

Micro-activities for C Programming Learning

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The School of Technology and Management is not responsible for the opinions expressed in this report.

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Abstract

Programming introduction disciplines have been subject of concern, discussion and study between teachers in many meetings of the courses of Information Technology in the institutions of higher education. This work was created to contribute to the success of these disciplines, seeking to increase motivation and autonomy of students in solving programming exercises. The proposal consists of making micro-activities based on Webquests where the student has access to a carefully selected content that will give support for a second phase, the development of a set of increasingly complex tasks. This thesis is focused in C Programming Language classes and discuss how to implement webquest on those classes in order to improve the pedagogical project. This document will also describe the structure of WebQuest and discuss the experiments conducted with students in a classroom.

Keywords: Development of Teaching and Learning, Information and Communication Technologies, WebQuest.

Resumo

As disciplinas de introdução à programação têm sido objecto de preocupação, discussão e estudo entre professores, em muitas reuniões dos cursos da área das Tecnologias da Informação nas Instituições de Ensino Superior. Este trabalho foi criado para contribuir para o sucesso destas disciplinas, procurando aumentar a motivação e autonomia dos alunos na resolução de exercícios de programação. A proposta consiste em fazer micro-atividades baseadas em Webquests onde o estudante tem acesso a um conteúdo cuidadosamente selecionado que vai dar suporte a uma segunda fase de desenvolvimento de um conjunto de tarefas com complexidade crescente. Esta tese está focada na linguagem de programação C e discute a implementação de um webquest nas aulas de programação a fim de melhorar o projeto pedagógico da disciplina. Este documento descreve a estrutura do WebQuest implementado e discute as experiências realizadas com os alunos em sala de aula.

რეზიუმე

პროგრამირების შესავალი დისციპლინები იყო დისკუსიის საგანი მასწავლებლებს შორის საინფორმაციო ტექნოლოგიების კურსებს შორის უმაღლეს საგანმანათლებლო დაწესებულებებში. თეზისი შეიქმნა იმისთვის, რომ ხელი შეუწყოს ამდაგვარი დისციპლინის წარმატებას, ცდილობს გაზარდოს მოტივაცია და ავტონომიურობა სტუდენტებს შორის პროგრამირების ამოცანების გადასაჭრელად. თეზისი მოიცავს მიდგომის შექმნას, რომელიც ეფუძნება Webquest-ის ტექნოლოგიას, სადაც სტუდენტს ხელი მიუწვდება მისთვის სპეციალურად შერჩეულ მასალაზე, რომელიც მეორე ფაზაზე უზრუნველყოფს მის მხარდაჭერას განვითარდეს შედარებით რთული ამოცანების ამოხსნის დროს, ორიენტირებულია C პროგრამირების ენის სწავლებაზე და იხილავს, თუ როგორ გაკეთდეს webquest-ის იმპლემენტაცია იმისათვის, რომ გააუმჯობესოს პედაგოგიური მიდგომა. თეზისი ასევე აღწერს WebQuest-ის სტრუქტურას და განიხილავს სტუდენტებთან ექსპერიმენტის ჩაატარებას.

Contents

Introduction.....	10
Teaching and Learning Methodologies	4
Micro learning activity	5
Student-centered approach to learning.....	7
Inquiry-based learning	8
Cooperative learning	10
The role of the teacher in WebQuest	11
Other projects related to WebQuest	13
Webquest as impact on Developing Teaching Skills of Physical Education Teachers,Minia University, Egypt.....	13
The effects of using WebQuest on reading comprehension performance of SAUDI EFL students.....	16
Main objective and outcome of the thesis	19
Used technologies.....	20
Structure of developed WebQuest	20
Learning experience validation and application	33
First experiment and assessment	33
The second experiment description	36
Analysis of results and possible improvements	40
Conclusion	41
References.....	42

Table of Figures

FIGURE 1: STUDENT CENTERED APPROACH.....	8
FIGURE 2: INQUIRY-BASED LEARNING.....	9
FIGURE 3: SCORES OF BOTH GROUPS COMPREHENSION PERFORMANCE IN THE POST-TEST.....	18
FIGURE 4: WEBQUEST STRUCTURE.....	20
FIGURE 5: INTRODUCTION PAGE.....	21
FIGURE 6: PROCESS PAGE – BRAZILIAN SUPERMARKET.....	22
FIGURE 7: PROCESS PAGE - ARRAY DECLARATION.....	23
FIGURE 8: PROCESS PAGE – CODE EXAMPLE.....	24
FIGURE 9: PROCESS PAGE – EXAMPLE OUTPUT.....	25
FIGURE 10: TASKS PAGE - ADVICES.....	25
FIGURE 11: DESCRIPTION OF TASK 1.....	26
FIGURE 12: SUM AND AVERAGE ANIMATION.....	26
FIGURE 14: TASKS PAGE – ONLINE COMPILER.....	27
FIGURE 15: TASKS PAGE – PARAMETERS.....	27
FIGURE 16: TASK 2.....	28
FIGURE 17: ANIMATION FOR TASK 2.....	29
FIGURE 18: TASK 3.....	29
FIGURE 19: ANIMATION FOR TASK 3 – STEP BEFORE.....	30
FIGURE 20: ANIMATION FOR TASK 3 – STEP AFTER.....	30
FIGURE 21: EVALUATION TABLE.....	31
FIGURE 25 - TEST RESULTS (ARRAYS IN C).....	35
FIGURE 27: SPEND TIME FOR EACH TASK.....	39

Tables

TABLE 1: THE TEACHING PRACTICE OBSERVATION SHEET.....	15
TABLE 2: SECOND EXPERIMENT QUESTIONS AND RESULTS.....	39

1. Introduction

The Computer Science courses in Portugal are characterized by being the confluence of major areas of knowledge, namely the engineering computers, related hardware, operating systems and data communication networks, information systems, that address the concepts of software engineering and databases, and computer science, focusing on languages and programming techniques, among others.

For this last area, transversely to higher education institution is well known problem of student success in programming disciplines. Almost all study programs of the Information Technology area include one or two programming courses in the first year and was immediately seen as a challenge by the students. It is difficult for a beginner student to structure the thinking in order to achieve complete mapping between the problem to be resolved and the program (code) that resolves. However, there are students who do not get excited by the challenge and enter a state of demotivation that hinders learning [5].

As soon as students meet difficulties concerning the development of algorithms or the coding in a programming language, they give up and do not try to continue and solve problems; they feel like "programming is such a demanding activity that only some illuminated can do that".

Computers provide students with access to a large number of authentic learning resources and opportunities to interact with other speakers of the language [15]. The students for finding useful information on the Web, they need to read everything extensively, evaluate content of texts, select useful information, and synthesize materials to construct meaning. They also have opportunities to use the target language through reading, writing presentations, listening to peers' opinions, and discussing ideas on interesting issues.

Learning programming is a complex task that poses significant challenges. Students face different kinds of difficulties at various levels that traditional teaching/learning methods are not able to cope with resulting in a high rate of failures. That students' main difficulties are:

- Understanding the problem due to their unfamiliarity with the subject or due to the inability to interpret the problem statement (identify its meaning);
- Thinking in a logic way to decompose the given problem into successively smaller parts and to write the correct algorithm (sequence of unambiguous and elementary operations) to solve it;
- Learning the language syntax and semantics (Paula Correia Tavares, Elsa Ferreira Gomes. Pedro Rangel Henriques).

We choose the WebQuest strategies which is based to solve task independently, use web applications that can increase the involvement of students in comprehension and development tasks. The WebQuest model was created as a tool for integrating Internet use into classroom activities. The WebQuest asks young people to use the Internet to learn about an issue and apply that knowledge to attitudes and to enhance their own environments or future orientations [18].

The developers of the WebQuest, Bernie Dodge and Tom March, have written widely about the technique, suggesting that it is a synthesis of inquiry methods, cooperative learning, problem-based learning, constructivism, and technology integration. While each of the foundational practices has its own body of research, there is limited research about the WebQuest model itself [8].

Educational technologies have become more advanced, educators have developed new tools to learn from the World Wide Web. WebQuests are one instructional strategy. This inquiry-based activity allows for collaborative learning and differentiated instruction as students work on authentic, interdisciplinary projects. inquiry-based instructional strategy involving Internet research. Findings from the study support previous research on the advantages of using WebQuests for instruction, including consensus that WebQuests are motivating for students.

