

Communication Support Needs for Education in a Global Context Based on Suitable Information Technologies

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ABSTRACT

This paper is centered on the implementation problems of learning activities for better education in a global and information society. Modern education must respect dynamic changes in society based on preferences of business and need for competitive advantages; therefore, education seeks optimal ways to obtain the necessary knowledge and skills. Communication has an important place in education. The presented analysis is dedicated to Forum activity, with links to other learning activities like Database, Survey, or Wiki from the Moodle platform. The Forum activity is difficult for creation. Teacher must use on-line help or a specialist on the Moodle for optimal Forum creation via eighteen items. Other analyzed activities need smaller volume of work, but prompt implementation requires simplification using ideas of computational intelligence, and e-learning for knowledge society.

KEYWORDS

analysis, communication, e-learning, global context, information technology, Petri Nets

1 INTRODUCTION

Progress and innovation are frequently used terms. Their importance is supported with the aim to offer new and not yet unused solutions in order to gain a competitive advantage in the dynamic

environment of modern society. Businesses from different disciplines have overcome everyday barriers caused by competitive forces and customer requirements. The pressure is placed on standard requirements like price, quality, delivery date, and of course on soft skills like positive communication with presentation, creativity and ability to solve unexpected problems.

These soft skills help to redefine and to implement suitable methods for required services and products. Such an approach leads to something improved or new (solution, procedure, device, form or style). Improved and new solutions often use techniques like metaphorical thinking, deferring evaluation, mind maps, control issues, configuration analysis, brainstorming, or creative board [1]. Optimal communication is needed for effective activation of these techniques.

The 21st century is a time of big changes that also influence communication; therefore, it is necessary to change and adapt suitable possibilities based on factors of communication. David Gruber defines key functions of communication for success [2]. Communication functions are informative, instructive, educational, sociable, persuasive, empowering, motivating, and these functions have an influence on the formation of personal identity and perception of education.

2 MODERN EDUCATION AND ANALYTICAL THINKING

Modern education must respect the needs of communication in business (also information technology users) in the global information society. It is difficult, because many claims are posed on education. Estimates of future needs for knowledge in Europe are based on the prediction that employment positions will be increased by at least 14 million jobs in business activities and various services between the years 2006 - 2020 [3]. Expected changes in employment structure will induce changes in education, with links to necessary qualification and the young “net” generation. A suitable methodical basis is the application of interactive methods of education, with principles of educational constructivism, critical thinking, interaction, and co-operation [4, 5]. The inspiration can be education concepts in the world to realize suitable education:

- Substantial focus on real phenomena - theories are not primary.
- Active approach to the selection of topics with conditions for development of critical thinking.
- Possibility of intervention into fact - greater importance of ethics and philosophy.
- Emphasis on management science - increased connectivity in solving problems.
- Applied discursive model of professional dialogue - principles of deconstruction and reconstruction [6].

The above-mentioned concepts are very important in education and for task problem-solving. The default way to solve identified tasks is defined via problem definition, problem analysis, searching the problem for alternatives,

evaluation and selection of the appropriate alternatives, implementing decisions and monitoring with evaluation [7].

Analytical thinking helps to better solve the identified problems. Analytical thinking creates processes where one opinion is derived from another, so that the end result is based on well-founded conclusions. Such thinking needs available information, selects the important data, demonstrates and verifies existing relations. It is important to work with the corresponding data, to compare the comparable with suitably defined metrics, and the context of the search must be based on verifiable and relevant experience and information.

Information technology is an integral part of modern practices in education. These technologies are able to support activated teaching methods. The application of such a method respects the relationship to Bloom’s taxonomy of educational objectives [8]: to create, to evaluate, to analyze, to apply, to understand, to remember.

Continuous availability of information via the Internet changes the view on knowledge. The need to be able to remember information is replaced by the need to know the context and where to find the necessary information. Substantial skills lead to the information processing via a knowledge basis with Internet service and information source support.

