УДК 004.9:378.14

# TOP-DOWN E-LEARNING

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*Традиционное образование поставляет учебный материал от простого к сложному, и, как правило, не принимает в расчет базисный стереотип сознания, который рассматривает знание, главным образом, как инструмент для удовлетворения потребностей. Отделение знаний от иерархии потребностей учащегося является причиной плохого усвоения и запоминания учебного материала.*

*Настоящая статья знакомит с новым подходом обучения (электронное обучение «сверху вниз»), которое предоставляет учащимся знания, подчиненные иерархии потребностей. Предлагаемый подход облегчает познавательную активность, поставляя знания в форме схем, и освобождая таким образом учащегося от трудоемкой самостоятельной переработки входящей информации во внутреннее представление (в схемы).*

Ключевые слова: *конструктивизм; ключевой стереотип сознания; удовлетворение потребности; представление деятельности; обучение с помощью схем; электронное обучение «сверху вниз».*

*A traditional education provides a learning content from simple to a compound and, as a rule, doesn't take into consideration a basic stereotype of consciousness, which applies knowledge, mainly, for the satisfaction of needs. Knowledge disconnection with a learner's hierarchy of needs causes slow mastering and memorization of learning content.*

*This paper introduce to a new learning approach (Top-Down e-learning) that provides learner with knowledge under hierarchy of needs, arranged from simplest to simple and from simple to the compound need. Suggested approach facilitates cognitive activity by providing knowledge in form of schemata, and delivering thus a learner from laborious independent translation of incoming learning objects into an internal representation (schemata).*

Key words: *constructivism; a key stereotype of consciousness; satisfaction of need; an activity representation; Top-Down e-Learning, and schemata based e-learning.*

## 1. Introduction

A traditional education is an objectivistic one. Its adepts believe that knowledge and truth are an objective reality, which learners are obliged to replicate in their consciousness.

In distinct from objectivists, constructivists contend that knowledge and truth are constructed by learners and couldn't be transferred.

Representatives of both parties could be reconciled with an existence each other long ago, if they took into consideration the reasons of Vladimir Solovyov, stated by him more than 100 years ago: "Objectivism is a tendency to assess things, people and events based on their precise study, regardless of private preferences and preconceptions… In this sense, objectivism is required for every scientist and critic. But the absolute objectivism should be recognized as impossible… In any case we must remember that a contrast between subject and object is not something absolute and final and that the full truth can be neither just an objective nor purely subjective".

Unfortunately, despite the fact that our understanding of the world changes permanently (and objectivists know about that), and from another hand constructivists cannot intelligibly explain how learners construct knowledge, a conflict of interests continues. Moreover, the objectivism has so deeply ingrained in public consciousness that its adepts often don't know about that.

Educators sincerely consider that their duty is to carefully decompose a learning content and to control how learners mirror it in their mind.

Developers of next Web's machine-readable generation (Web 3.0) want to provide the automatic (or semi-automatic) search of required information, a treatment of user's data and an automation of decision making, i. e. they imagine the future Web 3.0 as user-centric. Herewith, Web 3.0 is grounded by ontology that is something independent from reader and context, and is something independent from applications [1], i. e. knowledge basis of Web 3.0 is strongly objectivistic and has no relation to the user's operating environment.

In former times the traditional objectivistic knowledge oriented education has been justified by a social context, where the knowledge and erudition were valuable in itself.

Academician A. Novikov analyzing an essence of, so-called, industrial (a traditional) education, said: "Today's science has lost a role of the backbone factor of the organization of a society and … scientific knowledge should become only one of components of the learning content equally with other forms of human consciousness" [2].

Modern society needs a novel learner-centric education that provides a useful activity oriented knowledge and supports a learner's cognitive activity.

Developers of Web 3.0 don't take into account that Internet users long ago have voted for centralized well-structured knowledge Web resources and for the dynamic person-driven communities in opposition to Linked Data, which Web Consortium (w3c) promotes at the present time.

Success of Wiki demonstrates a great need of people in the open well-structured knowledge Web resource.

And what does Wiki do? Wiki provides users with information for problems' solving.

But people need Web resource that will provide solutions of problems rather than information for problems' solving. This resource should accumulate both generic and private knowledge and experience.

Education and e-Learning (include Lifelong and Corporate e-Learning) is one of main needs of modern society.

The main problem of education is an attitude to knowledge: What is knowledge? What is a nature of cognition? How to represent knowledge? How to support a cognitive activity of a learner? Thus, an attitude to knowledge is a key issue of modern society, including Web community.

This paper provides a novel education approach, namely, Top-Down e-Learning, an essence of which is a pervasive support of a learner's cognitive activity by knowledge represented as nested schemata, which form Web resource that accumulate both generic and private knowledge and experience.

The rest of article is structured as follows: Section 2 introduces a key stereotype of consciousness that associates reasoning, knowledge and activities with a satisfaction of human needs; Section 3 associates a satisfaction of personal needs with a carrying out of social activities; Section 4 explains basis aspects of Top-Down e-Learning; Section 5 introduces Top-Down Education; Section 6 summarizes information about suggested approach of learning.

## 2. A key stereotype of consciousness

In any given moment a human carries out a certain sensible activity.

Any sensible activity is aimed to satisfy a certain need. Any sensible activity realizes certain scenario, plan or algorithm that is supplied by reasoning. Reasoning starts after recognition of a need. Recognition of a need itself may be considered as a primary reasoning. Reasoning picks out the most appropriate scenario of the need satisfaction from available or composes a new one using generic and private experience and knowledge.

Thus, our consciousness always adheres to one route: need — reasoning — action. Herewith, a need initiates reasoning, and reasoning uses knowledge as operational resource (Figure 1).

