

Inventing A New Way of Learning ³/₄ Constructive Fundamentals of a Multimedia Teaching Methodology

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A Couple of Questions as We Begin

Is inventing a new way of learning even possible? Isn't learning a natural process, in which a person uses his or her own experience and practical knowledge to change their attitude, knowledge and behavior? If this is true, how can you describe and control this learning process? How can you strengthen and encourage the learning process or hinder and suppress it? How can learning be optimized? How can you learn to learn? And how can the researcher and the teacher positively influence the student in the learning process?

In order to shed light on these questions, we must ask ourselves what, according to the latest scientific research, occurs during the learning process. Only then can we understand how this process can be advanced.

The Traditional Teaching Environment

What does a traditional teaching environment look like? The teacher, normally a specialist in his area of knowledge, wishes to convey his knowledge to the students. He knows what the students should learn and what they should know. Normally he assumes that there is an optimal way to achieve the learning goal and tries to present his material so that this learning objective can be achieved by the students as quickly as possible. In order to do this, he analyzes the material to be taught and breaks it down into small, tangible units that he gradually dishes out to the students. In so doing, he always proceeds from the easiest to the hardest. These morsels of information that he prepares are those that he conceptualizes; in other words, he assembles the teaching material that, in his mind, appears to be appropriate to convey the information. In the lesson he tries

to present this material clearly to his students. He tries to fulfill the expectations of the average student, as he seldom can focus on each individual in the class. Learning is reinforced by means of repetition. In this way, the teacher is, to a great extent, active and holding the reins. He expects the students to follow him.

The student reacts to the various actions of the teacher and tries to follow the teacher's methods, to perform them and to understand him. In this way, the student tries to acquire the knowledge of the teacher. He tries to find out what the teacher expects of him and what knowledge he, as the student, should remember. He tries to acquire this knowledge in the form of rules (algorithms).

New Technology $\frac{3}{4}$ a Higher Quality?

For the last few years, teachers, mostly those employed in the industrial training and development areas, have had a new and effective helptool on their side - the computer, or, more specifically: multimedia technology. This helptool offers the teacher a number of advantages in presenting learning material in a more flexible and effective way:

- The computer can manage and offer an enormous amount of information.
- The learner can decide for himself when he wants to learn.
- The learner can decide how much he wants to learn at one time.
- The learner can set his own speed of learning (tempo).
- The learner can decide how often he wants to repeat material or certain parts of the material.
- The various methods of presenting the material (plain text, sound, picture, animation, film) have been shown to enhance the student's capacity to retain information.
- The computer presents itself as a most patient and, simultaneously, a most relentless teacher.

In short: learning, above all, self-driven learning, shows an improvement in quality through the use of multimedia.

Inherent Problems

The following problems in teaching, with or without the new media, are well known:

- The amount of information overwhelms the learner. Complex subject areas seem especially inaccessible to the beginner.
- In spite of all the efforts by the teacher or the computer program, much is incorrectly or only partially learned.
- Knowledge gained is easily forgotten again.
- Knowledge gained does exist, in principle, but can not be recalled in certain instances or used properly in the appropriate situation. This type of knowledge is called "inactive knowledge."
- Knowledge gained can indeed be activated in the learning situation, but is not usable in other situations. The knowledge cannot be communicated. The ability to transfer information is lacking.

If used in the same manner as the teaching methods described above, the computer does not really help solve these typical problems. Multimedia is not a cure-all and not a solution, just a tool whose usefulness depends how it is used and on the user himself.

Theories of the Nürnberg Funnel Teaching Methods

In my opinion, the following theories are responsible for the problems described above:

- Learning material is fundamentally communicable.

- The instructors/experts know what the student should know in the future and therefore should learn. He knows what the student needs.
- The teacher more or less knows the learning process of the students and can direct it.
- An optimal method of conveying learning material exists.
- Knowledge can be transferred from the teacher to the student with the help of language (written/spoken).
- The job of the teacher is to give the answers.
- The job of the student is to more or less acquire passively the learning material and retains it. In this way he gradually acquires the knowledge of the teachers.
- The learning material is an impersonal thing that often confounds the student with its complexity. Learning well, means learning a lot.
- Success in learning is achieved conveying information by a variety of methods, through dishing out of bits of learning sequentially, that is, from the easiest to the most complicated.

In its purest form, this learning methodology is called the Nürnberg Funnel Teaching Method. However, there appear to be more effective methods of teaching and learning, regardless of topic, whether medical, business management, information technology or language.

A Few Words about Paradigms

In the following, I would like to discuss a paradigm change that has taken place in the last few years and appears to have an extremely productive effect on learning with the new media.