Each individual builds his or her own knowledge separately based on experience and personal learning. This learning is an important part of the contacts and connections created with the support of Internet information technology. This reality affects personal growth based on a creative on-line environment via defined stages: co-

creation, participation, instructions, openness [9].

Information technology users need to improve own knowledge, and continuous learning is necessary. Globalization trends are tangibly applied in the development of information technology products [10, 11]. Users can select from many applications, various forms of implementation, or computer support for realized activities. The main advantage of these trends is diversity and co-operation. Users can co-operate via the Internet, and also share opinions and experience for better performance of information technology products.

3 INFORMATION TECHNOLOGY ABILITIES

There are many applications for big, medium-sized, and small companies, as well as individuals. Intensive solutions (Oracle database system, UNIX operating system, Business Intelligence (BI) and Customer Relationship Management (CRM) products) adapt user the environment to quick and user-friendly processing. Effective use of selected software requires optimal knowledge and skills. The aim of education is to seek optimal ways to obtain the necessary knowledge and skills, based on current development and modern trends.

Operating systems, database systems, BI, and CRM products often belong among implemented information technology products. Their importance is higher in relation to data processing. Data and information is a relevant commodity for an information society. Companies, organization, and individuals search for an optimal method of data management and processing. Information technology offers a wide

spectrum of products, from complex resolutions to individual use:

- Operating and database systems

An operating system often makes up the basic software of every computer. The reason is the need to work with available hardware sources of computers or notebooks. Default installed applications can work correctly with access to memory, processors, disks, LAN (Local Area Network), and other devices, such as printers, plotters, USB memory. Known operating systems are Windows, Mac, iOS, and Linux. One must remember about other operating systems like AIX, Android, FreeBSD, HP-UX, NetBSD, OpenBSD, Palm, SunOS, Symbian, and Windows Mobile [12].

Database systems are dedicated to data storage, and their subsequent processing, searching, and analysis. Database systems have the necessary tools for optimal data storage and subsequent handling. Known database systems are systems from vendors such as Oracle, IBM, Microsoft, but also vendors with far a smaller percentage representation, such as Teradata, Sybase, Progress Software, or InterSystems [13].

- BI and CRM products

BI products have close relations to database systems and hard conditions in a globally competitive society. Companies, organizations, and individuals face tough market conditions, competition, and user preferences. They must seek ways of improvement and innovation. BI products offer the ability to uncover unexpected connections. Users select from many applications, such as Talend, Actuate, SQL Power Software, Jedox, MySQL AB [14]. Pentaho [15] and JasperSoft Suite [16] are additional well-known products with a global

community of users. Traditional products are from Oracle, SAP, and IBM.

CRM products are centered on customer services, and create a background of customer service for existing customers. Analysis of customer services and preferences is also included in specified products. Well-known applications are Oracle CRM, and SAP CRM. SugarCRM, SplendidCRM Software, CentricCRM, Hipergate, Compiere, and vtiger CRM belong in the Top 10 product list [17].

Trends lead to individual user work with these systems without help from information technology specialists. This aspect is important for individuals, small and mid-sized companies that have minimal financial and personal resources. One advantage is that these applications and systems offer a user-friendly environment, with various levels of adaptability. Standard often makes web environments based on links to necessary menus or commands. Navigation is intuitive, with on-line help. The leader in this field is an Oracle database system. Oracle database systems [18] have precisely elaborate architecture in all details.

Users need to understand selected applications. They often fail in orientation of menus, options, and features; therefore, they request help with configuration, data creation, and other practical processing matters. E-learning can solve these tasks. An advantage is that:

- Practical installation with setup for specified software is showed.
- Optimal use of the software, with important features for real application, is described.
- Needed time is saved with immediate insight on specified themes.

- Practical skills and knowledge are gained with practical experience from software usage.
- Better understanding and expression in groups of students (information technology users) is based on interactive communication.