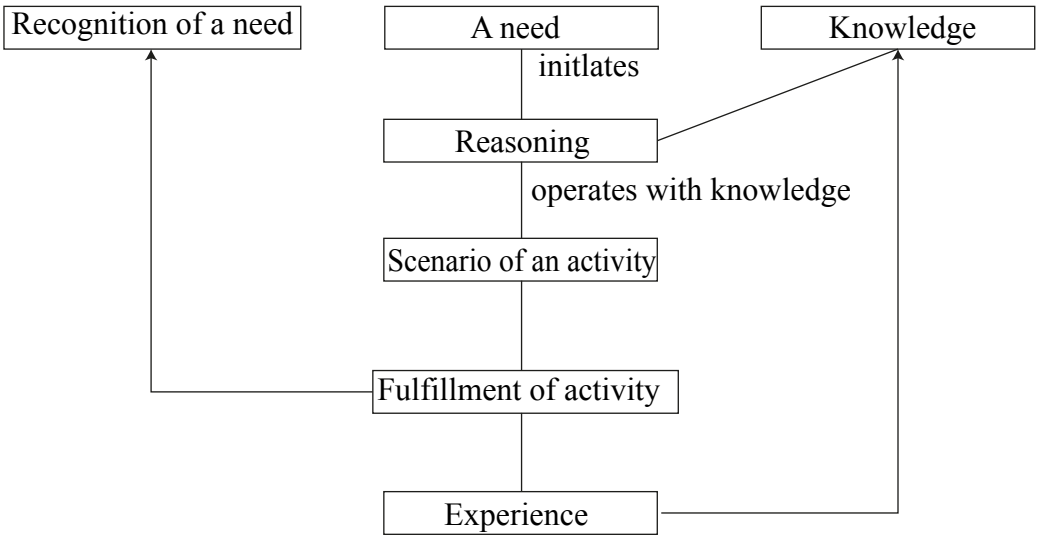


**Fig. 1.** A key stereotype of consciousness

This entails, at least, two very important conclusions.

Firstly, what a human knows is caused by his private hierarchy of needs. The same applies to the mankind as a whole. Knowledge defines features of a human's behavior and, eventually, his individuality. From this it follows that a private hierarchy of needs forms a personality.

Secondly, a traditional education forces learners to study the isolated knowledge, and by that destroys the consciousness stereotype.

This destruction causes a majority of difficulties related to the traditional education. In these circumstances a cognitive activity of a learner becomes a task with indefinite input and output conditions (owing to lack of a need driven motivation). If a learner didn't find a location for new knowledge in his private semantic system (which is defined by his hierarchy of needs), knowledge becomes unaddressed.

Unaddressed knowledge subjectively perceives as abstract one and requires additional efforts for the retention in the mind. If during some time the abstract knowledge isn't claimed, it is forgotten. Retention time of abstract knowledge in memory depends on its size and specific features of a learner.

A mastering of any learning object in concordance with a basis stereotype of consciousness means an observance of following rules:

1. A studying of social needs that are served by given learning object (every need itself, its origin, a correspondent social and domain environment);

2. A studying of roles of given learning object in an origin or in a satisfaction of needs;

3. An expansion or correction of personal hierarchy of requirements by means of given learning object;

4. A studying of given learning object in details.

### 3. Private Needs

Semantic coordinates of any need defines a precise location the need in the hierarchy of needs.

Abraham Maslow have investigated personal human needs and discovered relationship between a motivation and a need [3].

Maslow distinguished 7 basis classes (hereinafter Personal M-Needs) of human needs:

1. Biological and Physiological needs — air, food, drink, shelter, warmth, sex, sleep, etc.

2. Safety needs — protection from elements, security, order, law, limits, stability, etc.

3. Belongingness and Love needs — work group, family, affection, relationships, etc.

4. Esteem needs — self-esteem, achievement, mastery, independence, status, dominance, prestige, managerial responsibility, etc.

5. Cognitive needs — knowledge, meaning, etc.

6. Aesthetic needs — appreciation and search for beauty, balance, form, etc.

7. Self-Actualization needs — realizing personal potential, self-fulfillment, seeking personal growth and peak experiences.

A satisfaction of above-mentioned needs is carried out in a social environment during or thanks to a social activity of a human.

By social activity of a human we mean any activity oriented to the satisfaction (directly or indirectly) of his Personal M-Needs. Carrying out any social activity, a human every time acts as a consumer, a producer or a provider of certain human need's satisfaction. It's may be need in any product, any service or any kind of human communication.

Looking ahead, we can say that in accordance to the key stereotype of consciousness and Theory of social needs [5] reasoning, scenario of an activity and fulfillment of an activity are derivative needs of any given need. Thereby, since a social activity as a whole provides a satisfaction of human needs, it becomes his key need.

Needs are specified and objectified in the motives that are driving force of human activities [4].

We give the definition of motivation: motivation is a sensed need.

Therefore, in order to master a social activity, it should be perceived as a component of a hierarchy of Personal M-Needs.

Having recognized a social activity as a need, an individual recognizes a performance of all accompanying conditions and actions as a need.

Any social activity is provided by the following set of supporting activities:

1. Learning (an academic, a professional, lifelong as well as a learning based on an imitation or on the watching).

2. Security (physical, technical, ecological, economic, etc).

3. Recovery (a correlation with external conditions, prophylaxis, repair, correction, reconstruction as well as a processing of non-standard situations).

4. An interaction with other participants of performed social activity (with friends, with members of a family, with members of a team, with participants in industrial relations, etc).

5. Interaction with outer sides which provide public work or influence it (parents, the enterprises-intermediaries, providers of service, etc).

6. Logistics.

Realizing of the need to perform all of these ancillary activities entails motivation of solving all problems that arise during their implementation. Thus, these problems are derivative needs of the given need.

Since an implementation of social activities is motivated by Personal M-Needs, the success of learning depends on a realizing by a human of a contribution of learning content into the satisfaction of Personal M-Needs.

If it doesn't occur, any knowledge component of studied social activity is recognized as disconnected with hierarchy of Personal M-Needs (extended by the need to implement social activities), and its mastering directly depends on level of abstract thinking of a learner and his abilities to memorize.