A prerequisite of every didactic is the paradigm which exists behind it. This paradigm, the opinion, of how learning, as well as human understanding and

perception, functions, influences the method by which it is taught. Now as every academic theorist knows there are paradigms that show no empirically proven facts, but to a certain point always use interpretations, estimations and tests to describe them and from which to draw a conclusion. The paradigms (theories) also directly determine the manner, the teaching, the didactic, the lesson. They also determine the attitude of the teacher to the student as well as the attitude of the teacher and student with regard to the material taught.

The presentation of learning shapes the teaching, the method of teaching draws on the theory of learning.

Constructivism, a Russian School of Painting?

The stimulus for a new comprehension of what happens when a human being learns - I am focusing here on knowledge acquisition - is provided by new findings in the fields of brain physiology, neurobiology, cognitive psychology, linguistics and information technology.

These findings shed new light on the question of how the human brain processes information and saves it as knowledge. They are extremely stimulating for teaching methodology and learning with multimedia. So what kind of findings are we dealing with here?

The Human Brain is a Relatively Closed System...

- The human brain focuses most of its time and energy on itself. This means that a large amount of neurons receive their input from other neurons in the brain. Only a relatively limited amount of outside influences have a marginal influence on brain activity. The brain organizes everything that is perceived and permanently interprets it.

- The information that comes from outside via the sense organs offers the mind not quality, but just quantity. This means that the brain does not perceive music from outside, but only impulses in the form of nerve stimulation. The impression of that which is perceived as music is first produced in the brain. In the same vein, we do not really see things — our optic cells are stimulated and they relay impulses back to the brain. In other words, we do not see things how they really are, but only how our mind interprets them.
- The brain organizes itself in order to give the individual the ability to survive. It creates a construction of the world so that it is able to function. So that it fits into the world. Or, as Piaget said, the brain does not construct itself in order to obtain a representation of ontological facts, but to achieve and retain an inner balance (equilibrium). The criterion of world creation is viability, e.g., the ability to survive, not reality.
- There is no objective knowledge in the world, the external being, the thing-in-itself (Kant), but always just our perception of the world. And this perception of things only can only be compared to our perception of things, not to the things themselves.
- We are the creators of our reality.
- Understanding means creating an interpretation that is appropriate for a situation.

The Human Brain is Organized Like a Network

- The human brain is made up of around 20 million nerve endings (neurons) that are either activated or deactivated reciprocally by electrical signals. This electrical wiring in the brain is constantly changing; it appears to act very dynamically. When thinking, the neurons are active and generating specific structures.
- Knowledge as a result of the learning process is a complex, interwoven, dynamic system in the brain that manifests itself in the integration of neurons. We record patterns and structures. I would like to emphasize here the

concept of Semantic Networks from the field of cognitive psychology, as well as the theory of Cognitive Maps, which describe knowledge structures as a three-dimensional network.

- The brain has the ability to adjust itself continuously to its requirements (neuroplasticity).
- This conception of the world is changed and adapted during the learning process. All outside influences are then either integrated into the existing knowledge base or thrown away.
- Individual constructions are ingrained in cultural constructions.

Language Cannot Transfer Constructions

- Language is not a method of passing on knowledge. Information exchanged is constantly being interpreted. "The meaning of a word is its usage in the language." (Ludwig Wittgenstein) This usage is flexible and relays the intention of the speakers, not the meaning of words. (Grice)

Consequences of the New Paradigms for Teaching and Learning

The constructive presentations have the following consequences for learning and teaching:

- Learning is an active process of knowledge construction, i.e., the reorganization and conveying of human constructs. Accumulation of knowledge exists only in connection with knowledge already at hand. What does not fit in the existing structure is thrown away. The student has to actively participate in the learning process, he must ask questions and be able to work with the material provided in his own way. The student should be given the opportunity to actually do something.

- Learning is an individualized construction of the human spirit. For this reason there are as many separate and inconceivable ways of learning as there are students.
- Knowledge is not transferable. It is impossible for a teacher to directly import his knowledge to the student. The teacher helps the student much more by his actual doing — through notes, questions and information on how the student can accumulate knowledge himself. In doing this, he can only partially and indirectly control the process of knowledge acquisition. In the terms of Socrates, the teacher is consultant, supplier, coach, mid-wife. (Mäeutik describes the Socratic methodology through the use of clever questions to gain answers and opinions that the partner is not even aware of having.)
- First of all, the right questions need to be raised in the learner. Only when the true questions are raised does the learning process itself begin. "The problem in learning are the questions. Understanding begins with the questions. And questions cannot be transferred, you cannot teach them or learn them. Indeed, you cannot ask yourself a questions, they come to mind. Only when a question is truly posed, can one understand it." (Gallin/Ruf, p. 37) Before the learner is overwhelmed with answers, he should know the questions, understand the problem. Only afterwards is he receptive to the learning material and the answers.
- Learning difficulties and problems are not able to be solved quickly, but instead present a chance to pose the essential questions and delve deeper into the theme.
- Learning means constructing mental and cognitive maps, that are continuously broken down and refined. Not proceeding sequentially from the simplest to the most complex, but the entire structure is able to be constructed that increases strength during the personal learning process, e.g., totality before details.
- A core idea (concept from Peter Gallin and Urs Ruf) is a vague suggestion of the entire material, that hints to the learner the fundamental essence of the learning material schematically. Core ideas are "an attractive starting point of

a personal learning process” (Gallin/Ruf, p. 88). They ”have to be produced so that they raise questions in the singular world of the student, that steer their attention towards a certain subject area of the lesson.” (Gallin/Ruf, p. 37)

