COMPUTER TRAINING IN THE GLOBAL SOCIETY WITH INSPIRATION FROM SWARM INTELLIGENCE

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Abstract: *This paper is centred on optimal computer training in the global society with a link to suitable course design. IT (information technology) competences create a wide range of knowledge and skills. The reason is application of diverse software. Education must respect ongoing dynamic changes. This reality requires optimal course design by auto-self structure. Swarm intelligence offers a good inspiration. Dynamic course structure is based on the evaluation of educational activities. This solution reflects student preferences (as pheromones) and supports better computer training.*

Keywords: education, global society, IT competences, swarm intelligence

INTRODUCTION

The information society places hard conditions on all human activities in all fields. These conditions are linked with requirements on quality, design, usefulness, friendliness, and immediate availability. The perception of product and service is discussed on the Internet. (Riley, 2013) There are blogs, communities, and specialized websites like Facebook, LinkedIn or Twitter. IT (Information Technology) users search for various views on a given topic with the idea to find an optimal solution. They use various software, e.g. freeware, shareware, demo, cloud resolution and standard software with licences. There is great availability of such software on the Internet, without any conditions, or via registration. A positive fact is that software is accessed for many complex issues – database systems, Business Intelligence and CRM (Customer Relationship Management) products, mobile technologies.

IT users must have good experiences with installation, configuration, optimization and default software usage. In many occasions, software installation is intuitive via a guide with a few easy questions (e.g. installation type, work directory for installation, user name, e-mail contact). Further software usage is not as easy. The IT

user has to follow required rules for given fields. Database systems respect rules for data storage in database files. Business Intelligence must respect conditions for optimal warehouse creation. CRM products correctly relay information about customers with an optimal website. Mobile technologies require immediate availability. Education plays a difficult role in this IT diversity. Education must respect user preferences and IT trends.

1. IT COMPETENCES IN THE GLOBAL SOCIETY

IT competences are influenced by actual IT trends. There are a number of surveys, studies, analyses and a great amount of research on this topic. For example, the Gartner society predicts key trends of IT development (Analysts 2011):

- Tablets.

Tablets are small devices used for communication between managers, customers and other users. Their benefit is size and connectivity via WiFi. Well-known operating systems are Google Android, Intel/Nokia MeeGo, Samsung Bada, Apple iOS, MS Windows 8. (Brůcha 2013)

- Applications for mobile technologies.

Such applications respond to touch and voice with connectivity to information systems. There are requirements regarding on-line communication, navigation, web access, document processing and fun. (Malý, Kozel & Slabý 2008)

- Context-aware computing.

Better offers are provided with suitable information about the environment, user preferences and activities. Answers to default questions like “who?”, “what?”, “where?” are important for activities, and IT users want an adequate reaction based on actual context. (Khan 2006)

- Wider range of analysis.

Data analysis creates various views based on actual data with cloud support. Such resolutions support better cooperation and decision-making. The auto-self activities are supported via adaptive business intelligence. (Khan & Kalbande 2013)

- Large volumes of data.

Data volume is increasing and their processing is complicated for actual information technology. A database system must process data very quick with links to further analyses. In this situation, a good solution is given by an in-memory layer of the database system that ensures data processing in memory with quick results. (The hottest trends in databases, 2011)

- Cloud computing.

Cloud offers the IT user options to apply instance creation with a virtual server (for example: Linux, OpenSolaris, Windows) and use this server for a selected application. Such applications (in cloud) are well-known. Everyone knows Google Apps with Gmail. (Waddington, Zhang, Knight, Jensen, Downing, Ketley 2013)

IT users need various skills and knowledge for the optimal implementation of information technology. Practical IT implementation creates a press on their users. These users must adequately respond according to the current situation: to monitor needed information, to search new context, to analyze actual conditions, to communicate with other IT users, to send requested information, to record video, and many other activities with the support of IT. Education must offer students various educational documents in exceptional quality and diversity for better IT competences. The reason is necessary variability based on student preferences and skills.

2. VARIABILITY OF EDUCATIONAL MATERIALS

Students and teachers use educational platforms for appropriate support educational activities. Education with IT support brings more dynamics and availability. An educational platform allows a person to login into a system according to user preferences. Students consume volumes of information from a given field. An educational platform such as Moodle (Moodle 2013) supports:

- Reading default educational documents.

