

SUBJECT INFORMATION TECHNOLOGY IN MILITARY EDUCATION – CIVILIAN STUDY

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Abstract: *The paper deals with the new experience connected with the subject “Information Technology” which was gained at the Faculty of Military Technology, University of Defence, Brno, Czech Republic. The attention is focused on the new civilian Bachelor’s degree study programme “Technologies for Defence and Security” where the subject “Information Technology” is included in the first semester of studies.*

Keywords: *algorithms, computer networks, information technology, university, programming*
MSC2010: *68W01, 68N15, 68P05, 97Q60.*

1. INTRODUCTION

Although the Faculty of Military Technology (FMT) of the University of Defence (UoD) main focus is on military students for the Czech Armed Forces, the FMT is also realizing civilian study programmes. It enables better usage of the human and technical resources of the FMT. The text of the article follows [1] where the subject “Information Technology” was for the first time introduced but that subject was tailored for military students of the FMT UoD. Now the different subject “Information Technology” which was prepared for civilian students of the FMT UoD, is introduced.

The goal of the paper is to introduce the study plan of the subject, its teaching methods and rules for passing the exam. The findings from the first semester of the subject teaching are included.

2. NEW UNIVERSITY OF DEFENCE CIVILIAN STUDY PROGRAMME

Since 2015, the FMT UoD has been started the new civilian Bachelor’s degree study programme “Technologies for Defence and Security”. It covers three fields of study: “Communication and Information Technologies”, “Technologies for Protection of Assets and People” and “Weapons and Ammunition”. Two new fields of study are being prepared for accreditation process. These are: “Aviation Techniques” and “Geography and Meteorology for Defence and Security”. The subject of “Information Technology” is included in the winter semester of the first year of studies.

3. SUBJECT “INFORMATION TECHNOLOGY” CONTENT

The subject of “Information Technology” is a mandatory subject for all FMT UoD civilian students in the first semester of their Bachelor’s degree study programme since 2015. The guarantor of the subject is Department of Communication and Information

Systems(CIS) but Department of Military Geography and Meteorology is also involved in its teaching. Three main part of the subject are described in Table 1.

Table 1 – Content of the subject “Information Technology” for the civilian students FMT UoD:

Programming	Introduction into algorithms, data types and data structures, statements of a high level programming language, structure of a program.	Lectures 6 hours
	JavaScript program running, input and output in JavaScript, usage of an array in JavaScript, string processing, user defined functions, buttons and input field on a webpage.	Laboratory exercises 26 hours
Computer Networks	Introduction into computer networks, history, division, forms of realization, network architecture reference model ISO/OSI, model TCP/IP, local computer networks including wireless networks, Ethernet, fundamental suite of TCP/IP protocols, planning of the address space, CIDR, VLSM, routing, safety.	Lectures 14 hours
	Basic configuring of network devices, realization of simple networks and their diagnostics.	Laboratory exercises 8 hours
Geography	State coordination Systems S-JTSK and WGS 84, approaches to expression of location, digital geographical data, their formats, methods of their obtaining	Lectures 4 hours
	Geographical Information Systems (GIS)	Laboratory exercise 2 hours

The subject Information Technology is immediately followed in the next semester by the subject “Modeling and Simulation”. This subject is focused on the software

Matlab&Simulink [2, 3] and its content is divided into 16 hours of lectures and 32 hours of laboratory exercises.

4. TEACHING METHODS USED

The subject of “Information Technology” was for the first time studied by civilian students FMT UoD in the winter semester of the academic year 2015/2016. Lectures were provided in a high capacity lecture hall for all students at the same time. Lectures focused on each of the three main parts of the subject were realized by appropriate vocational specialist. Laboratory exercises were provided for the groups of maximum 20 students. The most of students worked on their own notebooks during the laboratory exercises focused on programming. They respected the recommendation of the lecturer to use their own computers which they were familiarized with.

In the academic year 2015-2016 four members of CIS Department academic staff and two members of Department of Military Geography and Meteorology took part in the subject teaching. The teaching process was coordinated by the guarantor of the subject and no serious problems occurred.

Programming tasks were especially focused on the array data structure and statements of branching, switch and cycles. Students were practically acquainted with the basics of event programming on the web page. Examples of programming assignments were similar to them as published in [1] for the FMT UoD military students.

The stress were put on the fact that students should be fully familiarized with three basic control structures (sequence, branching and cycle) and their use in writing algorithms by JavaScript programming language.