“Inquiry ... requires more than simply answering questions or getting a right answer. It espouses investigation, exploration, search, quest, research, pursuit, and study. It is enhanced by involvement with a community of learners, each learning from the other in social interaction” [12].

In this context learning experiences within a discipline of programming in C are implemented. Experiments were mounted in parallel and are based on WebQuests [1].

Learning method of Webquest has following advantages:

- Internet sites are pre-selected and students don't waste time searching.
- Students are lead to use higher level thinking to process information.
- Students will access information that is up-to- date.
- Makes efficient use of the net.
- Lessons are designed to motivate students by capturing their interest.

The WebQuest, is especially helpful in meeting the needs of students with disabilities within general education classrooms. Students with special needs sometimes experience information overload when first learning about computer programs. Consequently, they need lists or steps to follow. According to

research, independent activity—including well-defined search options—works best with specified steps that help reinforce these skills [19].

Support for professional development through using the “WebQuest technique” builds on a model of learning, where practitioners are challenged to find new ways of locating information and of integrating technology in education. In this sense, to use of WebQuest may represent interesting teaching-learning experiences.

2. Teaching and Learning Methodologies

Generally there are models and guides for designing educational activities, environments and experiences. Instructional strategies, or teaching methods, depend on a number of factors such as the developmental level of students, goals, content, and environment including time, physical setting and resources. A single method cannot meet all of our goals to teach, here we will discuss about micro-learning activity which is based on E-learning methodology. Today we find an increasing number of applications supporting collaborative learning. It is hard to explain that the learning theories which are based in the collaborative interaction between learners are entirely responsible for this shift of paradigm [20].

However, there are some pedagogical approaches to transforming educational practice that seem better suited for the job than others. Learner-centered methods of content delivery allow students the opportunity to control their learning since they require students to take responsibility for their learning by being actively involved in the learning process rather than simply passively receiving information from a lecture [21].

E-learning is a computer based educational tools which enables student to learn at any time and anywhere. It has ability to share materials for student in all kind of formats such as video, pdf, document etc. With Electronic learning methodology teacher can update content within the page quickly and give student latest information.

The term “e-learning” has only been in existence since 1999, when the word was first utilized at a CBT systems seminar. Other words also began to spring up in search of an accurate description such as “online learning” and “virtual learning”. However, the principles behind e-learning have been well documented throughout history, and there is even evidence which suggests that early forms of e-learning existed as far back as the 19th century [22].

E-learning let us to add some materials, links and other resources for learners easily. People prefer to use it and communicate each other by email and so on. Using e-learning method means that student can gather information simply that’s why we decide to use this approach. Students can gain special skills such as how to work and learn Independently.

2.1 Micro learning activity

Micro learning is a new research area aimed at exploring new ways of responding to the growing need of lifelong learning or learning on demand for members of our society, such as knowledge workers. The result of this study highlights the importance and need of micro learning in education industry [16].

Micro-learning focuses on the design of micro-learning activities through micro-steps in digital media environments, which already is a daily reality for today's knowledge workers. These activities can be incorporated into a learner's daily routines. Unlike "traditional" e-learning approaches, micro-learning often tends towards push technology through push media, which reduces the cognitive load on the learners. Micro-learning is an important paradigm shift that avoids the need to have separate learning sessions since the learning process is embedded in the daily routine of the end-user [23].

Micro-learning activity is limited by software or device and can offer information. It can be understood in multiple ways, can be refer micro aspects. Micro-learning methodology is based on observation and data collection. The main objectives of this study is to create knowledge among the readers on the importance of micro learning as strategic process for creating, retaining and applying knowledge learning and how that knowledge helps achieve planned outcomes, benefits or results. Micro learning plays an important role in that stage of knowledge creation as many learning processes are based on observation concepts. Every observation is a micro-step in the process of learning and theory/knowledge construction. This technology supports the process of documentation of observational knowledge; e.g. by providing structured forms for documentation. Concepts of micro learning offer flexible and dynamic alternatives which are needed in view of medial, societal and environmental changes [16].

The student failure rate in 1st year of programming disciplines of Computer area courses is quite high. Teachers have made a great effort to improve results based on classes in practical exercises resolution at the expense of theoretical presentation slides. The course of classes is based on the solving of chips that students are making with the help of the teacher who often ends up having to explain already pre-defined solution without students have time to get it themselves. Typically, students feel the solution but are not capable of producing. It is needed a method that helps students to organize the learning process, inspire them to involve in a wide range of activities deeply.

Usually the computer technology is used as an auxiliary tool in preparing documents such as presentations and reports and not as a learning tool. WebQuests emerged as a method of integrating the use of the Internet in a positive and controlled manner in the learning process. WebQuest is defined

as an activity oriented to research where some or all of the information to which the student has access comes from Internet resources [2]. It is clear that online learning is growing fast , WebQuest used to exposed to several online resources, students are required to gather information about a specific topic [2].

In a typical WebQuest activity, students use the Internet to access specific information on a defined topic, researching first as an individual and then engaging with others in a small group activity that results in sharing and integrating research results with others.

It can be used inside and outside the classroom, to the accompaniment of the teacher or independently. The WebQuest can be a way to work and monitoring work by students during these times. WebQuest uses authentic task to motivate students' investigation of a central, open-ended question, development of individual expertise and participation in a final group process that attempts to transform newly acquired information into a more sophisticated understanding [24].

The time should not be too rigid, allowing each student to act according to their learning, both inside or outside the class period. Even the WebQuest can be used in programming contests, where a race against time can also be used as a differentiating element between the various teams. In this case, the objective of the work presented and described in this thesis does not fit in a competitive environment, leading the student for several problems in the construction of their knowledge.

In this context, it is essential that the division of the contents to acquire the various tasks proposed, the increasing complexity of the same and the appropriate and timely aid associated with each of the exploitation of crucial examples, the immediate feedback of the solution submitted with precise indication of errors lexical, syntactic and semantic indicating possible resolution, the possibility of more than one submission, are considered, the most important factors for the construction of the WebQuest [6].

There is majority agreement that the model is adapted to the competences teaching system and that it is positively received by students, despite the fact that it means more work and involvement for them.

When appropriately used, the web will surely transform the notion of teaching-learning: long-life education, change of settings and roles in the teaching-learning processes, etc. The web, indeed, reinforces the reading and writing skills as well as promotes the skills of information searching and problem solving.

2.2 Student-centered approach to learning

Student-centered approach is an instructional approach in which students influence the content, activities and materials. This learning model places the student (learner) in the center of the learning process. The instructor provides students with opportunities to learn independently and from one another and coaches them in the skills they need to do so effectively. The Student-centered approach includes such techniques as substituting active learning experiences for lectures, assigning open-ended problems and problems requiring critical or creative thinking that cannot be solved by following text examples, involving students in simulations and role plays, and using self-paced and/or cooperative (team-based) learning. Properly implemented Student-centered approach can lead to increased motivation to learn, greater retention of knowledge, deeper understanding, and more positive attitudes towards the subject being taught [13].

Student-centered learning can also be viewed from the perspective of an influential report from the National Research Council (1999) that synthesized research on learning and recommended organizing learning environments around four foci: knowledge-centered, learner-centered, assessment-centered, and community-centered (Student-Centered Learning Addressing Faculty Questions about Student centered Learning [13].

In addition student-centered learning approach provides skills for life, creates independent students and responds to the changing and differing needs of individual learners. Learners are active participants in their own learning and the most important thing is that they can make decisions and be able to plan their own way of solving a problem.