A satisfaction of Personal M-Needs, extended by the need to implement social activities, is grounded by a system of contribution relations that links knowledge (include a learning content) with activities, activities with social needs and social needs with Personal Needs (Figure 2).

We can tell that any hierarchy of Personal M-Needs is mirrored to certain sub-hierarchy of social needs and correspondent derivative needs. Herewith, just this sub-hierarchy of social needs (hereafter, Private Needs) and features of their satisfaction define individual qualities of a person.

Thus a learning process will be successful if a studying knowledge serves Personal Social Needs or social needs correlated with them.

### 4. Down the Up Staircase

"Authors of the learning content seek to represent it (as a rule, only scientific knowledge) in the most modern and best systematic way — in terms of the structure of scientific knowledge itself, rather than in terms of mastering of its by student, and, most importantly, not in terms of personal need for him, for his future professional activity" [1].

A traditional education is Down-Top education.

Authors of the learning content make decomposition of the learning content, whereas

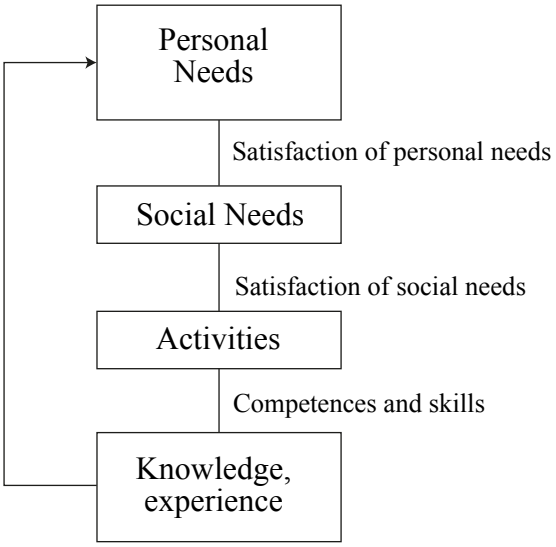


**Fig. 2.** Personal Needs causes an experience, and an experience causes personal needs

its composition is materialized by the learners themselves.

How they do it? They do it by means of the cognitive activity.

In accordance with the key stereotype of consciousness any activity satisfies certain need. What need does the cognitive activity satisfy? Evidently, the cognitive activity satisfies a need for education.

This implies that a learner should perceive a need of education. Moreover, the need for education should be perceived as a personal need.

What is a cognitive activity? It is a kind of investigation.

Cognitive activity of a learner is an investigation of unknown to him subject area, which grounds a fulfillment of certain professional activity. As any investigation, a cognitive activity of a learner represents a consecutive clarification of taken for a basis scenario of a professional activity.

Since "Schemata truly are the building blocks of cognitions" (D. Rumelhart), a more appropriate form of professional activity's representation is schemata.

An investigation means a concentration on the object of the investigation. A process of the concentration represents an ignoring of all objects that don't relate to the object of investigation.

What does it mean? It means that it isn't enough that the need for education belongs the hierarchy of Private Needs; it should have a high priority in this hierarchy.

In accordance with the Third Law of Pedagogy [1] a human masters knowledge from the simplest to the simple, from the simple to more complex. It is hard to argue with that: to learn to read, you must first learn the alphabet. Thus, firstly, a learner learns knowledge required for operations of professional activity and every operation itself; secondly, a professional activity as a whole and after that he learns how to satisfy social needs and what any correspondent need itself is.

But the same logic leads to the opposite result. Really, Personal M-Needs are the simplest (at least, well known) needs, the simple needs are social needs and more complex needs are activities and derivative problems.

A moving from simplest needs to the complex needs specifies a learning process in the reverse of the above. Following the logic of needs we come to the Top-Down Learning.

It doesn't mean, for example, that a learner should learn a theory of limits after the differentiation. It means that he learns a theory of limits well understanding its contribution to the differential calculus as well as on the stage of the theory of limits a learner knows a contribution of the differential calculus to the integral ones and to the solution of the equations of mathematical physics.

### 4.1. Basic principles of Top-Down e-Learning

In distinct of the traditional education that provides the decomposition of learning content and doesn't help learners to synthesize a professional activity representation, Top-Down e-learning is Activity Oriented Education and provides a learning content from Top (from the social needs and applicable activities representation, i. e. from a composition) to Down (i. e. to detailed learning objects). Any learning object contributes to the professional competence of a learner.

A learner masters a learning content by delegating a motivation of Personal M-Needs satisfaction to motivation of education, then for a possession of professional activity aimed to the satisfaction of applicable social needs and so on to learning objects' acquisition.

#### 4.1.1. The need for education, as an integral part of the hierarchy of Personal M-Needs

In accordance with the key stereotype of consciousness, recognition of a need motivates a reasoning process.

Generally speaking, a motivation is a steady mental set at the fulfillment of certain activity (that satisfies a certain need).

What does reasoning represent in case of education?

In case of education reasoning represents a cognitive activity.

A cognitive activity is a kind of a self-contained investigation. Learners should be well motivated to provide an independent investigation. A motivation presumes an occurrence of a personal interest. A personal interest, as a rule, accompanies a satisfaction of individual need.

Thereby, the top-priority task of successful learning process is to expand the hierarchy of Personal M-Needs by the need for education.

Only a need perceived as a personal can motivate reasoning process aimed to this need's satisfaction.

Therefore, a need for education should become a conscious personal need.

Education as a whole is a proved approach of the Personal M-Needs' satisfaction.

A child-rearing should without fail provide as an integral part, the need for education.

#### 4.1.2. The need for professional learning, as an integral part of the hierarchy of Personal M-Needs

The next stage is the expansion of the hierarchy of Personal M-Needs by the need for professional learning. To do this, firstly, it is necessary to study the social needs that are directly or indirectly provided by selected professional activity and to include them into the hierarchy of Personal M-Needs.

Secondly, it is necessary to study a generalized scenario of professional activity, including all its main stages, components, features and aspects.

And, thirdly, personal need of professional learning motivates the study of learning content, each module of which provides or supports (directly or indirectly) any part, feature or aspect of professional activity.