Each assignment was step by step analysed and programmed. Finally, the students were asked to prepare a simple protocol in MS Word. The protocol had always four parts:

- Assignment;
- HTML file content;
- JavaScript file content;
- Documentation from program run preferably in more than one web browser.

The concrete example of that is shown in Fig. 1, Fig. 2, Fig. 3, Fig. 4 and Fig. 5.

Put random data into two vectors named Alex and Ben which have 5 elements with indexes 0 to 4. Vectors have to contain whole numbers from the interval $\langle 1;7 \rangle$. Realize the button on the webpage and assign a user defined function to it. This function will calculate the scalar product and the result will be displayed by alert window.

FIG. 1. Text of assignment

```

<html>
  <head>
    <title>Programming in JavaScript</title>
  </head>
  <body>
    <h1>Assignment 13: Work with Arrays</h1>
    <p>Scalar product of vectors:</p>
    <button id="btnScalProd">Calculate scalar product</button>
    <br>
    <script src="script13.js"></script>
  </body>
</html>

```

FIG. 2. Content of HTML file

```

var Alex=[], Ben=[], i;

btnScalProd.onclick = function() {
  var spv=Alex[0]*Ben[0];
  for (i=1; i<5; i++) {
    spv=spv+Alex[i]*Ben[i];
  }
  alert("Scalar product of vectors Alex and Ben: "+spv);
};

document.write("<br>Content of vector Alex:<br>");
for (i=0; i<5; i++) {
  Alex[i] = Math.floor(Math.random() *7)+1;
  document.write("vector component with the index "+i+": "+Alex[i]+"<br>");
}
document.write("<br>Content of vector Ben:<br>");
for (i=0; i<5; i++) {
  Ben[i] = Math.floor(Math.random() *7)+1;
  document.write("vector component with the index "+i+": "+Ben[i]+"<br>");
}

