

# What can multimedia add to the optimization of students' study habits?

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*Abstract:* - Multimedia applications, an interactive system of digital media, where multimedia information is selected by the user himself according to his individual needs, give us an excellent chance how to support demonstrating, visualizing, describing and testing the explained subject matter to be much clearer and comprehensible. In the paper we present just a few ideas that have proved successful in optimization of students' study habits with help of modern technology.

*Key-Words:* - Multimedia study material, virtual learning environment, self-preparation of students

## 1 Introduction

Students find modern technology very handy when looking up things of their own interest. The teachers should take advantage of this fact and should try to prepare for them such multimedia study material, which would optimize their study habits. It means to make their study more effective, time-efficient and explained topics more comprehensible.

When teaching a subject we always lay stress on applying the following principles so that our students, at least most of them, have entirely understand the explained subject matter.

### *Teaching in contexts*

We investigate a particular problem from more than one point of view if possible, modify a problem and discuss the mutual relationships among solved problems. In this way students are forced to think about each problem more than usually. By comparing the various attitudes the students are able to get deeper into the problem and to understand it.

### *Explanation of the topic on real examples*

In order to enrich students' view of discussed subject matter and deepen their awareness of it, we try to describe a particular problem on real life examples. We force our students to add their own examples describing the topic to be sure that they can understand it.

*Visualization of the particular issue as well as it is possible*

Demonstration and visualization make the subject much clearer and comprehensible. "Students need images and visualization in addition to words. Science learning is about creating images in mind, and teaching should support such image formation." [1]

### *Intensification of students' self-preparation*

We try to prepare interesting study material for self-preparation of students to force them to study regularly

as possible to be prepared for lessons. Lessons can be run more efficiently, like a discussion or consultation, then.

This paper illustrates some advantages of prepared multimedia study material for students studying in the full-time form of study. On a few examples of multimedia products created by our students on a script given by the teacher with regard to students needs we discuss benefit of the possibility to use multimedia material visualizing the subject matter and testing knowledge of students through several kinds of self-tests. We also mention some advantages of virtual learning environment containing such study material.

## 2 Multimedia Presentations

Multimedia presentations are usually used to describe a topic and illustrate it using visualization of objects and processes. They mostly enable to test the explained matter using several prepared exercises as well. Let us briefly describe two presentations used within the subject Graph Theory and emphasize their different usage.

The *subject Graph Theory* is a compulsory subject taught in the fourth term. Its aim is to develop and deepen students' capacity for logical thinking. Students gain a basic level of competence in graph theory and graph algorithms. Well-prepared students in the area of graph theory and graph algorithms should be able to *describe various practical situations with the aid of graphs*, solve the given problem expressed by the graph, and translate the gained solution back into the initial situation.

## 2.1 Presentation “Combinatorics”

Combinatorics is strong equipment for increasing of logical thinking and students gain the basic knowledge in this area at the secondary school. In the subject Graph Theory *we presume* that our students are familiar with the basic combinatorial concepts. In the case that they need *revise their knowledge*, they have the presentation called Combinatorics created in the Macromedia Director environment by the student within his thesis available.

The presentation consists of the *explanatory part* (definitions, theorems and solved examples) and the *solutions of demonstrated examples* to the given topic. Examples are lined up according to their level from the easiest to the most difficult. The presentation also contains a collection of unsolved examples with references to their results.

## 2.2 Presentation “Zoo”

The presentation is created in the Macromedia Flash environment by our student within his bachelor work. It explains and illustrates step by step how to find Euler trail using the Edmonds-Johnson approach. The method is applied on the practical example how to walk whole zoo (see Fig.1).

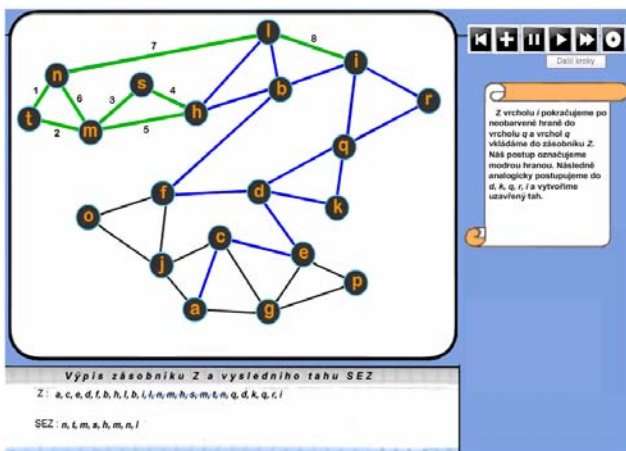


Fig.1

With help of this presentation students can briefly *revise the topic* when it is needed. Students who miss the lecture can use it as a *useful complement* of the printed study text.