#### 4.1.3. Schemata

All of the above stages of the top-down cognitive process from the learning of any current need to the needs derivative from it are presented in the form of semantic schemes that are available by both human and software agents.

Knowledge in the mind of human is represented in form of schemes.

The first who have referred schemes in the context of knowledge representation was E. Kant [6]: "For generation of schemes the consciousness detects a general "kernel" of set of objects by means of subtle portrayal of these objects and switches the attention from the content of an image on the portrayal itself, generating by such way an algorithm (scheme) as a method of these objects' construction".

The term schema itself was set in operation by F. C. Bartlett [7] in 1932. His "scheme principle" is a result of processing a large repository of recorded remembrances. His ideas initiated a theory of scheme in the early seventies of the last century (M. Minsky, D. Rumelhart [8], R. C. Anderson [9], R. Schank etc.). This surge of interest in schemes was caused by researches in the field of artificial intelligence.

In accordance with a theory of scheme all our knowledge is embedded in schemata and "the most of our reasoning ability is tied to particular schemata related to particular bodies of knowledge" [8].

People spend much time and power to convert

an incoming data into schemata. It is obvious that the only one true way to facilitate an assimilation of new knowledge is a representation it in form of schemata directly [9].

The main problem of the modern theory of scheme is a possibility to apply schemata for the representation of non-generic knowledge [10].

Apologists of scheme theory consider that sketchiness is a form of mind-mapping for any complex knowledge. Their opponents deny such opportunity for all "…objects, situations, events, sequences of events, actions and sequences of actions" [8]. Evidently, the stumbling block is a representation of new, spontaneous, non-systematic, daily knowledge as well as private experience.

Really, the lack of cornerstone of knowledge analysis can and should lead to distrust of any claim to universality of the knowledge representation.

In spite of the fact that our goal is a new approach of academic learning, there are no reasons to orient it to generic knowledge only. Moreover, we ensure an improvement of the operational knowledge base at the expense of private experience affiliated experts.

The system should provide a topicality of knowledge, since it is oriented not only to an academic education, but to lifelong e-learning, corporative e-learning as well as to e-learning of any human experience from skill in handling industrial technologies to using of consumer devices and cooking.

Therefore, suggesting a new approach of e-learning, we strictly rely on key stereotype of consciousness as on the basis principle of knowledge analysis and representation, on the one hand, and we provide generalization of the private experience and privatization of generic experience, on the other hand.

#### 4.1.4. A support of cognitive activity

First of all, we support a cognitive activity of learners by providing them with knowledge in form of schemata directly, delivering them, thus, from the necessity to process the incoming information into the internal representation (semantic schemata).

Jean Piaget [11] used term schemata to describe patterns of similar experience. Piaget considered that knowledge is not transferred; it is constructed by a human in the course of his cognitive activity.

Really, how does a learner's cognitive activity construct knowledge in the condition of the traditional education?

The traditional education provides a learner with well-structured decomposition of the learning content. A learner triggers his cognitive activity to process the learning content into schemata that serve his needs. Herewith, he overcomes the following obstacles:

— Individual features of the lectors' presentation of the learning content.

— As a rule, the end-semantics of the course becomes available in the end of course. Under the end-semantics we mean here a logical completeness of the learning object.

— The end-semantics of the separated learning objects becomes available in the end of course.

— A discovering of relations between learning objects.

— A discovering of a contribution of any learning object into the end-semantics of the course.

— As a rule, the final-semantics of the course becomes available in the end of education. Under the final-semantics we mean here a contribution of the learning object to the personal understanding of the professional activity (i. e. a pragmatic completeness of the course).

— An understanding of relations between courses becomes available in the end of education.

— A learner independently constructs in his mind a representation of the professional activity in form of embedded schemata and correlates it with his own unique personal life experience and professional activity.

Figure 3 demonstrates what schemata should be built by a learner in his mind during the traditional education for any learning object. The top-scheme of the professional activity contains, in general, a basis scenario of this professional activity as a sequence of actions and description of operational resources. Any action is described by means of embedded schemata as a set of satisfactions of certain need in the different situations. Any satisfaction of need is represented by means of top-scheme and embedded schemes. Any operational resource