Students have access to default educational documents in PDF files, PowerPoint presentations and text files (like MS Word, Writer).

- Viewing images and recordings.

Students may view images and watch films like videos and simulations. These documents are user-friendly with respect to visual demonstration of the required method.

- Special activities like database, glossary and wiki.

These activities help with orientation in a topic. Students select a different method of learning with the aim to repeat important concepts, terms and definitions.

- Communication between students and teachers.

Such activities are forums, workshops and e-mail. These activities are a standard part of learning in class. E-learning also needs these activities for better specification, clarification and detailed descriptions. Communication also enables a person to share impressions from learning and first insights.

- Feedback via tests, surveys and explorations.

Test activities bring a necessary degree of learning control. Students and teachers see actual results based on answers. Feedback is important with respect to stress on adequate skills and knowledge. Students must discern their current abilities that they offer in practice. Teachers must know about their actual results in the form of transmitted knowledge to students.

- Special educational activities like lessons.

This activity helps with orientation in a topic. Students are introduced to needed definitions, methods and procedures. This interpretation is followed by a test section. Based on the answers, students are referred to a new lesson (if the answer is correct), or to the same lesson (if the answer is incorrect). This approach is suitable for better support of optimal knowledge and skills acquisition.

3. COMPUTER TRAINING WITH INSPIRATION FROM SWARM INTELLIGENCE

The above-mentioned educational activities help to define computer training with optimal course design. The teacher can easily create required activities with the use of guides or templates with default settings and items. The question is about their selection and location in the course. Optimal course design should reflect a student's perception. Students compose a mosaic of knowledge and skills of their own experience from education and practice. Some students prefer videos, simulations and communication via a forum. Some students better understand a topic based on reading documents with a discussion to follow. Some students prefer the method of testing with ad-hoc answers. Some students need a challenge in the form of a complex task for individual problem-solving. And of course, some students like to solve tasks in groups with interactive communication.

The students' spectrum of priorities is diverse, and education has a difficult role in order to conform to all student priorities and needs. This situation complicates dynamic changes in student preferences and societal needs. Teachers may estimate suitable course design based on cooperation with students. The other method is inspiration from nature. There is a specialized field that is focused on swarm intelligence. (Hazem & Janice 2012) Swarm Intelligence is used for simulating the collective behaviour of swarms. These swarms create social colonies in nature (ants, bees and birds). The unique benefit is visible in seeking a suitable resolution. These swarms create individuals with limited capabilities, but the swarms find the optimal solution based on cooperating on the task needed for survival. (Lim, Jain & Dehuri 2009)

The global information society needs cooperation for gaining the optimal solution from existing tasks, obligations and problems. The countries of the EU (European Union) face economic hardships such as low economic growth and high

unemployment (Walker 2013) with links to violence and discrimination. For active resolution in urgent tasks, people need cooperation, communication, good orientation in the topic based on suitable skills and knowledge. These capabilities must be improved. Necessary improvement brings education with practice, and nature brings inspiration into practice and education. Swarm intelligence is practically applied in many areas (bioinformatics, business, data mining, dynamical systems, finance, finding optimal routes, image analysis, machine learning, medical informatics, scheduling, structural optimization). (Hazem & Janice 2012; Udgata 2010)

The presented idea is inspired from swarm intelligence that is applied in education. Based on the Ant Colony Optimization Model (Keller & Gordon 2009; Chan & Tiwari 2007), optimal course design is defined with links to educational activities. This model describes the behaviour of ants on their way for food. Some ants found the shortest path to the food. They mark this way with pheromone and this path is more attractive for other ants. These ants follow this marked path. Please see Figure 1.