The above mentioned tasks and needs put a lot of pressure on the teacher (tutor), and his/her skills. The 21st century teacher is characterized by certain features. Their list is optimally summarized by Andrew Churches [19]:

- The adaptor.
- The communicator.
- The Learner.
- The Visionary.
- The Leader.
- The Model.
- The Collaborator.

Co-operation is important in teaching. Information technology has tools to support interactive communication. Websites, such as Ning, Bebo, Myspace, Secondlife, Wikipedia are interesting for students. Another necessary feature is initiative. Initiative is important for co-operation and visionary access. Teachers must first define tasks and exercises. This approach shows students that everything they get is knowledge; therefore, the teacher of the 21st century must actively use communication and information technology, know how to manage, control, and moderate [20, 21, 22].

Effective education needs an optimal design of offered courses. Teachers have a number of education platforms for accessing various education materials, video-simulations, tests, glossaries, wiki and so on. Students often positively evaluate activities like wiki for an overview of topics of seminar papers or glossaries as a reference of important terms. A relevant composition of

specific courses helps to solve communication with students and analysis of offered learning activities in the implemented platforms.

4 NEEDED COMMUNICATION FOR BETTER E-LEARNING

E-learning is a highly communicative matter. The term pedagogic communication has many forms of interpretation. The standard definition of communication states that pedagogical communication is an exchange of information between participants of educational goals [23]. Effective communication is based on four principles of education for the development of a learning society in a global world, defined by the International Commission on "Education for the 21st Century" in 1993. These principles define the role of education by Delors concept of four pillars:

- Learn to know - picking up tools for world understanding, and develop skills necessary for learning.
- Learn to do - learning to creatively intervene in the environment (natural and social).
- Learn to be - understand your own personality and its formation in accordance with generally accepted moral values.
- Learning to live together - able to work with others, and can contribute to society [24].

Communication skills are essential for the ability of each teacher to improve the relationship between him or herself and the students. An important condition is to ensure optimal communication and transfer of information. Communication in the classroom (classic or virtual) creates links between students and teachers. The quality of communication

affects the level of education and the existing relationships of each class or group. Students and teachers have problems with communications. The reason rests in the problem with suitable presentations of the study topic with an emphasis on what is important, the need to listen and finding a way to contact the audience. Poor communication creates barriers for the effort to improve the quality of education. It is also true in education that quick and responsible work with much information through immediate processing and respect into defined goals gains success.

Communication is an important hidden power, because data is created by users, and applications are focused on providing convenient services to users to obtain the maximum volume of unique data. A collective approach is effectively used, and contracts with users are based on licenses. Applications are developed as a group of co-operating data for services and functions. This development is maximized with the use of software modules from the category of Open Source.

The Moodle platform is often used to support learning activities and the distribution of study documents. Standard activities are focused on the creation of links to files or the web. The teacher can create additional objects to support interactive communication between the teacher and his students. Moodle offers about 10 learning activities, such as Wiki, Test, and Survey. Selection and arrangement of these activities depend on the teacher. A good starting point for the optimal selection of available objects is analysis of these activities on the basis of Petri Nets, with an incidence matrix and reachable markings. Links to video simulation offer attractive solutions with

support visualization. This method allows the comparison of the implemented resolution, and the selection of optimal course composition for information technology education.

5 ANALYSIS OF LEARNING ACTIVITIES FROM THE MOODLE PLATFORM

This analysis is dedicated to Forum study activity from the Moodle platform of the Learning Management System [25, 26]. Forum activity is an activity to support communication throughout a course. Available communication is realized between course participants (students and teachers). The teacher can create a Forum activity in edit mode for the specified course, then the Forum study activity is added from the existing menu. The next screen contains necessary items for the creation of a Forum activity:

- Forum name
- Forum type
- Forum description
- Contribution for everyone by e-mail
- Mark unread contributions
- Maximum attachment size
- RSS channel
- Number of last RSS contributions
- Type summary evaluation
- Mark
- Limit contributions from data in this range
- Blocking period
- Block after reaching number contributions
- Alert after exceeding number contributions
- Mode groups
- Visible
- Identifier
- Mark category

The teacher can use the default setting for forum creation. Some items are required, such as Name and Describe. Forum creation is finished by buttons at the end of the screen. There are buttons, such as Save and return to course, Save and display, and Cancel. The significance of the buttons is intuitive. If a forum exists, students and teachers can use this activity from the course web site via a web link. New contributions (questions) are added with “Add new contribution/question” button. A participant can write new contribution or question with necessary items (Object and Report). Added contributions are displayed in a dedicated area with information about contribution objects, author, answers, and date.