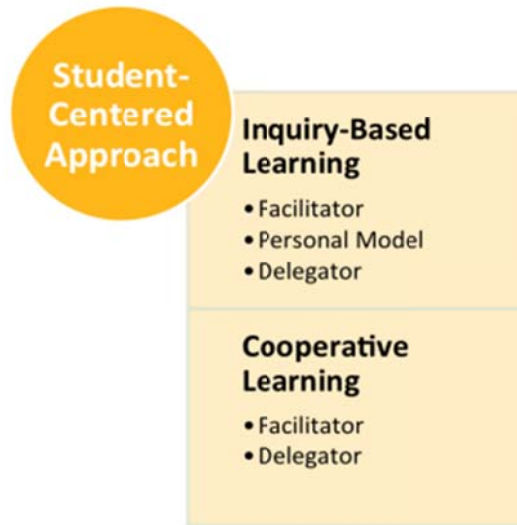


Figure 1: Student centered approach

A central concern of learner-centered approach is learning, and so evaluation in the student-centered classroom is not just to generate grades but, more importantly, to promote learning (Weimer, 2002). This means that the processes used will also change. Course objectives and learning goals will be clearly stated, and students will be taught to assess their own work and their peers by asking critical questions in a constructive manner. They will be given many opportunities to practice the theoretical and practical skills they are expected to learn and perform [22].

2.3 Inquiry-based learning

It is important to appreciate the place of inquiry in a historical context both in terms of the long Western tradition of knowledge creation and inquiry and in terms of the ways traditional approaches to education have hindered efforts to organize education towards these ends. Forces in the world today are simultaneously challenging traditional notions of education and pushing jurisdictions of education around the world to change how they think about and organize education [18].

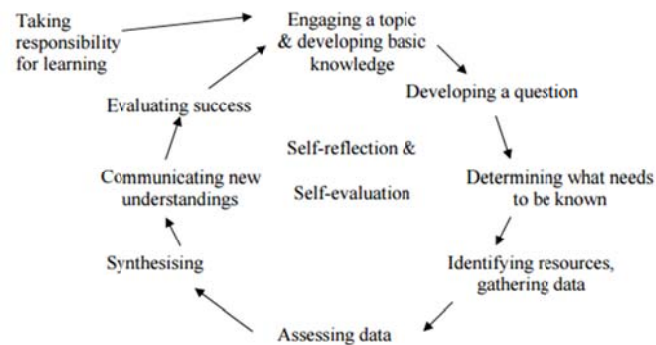


Figure 2: Inquiry-based learning

Inquiry-based learning is an approach to teaching and learning that places students' questions, ideas and observations at the centre of the learning experience. Educators play an active role throughout the process by establishing a culture where ideas are respectfully challenged, tested, redefined and viewed as improvable, moving children from a position of wondering to a position of enacted understanding and further questioning (Scardamalia, 2002).

There are, however, some pedagogical approaches to transforming educational practice that seem better suited for the job than others. What follows is a review of the key characteristics of inquiry-based learning which it is supporting students to become motivated, collaborative and innovative learners capable of engaging in their own inquiries and thriving in a world of constant change.

For students, the process most of the time involves open-ended investigations into a question or a problem, requiring them to engage in evidence-based reasoning. For educators, the process is about being responsive to the students' learning needs, and it is so important that knowing when and how to introduce students to ideas that will move them forward in their inquiry. Together, educators and students co-author the learning experience, accepting responsibility for planning, assessment for learning and the advancement of individual as well as class-wide understanding of personally meaningful content and ideas.

Inquiry-based learning concerns itself with the creative approach of combining the best approaches to instruction, including explicit instruction and small-group and guided learning, in an attempt to build on students' interests and ideas, ultimately moving students forward in their paths of intellectual curiosity and understanding [12].

This emphasis on knowledge creation and elaborated communication will require new approaches to assessment. These new forms of assessment will require more sophisticated performances of deep understanding. This will include to ask students solving some problems and participate in tasks reflective of work engaged by particular disciplines. While traditional forms of summative assessment often demand one right solution or response, these more sophisticated performances of key competencies will require quality and evaluation of student work. Formative feedback loops that provide ongoing descriptive feedback will help students that enhance works in progress.

2.4 Cooperative learning

Cooperative learning is one of learning approach which can be given to students in lecture classes, laboratories, or project-based courses. Sometimes is called as small-group learning, generally it is like a instructional strategy in which small groups of students work together on a common task. The task can be as simple as solving a multi-step problem together. In cooperative and individualistic learning, you evaluate student efforts and possibilities on a criteria-referenced basis while in competitive learning you normally grade students on a norm-referenced basis of them.

The term cooperative learning (CL) refers to students working in teams on an assignment or project under conditions in which certain criteria are satisfied, including that the team members be held individually accountable for the complete content of the assignment or project. This section summarizes the defining criteria of cooperative learning, surveys CL applications, summarizes the research base that attests to the effectiveness of the method, and outlines proven methods for implementing CL and overcoming common obstacles to its success [25].

3. The role of the teacher in WebQuest

The maximum effectiveness of our approach requires the teacher's ability to review, mark and grade each solution written by students. Instant feedback is very important for the acquisition of knowledge. Independently of the particular learning strategy, it really motivates students.

Underlying this approach is the idea that both educators and students share responsibility for learning. For educators, the process is about being responsive to the students' learning needs, and most importantly, knowing when and how to introduce students to ideas that will move them forward in their inquiry. Together, educators and students co-author the learning experience, accepting mutual responsibility for planning, assessment for learning and the advancement of individual as well as class-wide understanding of personally meaningful content and ideas [25].

It is necessary to make provision a beginner student's knowledge, how to select Tasks to simplify their solution and give them the correct direction.

There exists two different concept to learn programming for beginner students, one is learning programming and other one is to learn syntax. First of all it is a strategy to solve the tasks, it means that they are going to perform several steps to understand the proposal works, thoughts about algorithms, make code and test it. We created Webquest tasks and we considered that their difficulty level is properly to students knowledge. With this approach student can understand problem solving strategies. We have analysed the importance of feedback in the teaching-learning process and tools for automatic evaluation of programs that can be integrated in teaching process. Most of the learning activities for the class are traditionally carried out by the instructor: choosing and organizing the content, interpreting and applying the concepts, and evaluating student learning, while the students' efforts are focused on recording the information. Weimer (2002) makes the point that in the student-centered classroom the roles of teacher and student need to change, so that the teacher changes from the "sage on the stage" to the "guide on the side" who views the students not as empty vessels to be filled with knowledge but as seekers to be guided along their intellectual developmental journey.

Tasks were selected based on the beginner student's knowledge in C programming language. They were selected according to the complexity - first task is more easier than the second and so on. Its purpose is to develop students knowledge and skills step-by-step, to use the knowledge earlier about arrays, consider the algorithm to solve the problem and the most important is the use of suggestion, hints and links which are specially designed to make them solutions easier.

Another important approach is Animation pages in WebQuest. Generally the animation tools provide a visual metaphor that significantly help the understanding of main concepts. An animation is a natural approach of expressing behaviors. With this approach student is stimulated to progress his activity.

Many researches have been working to identify the rules that should be followed while designing and creating visualizations and animations effective for teaching. As computer programs can be hard to understand when presented in a textual format, it is expected that a better comprehension could be achieved with an animated graphic format [26].

Moreover, students have an opportunity to assess their own knowledge itself, teacher does not determine how much time spend student on each practical assignment. We made an Evaluation page and they are free to evaluate their knowledge, for instance to define how much time they spent, how many times compiled program. That's very different from the traditional method, where teacher assesses each student's knowledge in a particular field of study.

4. Other projects related to WebQuest

The WebQuest should also be evaluated in various subject areas with learners of differing age groups and academic abilities. In this section we will discuss several project which is related to WebQuest.

4.1 Webquest as impact on Developing Teaching Skills of Physical Education Teachers, Minia University, Egypt

The purpose of this study was to define the use of WebQuest impact on the teaching performance of teacher candidates enrolled in Minia University. The aim was to improve practitioner's subject knowledge and expertise in Physical Education subject.

Twenty-eight, third-year teacher candidates were involved and were randomly divided into two groups: a control and experimental (14 teacher candidates each). All of them were instructed by the two researchers; one for the experimental group using the WebQuest technique, and the second control group using the conventional methods of instruction (e.g. lecturing and modeling). A teaching practice observation sheet was used to assess the teaching performance of the participants. Support for professional development through using the 'WebQuest technique' builds on a model of learning, where practitioners are challenged to find new ways of locating information and of integrating technology in education. The idea of this study was to compare the WebQuest technique to the traditional techniques used in teacher preparation institutions in enhancing preservice teachers' teaching skills.

