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**PROCEEDINGS**

**6th MEDITERANNEAN INTERDISCIPLINARY FORUM  
ON SOCIAL SCIENCES AND HUMANITIES,  
MIFS 2018,  
*24-25 May 2018, Barcelona, Spain***

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# **The App *Save Yourself* Improves Knowledge in Earth Environmental Emergency and Safe Behaviors**

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## **Abstract**

*Saving Yourself* is an App from the methodological experience of Learning on Gaming, which is a new teaching approach: to learn while playing, that is different from Edutainment, designed both to educate and entertain, and Gaming to Learn, which consists of playing a game without specific didactic to outcome knowledge. With Learning on Gaming the game “hides” didactic inside the game: this could improve learning processes and, at the same time, renew teaching competences of mentors. Our experience is based on the application of Learning on Gaming to Digital Game Based Learning, through a Computer Class Role Playing Game (CCRPG).

Adventure pathways of these CCRPG are focused on Earth Sciences and are interdisciplinary, multilingual and they are a good example of innovative teaching. As a CCRPG spin-off, “Saving Yourself” is an App for Educators, Trainers, Teachers, Students, to know the earthquakes and volcanoes and strategies to reduce the risks associated with these phenomena.

The App is intended to provide the most immediate and useful way to behave in the event of a geological emergency, with particular reference to volcanology emergency and seismic emergency. It can be used at school to optimize security education measures, but it can also be a game that is useful to rethink what has been learned.

*Saving Yourself* is for all ages, because there are versions of the activity for kindergarten, primary school and secondary school and it is multilingual. It takes advantage of Games, ICT (Information and Communication Technologies), Innovative Teaching, to activate digital, scientific and technical skills.

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**Keywords:** App, Education, Gaming, Safety, Emergency

## Introduction

An innovative teaching technology combines ICT, traditional and modern media, and social networks, where gaming is a key element. (Maraffi, S., Paris, E. & Sacerdoti, F. M., 2017). Chapman and Rich (2017) claimed that games might encourage students to spend more time studying, be more engaged, and as a result, learn more. This new way of learning offers new opportunities to use collaborative tools, allowing the students to co-construct knowledge efficiently (González-González, Collazos, Guerrero, & Moreno, 2016).

Educational technologies that use more suitable tools to students improve the teaching-learning process; games and video games are excellent educational vehicles, so we have developed and successfully experimented a Computer Class Role Playing Game (CCRPG): GeoQuest Project (Maraffi, S., Paris, E. & Sacerdoti, F. M., 2017). Adventure pathways of these CCRPG are focused on Earth Sciences and are interdisciplinary, multilingual and they are a good example of innovative teaching.

From the methodological experience of Learning on Gaming, derives an App to improve Earth's Sciences, particularly Geophysics, and above all to improve environmental and safety education (Fig. 1).



Figure 1. Saving Yourself versions for volcanological and seismological emergency.

## Methodology

*Saving Yourself* is an App on iOS (<https://itunes.apple.com/it/app/si-salvi-chi-pu%C3%B2/id1251674281?mt=8>) to learn the correct behaviors in Earth Environmental Emergency. The App is intended to provide, in the most immediate and practicable way, what are the correct behaviors in the event of geological emergencies, with particular reference to volcanological and seismic emergency. The adventures has been built for different ages; they can be used at school to optimize education safety measures, but can also be useful to refresh what has been studied.

Methodology is storytelling, gaming (Fig. 2), use of information and communication technologies, innovative teaching. For the youngest we can use storytelling to bring kids through our comics. Through the myth, for

example, we talk about Volcanological emergency of Vesuvius and we exploit the mythology of Homeros or Virgil's poems.  
All *Saving yourself* apps are enriched with original designs, suitable for the



Figure 2. Methodology is storytelling, gaming, use of information and communication technologies, innovative teaching.



Figure 3. Another engage element is multiple game levels, with different prizes: a green belt, a red belt, a blue belt, a safety star.

youngest, and nice for all ages. Another engage element is multiple game levels, with different prizes: a green belt, a red belt (Fig. 3), a blue belt, a safety star and so on. At the end of the game, each player can do a test to check what kind of “emergency expert” he or she has become.

Another important point of strength is immediate feedback (Fig. 4): wrong answer is indicated in red, while the correct answer appears in green. Then follows some explanation on the right answer. Through the App and the game, a wealth of valuable information is provided; for example, the rise of the gas inside the magma, or terms such as vulnerability, danger, and risk.

With GIFs, the geophysical mechanisms are clarified (Fig. 5), so it is easier to defeat frequent misunderstandings. In particular earthquake version aims to get aware and responsible informations, to avoid panic, to keep a healthy caution.



Figure 4. Immediate feedback: wrong answer is indicated in red, while the correct answer appears in green.



Figure 5. With GIFs, the geophysical mechanisms are clarified.

## **Conclusion:**

Apps are today the best vehicle to meet the interest of young people (Maraffi, S. & Sacerdoti, F.M., 2017). *Saving Yourself* is freely downloadable and available for everyone. The dynamics of levels and prizes pushes the player to move forward and at the same time to acquire the necessary knowledge and skills.

The final test certainly helps to give the player the awareness of the degree of learning achieved, but can also serve to push to repeat the experience to improve their results. We know, in fact, that the self-test proposal is an element of strong appeal, which is often used in publicity and communication.