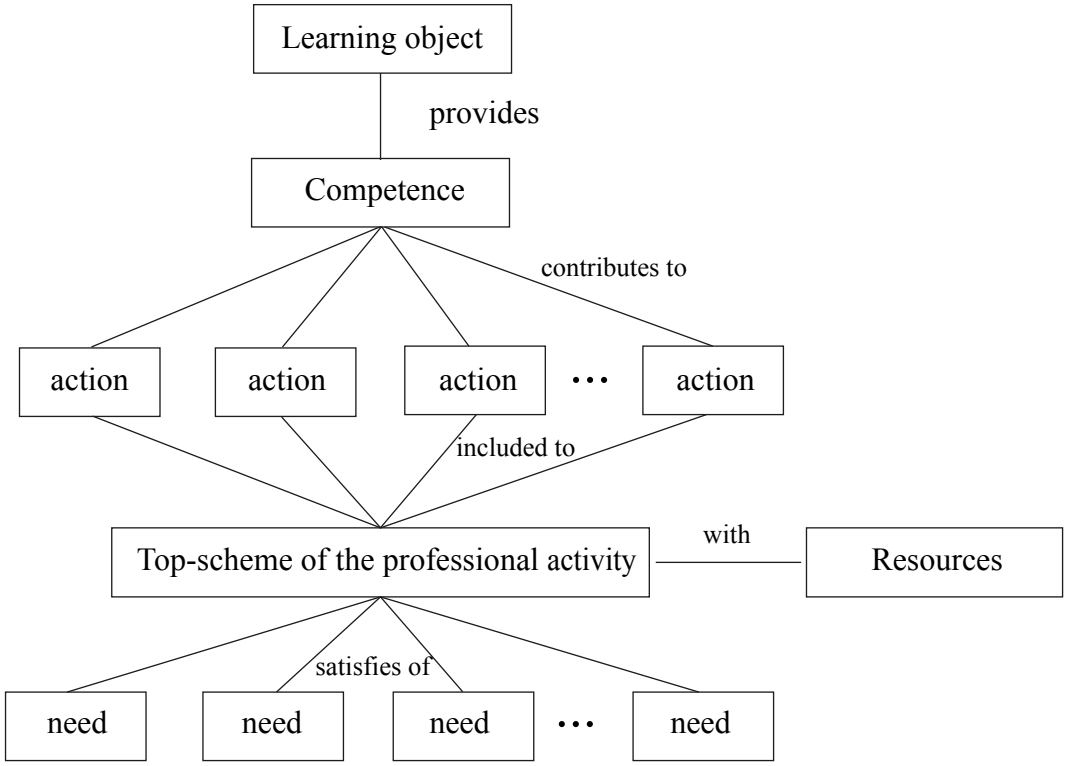


**Fig. 3.** Schemata as a reault of cognitive activity

is represented via a declarative description and as result of certain activity (an acquisition, a purchase, a production, an installation, etc.).

Top-Down e-learning services the cognitive learner's activity providing learning content in the reverse order to that shown in figure 3, bypassing, thereby, above-mentioned obstacles.

**4.1.5. A learning content**

Traditional education provides a learning content with the following imperfections:

— Learning objects are, as a rule, unconnected directly one with another and all together with a target professional activity; therefore a practical value of any learning object is not evident for a learner.

— Learning objects are represented in an arbitrary form due to the lack of a standard semantic structure of a learning content.

— The standard duration of a lecture is two academic hours, whereas the maximal stability of attention is equal 12 sec [16].

— The learning content is built on the basis of an experience of its author; herewith the author's experience is hidden from a learner.

— Creating the learning content, its author has in mind certain basic level of knowledge, which all students should possess.

Top-Down e-Learning provides a learning content as a detailed domain representation. By domain representation we mean a linked set of Need Satisfaction Domains.

What is Need Satisfaction Domain?

Scientific knowledge is knowledge about causal-effect relations [12]. Therefore a scientific analysis of any phenomenon always starts from the investigation of its causes. This paper postulates that any domain knowledge origin and application is caused by a satisfaction of Human need. It means that we consider domain knowledge in the network of Human needs relation.

The social needs form, ground and constitute all fields of knowledge. Any domain knowledge grows and ramifies in course of certain social need's achievement. Therefore Human activities that achieve any social goal play a key role in the formation of corresponding domain knowledge, and so domain knowledge representation must contain target activities descriptions.

Semantics of any domain entity is defined by its contributions to an achievement of domain's objectives as well as to the fulfillment of corresponding activities. Herewith any domain entity is designed for certain domain activity's need achievement.

Therefore domain semantics and domain ontology mapping mirrors domain activities' structures and dynamic.

Suggested domain representation approach fits the above considerations.

In pursuance of the human common sense, we unite knowledge, which represents all known ways of each need's satisfaction into the separated areas of experience (Need Satisfaction Domains). We describe Need Satisfaction Domain in Need Language [13] as Need Language (NL) program by means of two ways: using NL editor or by means of the system engine (a system engine generates it automatically in response to the client's specifications captured by means of a query-answering interface). In any case a client specifies the following:

— definition of a need,

— semantics of a need (a need's semantic location and a need's origin that includes all meaningful situations and causers),

— all meaningful resources or instructions for their obtaining,

— all meaningful operative scenarios of the need satisfaction.

As a rule, Need Satisfaction Domain integrates knowledge of different subject areas.

A curriculum should provide the following sequence of learning modules:

1. Linked social needs, a satisfaction of which includes or consists in the carrying out of certain professional activity.

2. Types of professional activities that suitable those different social needs in different situations.

3. Resources that ground professional activities (types, destinations).

4. Scenarios of professional activities (plans of professional actions).

5. Resources that ground professional activities (origins, operating instructions).

6. Learning objects that (directly or indirectly) explain, support or/and provide professional actions.

7. Typical problems of professional activities and actions.

Herewith, note that Top-Down e-Learning provides learning content with the following advantages as compared with traditional education:

— Learning objects are represented in a form that is understandable both for human and for software agents.

— A subject area and learning objects are represented by means of nested semantic schemes.

— The standard duration of a stability of attention (less than 12 sec) is enough to master a scheme.

— Traditional representation of a learning content in the textual, audio- or/and video-form is structured according to these semantic schemes.

— Semantic schemes jointly represent a professional activity as complete as possible (i. e. a scenario of a professional activity include professional actions and appropriate social contacts and activities).

— All semantic schemes realize the same framework, namely, Need Language (NL) framework.

#### 4.1.5.1. Need Language

A markup Need Language (NL) is intended to express the propositions about needs' satisfaction using precise formal semantics. NL programs are available both via Internet and as desktop software.

NL language is designed to provide a basic foundation for Intellectual Human-machine Interface, aimed to the semantic search of a customer problems' solution from background information to the pervasive monitoring and support of professional or/and any other activities of the customer. For this purpose NL based system specifies words' meanings, provides the intellectual composition process that leads from words' meanings to understanding the customer's problem, extends his specification by means of domain knowledge base, and builds a Need Satisfaction Domain that is in line with the customer's activity.

The meaning of any assertion in NL represents an unique semantics of certain experience that is mentioned here as a content of total Human experience depository, intended for providing a support of learning and problem solving. The idea is to provide new abstract data

types for both machine and human reasoning support.

The system engine provides the deep analysis of the nature of the things described by NL language during the specific semantic processing. Herewith, the owner of the experience, presented in the domain knowledge base, is responsible for its use.

Initial semantics and ontology presented by domain experts are considered as generic. It provides the basic ontological-semantic dictionary which is used by the system engine for "understanding" of private professional slang and for the semantic translation of NL assertions from one domain slang into another.