In this experimental study there were chosen third-year teacher candidates because they start their school placement and find it difficult to adapt with their first encounter with real teaching situations. In the traditional instructional methods of preparing these teacher candidates, they watch models, study available materials on the teaching skills, teach exactly the same way they were taught with limited improvisations, and wait for feedback. They needed training that allows them to find the knowledge themselves, also identify their weaknesses and strengths and assess their own practices. During the experiment period, the teacher candidates in the two groups studied the three main teaching skills such as planning, implementation and evaluation.

A lecturer within the faculty of Minia University, monitoring and offering help when experimental group needed. Participants in the control group, on the other hand, were lectured on these skills by their instructor (the coauthor, a lecturer at the faculty Minia University), watched her modeling the skills, and finally peer-taught a model lesson of their own preparation.

The time for each session was assigned 120 minutes to simulate the pre-scheduled timetable set by the college regulations. One session was devoted to the orientation at the beginning of the program. The other 20 sessions were divided into 5 major cycles representing the five lessons provided in the WebQuest (each consisting of 4 successive sessions). Pretest scores for the observation sheet were obtained for each participant of the two groups to understand their level of performance considering the three target teaching skills before being exposed to the treatment intervention; each of them was videotaped while teaching one model class in the university sports hall. Three external judges observed the videotapes, rated their performance using the observation sheet two times for each participant once for the pre-measurement and the second one for the last, and the average was calculated from the three obtained raw scores of the judges giving a total of two scores for each participant to ensure objectivity of the evaluation process.

A random selection divided the experimental participants into three sub-groups. The students then went through the five WebQuest Cycles; in each cycle, participants were required to choose one lesson from the WebQuest and prepare a lesson plan to peer-teach at the end of the cycle. The suggested five lessons incorporated different types of warm-up, physical preparation and basic skills and participants who were surfing the WebQuest were required to choose one of them with all its components for their peer-teaching. Each cycle consisted of four successive sessions. The task for each group was changed among cycles switching the three target teaching skills among the groups giving the Physical Education candidate teachers the opportunity to choose from among the different exercises that can be employed in applying these skills [11].

The teaching practice observation sheet was like questions, below there are several statements of Lesson Planning Skills.

N	Statement	Always	Sometimes	Never
I. Lesson Planning Skills.				
1	Lesson objectives are clearly stated.			
2	Objectives are behavioral, observable and measurable.			
3	Objectives suit the level of maturity of students.			
4	Levels of learning for each area of the lesson objectives are clear and specific.			
5	Place of the lesson is well-equipped in a way that allows the implementation of the activities of the lesson.			
6	The content (description of the desired performance and the learning stages) is formulated in a clear manner that suits students' age level.			
7	Evaluation techniques that assess the achievement of the objectives are specific.			
8	The educational resources used by faculty to increase the effectiveness of teaching are mentioned clearly.			
9	The alternative tools mentioned suit the designed activities, students' number and their level.			
10	Lesson formations suit the designed activities.			
11	The chosen method of teaching is specified in a manner that suits the educational situation.			

Table 1: The teaching practice observation sheet

Result and discussion

This study marks the first attempt to apply the WebQuest technique to the Physical Education teacher candidates in the Egyptian environment. The research question was to what extent would using the WebQuest technique in the teacher preparation programs affect the teaching performance of the Physical Education teacher candidates. Results indicate that the conventional methods used in instructing the control group had a positive impact on developing the teaching skills of third year Physical Education teacher candidates, while using the WebQuest they were more independent and improved their skills.

This public presentation by student teachers of their new learning is in itself a significant element in students' learning experiences. This way, learners move beyond the knowing theory to being able

to use knowledge appropriately as they understand the broader implications and applications of their learning. The researchers attribute these results to the fact that electronic learning, in contrast with the traditional face-to-face learning, provides time flexible, selective, self-paced, effective and convenient way for learning opportunities especially for student teachers. The designed WebQuest served as a good example of integrating the Internet in education, and also provided learners with educational resources that they would never approach in a traditional class. Learners were also introduced to various topics, instructional resources, evaluation techniques, models, along with a wide variety of delivery methods used to reach the different types of learners helped in enhancing retention which was also better than in a traditional teaching learning approach.

4.2 The effects of using WebQuest on reading comprehension performance of SAUDI EFL students

In this context we will discuss effects of using WebQuest on Saudi male EFL students reading comprehension performance. In this case experimental group received traditional teaching and WebQuests at the same time as supplementary activities. The control group received the traditional teaching only. The students' comprehension performance in the post-test was compared for both groups in order to determine whether there were significant differences between the groups in relation to the treatment.

Significant differences occurring in the experimental group's post-test comprehension performance when compared to the pre-test indicate that using WebQuest can improve students' reading comprehension performance. The results indicated that WebQuests have potential for use in promoting reading comprehension. Teachers and students do, however, need to be trained in order to use WebQuests more effectively. The study was conducted in a university first year preparatory program. Students were enrolled in the Intensive English program with 20 weekly contact hours for two semesters and a summer. The main purpose of this program was to develop students' English language proficiency and equip them with the essential language skills needed for academic study and their future professional life. There are six levels of proficiency in the program where level six is for advanced learners and level one is for false beginners. Level three is considered pre-intermediate. The participant students were selected using a simple random selection and two sections were chosen to participate. There were 42 students in the experimental group and 41 students in the control group. The two

sections were used for a total of 10 sessions (50 minutes each) over a seven week period. The sections' teacher is a native speaker of English and has taught English for seven years. He has experience with using WebQuest, therefore, no training was needed.

The WebQuests designed were sent to three experienced EFL teachers to check for appropriateness for the students' level of proficiency and topic. In addition, they were reviewed by two educational technology professors for its face validity. In each WebQuest there were two main pages, the teacher's and the student's. The student's page included five parts which is like standard WebQuest template. The first part was the introduction which gives general information in a motivational way about the whole WebQuest. The second part is the task which is a description of what the students should do. The third part is the process and it includes detailed steps describing what exactly the students are required to do. The fourth is the evaluation part which includes a rubric that shows the students how they will be evaluated. They should accomplish at the end of the task. The final part is the conclusion which provides the students with further websites if they want to read more about the topic. The other page is the teacher's page which includes instructions for teachers who will use the WebQuest. Should be noted that like our WebQuest topics were chosen according to the students' level. The researchers tried to use various topics interesting to university level students.

During the experiment period the teachers displayed the WebQuests on the white board and divided students into groups. Each group worked on one computer separately. First, the teacher presented the WebQuest's homepage on the class white board explaining every part clearly in order to help students complete the task carefully and answer the questions. Following this instruction, students worked alone. The teacher's continued presence was, however, important as he is often called on to answer questions and address technical problems. In the first week, both the experimental group and control group received the pre-test before the treatment and instruction. The treatment period was four weeks. During the treatment period, the experimental group received researcher-designed WebQuests embedded as supplementary materials in the traditional way of instruction. Each WebQuest took two sessions a week. In week six, both the experimental and control group students received the post-test.

Result and discussion

This study program investigated the impacts and results of using WebQuests on students' reading comprehension performance. Will there be a significant improvement in the students' between control

and experimental groups ? In order to answer this question below Figure 27 reports the paired samples results statistically:

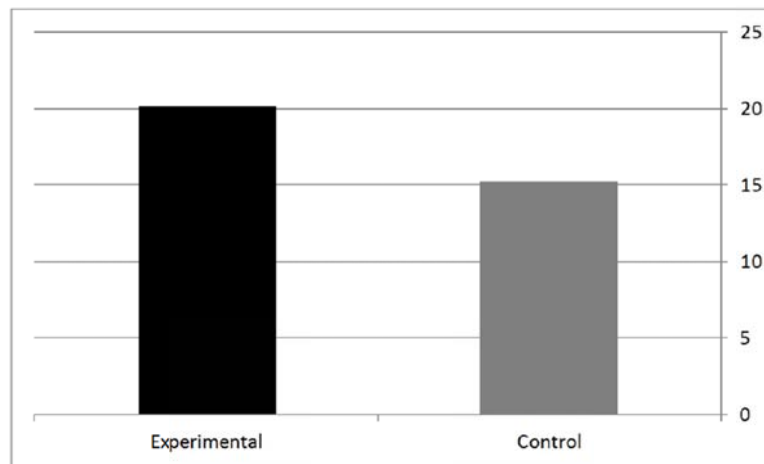


Figure 3: Scores of both groups comprehension performance in the post-test

The results of both groups showed that there were significant improvements in students' reading comprehension performance over time. As discussed efficacy of WebQuests suggests that the task supports reading comprehension because it requires student analysis, synthesis, evaluation, judgment, problem solving and creativity [15]. Scaffolding teaching, in which a knowledgeable teacher provides individualized support for students, is a method that aims to build on prior knowledge while internalizing new information or skills such as with WebQuest, the task utilized in a scaffolded teaching activity should be just beyond the current ability level of the student. The students of this study, only needed help to get started on the task and then managed to continue on their own with no difficulty and problems. Although the teachers who participated in this study were experienced with WebQuest, teachers in general need to be provided with training to explore the usefulness of WebQuests and to master its integration in their classrooms.