## 2.3 Summary

The first presentation offers students the possibility to *completely revise the large subject matter*. The second presentation serves as *detailed visualization of the given topic* explained within the lecture.

## 3 Multimedia Programs

Biggest advantage of the programs, as opposed to the presentations, is the fact that there is the possibility to create an infinite number of needed examples. At first let us devote attention to the illustrious multimedia program “Graphs” [2] used also within the subject Graph Theory (see the chapter 2). Then we briefly introduce another program used within the subject Algorithms and Data Structure.

The *subject Algorithms and Data Structures* is a compulsory subject taught in the first term. Its aim is to develop logical thinking of students, teach them to create simpler algorithms and to understand more difficult ones. *Algorithms are written in the Czech meta-language. Students write them on papers.* The subject is placed before the other subjects dealing with algorithmic and programming skills.

### 3.1 Program “Graphs”

The program was created in the Delphi 5 environment by our student within his thesis. The main purpose of this application is a visual representation of basic graph-concepts and graph-algorithms using a colouring process on graphs created within the program.

The program enables creating new graph, editing it, working on it (moving, colouring vertices, edges, etc.), saving graph in the program, saving graph in bmp format. It allows to open more than one window (see Fig.2) so that two (three) objects (algorithms) can be compared at once.

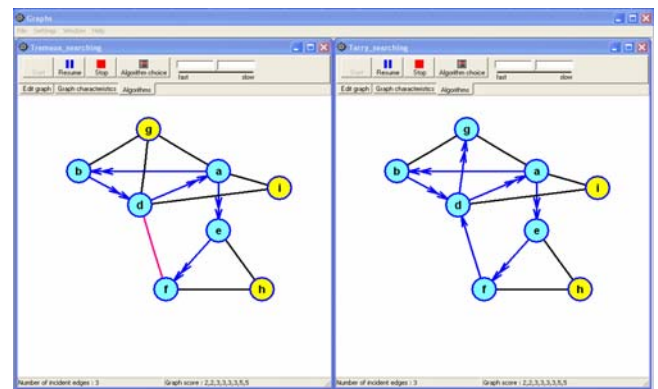


Fig.2

The program “Graphs” *enables the teacher to complete his/her explanation within lectures*, the possibility to open more than one window enables him/her to *explain the problem from more points of view* and *show mutual relations among used concepts, algorithms*. The possibility to save each created graph in bmt format allows the teacher *easy insertion of needed graphs into texts and presentations*.

Using the program students can *revise a lot of subject-matter within the area of graph theory*. They can use not only graphs prepared by the teacher but also their own graphs and explore the properties of these graphs. The possibility to open more than one window enables them to *follow mutual relations among used concepts and algorithms*. The option "Save Graph in bmp format" enables them *easy creation needed graphs for their assignments* where describe various practical situations with the aid of graphs and solve the given problem.

### 3.2 Program "Algorithms"

We have already mentioned that students write their algorithms on paper. There was an important question. How can students get feedback for their solution written on papers in the Czech meta-language (Czech transcription of pseudo Pascal - the basic commands) when studying at home and preparing for lessons? Of course, they have two books ([3], [4]) containing many solved examples, prepared for the subject Algorithms and Data Structures, available. Nevertheless, there are a lot of other tasks that we give our students to solve.

This was the main reason, why the program "Algorithms" [5] was created. It was developed in Borland Delphi environment within the thesis. It is user friendly and provides entire graphical comfort for users.

Using the program Algorithms students can place their solutions of the given tasks in the program and the program *shows them step by step how their algorithms work*, if they are correct or not. The program also shows actual values of used variables in each step of the algorithm's process (see Fig.3).

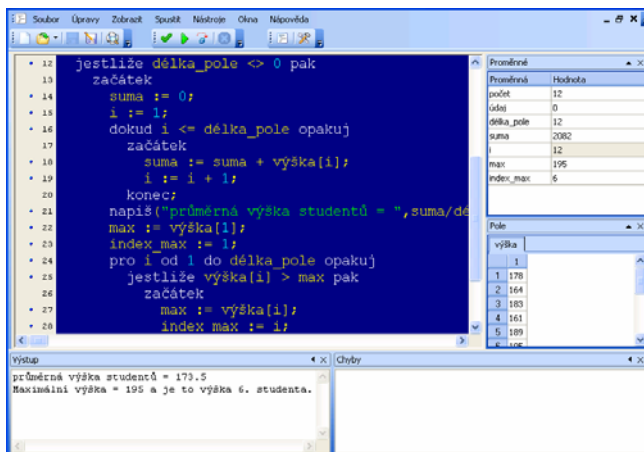


Fig.3

The program is not only a *substantial help to students in their self-study* but it helps also teachers to prepare text materials (lectures, tests etc.).

### 3.2 Summary

The program "Graphs" enables the teacher to *complete his/her lectures in the way that explained topics can be more comprehensible*.