NL system considers NL's service words (reserved words) as semantic tags that are used for the semantic marking of the NL assertions. This provides, in particular, such functions of Intellectual Human-Machine Interface as "understanding" of semantics of customer's situations and customer instructions, generation of queries, and the generation of a plain text in response to a customer's questions and requirements.

NL allows expressing semantic information about domain data that participate in a decision process. The underlying ontology supports the intelligent interface, by means of which a customer inputs the specification of his needs, manages the solutions, asks questions, receives justification and explanation, and, conversely, the system supports the process of the customer's reasoning, asks him questions, and generates the justifications and explanations.

In particularly, if a system recognizes a customer's need and finds in the domain knowledge base a method of its satisfaction, it will able to explain all details of the customer problem's solution using underlying ontology and semantics of components.

NL system uses an explicitly expressed semantics of the domain data for the restoring of a customer's personal system of values that provides the "understanding" by the system of the customer's specifications.

The knowledge of personal system of the customer's values includes the correspondence table between terms of the customers' professional slang and generic domain ontology, and also a system of associations between the customer concepts and situations, activities and constructive elements of the domain knowledge base.

The knowledge of personal system of the customer's values grounds a mutual understanding between man and machine.

Summing up, Need Language is a semantic markup language. Need Language uses as semantic tags Reasoning Ontology that is derived from the top reasoning ontology's tree [12]. Reasoning ontology defines Need Language framework.

— Need Language is used for the description of Need Satisfaction Domains.

— Thus Need Satisfaction Domain's description is a description of target subject area, which is structured by means of Reasoning Ontology.

— On the one hand, Need Satisfaction Domains' descriptions constitute Experience base, where as a search keys may be used units of Reasoning Ontology.

— On the other hand, any Need Satisfaction Domain's description may be used as a repository for scenarios of a need satisfaction's activities.

#### 4.1.6. A learner interface

Knowledge base of any curriculum is equipped with interface for its filling and administrating and with interface for the learner. The system engine semi-automatically translates questions and requests to the responses, explanations and ready to use solutions as well as provides testing, simulations of the studied processes, the generation and verification of the course works.

##### 4.1.6.1. A semi-automatic response to user statements

A system engine provides a semantic search, using function words (semantic tags of Need Language), domain concepts, an available set of the domain's situations, names of needs and other knowledge of Need Satisfaction Domain.

A system engine provides a semi-automatic translation of arbitrary domain-related sentences and requirements of users. Parsing any user's text, a system translator builds expectation of its semantics as a whole (i. e. it attempts to detect a type of the given text and a suitable Need Satisfaction Domain or a part of it) and asks a learner an approval of the semantics. Having received the confirmation of a learner,

a translator generates a response or requests the missing information and so on.

In the event that computed semantics is not confirmed, a translator generates queries that allow defining a suitable semantics, specifies missing information and generates a response.

For example, an explanation mode of the translation is launches by queries in form "Why X?", "Why X is obtained?", "Why X is obtained instead of Y?", "What is X?", "How does X work?", "How to apply X?", "What I must possess for X obtaining?", "What activity does satisfy my need N?", "What resources are necessary for the activity X implementation?", "What constructive elements are included to the activity X?", "What is a contribution of the constructive element CE to the activity A?" and so on.

In response to these queries an explanation mode initiates a query-answering interface to localize of suitable segment of knowledge base and, using causal-effect basis of Need Satisfaction Domain representation, generates answers to user queries.

**4.1.6.2. Testing**

Due to a causal-effect foundation of Need Satisfaction Domain representation, a system engine is able to verify a mastering of learning content by learners. To initiate a testing mode of the system engine, a learner localizes relevant schemes by means of Ctrl-Shift and clicks in pop-up window the command "Test". Another way to initiate a testing mode is a written request in form "Test X.Y", where X is a name of a need, Y is a path to the relevant part of the Need Satisfaction Domain. A testing mode starts also automatically after a completion of a looking through any next scheme. In the last case a learner has the right to answer the questions or to skip theirs.

**4.1.6.3. Simulations of the studied processes**

A simulation mode of the system engine provides a simulation of available actions and activities in response to a learner's specifications.

What it means? A learner arbitrarily changes a tuning of Need Satisfaction Domain that includes an origin of a need, available resources as well as parameters and an algorithm of a need's satisfaction activity. In the course of computing experiment a learner explores a behavior of target environment. His goal is a knowing an influence of any component of Need Satisfaction Domain on the need's satisfaction.

**4.1.6.4. A generation and verification of the course works**

For the lifelong and corporate e-learning it is typical a need to get knowledge of extraneous domains with the purpose of use their in the target activity. It may be any resource, object, device, activity or separated action. A learner wants knowing how to apply those resources, objects, devices or carry out activities and actions to his advantage.

A need to get extraneous knowledge always represents a request that includes a specification of qualities, properties and/or functional features in certain operational context.

In response to such specification a search mode of the system engine finds suitable segments of extraneous Need Satisfaction Domain and provides their as embedded schemes or/and as a plain text.

**4.1.7. An educator's interface**

An educator supplies a learning content by means of using the query-answering interface or Need Language editor.

Answering the questions or applying menu of Need Language editor, an educator reproduces a key stereotype of consciousness in application to a subject of his competence.

He defines a new need or points at a need, which is already represented in the system knowledge base, and clarifies its components.

A supervisor of curriculum is responsible for creation schemata of competences and corresponding list of competent educators, which cover a target Need Satisfaction Domain. A system engine verifies incoming information based on the available knowledge.

**4.1.8. A learner's activities**

In the traditional education a learner plays a passive role in the learning. More exactly, he is driven by an educator.

And what is more, a learner should perform all educators' requirements and instructions, even if he doesn't understand their meaning for the future professional activity. A learner should adapt to an individual manner of every lecturer.

A learner is forced to extract semantics and a practical value of learning objects independently, and a learner is forced to compose a field of professional competence independently.

In the Top-Down e-learning a learner plays an active role.