Additionally, the study was limited in using a comprehension test as the predictor of reading comprehension. This limitation made it difficult to generalize the results to other classroom contexts. As the study suggested WebQuests had positive effects on reading comprehension, more qualitative

investigation is needed into the processes that students followed that helped enhance reading comprehension.

5. Main objective and outcome of the thesis

The WebQuest proposes a learning experience available on the web and provides an engaging environment for information about monitoring content and problem solving. Additionally, WebQuest promotes learner autonomy in relation to the teacher and their reasoning ability, providing carefully chosen links as a source of learning, a search for information in an efficiently structured manner, a set of tasks to develop and formative assessment system and self-assessment. The teacher develops a paper guide instead of only transmitting information. The student must learn to use the information rather than just assume knowledge of it [21].

The main objectives for experiments also were to understand the behavior of students facing a new and different situation.

It is very important to give students the opportunity to practice solving programming exercises by themselves. Receiving feedback is essential for knowledge acquisition. New tools arose (especially in the area of programming contests) to allow for the submission of solutions to the exercises proposed by the teacher and to assess them, returning immediately information about the submitted answer. These tools can be incorporated into teaching activities, allowing students to test their work getting immediate feedback. Automatic Assessment or Evaluation systems, as they are called, significantly improve students' performance about their knowledge.

The proposal described in this thesis is based on a web platform (accessible from all places that the student attends), presenting the problems on a contextualized and interesting way, suggesting the division of short tasks, measurable and resolution with an increasing degree of difficulty, giving immediate feedback of providing the student, possibility of more than one attempt to solve, suggestions for improvement, plus explanations on other solutions, classification obtained and connection to the following learning steps.

The expected outcome of this kind of teaching was to become the student more autonomous, independent and to try a different approach of studying. It was interesting to observe and report such teaching methodology.

students can declare, initialize, print, search, insert and remove array elements in C. As a prerequisite, the student must have a basic understanding of the C language, such as data types, flow control structures, writing and reading instruction, setting functions. The methodology allows students to organize their learning session so that is convenient for him: He can start by doing an exhaustive study of all the available contents and then proceed to the development of the tasks or simply return to the content only when he feels the need.

WebQuests have a common format as we can see on Figure 4, that includes an introduction to the WebQuest, students will follow with links to appropriate websites, a description of the tasks students will complete an outline of the process evaluation, conclusion, and teacher page.

The WebQuest's **Introduction** page provides an overview and essential background information about programming and some imaginary view how to program easily. Basic programming concepts the students should be aware of before starting the WebQuest. The Webquest's Introduction page provides a good starting point for students.

On Figure 5 student can read information about programming like composing the music, designing a house and other things.

Array Tutorials For C Language


Home	Introduction Programming is one of the most valuable skills you can pick up in these modern times to stretch your brain and create something awesome.  Basically, writing computer programs involves describing processes and procedures. Creating a computer program can be like composing music, like designing a house. The first thing about programming is to learn and become comfortable with it. Let's start !
Introduction	
Process	
Task	
Evaluation	
Conclusion	
Teachers	

Figure 5: Introduction page

Process: The Process page in a WebQuest is where the teacher suggests the steps that learners should follow to complete the WebQuest. Learners can find resources, links, documents which are very important to be prepared to perform the tasks. As can be seen in Figure 6 the Process page also introduces a motivated context to the activity that will also be used during the tasks. In this case there is the story about Brazilian successful supermarket and the student will be manager.

Array Tutorials For C Language

Home	<h3>Successful supermarket</h3> <p>This learning experience takes place in an imaginary world: you are a supermarket manager. Every day you have to deal with collections: collections of employers, collections of products and prices.</p> <p>In order keep ahead of the competition you have to be better and do better than the other supermarkets. You know that C arrays are a technology that store and manage several items of similar information. However, you do not know the sufficient to be fluent in using them.</p> <p>You feel that you need more information. There are other supermarkets also working on the same subject so you have to hurry! Hire a consultant and learn about arrays with the result.</p>
Introduction	
Process	
Tasks	
Evaluation	
Conclusion	
Teachers	

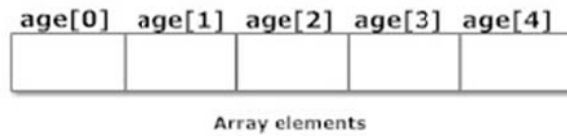
Figure 6: Process page – Brazilian supermarket

Student can imagine that he is the Manager of Brazilian supermarket and has some problems to solve. For instance he has statistical data for analyse such as, collections of employers and products. Links helps students if they feel that this information is not enough and they need more. The link is about Array Tutorials in C programming language. This link is helpful because students can remind how to declare array, how to write array elements and how to access each element. All the text follows the proposed motivated context using sentence:

“Suppose that you need to store your employees ages..”

In **Process** Page student can see some information about Arrays imaginary:

- `int age[8]; // integer array`



Each element is accessed using indexes: `age[3]=45;`

Figure 7: Process page - Array declaration

Also in the **Process** page, there are two programming code fragments and the student can also see how to complete the code in C. “Print the array here” means that students can finish program by his own.

```
1. #include<stdio.h>
```

```
main(){
```

```
float salaries[8];
```

```
/* fill the array here*/
```

```
for(i=0;i<8;i++)
```

```
/*print the array here*/
```

```
...
```

```
}
```

```
2.
```

```
#include <stdio.h>
```

```
int main () {
```

```
int n[ 10 ]; /* n is an array of 10 integers */
```

```
int i,j;
```

```
/* initialize elements of array n to 0 */
```

```
for ( i = 0; i < 10; i++ ) {
```

```
n[ i ] = i + 100; /* set element at location i to i + 100 */
```

```
}
```

```
/* output each array element's value */
```

```
for ( j = 0; j < 10; j++ ) {
```

```
printf("Element[%d] = %d\n", j, n[j] );
```

```
}  
return 0;  
}
```

After programming fragment there is link where student can read how to complete:

- Declaration syntax of Array
- How he can print it on the console

There is also an example of C program (Figure 8) and output (Figure 9).

Example:

You are responsible for reporting all your income and are interested in analyzing your Supermarket budget. You have a report of your employees salary with bonuses, which they got last month. You need to order it by descending order.

```
#include <stdio.h>  
#include <stdlib.h>  
int main ()  
{  
    int number[30];  
    int i, j, a, n;  
    printf("Enter the number of employees\n");  
    scanf("%d", &n);  
    printf("Enter the salary report:\n");  
    for (i = 0; i < n; ++i)  
        scanf("%d", &number[i]);  
  
    for (i = 0; i < n; ++i)  
    {  
        for (j = i + 1; j < n; ++j)  
        {  
            if (number[i] < number[j])  
            {  
                a = number[i];  
                number[i] = number[j];  
                number[j] = a;  
            }  
        }  
    }  
    printf("Salary arranged in descending order:\n");  
    for (i = 0; i < n; ++i)  
    {  
        printf("%d\n", number[i]);  
    }  
    return 0;  
}
```

Figure 8: Process page – code example

```
Enter the number of employees
7
Enter the salary report:
458 789 1258 698 326 578 336
Salary arranged in descending order:
1258
789
698
578
458
336
326
```

Figure 9: Process page – example output

Tasks: The Tasks page includes problem description that learner must solve. There are three different tasks and they are ordered by level of difficulty. There are also some advice for student to feel selfconfident and motivated to set goals by their own program code. Students should expand their knowledge and try to perform the tasks.