```

FIG. 3. Content of script file

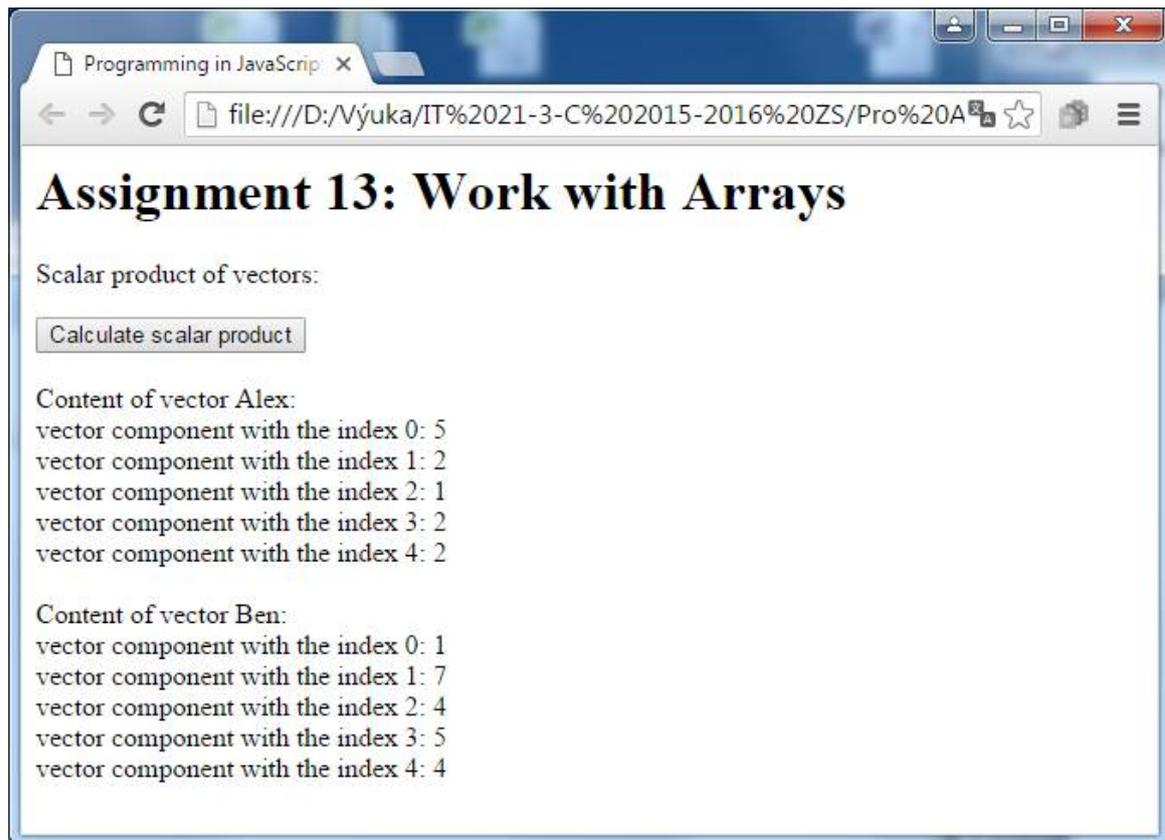


FIG. 4. Screenshot (a) (b) - script run in Google Chrome environment

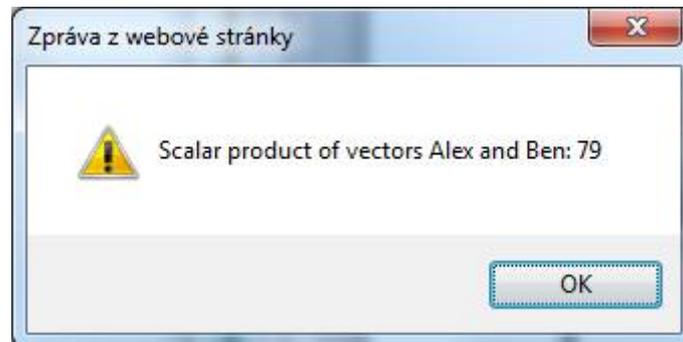
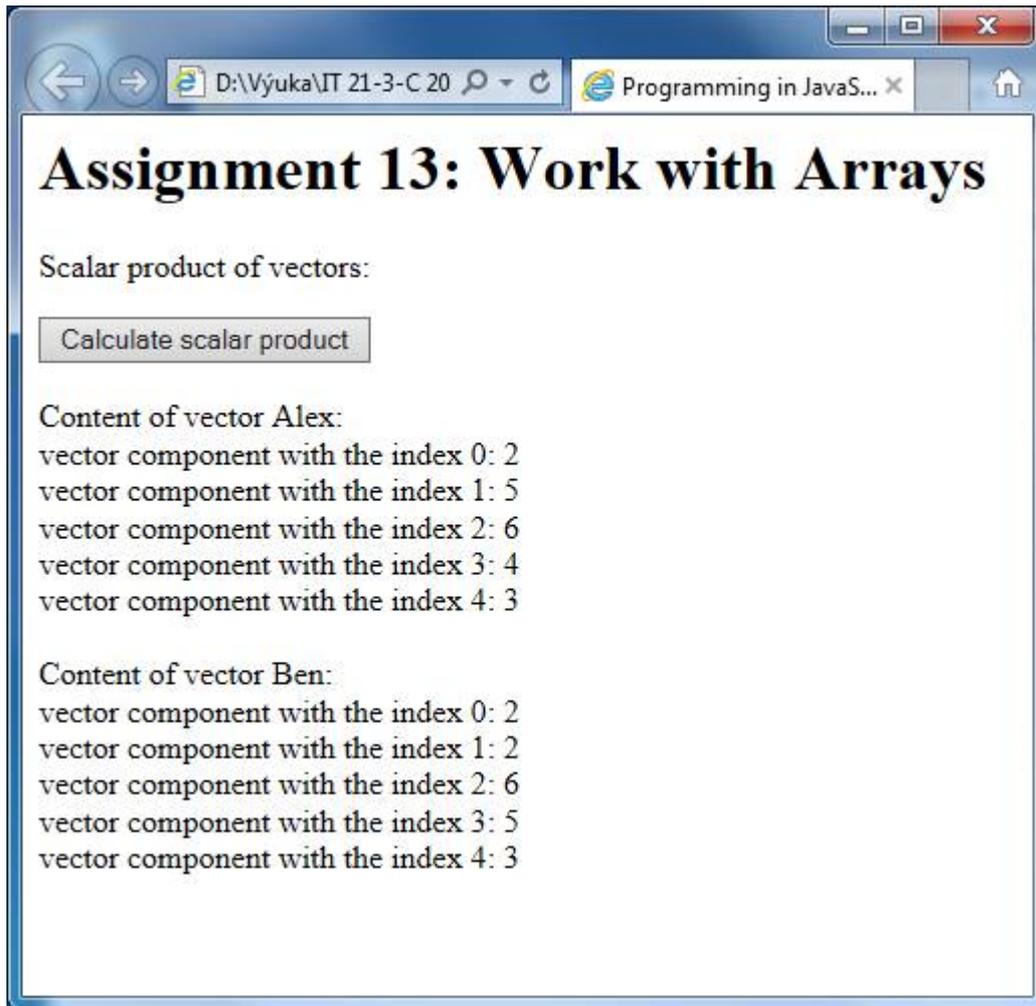


FIG. 5. Screenshot (a) (b) script run in Microsoft Internet Explorer 11 environment

Many good information sources connected with JavaScript programming language can be found at the Internet [4, 5, 6]. Teachers and students can access them according to their needs.