He masters schemata and uses system engine modes to obtain explanations, testing and answering; if ambiguities remain, the learner addresses to the educator.

Consistently detailing contents of schemes, a learner finds out unknown (for him) learning objects and defines a personal sequence of studying.

A learner uses a simulation-mode to study features of professional actions under different input conditions and/or by changing their scenarios.

Navigating through the schemata, a learner forms an individual perception of Need Satisfaction Domain in the context of a satisfaction Personal M-Needs.

**4.1.9. An educator's activities**

In the traditional education an educator develops the learning content and lessons arbitrary and plays an active role in the learning, namely, he manages the learning process. An educator understands a learning process as a performance by students of his requirements and instructions and he is responsible for the learners' progress as well as he monitors and evaluates the learners' progress.

In the Top-Down e-Learning an educator plays a passive role in the learning, namely:

— he supplies knowledge to the system's knowledge base by means of query-answering interface;

— he administers the system knowledge base,

— he answers to a learner's questions, and

— he supports a learner's cognitive activity as a coach.

**4.1.10. Global Experience Base**

Semantic schemes of Top-Down e-learning provide well-defined semantics. This means that a learning object, written by a developer, can be unambiguously interpreted by another one or by software agents. It follows that a learning content, semantically designed properly once, does not need to redesign by any educator.

Such learning content, aggregated under a hierarchy of social needs as distributed Web resource and updated by affiliated experts, will constitute integrated knowledge base that can be used as a basis of Global Experience Base (GEB).

GEB will ground the following user-centered activities anywhere and in anytime:

— An academic e-learning,

— Lifelong e-learning,

— Corporate e-learning,

— Recognition of human activity,

— Support of professional and social activities,

— Decision making based on the Internet of Things' data,

— and other Social Web activities.

**4.1.11. Top-Down e-Learning as a mode of Social Web**

Top-Down e-Learning provides an academic e-learning, Lifelong e-learning and Corporate e-learning.

An academic e-learning is a mode of Lifelong e-Learning.

Lifelong e-Learning, generally, operates with knowledge, applicable in everyday individual, domestic and professional life as reference information, operational instructions, and as an experience in the satisfaction of needs and problems.

Lifelong e-Learning contributes to Global Experience Base that will ground a Social Web service of incoming Web 3.0.

An evolution of Semantic Web technologies will inevitably transform Web 2.0 to Web 3.0 (Social Web) that enables software agents to operate with the Web data more intelligently and perform tasks on behalf of users.

Top-Down E-Learning will provide Web 3.0 with permanently upgraded foundation of Global Experience Base that grounds automatic and semi-automatic support of social connections as well as professional, domestic and personal activities of users anywhere and in anytime.

Social Web provides a customized semi-automatic Web service (e-Help) based both on Global Experience Base and on awareness of user's life activity.

E-Help includes the following e-activities:

— E-Home Job,

— E-Professional Job,

— E-Business,
— Top-Down E-Learning,
— E-Health,
— E-Social Connections,
— E-Leisure.

Top-Down e-learning forms a foundation of Global Experience Base. Practitioners from the broad spectrum of Human activities supply their exclusive experience via an educator interface. The Semi-automatic Acquisition of the Web content [14] provides Global Experience Base with human experience published in the Web.

Interacting with an educator interface, Social Web user provides a knowledge system with actual information related to activities that ground his life activity. System engine verifies incoming data and updates it by means of available generic and private experience accumulated in Global Experience Base.

Furthermore, Social Web user has the right to publish in Global Experience Base his exclusive experience in the satisfaction of any need.

A system acts as executive supervisor and guides an execution of Social Web user's activities in response to the specification of current situation. A system acts as a coach, if user's actual activity is an education.

Analyzing user needs and problems, a system provides him with missing experience both generic and private under the terms of its owners. In case of need a system takes upon itself a forming of user-centered social connections (communities, teams, clients, etc).

### 5. Top-Down Education

The main task of the educational process is the training of a new full-fledged member of society. It means that, firstly, the system of personal priorities should be coordinated with public priorities and, secondly, a person should be able to establish and maintain social relations, to perform the required social roles and functions, as well as to possess the necessary set of skills and to be the professional in one or several socially-significant subject areas.

There is only one way to become a full-fledged member of society. It is a learning, more exactly, a cognitive activity.

Therefore, from the very beginning an education system should form a personal hierarchy of needs in compliance with a hierarchy of social needs. Herewith, even initial personal hierarchy of needs should include as an obligatory component a need for learning.

There are sufficient reasons for a providing a learning by means of schemata from the very beginning. A child must treat a big volume of similar experience before he will be able to generalize it and express it in form of schemata. It will go faster, if knowledge will be representing in form of schemata from the beginning.