Array Tutorials For C Language

Home
Introduction
Process
Tasks
Evaluation
Conclusion
Teachers

Here are some advices for you:

Take a deep breath and keep yourself focused and motivated. In this Task page you are really managing your supermarket. Use experience from similar problems that you faced before. You want to control your budget, track the statistical information and do some concrete calculations in order to help your business be successful. **Good luck.**



Figure 10: Tasks page - advices

After advice on Figure 10 there are Tasks. In Task 1 is given an array and at first students need to show it on the console. At second they need to calculate sum and average.

Task 1 :

List shown below represents the monthly salaries of your 8 employers: {456,123,120,659,457,130,156,554} Using the same program, perform the following tasks:

- Print data in console.
- Calculate the sum of all the salaries and the average salary.
Sum and Average animation.
- Find the maximum and minimum salary.
Maximum animation, Minimum animation.

See **output** here and onthen try the above example solve with **online compiler**, but before start to write programming here are some helpful **suggestions** for you.

Figure 11: description of Task 1

Concerning the Tasks page there are also animation pages to get everything clear for students, they can use Next and Back button, where Sum value is changing in every step.

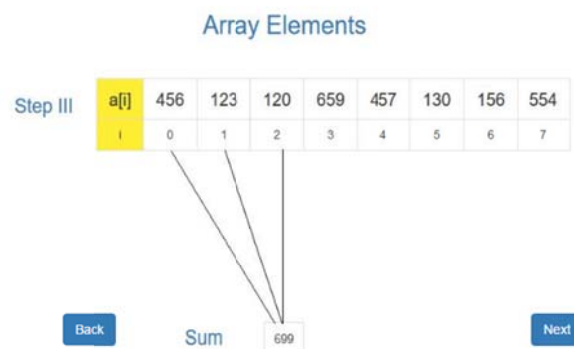


Figure 12: Sum and avarage animation

On Figure 12 and Figure 13 students can see the first and last step of animation page to calculate sum and average.

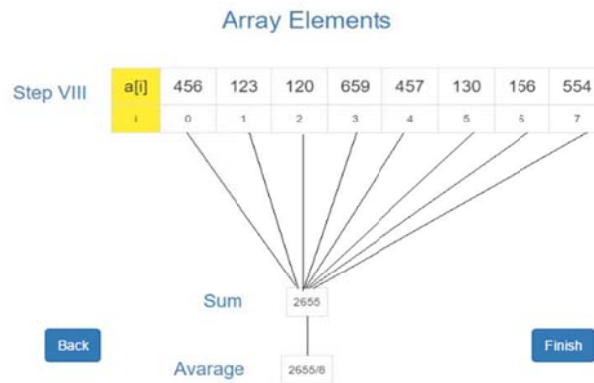


Figure 13: The last step of sum and average animation

and at last they need to find minimum and maximum elements. In each task there are Outputs, which is also important to compare their result. Below is the online compiler where students can compile, execute program and show their result.

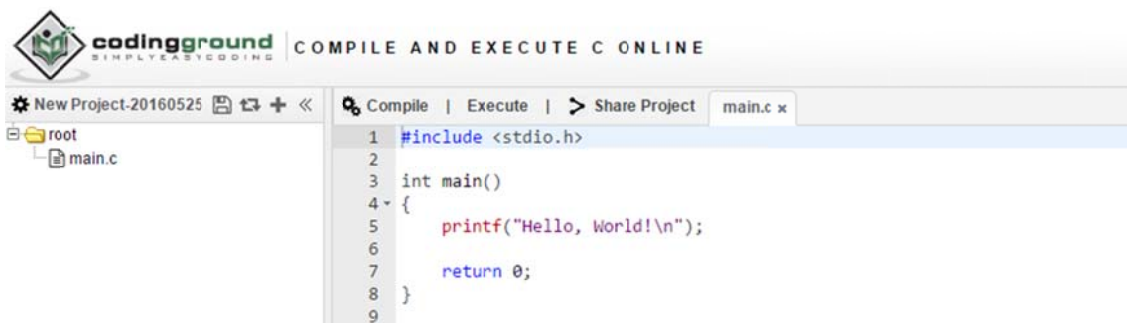


Figure 14: Tasks page – online compiler

Figure 15 indicate that at the end of each task student must submit some information:

email Is correct: Start: End:
 Attempts:

Figure 15: Tasks page – parameters

Email - the student should insert his email

Set if his Task is correct or not, if it works or not

Start : when he started to do it

End: when he finished to do it (in order to evaluate the real working time)

Attempts how many attempts were performed by the student to make it.

Task 2 :

You have an informative statistical data of customers entering in your supermarket during several days. But suddenly you discover that this data is wrong and have to delete one of it's entry. After deleting the entry your program must display correct data. The program will start by prompting for the input parameters: number of days and customer entering data.

Test case:

Enter number of days

5

Enter 5 days customers entering data:

1254 4588 8952 1366 9287

Delete an entry data at desired position

3

Output:

1254

4588

1366

9287

Figure 16: Task 2

In Task 2 student has statistical data of customers entering in his supermarket and he needs to delete one of them. It is more difficult then the previous task. With Test case and Output they can consider the concrete case and result. Animation code is also provided.

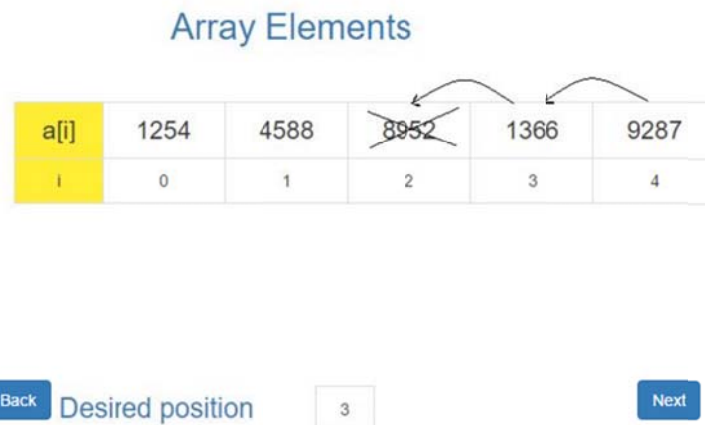


Figure 17: Animation for Task 2

Task 3 is more difficult than Task 2 and Task 1.

Task 3 :

You are interested in performing some statistics about your supermarket products. You received a report which shows the amount of coffee sold in each day during one week. Write the code needed to check if you sold the same amount of coffee during two or more days of the week. Generate the necessary data using the random function (each data element should be between 100 and 200). At the end, the number of times of each quantity should be displayed.

Test case:

Enter the number of days: 7

[100, 105, 190, 145, 105, 105, 190]

These numbers were automatically generated by rand() which is a C library function.

Output:

105 - 3 times

190 - 2 times

Use information about **random numbers**, **animation**, and **online compiler**, some help for **solution**.

Figure 18: Task 3

The description, Test case and output of Task 3 there are on Figure 18. Link for random numbers will let

them know how it works. Students need here to generate random numbers from special range and they can see the range formula within the solution page.

Animation pages before and after compare numbers (Figures 19-20).



Figure 19: Animation for Task 3 – step before

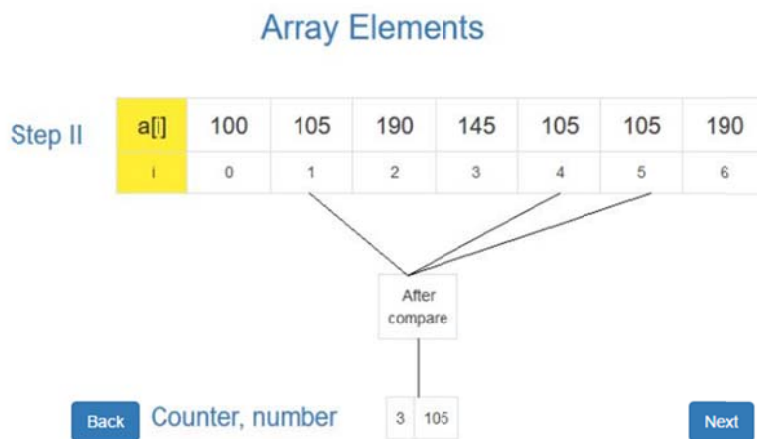


Figure 20: Animation for Task 3 – step after

Evaluation page implements an assessment tool. This page is presented by Evaluation table on Figure 21 and was created for learners to know how their work will be evaluated at the end of the lesson. Each WebQuest task has been scored by category:

Is it correct or not, if the task is correct then student gets 10 point.

