some information about them, show the picture of them and even make it possible to listen to the sound, but make children go out and touch them, and smell them in order (for example) to identify or define these characteristics of the alive thing, taking them into account while solving this or that puzzle provided by computer.

And then another step should be stimulated and so on. In this case computer will help to acquire knowledge but not substitute the reality. Children won't loose "trifles", and they will understand the global things. They'll realize themselves as a part of the environment, nature, and in this case computer technologies will help them to penetrate the essence of things much deeper.

The final aspect of the considered problem "Child and Computer" is as follows. Young children are fond of painting. Nowadays they start painting with the help of a computer more often than with the help of a pencil. A well-known French painter Corot said that a landscape is a portrait of the soul of a painter. It means that landscapes as well as seascapes are very important. In order to draw, the child should be inspired by a beauty. I am afraid whether a child can be inspired by a computer picture better than by alive nature. Drawing without inspiration is the same as eating food without taste and delicious smells.

Computer in all its manifestations should enlarge and improve and make better our life but shouldn't diminish the opportunities, spoil the life and make the consequences worse.

Conclusions

Some time ago I asked a group of teenagers to explain the difference between stars and fireworks. The idea was adapted from Oscar Wilde. In his story "The Remarkable Rocket" the King noted, looking at the fireworks, that he preferred fireworks to stars. The students said: "Stars are part of our life. And fireworks are part of pleasure. Stars are eternal, fireworks - fleeting. Stars are alive, fireworks - hand-made. Stars bother us like thoughts in our heads. But we need fireworks as well as stars, because fireworks were created by a person inspired by stars".

If teenagers feel the difference between stars and fireworks, they should feel the difference between the brain and the computer. I suppose that a computer, as a hand-made "brain", should be regarded by teenagers as a necessary tool helping them to receive required information, to get in touch with other people, to take a decision, to process the information. However, the work of teenagers' own brains, their creative and information processing abilities should be respected, realized consciously and appreciated as well.

In this paper the hypothesis is put forward that the realization of the ‘Thought-Producing Self’ of the child is the principal cognitive precondition of successful acquainting the young child with computers. If this precondition is satisfied, systematic interaction with computer will not prevent the child from realizing his/her potential of creative thinking. It appears that this hypothesis needs to be widely discussed by computer scientists, cognitive scientists, and teachers due to its great importance for new information society.

My eleven-year-long large-scale study provides weighty grounds to believe that the system of emotional-imaginative teaching (EIT-system) allows for realizing the ‘Thought-Producing Self’ of each average child by the age of seven-nine. This has been achieved at lessons of foreign languages (English and German), literature, poetry and art - the areas of studies generally accepted as central to young children’s humanitarian development.

The EIT-system was developed mainly in the English language context. This system realized a new approach to developing children's symbolic information processing skills (first of all, natural language processing skills) and creativity. That is why it may be conjectured that the methods described above can substantially contribute to the progress in pre-university education in many countries.
The idea of constructing computer games of a new class was set forth. Such new games are to develop in children the love to the nature, the understanding of the nature, the desire to communicate with the nature. If computers won't stimulate children's interest towards real life, then in future they'll cry about the "death" of a computer but will be indifferent to the real death of the nature. Hence the elaboration of such computer games should contribute to the creation of cognitive preconditions of sustainable development. Otherwise our generation should be blamed for the lack of responsibility and the lack of anticipation. Being carried away with new technical possibilities, we should be careful not to destroy the creativity of the young generation and not to destroy the inheritance of the previous generations.

References