The following rows show a practical application analysis with Petri Nets [27] for creating a Forum as one of the available activities of the Moodle system for the course “Operating Systems.” The given model describes reality with objects of Petri Nets; it is displayed in Figure 1. The start point is place P1_ListCourses. This place displays the screen with registered courses of teacher. The next route leads through the transition T1_Select_Course to place P2_Course_Identification. The transition rests in the selection of a course by the mouse and the scroll-bar. Place P2_Course_Identification displays on the screen a visually marked record of the course. Next steps are intuitive. Model build follows defined places:

- P1_ListCourses – displays a list of registered courses.
- P2_Course_Identification – displays a visually marked name of the specified course.
- P3_Course_Information – displays specified groups of information, materials, and activities for editing.

- P4_Learning_Activities – accesses offered activities.
- P5_Forum – accesses needed information about Forum.
- P6-1_Name, ..., P6-18_MarkCategory – accesses items for creation of Forum.
- P7_Course_DisplayContent – displays actual information about the course.

Needed transitions of the defined model are:

- T1_Select_Course – searches specified course (specified via scroll bar).
- T2_Display_CourseContent – selects needed information about selected course (selects course by mouse).
- T3_Editing_Course – specifies the edit mode of needed information,

- materials, and activities of a course (button Activate edit mode).
- T4_Add_Learning_Activity – specifies the menu for the creation of a public inquiry, list of questions, database, chats, forums, glossaries, tests, Wikis, SCORM, and lessons (menu Add an activity).
- T5_Edit_ListItems-Forum – accessible registered items for Forum creation.
- T6_SaveAndReturnToCourse – confirms registered information created by edit process (button Save and Return to Course).
- T7_Return_ListCourses – displays all registered courses of teacher for next course select (button Deactivate edit mode to end the editing, select next course via mouse and scroll bar).