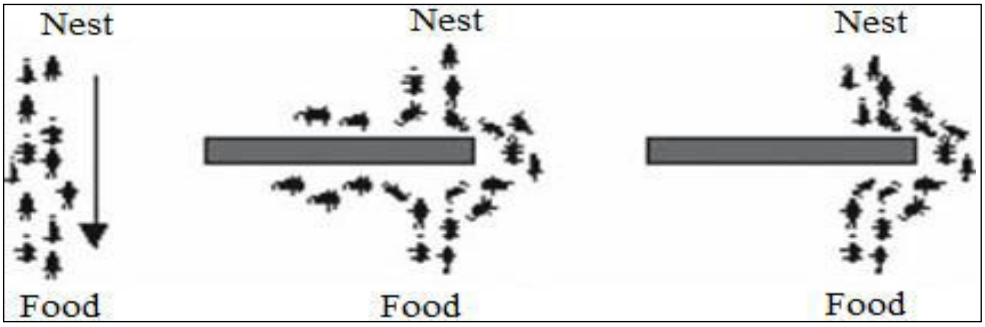

Figure 1. Ants' stigmergic behaviour in finding the shortest route between food and nest

Source: Dorigo & Stützle, 2010

In parallel view, educational activities are understood as a path to knowledge and skills. The question is about their optimal composition in a course (optimal path). Students and teachers are individuals in the class (virtual or default swarm). In nature, the ant swarm found the optimal resolution to the task via pheromones. The class (swarm) of students and teachers also seeks an optimal resolution to the task using student preferences and practice. These preferences make pheromones; therefore, actual use of educational activities must continuously be monitored. Good experience brings monitoring through log files. Monitored preferences suggest better course composition. Based on obtained information, teachers create an optimal course design or lecture structure. Please see Figure 2.

The preferred educational activities will be used in the main part of course; other activities (with small preference) will be placed in an additional section of the course (in the final part). For easy implementation, evaluation of educational activities must

be marked with a preference value (for example, a range from one to five like grades in school), and the order of educational activities is given a mark from the lowest to the highest mark. The optimal path to knowledge and skills is defined with the preferred course design based on auto-self order of educational activities via preference evaluation.

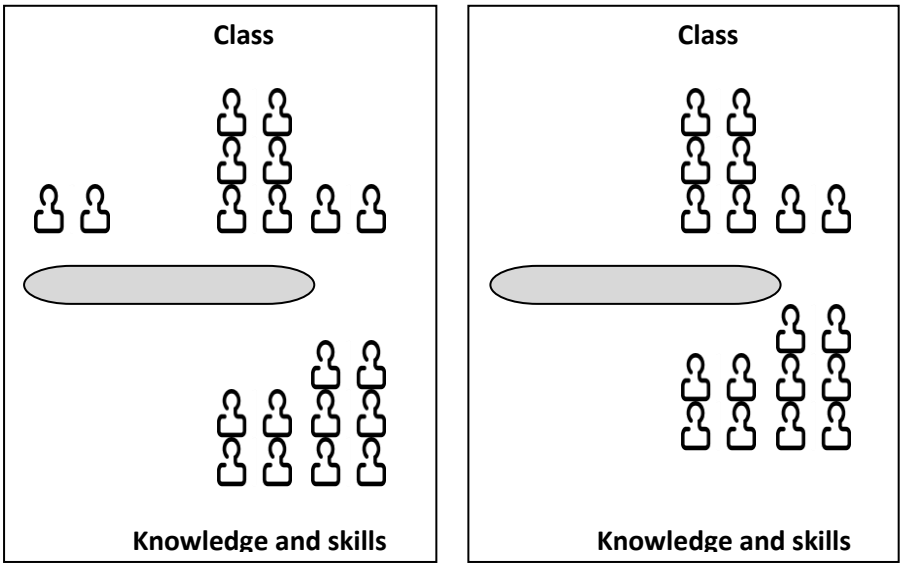

Figure 2. Design Selection of Educational Documents by Student Priority.

Source: Own

CONCLUSION

The global society is exposed to pressure on realized activities. Challenging requests exist for the optimal offer of products and services. Information technology helps with information distribution in society. There is various software to support needed activities based on complex issues. IT users must apply such software based on knowledge and skills. The range of needed knowledge and skills corresponds to software variability. Suitable IT competences bring education and practice. Education must respect the diversity in student preferences and practice with the support of an educational platform. For example, Moodle offers activities like documents, images, videos, simulations and special activities as database, forum, glossary, lesson, test, wiki, or workshop. Optimal computer training influences course design. By default, teachers create courses based on manual creation of needed activities. For dynamic changes, dynamic course design is required by auto-self course structure. This solution is inspired by swarm intelligence and preference evaluation of created activities by students. The aim is to find the optimal path to knowledge and skills for better computer training.

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