The high score also depends on Number of attempt, it means that if students can solve task by one time and they can get additional 5 point.

The time is also very important because every task have predefined guessed time.

Student can choose score in the table and the total score is given at the bottom.

Evaluation Table							
Exercises	Check	Score	Number of attempt	Score	Time	Score	Sum
Exercise 1.A	Correct	10	1 time	5	10 minutes	5	0 ▼
	Not correct	0	>1 time	0	>10 minutes	0	
Exercise 1.B	Correct	10	1 time	5	10 minutes	5	0 ▼
	Not correct	0	>1 time	0	>10 minutes	0	
Exercise 1.C	Correct	10	1 time	5	10 minutes	5	0 ▼
	Not correct	0	>1 time	0	>10 minutes	0	
Exercise 2	Correct	10	1 time	5	30 minutes	5	0 ▼
	Not correct	0	>1 time	0	>30 minutes	0	
Exercise 3	Correct	10	1 time	5	60 minutes	5	0 ▼
	Not correct	0	>1 time	0	>60 minutes	0	

Figure 21: Evaluation table

The **Conclusion** section of a WebQuest provides an opportunity to summarize the experience, to encourage reflection about the process, to extend and generalize what was learned.

Suggests learners to expand their knowledge and gives tips which depends on scores, it is presented by table with distributed scores. Each section of table has explanation and brief description what students should do after getting scores.

Scores	0-20	21-40	41-60	61-80	81-100
Advices	You need hard work to learn C Programming Language. You should find some tutorials for beginners.	You know some C Programming Language, but it is only beginner level. It would be better if you start doing from the first task again, watch some tutorials and use visualization program.	Your C Programming Language skills are better than beginners, but it is not enough. You should work more to improve your knowledge.	You know C Language but you need to expand your knowledge.	Great, You are the most successful student. Your result is really awesome.

Figure 22: Conclusion page

The maximum score is 100 point.

Teachers Page is the last part of Webquest, with this page students can find information about teachers.

Learners can contact by email to share their opinion about Webquest.

Array Tutorials for C Language

Home	Polytechnic Institute of Braganca (Portugal).
Introduction	
Tasks	Please feel free and send me your feedback by email.
Process	
Evaluation	
Conclusion	Thanks for your support.
Teachers	Email: Nino.godziashvili@gmail.com

Figure 23: Teachers page

The activity of Webquest is not isolated, it is subsequent activity and every page is connected to each other.

8. Learning experience validation and application

The application of the WebQuest in the classroom requires a detailed study of because it can has a great impact on its success. Thus, an application and evaluation methodology was designed. Two experiment were performed. The main purpose for this first and second experiment were the impact of the WebQuest in the C programming language tasks.

- to understand what are the main difficulties of the first year beginner students when facing a programming task: the interpretation of the WebQuest, the algorithm development and its implementation in a particular language;
- to understand the behavior of students facing a new and different approach;

8.1 First experiment and assessment

According to first experiment, students were randomly divided into two groups (A and B). Group A worked as a driver, following a traditional teaching and learning strategy, consisting of transmissive class and by subsequent application exercises. This group did not have access to WebQuests. Group B follows the WebQuest independently without teacher intervention beyond the clarification of minor issues and questions that arise.

Both groups perform a diagnosis test before activity and another after the activity, allowing them to compare the progress of each student and draw conclusions about your progress. Based on the progress of each student is made to compare groups. The result of this comparison allows to draw conclusions about the impact of WebQuest in teaching-learning process.

The experience on the C programming has been developed over 4 hours having the participation of 25 students in group A (without WebQuest) and 15 students in group B (with WebQuest).

The chart below shows for each student time spent in minutes in each of the tasks. Only two students could complete tasks and, in general, times are oversized (took longer than expected).

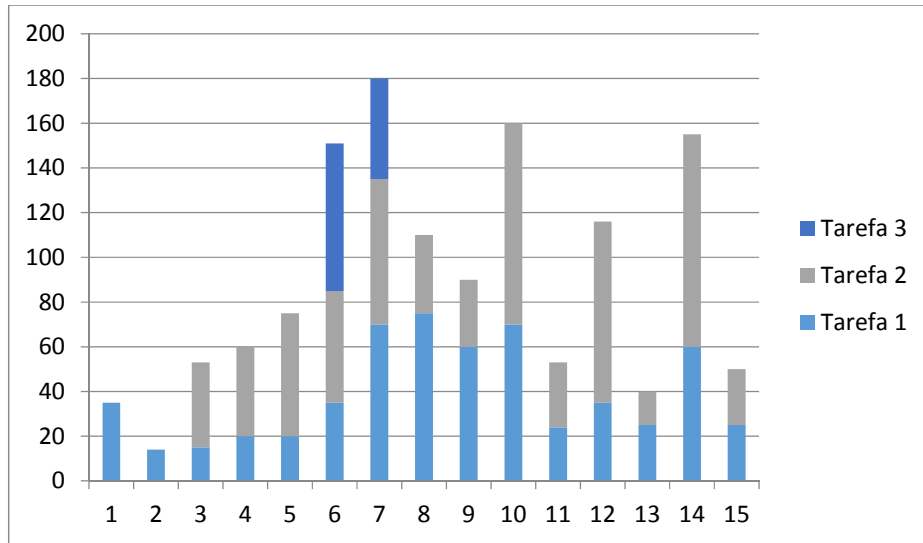


Figure 24: First experiment spent time

The total activity time was three hours and the average time for the first task was 39 minutes, the second 50 minutes and the third 55 minutes.

In each task, some students had an average of 20 attempts which also denotes a wrong attempting strategy without the ability to make informed decisions and apply logical reasoning.

Each test (and final diagnosis) lasted 45 minutes, each student assessed 0-20 values. For the class of arrays in C, there is an improvement in both groups A and B (Figure 1). 80% of students have maintained or increased their resolution capability of the exercises. However, in group B, which was developed by WebQuest we were expected better results. As a result the average ratings of the group A is higher than group B.

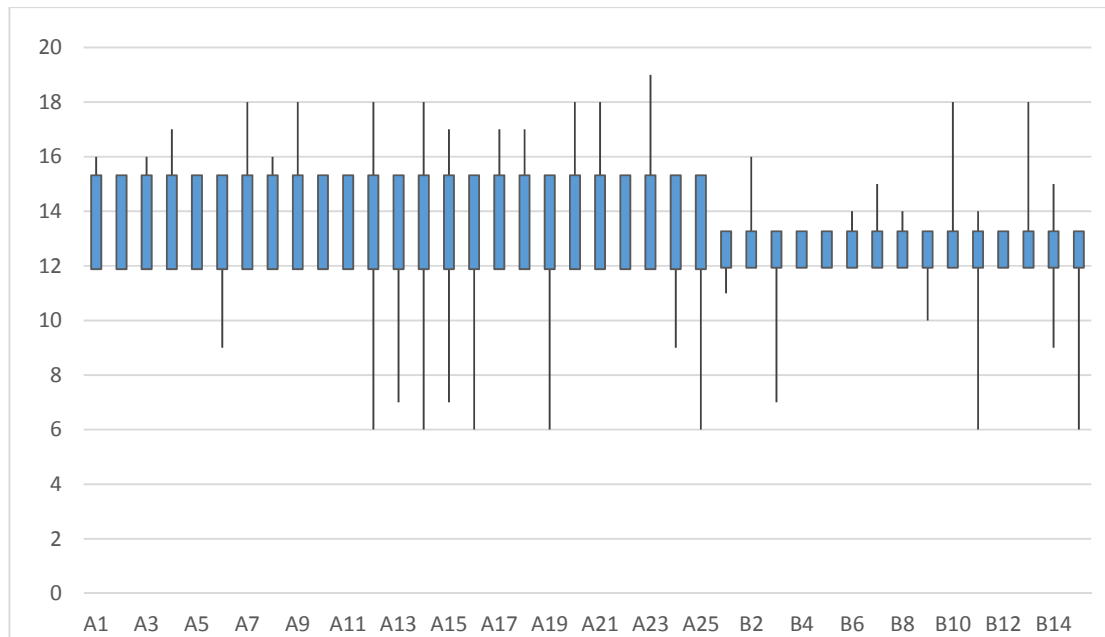


Figure 25 - Test results (arrays in C)

In this case, the difference between the two groups was not significant.