Both programs *save the teacher's time* very much when he/she prepares text materials and presentations.

Using these programs students can *revise explained subject-matter and deeper understand it*. They can very *easy prepare their assignments* with the aid of programs as well.

Students studying the English study program at our faculty can also use both programs because it is possible to localize them into English language (see Fig.2 and Fig.4).

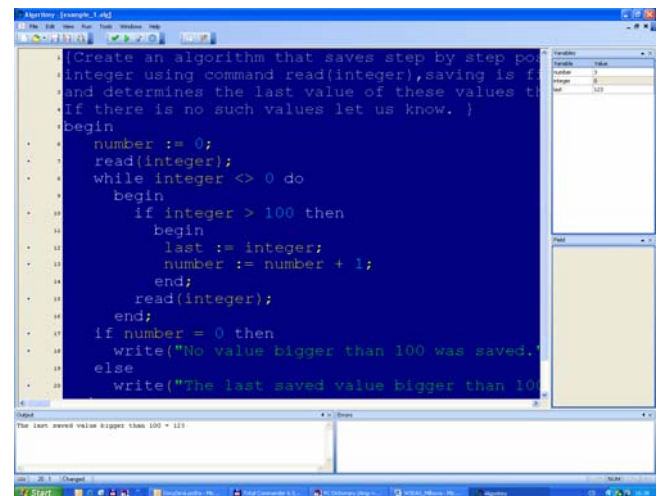


Fig.4

### 4 Interesting ways of on-line self-testing

"The feedback provided through tests helped students to recognize what they needed to know, appreciate what they already knew and understand, what they needed to do in order to learn, and what they didn't know" [6].

Our students can test their knowledge using programs described in the previous text. However they have various other possibilities how to do it.

At our university we have been using the professional virtual WebCT learning environment. There are tool enabling to prepare tests in easy way. Nevertheless, the kinds of tests prepared by WebCT tool need not be sufficient for each subject.

In the following text we illustrate "Tests with Help" intended for the knowledge testing within combinatorics. Then we introduce a nice application called ALGDS [7] containing interesting types of tests making testing of algorithms *amusing*.

## 4.1 Tests with Help

The tests “Tests with Help” (see Fig.5 – “Úlohy s nápovědou”) are created as a webpage and the link to it is placed in the WebCT environment within the subject Graph Theory.

Students read each given task and try to solve it. If they are helpless they can click on “the first help” (see Fig.5 – “1.nápověda”). If they are still helpless they can click on “the second help” (see Fig.5 – “2.nápověda”). Their solution they check using the offer “whole solution” (see Fig.5 – “celé řešení”).

On the Fig.5 you can see that both helps were used in the first task, the first help only was used in the second task and no help was needed in the third task.

**Úlohy s nápovědou - Kombinace bez opakování**

**První úloha**

Na letním táboře je 20 dětí, kolika způsoby z nich můžeme vybrat tříčlenné komando?

Kolika způsoby můžeme vybrat první z dětí? (20)

Kolika způsoby můžeme vybrat druhé z dětí? (19)

**1. nápověda**

**2. nápověda**

**celé řešení**

První dítě vybereme 20b, druhého 19b, třetí 18b. Nyní však celkový počet možností vydělíme 3!, protože nám nezáleží na pořadí dětí, v jakém je vybíráme, ale na konečné skupině. Číslo 3! (3 faktoriál) jsme dostali tak, že spočítáme počet všech pořadí, kterými jsme mohli již vybrané 3 děti seřadit.  $3 * 2 * 1 = 3! = 6$  (ABC, ACB, BAC, BCA, CAB, CBA) Ke stejnému výsledku dospějeme použitím vorečku pro kombinace bez opakování, C(3;20)

**Druhá úloha**

Rotu tvoří 3 důstojníci, 6 poddůstojníků a 60 vojnů. Kolika způsoby z nich lze vybrat oddíl, který tvoří 1 důstojník, 2 poddůstojníky a 20 vojnů?

Kolika způsoby lze vybrat do oddílu důstojníka? (3 způsoby)

**1. nápověda**

**2. nápověda**

**celé řešení**

Důstojníka vybereme třemi způsoby, 2 poddůstojníky C(2;6)b způsoby, 20 vojnů potom C(20;60)b způsoby. Celkově je tedy  $3 * C(2;6) * C(20;60)$  možností.

**Třetí úloha**

Kolika způsoby lze ze sedmi chlapců a čtyř dívek vybrat šestičlenné družstvo tak, aby v něm byla alespoň dvě dívky?