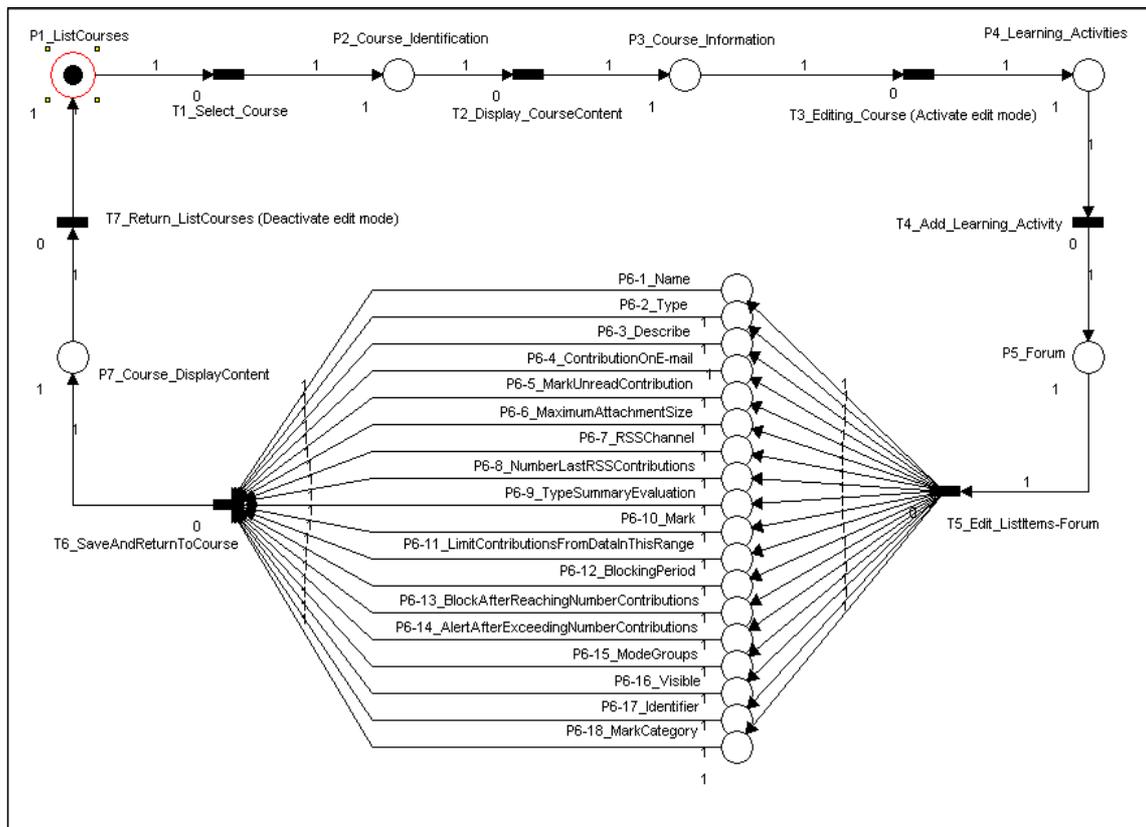


Figure 1. Method simulation for creating a Forum in the Moodle system

The validity of the defined model is verified by starting the given simulation. A route cycle is built from place P1 via specified transitions and places. Places P6-1, P6-2, to P6-18 illustrate items for Forum editing. If the teacher ends the edit mode, it is important to confirm the “Deactivate edit mode” button. This activity is represented by transition T7. The next route returns to place P1.

The above-mentioned model is a good point for further professional analysis based on linear and matrix algebra.

Default structure of Forum is defined as:

$$Forum = \sum_{j=1}^{18} P_{6-j}, \quad (1)$$

where P6-j (for j=1-18) are items for Forum definition in the Moodle system. Further analysis uses a standard way with an incidence matrix and set of reachable markings. To illustrate the incidence matrix and the reachable markings, please see Table 1. The breadth and complexity of the adopted solution is better visible.

Table 1. An analysis for a model with an incidence matrix and reachable markings

	Incidence matrix							t1→M1	t2→M2	t3→M3	t4→M4	t5→M5	t6→M6	t7→M0
	t1	t2	t3	t4	t5	t6	t7	M0	M1	M2	M3	M4	M5	M6
p1	-1	0	0	0	0	0	1	1	0	0	0	0	0	0
p2	1	-1	0	0	0	0	0	0	1	0	0	0	0	0
p3	0	1	-1	0	0	0	0	0	0	1	0	0	0	0
p4	0	0	1	-1	0	0	0	0	0	0	1	0	0	0
p5	0	0	0	1	-1	0	0	0	0	0	0	1	0	0
p6-1	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-2	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-3	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-4	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-5	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-6	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-7	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-8	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-9	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-10	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-11	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-12	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-13	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-14	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-15	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-16	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-17	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6-18	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p7	0	0	0	0	0	1	-1	0	0	0	0	0	0	1

An incidence matrix and set of reachable markings are used for a better illustration of designed systems with computer support. The incidence matrix describes structure complexity and functions of individual items within the modeled system. The incidence matrix represents amendment in places ($p_i, p_{i,j}$ for $i=1$ to 7 , $j=1-18$) as a whole number on the basis of the transitions (t_k for $k=1$ to 7). Items of the incidence matrix have values 1 or -1, if the edge exits or enters the node. Otherwise, items have a value of 0. The number of values 1 or -1 in each row of the incidence matrix indicates the input (output) degree of a node in the system. The set of reachable markings (M0, M1, M2, M3, M4, M5 and M6) displays available states of the system that can be reached from the initial state (M0) via defined transitions.