At the end the students were asked to answer a survey which indicated the degree of agreement with the following statements (Figure 26):

- 1- The WebQuest is clear and well organized
- 2- It was an interesting experience
- 3- The story is captivating and helps to accomplish the tasks
4. The complexity of the tasks is appropriate
- 5- The aid given is sufficient
- 6- The aids are useful
7. It would be useful to adopt the same approach to other topics

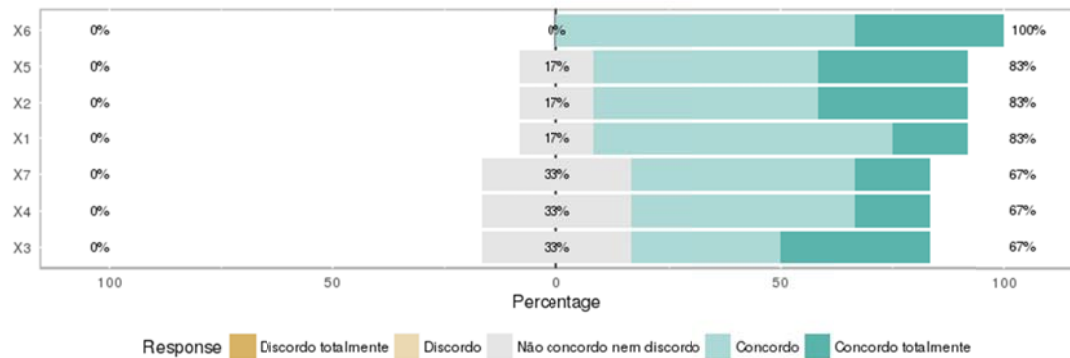


Figure 26: Approach to other topics

A first experiment result is that the students solved the first and second exercises faster with better evaluation. It is important to emphasize that the last exercise was more difficult than the previous.

Students showed a difficulty to solve the third exercise on account of the problem statement that was a bit more elaborate and new for them. This conclusion also supports our hypothesis that students had some problems to understand new statements and materials. This issue will be better explored in the experiment conclusions.

8.2 The second experiment description

The first experiment was not so easy for students, second and third tasks were difficult and they needed teacher for help that's why we decided to hold a second experiment where the students were not faced for the first time. Here we want to prove that the WebQuest would be much more useful as implementing learning tool. We changed and added some solutions and helpful links there.

We studied their attitude, to which task was difficult for them, and what to do in order to simplify their solution. According to the first experiment it was difficult that there were no animation page, and we added some animation page which was more understandable for them.

For the second experiment there were selected the new students that had not used WebQuest before. It should be noted that they were not warned in advance about the conduct of the experiment. At first we presented each page of WebQuest and explained what they needed to do. Also we asked them that they should start working from WebQuest Process page. The reason is that there were explanations and programming code that would be helpful. In order for the students we added more helpful link there for

support, for example an explanations how to use the Random function, which formula is necessary in order to get a specific range of numbers and so on.

During the experiment time we were observing their working. After they made tasks we asked some questions that we made it before. Here is special questionnaire about their working process, opinions and results:

The student reads the text carefully?	√
The student understand the text and he knows what he has to do?	√
It is a new challenge for him and he feels uncomfortable with that?	Approach is new for them but they are not uncomfortable
The student follows the webquest with curiosity?	√
The student uses each help? and how much time is spent in each help?	They did not use help links for each task because some of them was familiar
Set a score for each to represent the "helping" degree	TASK 1 20 % TASK 2 30 % TASK 3 50 %
He uses the information given to perform the task?	√
He performs the task correctly?	√

How many of attempts?	min 1, max 5 attempts
Time spent for each task?	min 20 minutes, max 1 hour
Comparing with the first task how difficult was to perform the second one?	Task 1 was easier then Task 2
There are some student suggestions to improve the webquest?	It was interesting and different approach for them, all page of Webquest was understandable, but some students suggested to use other compiler.
It was an interesting experiment?	√
It improves the student knowledge?	√
It improves the self-study capacity?	√

Table 2: Second experiment questions and results

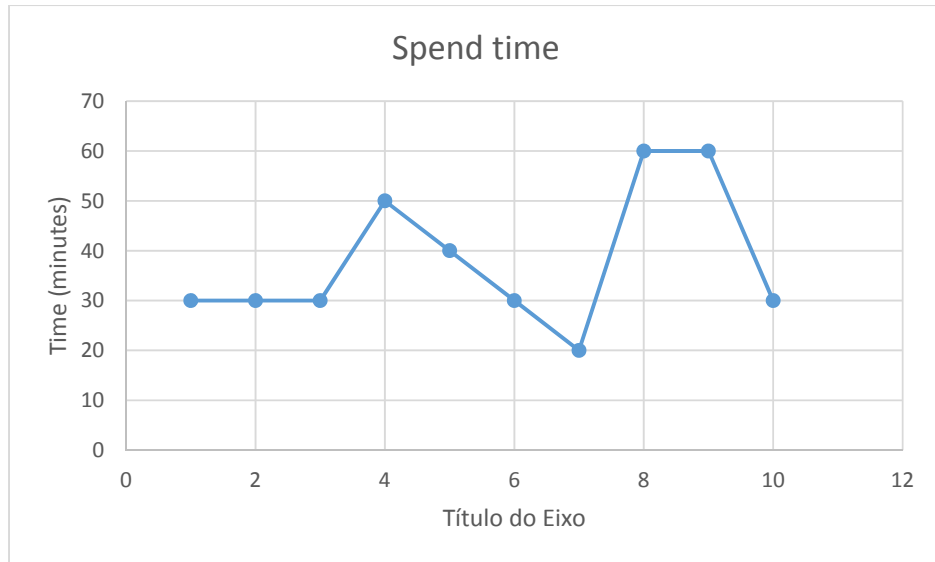


Figure 27: Spend time for each task

9. Analysis of results and possible improvements

According to the first experiment the weak capacity of autonomy of students makes them feel lost before the lonely search for a solution. Students feel a certain inertia in the text reading. Even if the information is easily accessible, most students did not have the ability to search, select and use the necessary information. Students did not show ability to concentrate to explore the learning path that was proposed to them. For all this and even though they have found an interesting experience, they felt some difficulty in solving tasks.

Another factor that could have induced the best ratings in the Group A (which did not use the WebQuest) is that this group had more time between the first and the second test. Such situations should be avoided in future experiments.

The second experiment was much more effective, students used the WebQuest as a complementing tool and they were able to solve problems independently. The use of this strategy awaken students to the possibility of independent action, encouraging them to incorporate into their routine research study, abstract, reflection and understanding of concepts.

10. Conclusion

A WebQuest is compared with other related projects and teaching-learning methods, in this case does not present a significant advantage in terms of content acquisition. However, there may be advantages in terms of acquisition of horizontal competencies in the sense of autonomy and student systematization capacity. Several studies show a significant improvement in the attitude of the students, an increase of: motivation, self help, personal development, interpersonal skills, satisfaction, independent thinking, team integration capacity, ability to practical application of knowledge, etc.

The study presented in this thesis corroborates the statements in that it has not been demonstrated to improve the content acquisition. However, we believe that the WebQuest had positive effects on motivation and students' reasoning ability and therefore should be used as a training supplement.

The evolution of the students' behavior along the two-hour lesson showed that the approach gave them better performance about array in C programming language. On one hand, we notice that the number of the students with accepted submissions has increased. On the other hand, the number of trials increased and the number of compilations errors decreased. This means that the motivation of the students argmented while the basic errors lowered. Motivation was one of our main concerns.

The experience reported also allowed us to understand how to better conduct future teaching methodologies. WebQuest mainly used for the training or teaching process, if we compare related works with our recent experiments make sure that the students were very interested in the new teaching methodology. In conclusion, students enjoyed the experience, consider that it was well organized, that the aid was sufficient and helpful.

In general, WebQuests should to be used but as training complement rather than replace traditional classes. Students will take better profit from WebQuest party in content review situations and practical applications.

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