Design Informatics Special Workgroup in View of Learner's Fields of Interest in Secondary Schools of Transcarpathia

Tamás Szimkovics, Gyöngyi Bujdosó

University of Debrecen, Debrecen, Hungary

szimkovics.tamas@gmail.com, bujdoso.gyongyi@inf.unideb.hu

E-learning can be used in many areas of education from higher education, company training to elementary schools. We examined the secondary school education, because this area is not sufficiently developed for the modern information society. We have to find practical methods to blend the means of e-learning and traditional education. Our motivations for creating a special workgroup on information technology (IT) is to mitigate the problems caused by the following:

- ✓ in Transcarpathian IT classroom's equipments are outdated and cannot serve quantitative and qualitative hardware and software for students,
- ✓ the actual IT workgroups are not enough interesting for the students because their curricula are not adapted to the pupils IT skills.

Our aim is to design IT workgroups using blended learning (Singh, 2003). To achieve this goal, we examine the students' IT skills by using Galois lattices Andor et al., 1985). We use learning management system to connect learners and teachers in a virtual learning environment. Among free LMS systems we are focused on those systems that are the most usable, suitable and motivating in secondary school education and have friendly interfaces. Our aim in teaching methodology is to develop the following skills: self-study, digital literacy, collaborative group work.

Introduction

IT curriculum development in the Ukrainian secondary schools has a great importance, it is shown by the fact that the Ukrainian Ministry of Education has strong focus on this area.[1] The Ukrainian Ministry of Education emphasizes on it IT teachers devote more lessons to teach by

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[1] Ukrainian Ministry of Education decision 16.04.2014 № 460: elementary schools 2-4 grade educating IT, 02.02.2016 № 73: increase the number of information technology teaching hours in 7, 8, 9 grade.

new curriculum. But the IT classrooms equipments are outdated and cannot supply students with quantitative and qualitative hardware and software. They were not updated since 2007. We try to overcome these difficulties by using blended learning methods. We are to develop the level of teaching efficiency by inventing methodology and adapting the curricula contents to the learners' skills and fields of interest.

Galois lattice used in education

Galois (concept) lattices are used in several fields of sciences as well (Graham, 2006; Singh, 2003). The Galois lattice is a graphic method of representing knowledge structures (Andor et al., 1985).

We used Galois lattices to determine which areas of informatics suits for each age group in the special workgroups. Each vertex of the Galois lattice denotes one closed subset-pair. Each closed subset-pair defines a relation between objects and attributes (Takács, 2000). In our survey, the objects are classes and the attributes are the IT topics.

Blended learning

If we do not want to use pure e-learning or pure traditional face-to face form in teaching, so we can use blended learning methodology. Both the e-learning and blended learning have many definitions. Here we define the term of blended learning interpretation the term of e-learning that we use in this article. E-learning in the form of education: when "the learner is at a distance from the tutor or instructor, that the learner uses some form of technology (usually a computer) to access the learning materials, that the learner uses technology to interact with the tutor or instructor and with other learners, and that some form of support is provided to learners." (Anderson, 2008:16) The blended learning is more than a blended form of online and the traditional education, it is a kind of symbiosis that connects the educational processes on many points (Graham, 2006). The question is when and which form of educational methods should be inserted into the blended educational processes? In order to answer this question we present a possible practical implementation of the blended learning. Main blended learning models: rotation, flex, self-blend, enriched-virtual.
1. Rotation model – In this model a controlled rotation of the traditional and the online learning takes place, which is defined by the schedule. The following forms of rotation model exist (Powell et al., 2015):
    a) Station Rotation – The full educational process realized in the educational institution.
    b) Lab Rotation – Education going on different campuses of the same institution. It is used mainly in higher education.
    c) Flipped Classroom – Differently from previous rotary models, students can learn not only in the classroom, but also at home

online form. Thus, the students have the opportunity to control the learning intensity, location and time, which helps of differentiated education.

d) Individual Rotation – This rotation model differs from the other rotation models because students do not necessarily rotate to each available learning station, but the schedule will be fixed.

2. Flex model – Contents and instructions are delivered to students primarily by the Internet. The schedule is flexible and supplies student's needs.

3. Self-Blend (or A La Carte) model – Students can choose one or more courses entirely online to supplement their traditional courses, which the teacher are made available in digital forms. Students can complete the courses either online or in traditional form.

4. Enriched-Virtual model – Content and instructions are presented mostly online. The flipped classroom is different, because students visit the educational institution mostly, when they stalling in online education. The Self-Blend model is also different, because the form of education extends to the whole school, not only for individual courses (Staker & Horn, 2012).

The models mentioned above illustrate well how many ways can be introduced by blended learning in the process of education. We have selected the Rotation-Flipped classroom model. For the other models (flex, self-blend, enriched-virtual) high level of learning autonomy is needed, and not characterised for students of secondary school education. Younger students (11-16 year) cannot focus always on the curriculum (learning material) without teacher's consecutive instructions, especially when the learning process has to be performed online.

E-learning systems

For using blended learning teaching methods, an e-learning system is needed. The minimum functionality set of the e-learning system that is needed for performing blended learning courses: identification of users for giving access to the appropriate educational materials, monitoring and logging user activities, possibility of interaction among users (Benedek, 2012). The e-learning systems can be divided into two groups: necessary to install it on the server or services used on cloud-based technology. Some examples of the most popular e-learning systems:

1. Installed server architecture: Moodle, ATutor, Ilias and Claroline.
2. Cloud-based (Service: SaaS - Software as a Service) e-learning systems: Teacher Dashboard for Microsoft Office 365, Edmodo and Google Classroom.