- The teacher becomes the researcher, who, together with the student, discovers the material area.
- The teacher motivates the learner by showing his own personal fascination of the subject material.
- The material acts as an interface dialogue with the learner, appearing as the teacher or the learning medium in a new form.

Features of Constructively Formed Multimedia Learning Program

With this understanding of learning imparted by Socrates, Vico, Comenius and by Montessori and Piaget in our century, the use of multimedia technology is subject to a new meaning. Multimedia is not a quality in and of itself, but simply a helptool. Just as the replacement of the slate with a notebook does not present a direct improvement, the use of multimedia alone does not do much. When multimedia is used not just as a training tool and/or for pattern drills, but for the possibility of allowing the learner to collect experience and to help him in knowledge construction, it offers fascinating possibilities.

This new quality describes the words learning world and learning environment. Effective learning programs offer the learner a world in which he can maneuver, in which he can find patterns, structures which he can investigate, stimuli that raise questions and help him to find answers. They do not overwhelm him with a specific series of pre-defined ”facts” but help him to discover things that expand or reconstruct the network in his own head.

Theoretically speaking, I see the following as features of a new learning program:

- The learning program is not an instrument to transfer information, but a reflecting system. It does not overwhelm its user with answers, but helps the

user to first of all pose questions, understand those questions, grasp the problems in the material before finding the answers.

- The program helps the user to get emotionally and mentally involved in the theme. It challenges the whole person. It tries to overcome the stark contrast between information suppliers and information recipients (= learner). It produces authentic interactions with the thematic area, instead of just transferring material. It offers provocations that lead to a discussion over the theme and without this, a true understanding is not possible.
- The program creates authentic and situation-based worlds of experience, that help the learner to construct his knowledge. It offers him a means of reflection and abstraction.
- The program offers structures that offer the learner starting points (anchors). Here he can activate his previous knowledge and absorb new information.
- The program allows the learner to be as active as possible. Therefore, it is just one tool among others with which to actively build knowledge. It is a helpful, useful and easily adaptable helptool to support the learning process.
- The learning system is a partner, consultant, coach.
- The learning system assists the user to perceive his own personal way of learning.

The first approaches can be found in the following learning environments:

Simulations break down complex correlations and make it possible for the learner to try things out and to recognize a system by using these correlations. By changing the parameters of the systems he can discover imminent structures as well as build and review a cognitive model. For the most part, simulations present very concrete, realistic situations. Their highly motivating factor lies in the instant reaction of the systems to the actions of the learner.

Game Plans integrate the learner in a system in which he is an active component, or player, not directed by external simulations. Due to its game-like and

competitive nature, a high level of emotional activity is required of the learner. The game plan offers a high degree of authenticity.

Microcosms offer the learner an environment to be researched. In contrast to Game Plans and Simulations, it is frequently more difficult for the learner to find his way in a microcosm. He has to come up with the requirements expected from him by himself, and discover the questions.

Conclusion

Learning is not a transfer of knowledge, but an active accumulation of knowledge structures, an active construction. This paradigm gives the learner a completely different role to that described in the Nürnberg Funnel Teaching Method. At the same time, the obvious ways that a teacher can influence possibilities are dramatically reduced and his job becomes more difficult. When he gives up the illusion that knowledge can be transferred by language and by directly controlling the learning process of the student, he is once again in a qualitatively new role. He then becomes a helper. In fact, he gives up his self-control of knowledge in an area, and together with the student, becomes the researcher. This role of the teacher demands much imagination and courage. Both teacher and student experience the learning material in a way that engage them emotionally and existentially.

This offers new perspectives for those that create learning programs,. Their options become more diverse and complex, but require essentially higher challenges. The creation of a complex learning world demands a high quantity of imagination and creativity from the creator. The advantages of this complex learning world stand in proportion to the expenditure on time and energy, however.

In summary, learning is the active engagement of an individual with the world and the things within it, with the goal of building a construct that keeps the individual in a stable condition. Or, in the words of Jean Piaget:

”The intellect organizes the world by organizing itself.”
(Glaserfeld 1997, p. 51)

It appears that the combination of the change in paradigms in teaching methods described here with the modern multimedia technology will offer a new, exciting and very efficient learning experience in the near future. With the increasingly shorter lifespan of the usefulness of acquired knowledge and the necessity of life-long learning, this new learning experience also appears to be urgently needed.

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