Similarly, the analysis of other learning activities from Moodle (such as Database, Survey, or Wiki) is available:

- Creation of a Database activity involves fourteen items to specify the Name, Describe, Available Form, Available To, Viewed From, Viewed To, Number of Required Entries, Number of Required Entries before Viewing, Maximum Number of Entries, Comments, Require Approval, Allow Evaluation of Records, Evaluation, and Common Settings.
- Creation of a Survey activity involves sixteen items to specify the Name, Describe, Choice Limit, Option 1, Option 2, Option 3, Option 4, Option 5, Add Three Items To Form, Limit Answer for, Display Mode, Publish Results, Confidential Results, Possible Change for Vote, View Unanswered Column, and Common Settings.

- Creation of a Wiki activity involves fourteen items to specify the Name, Describe, Type, Display Wiki Name on Page, HTML mode, Allow Binary Files, Setting Automatic Wiki Link, Students Rights, Wiki Name, Select Page Start, Mode Groups, Display, Identifier, Mark Category.

The realized analysis better shows a method of creating selected learning activities with a link to the needed volume of work and required simplification. Creation of a Database and a Wiki activity involves the same volume of work. A Survey needs about two items more. A Forum activity is difficult for the definition of required items. There are eighteen items to specify. Some from these items need further interpretation by on-line help, because their sense is not intuitive. Learning activities, such as Forum, Survey, and Wiki are well received by students. Database activity is problematic, in regard to practical use. Moodle offers a Glossary of study activity that allows appropriate access to information. The prompt implementation of available learning activities needs simplification with regard on computational intelligence [28], and e-learning for knowledge society [29].

The topic of learning activities is dedicated a number of studies with aim to analyze the effects of educational activities. They use different approaches such like:

- educational computer games as a part of e-learning based on the activity theory [30],
- student dialogue and nonverbal interactions in the two different learning scenarios [31],
- personalizing learning by student interests for improve student

motivation and better learning outcomes [32].

These activities define a theory for further development of education and learning activities. The interest is about communication for support learning activity. Learning activities solve different degrees of participation, questionnaire feedback, or effectiveness of shared environments. Realized studies often define relation goal alignment and market performance, or alignment and learning function with aim to show links learning activities on business results. The students indicate problems with learning functions, relations between learning and organizational goals, and ability to measure learning effectiveness. Just like a mirror, the needs and preferences of individuals and groups in education reflect changes in society; therefore, the need to realize standard surveys and analyses with regards to new conditions and support of information technology. Continuous analyses and their subsequent use for upgrading learning activities have a positive influence on:

- the positive acceptance of offered educational documents,
- increased motivation for continuous improvement in education,
- the coordination of visual and auditory perceptions based on analysis and synthesis,
- topic repetition with examples of good practice in the form of real stories, and
- easy and intuitive navigation for teachers and students with the support of Internet technology.

6 CONCLUSION

Global changes in society create new conditions for work in companies,

organizations, and for individuals. This reality has an influence on education with the support of information technology and implementation via realized activities. Information technology offers a large spectrum of available applications and systems. Business can select from many operating and database systems, CRM, and BI products. Business must understand these systems and applications for use in practice. E-learning has the ability to solve the need for optimal knowledge and practical skills based on learning activities and interactive communication. The teachers and students often use Moodle platform as background for education. The question is their contribution.

Realized analysis is dedicated to Forum study activity from the Moodle platform, with links to Database, Survey, and Wiki. Analysis is based on model simulation for creating selected learning activities via Petri Nets, linear, and matrix algebra. This analysis shows that a Forum is difficult for creation (with eighteen items) in regard to a Database (with fourteen items), Survey (with sixteen items), and Wiki (with fourteen items). The activation this study activity must be simplified based on inspiration from other products of information technology like Oracle or computational intelligence in the knowledge society.

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