Methods

In our survey we have examined the students' interests we wanted to know which areas of informatics they are interested in. For getting information about their interest fields we use questionnaires. Two-hundred questionnaires were filled by secondary and high school students. The examinees were 5th to 10th graders (102 female and 98 male). The students who participated in our research were selected from the following schools in Ukraine: Dayka Gábor №10 School of Uzhorod, Hungarian High School of Uzhorod, Kossuth Lajos №4 School of Beregove, II. Rákóczi Ferenc Vocational Schools of Beregove. Five points scale was used to determine students' attitudes, how much they are interested in special areas of informatics, i.e. in computer graphics, system administration, coding, robotics, game development with Scratch, Webpage editing and using Microsoft Office softwares. In compiling the question of the surway we relied on a questionnaire of the Australian Council for Educational Research (2005): OECD/PISA ICT (Australian..., 2005). Our questionnaire consists of four sections: personal data, home computing equipments, habits of using computing devices, preferences of the special IT areas. We analyzed the preferred areas by using Galois lattices.

After selecting the Rotation-Flipped classroom model, it is important to choose an e-leaning system for online education. The installed server architecture systems mentioned above have free licences, but the financial implications of hosting and maintenance may cause difficulties for schools. We decided to use a cloud service. The Microsoft cloud solution is more appropriate for corporate clients. The Edmodo has no user interface in Hungarian yet (Hungarian-language schools were examined), and learning processes are not so well controlled as in the Google Classroom. Finally the Google Classroom was chosen, because it can be connected easily to mobile devices (with Android operating system), many useful applications can be attached to it, it is easy to manage and configure it.

Results

Table 1 shows the results of the questionnaires. Each cell contains the average point of a given area per class. We converted the values to binary format, in this way the data are suitable to calculate the closed subset-pairs for the lattices (Takács, 2000).

Table 1. Students evaluation of IT areas

IT areas / Grades	Computer graphics	Web page editing	Coding	Office soft-wares	Game develop-ment	System administra-tion	Robotics
5	1		1	1	1	1	1
6	1			1	1	1	1
7	1			1	1	1	
8	1			1		1	1
9	1	1		1	1	1	1
10					1	1	

The relation table (Table 1) is needed to design Galois lattice. Closed subset-pair (see Table 2) list can be calculated from the relation table. The calculation of closed subset-pairs and drawing graphs (see Figure 1) was performed by a two-step Galois 2.01 program (Takács, 2000).

2. Table. Closed subset-pairs (Relations between students and IT areas)

n	Classes	IT Areas
1	5	1, 3, 4, 5, 6, 7
2	5,6,9	1, 4, 5, 6, 7
3	5, 6, 8, 9	1, 4, 6, 7
4	5, 6, 7, 9	1, 4, 5, 6
5	5, 6, 7, 9, 10	5, 6
6	5, 6, 7, 8, 9	1, 4, 6
7	5, 6, 7, 8, 9, 10	6
8	9	1, 2, 4, 5, 6, 7

Figure 1. Galois lattice: Relations between students and IT areas
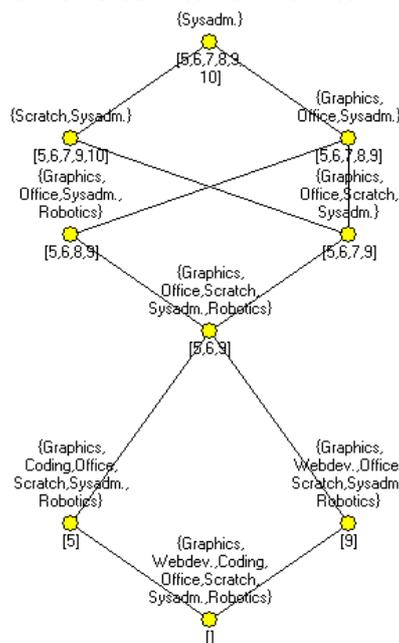
Graph analysis shows well which IT areas are interesting for learners. Each vertex on the graph represents a closed subset-pair. Above the

vertices of the graph IT areas are visible and below the vertices the grades of students can be seen. One of the most interesting result of the survey can be recognized in the graph: the most popular area is the duties of system administrators. The game developing and computer graphics are also interesting for the students. Less popular areas: web developing and coding. The graph also shows that the grades 5th and 9th prefer 6 themes from 7. The 10th grade students are interested in only two areas: web developing and coding.

After analyzing the results we decided to start coding special workgroups for the students between 7th and 10th grades. In the design of such special workgroup we used visual block programming (Scratch) because of its popularity. We decided to start the curriculum of the special workgroup by based on the Scratch program. The next step is to introduce the Phyton programming language. We use Google Classroom system for delivering a part of the content and the school materials.

During our survey we created a model that is suitable to form a student-centered IT special workgroups in a blended learning form. The model is divided into 3 steps:

1. Choosing appropriate areas and grades by Galois lattice (7-10th grades, coding and game development),
2. Selecting the suitable blended learning model (Here was Rotation: flipped-classroom),
3. Finding adequate online e-learning system (Google Classroom).

Conclusions

We found important results by using Galois lattice. We determined which areas of informatics and information technology are interesting for the age groups. The results showed that the traditional programming is not so popular as the visual block programming (i.e. game development in Scratch). We could make the IT programming special workgroup more efficient and more interesting for the students by using visual block programming. The Flipped-Classroom model that we used as a blended learning method made the educational process more efficient. We could improve the differentiated education by giving the opportunity for students to control the learning intensity, location and time. The traditional face-to-face lessons provided the right teacher's control and instructions.

Google Classroom was the adequate in our work for performing the online part of the blended learning model. We plan to examine the usability the popularity e-learning system based on more parameters during a future research.

Our next goal is to examine and measure the effectiveness of the IT special workgroup we designed and formed. We intend to monitor the changes of the special workgroup knowledge structures by using Galois lattices.

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