**1. nápověda**

**celé řešení**

Nejprve budeme tvořit družstvo složené ze dvou dívek, zbytek chlapi. To uděláme C(2;4) \* C(4;7) způsoby. Dále bude družstvo složené ze tří dívek a tří chlapců. To lze C(3;4) \* C(3;7) způsoby. Nakonec budou ve družstvu čtyři dívky a dva chlapci. C(4;4) \* C(2;7) způsoby. Výsledný počet výběrů družstva je součet těchto způsobů: C(2;4) \* C(4;7) + C(3;4) \* C(3;7) + C(4;4) \* C(2;7)

Fig.5

## 4.2. Web application “ALGDS”

The application is created within PHP language and it is intended for testing knowledge gained in the subject Algorithms and Data Structure. The link to the application is placed in WebCT within the subject Algorithms and Data Structure.

Web application “ALGDS” enables three kinds of tests:

- “complete the given algorithm” (see Fig.6 – “doplňování do algoritmu”),
- “order the given algorithm” (see Fig.7 – “seřazení algoritmu”),
- “solve the given algorithm” (see Fig.8 – “vyřešení algoritmu”).

The test “complete the given algorithm” demands to complete omitted parts in the algorithm solving the given task.

The test “order the given algorithm” demands to order all commands written in wrong order in the lower part into upper frames to get algorithm, which correctly solves the given task.

The test “solve the given algorithm” demands to determine values of some variables used in the algorithm using the given enter data.

**Doplňte chybějící části algoritmu tak, aby splňoval zadání**

Vypočítejte součin prvních  $p$  přirozených čísel dělitelných třemi,  $p=1$ .

```

začátek
součin:=...1...;
i:=1;
Řeš [p];
dokud i<=p opakuj
    jestliže i ...2... 3 = 0 pak
        začátek
            součin:=součin*...3...;
            i:=i+1;
        konec;
    napiš(součin);
konec.
  
```

1)

2)

3)

Zkontrolovat

Zpět na seznam testů | Znovu řešit tento příklad

Fig.6

**Seřaďte správně kód programu**

V žitélné posloupnosti  $a_1, \dots, a_n$  určete a vypište součet prvních  $n$  dělitelných pěti. Předpokládáme, že posloupnost je již uložena v poli  $a$ .

Zde vlozte část programu rozděleného níže.

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Zde vlozte část programu rozděleného níže.

pro i od 1 do n opakuj

napiš(součet);

součet = 0;

součet = součet + a[i];

začátek

konec.

jestliže (a[i] mod 5) = 0 pak

Zkontrolovat

Zpět na seznam testů | Znovu řešit tento příklad

Fig.7

**Projděte algoritmus a doplňte konečné hodnoty proměnných**

za předpokladu, že posloupnost (9,10,25,0,0,5,12,15,10,1) je uložena v poli  $a$ .

```

začátek
s = 0;
pro i od 1 do 10 opakuj
    jestliže (a[i] mod 5) = 0 pak
        s := s + a[i];
    napiš(s);
konec.
  
```

s =

Zkontrolovat

Zpět na seznam testů | Znovu řešit tento příklad

Fig.8

## 5 Virtual learning environment

The top applications of multimedia are represented by virtual reality. As we have mentioned above at our university the professional virtual WebCT learning environment has been using.

At the end of this paper let us briefly summarize how can virtual learning environment *used as a compliment to a subject* influence the optimization of students' study habits.

- Students have all electronic study materials assigned to the appropriate subject available altogether in one environment together with needed information.
- Students greatly appreciate accessibility to self-tests with automatic checking and to multimedia study materials visualizing the explained matter.
- The relevant study material is accessible whenever and wherever. In this way also students staying abroad within the framework of the Socrates Erasmus students exchange for several months are able to follow the subject.
- Students interested in the area explained within a subject can find additional material in the WebCT environment, and sources and information outside the immediate framework of the subject. Discussions on "a level" with their teacher can start. This is also one of the ways in which the teacher can train his potential thesis writers.
- In many subjects, the inevitable outcome of creating common projects is teamwork. Virtual study environments are inherently well-suited to this. Students can communicate with the teacher and each other, and discussions are accessible to members of the team only. Even as geographically isolated members of a virtual team, they can send requests for advice and parts of project to the teacher for oversight.
- Students find also very useful the possibility to find all the information about important dates (written credit tests, examination etc.) and evaluation of their work within the subject in one environment.

preparation and keeping main principles mentioned at the beginning.

Let us say again that visual presentations prepared with the aid of modern information and communication technology help to understand better explained matters and implementation of them into the lectures makes them interesting, illustrative and understandable, and their location within the virtual study environment enables the students to get, to complete, to test and to deepen their knowledge and increase their imagination.

Nevertheless, we would like to emphasize that it is always necessary to consider very carefully why and how to use modern technology as a part of the education.

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## 6 Conclusion

In our paper we discussed what can multimedia add to the optimization of students' study habits. We have shown how important and effective can be role of multimedia study materials supporting students' self