5. SUBJECT EXAMS

In the winter semester of the academic year 2015/2016 the students' knowledge and skills gained were for the first time tested. The author of the article had to test 37 students. Keeping in mind that students had to pass other 4 subject exams (Mathematics I,

Physics I, Basic of Electrical Engineering, Basics of Mechanical Engineering), final semester exam was done with respect to the following rules.

Firstly, the students had to pass the written test from the part 2 and the written test from the part 3 of the subject, that is from “Computer Networks” and from the “Geography”. This written tests were done during the semester independently. Then, the final subject exam was only focused on “Programming” part of the subject.

The final exam from the “Programming” had written part and oral part. During the written part students answered ten questions focused on programming terminology, connections among terms and explaining small parts of code in JavaScript language. The oral part contained discussion on written part and additional questions to students programming assignment, which was done at home and sent to the examiner before. Students solved three programming assignments at home which had to respect three groups of topic.

Finally, the students required grades according to the result of their written test from “Computer Networks” part and the result of their exam from “Programming” part.

6. GAINED EXPERIENCE

6.1 Target group input characteristics. Let’s have data sample of 30 students from the total number of 31 students who started the study field “Weapons and Ammunition”. Input questionnaire survey of the author has given important information for the teaching and learning process.

Almost all students finished high-quality and suitable secondary schools: 4 students passed their leaving examination at eight-year long grammar schools and 11 students passed leaving examination at four-year long grammar schools, 12 students at secondary technical schools, 1 student at the Police Academy, 1 student at an economic Lyceum and 1 student at an art school.

Total number of 7 students gained some experience in studies at other universities, 6 students tried to study at the other university but they stopped their study, 1 student graduated from the Faculty of Economics of another technical university.

There was no student in the sample without his/her own PC or notebook.

There were 16 students who gained some experience in programming before their studies at the FMT UoD but only 4 of them felt some basic knowledge from that times.

6.2 Subject exam results. The number of students who passed the final subject exam during the examination period was 18. At the end of the examination period 9 students from these 18 students had 100 % of credits and 9 students from these 18 students had 67 % to 87 % credits and they can continue their studies conditionally; they must pass all missing exams during the first 4 weeks of the summer semester. It is interesting that all these students passed the exam from the subject of “Information Technology”.

The number of students who had to stop their studies at the FMT UoD is 13 students. They got only 13 % to 50 % of credits but the minimum limit was 60 % of credits. It is interesting that no one from these unsuccessful students tried to pass the exam from the subject of “Information Technology”.

The author assume that step by step fulfilment of assignment by students during the semester brought a very positive effect on the exams from the subject of “Information Technology”.

6.3 Interpretation of the results from the author’s point of view. According to target group input characteristics and final exams results it is possible to formulate gained

experience as follows. The most suitable secondary schools for the successful studies at the FMT UoD are eight-year long grammar schools, high-quality four-year long grammar schools and high-quality technically oriented secondary schools. The failure in studies at another university can often be a prerequisite for the failure at the FMT UoD. Programming experience gained before entering the FMT UoD is useful even though the most of the students with this experience feel a low effect for their current knowledge. Computer ownership can be recognized as a current study standard. The key prerequisites for the successful studies are motivation and personal qualities.

CONCLUSIONS

Contemporary gained experience lead to possible next development of the subject “Information Technology”. The subject requires significantly different demands due to the previous knowledge and skills of students. The teacher should meet the input characteristics of the target group.

Inclusion of the subject of “Information Technology” in the education of all FMT UoD civilian students in the 1st semester of their studies is the optimal time. Algorithmic thinking of the technical fields students should be formed as soon as possible.

It will be suitable to discuss the experience gained during the first semester of implementation and maybe to slightly modify the second part of the subject content, that is the content of “Computer Networks”. This part of the subject seemed to be extremely difficult for the students.

The current number of a maximum of 20 students in the laboratory seems to be acceptable. If possible, students should use their own notebooks.

Oral exams are very important. Discussion with the students is irreplaceable. Written exams do not give complete feedback. Group programming assignment before exams is useful. It enables programming skills exchange among the students.

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