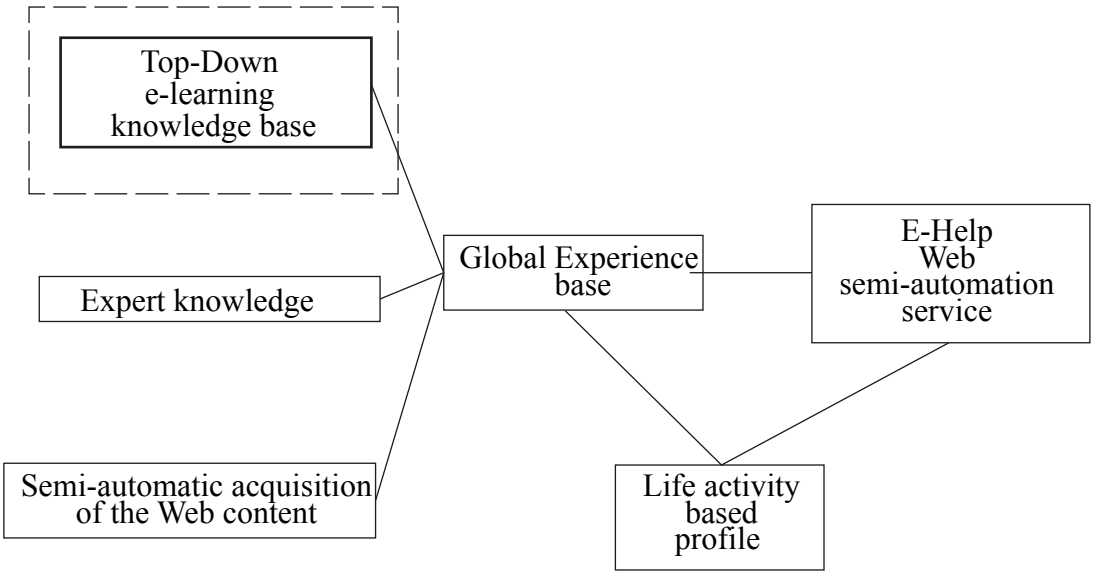


**Fig. 4.** Social Web

The worth-while experience in teaching by means of to mental cards (schemes) is given in work "5 simple ways to teach training of children Mind Mapping" from Marjam Vaher [15]. It proves that a learning using schemata exempts a child from the laborious producing of schemes and really quickens a mastering of knowledge.

Figure 4 shows how Top-Down E-Learning principles can assist all levels of education and ground Top-Down Education.

## 6. Conclusion

Top-Down E-Learning provides an academic

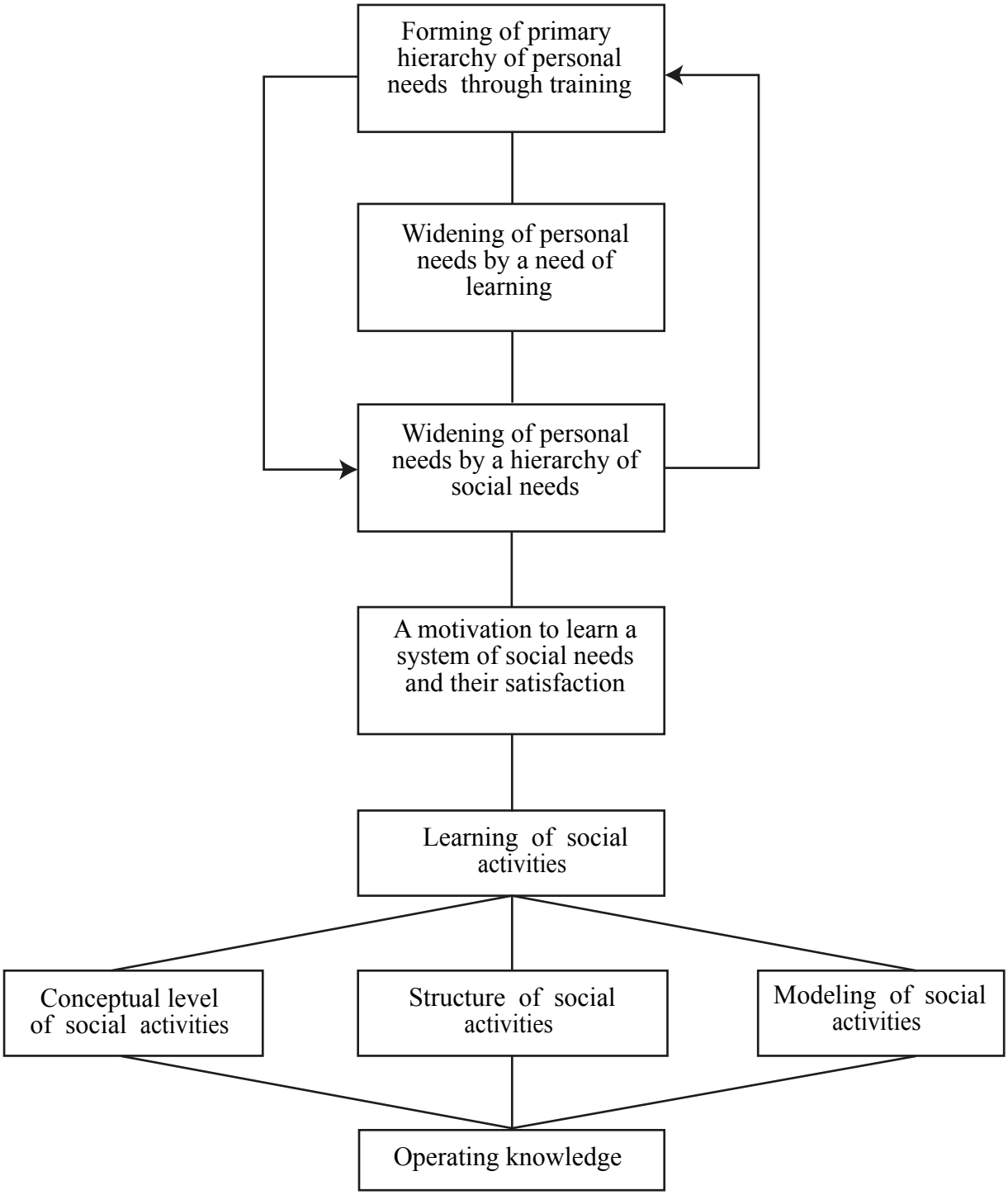


**Fig. 5.** Top-Down Education

education, lifelong and corporate learning.

In distinct of traditional education and existing e-learning educational software Top-Down E-Learning supports directly a cognitive activity of learners by providing modular-competence architecture of learning content. At that learning content covers a target subject area by means of nested semantic schemes, where learning objects explicitly contributes an unique competence to the target Professional Activity and are represented in a form that is understandable both for human and software agents.

A learner actively constructs professional competences and skills using schemata and help of an educator, which supports a learner's cognitive activity as a coach.

Top-Down E-Learning principles can assist all levels of education and grounds Top-Down Education (Figure 5).

Top-Down E-Learning acquires, accumulates, stores, and administers a human Experience that represents a core of Global Experience Base.

Global Experience Base, by-turn, grounds new comprehensive Web service of user's life activity.

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*Поступила в редакцию* *10 ноября 2011 г.*

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