All this improves to the experience of Learning on Gaming, which we have recently experimented extensively with more than satisfactory results (Maraffi, S. & Sacerdoti, F.M., 2018).

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# Anticipation in the Structure of the Solving Problems Skill

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## Abstract

In the study the accent is put on the significant role of the foreseeing in the heuristic aspects of the solving problems activity. Theoretical formulations are deduced and the possibility of its purposeful formation is well-founded on the basis of the developing training particularities by the solving problems process.

In order to attain the goal the following methods are used: content analysis, pedagogical observation, pedagogical experiment, method of the determination of a success standard and a correlation degree.

The obtained results of the theoretical and experimental work are directed to the integration with the intellectual development of children and pupils.

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**Keywords:** Anticipation, skills, scholar problems solving, developing training

## Introduction

### Essential characteristics of the stages of the process of solving problems skill formation

The infinity and the variety of the purposes and situations determining the different skills specificity predetermine also the difficulty in finding the universal conditions, objective laws and approaches for their formation. But the examination of the conceptions of their step-by-step development shows a close similarity. In his dissertation study P. Petrov relies on the conceptions of Hubert and Stuart Dreyfus as well as on those of Boris Minchev (Minchev, 1991) and describes the following **stages** determining some of their specific *characteristics*:

In *the first stage "the beginner"* realizes the purpose. Although the active examination of the *problem object field* its different components are perceived separately but with a wrong idea of entirety. An algorithm of the

executed actions is given or the trainee finds it himself. His capacity to listen to and to ask questions is limited.

By the increase of the experience of coping with the situation /problem solving/ in **the second stage “the advanced beginner”** finds or he is given the important components. He observes the rules during the most part of the execution. The trainee does not associate the accumulated at that stage multitude of situation aspects with precise and universal rules. *The heuristic operational structures of the solving problems skill are “related” to concrete problems.*

In **the third stage called “competence”** the executor learns or is learned to make a choice and to take decisions. The beginning of the capacity to remember whole situations /problems-components/ is put. The situation understanding is not yet related to effective actions on a behaviour level. *The particularities of the solving problems skill on an active plane are slightly verbalized.*

In **the fourth stage called “experience”** the situation is perceived as similar to the already known one. The trainee sees what is necessary to be done and he has to take decisions concerning the execution way. He has already a combination of approaches for a various effect. At that stage criteria about the interchangeability of the execution quantity and quality arise. *In the solving problems skill a great variety of algorithms and methods are worked. Some heuristic approaches are verbalized and/or mastered at a stage of arbitrariness.*

In **the fifth stage called “expertise”** the expert understands, acts and learns spontaneously through the results by *powerful heuristic processes* without realizing that process. *In the solving problems skill all that is fulfilled by habits, visual ideas and short mental chains.* At that stage one goes from a direct control of the situation to inner forms of control which leads to the skill behaviour components transfer. *The control when solving problems is spread from the result to the initial solving stages.* The situation understanding by the expert begins to divide a class of situations into subclasses each one of them sharing the same purpose and often the same solving method, a heuristic approach. A process of revealing of situation similarities begins which have seemed up to now incompatible. *“The image of problem world” is created completely* (Petrov, 2013).

The practice shows that the duration of the formation of the solving problems skill, the limited scholar time and other factors permit the trainee to achieve the third stage. These objective laws require decisions in the didactic structure according to the different methodologies of the educational fields.

The most problematic part of each theory of the study stages is the transition between them. Scientists working on these problems reckon that the transitions may be facilitated using strategies, approaches and

technologies especially if all this happens in compliance with the forthcoming stage (Vitanov, 1999). The following approaches are known: constructive approach, personally orientated approach, interactive methods application, study productive strategies etc. On the plane of the principal determinant – the purposes, a transition from the academic abstract knowledge to more practically orientated knowledge, skills and competencies and a training model focused on the study with understanding is obtained.

According to V. Petrova “... the constructive study involves in an active execution of various cognitive and practical actions. The creation of his own idea and the sense deriving from the acquired knowledge are obtained by forms and methods stimulating predominantly the understanding and the creation of his own logical construct before the memorizing and the reproduction” (Petrova, 2005).

## I.

Poyia (1972)/ describes most often the “macromodel” of the process of “solving” with the following clearly distinguishable and specific moments:

- problem understanding;
- idea arising and plan creation /a decision search/;
- plan realization;
- additional work on the problem after the answer obtaining.

In this order the mental processes characterizing these stages are the following: understanding, foreseeing when searching for the decision, correct conclusions building, reflection on the problem and its solving. According to some authors in terms of practice the processes of *foresight /prefeeling and prognostication/* (Petrov, 2011) and the *reflection* are slightly studied (Zhelev, Petrov, 2010).

**Especially interesting for us is the study of the anticipation /foresight/ manifestations as a main sign of the skill during the solving problems process and the search for mechanisms of its formation and development directed to the integration with the intellectual development of primary school children and pupils.**

Our motive for this focus is the view on the skills on an active and operational plane. Minchev (1991) distinguishes three groups of components in the skills structure: /1/ sense of situation, /2/ metacognitive actions and /3/ simple and complex habits of perceptive, memory and motor nature. The metacognitive components /one of which is the anticipation/ are considered to be those “stimulators” of the analytical and combinatory activity which participate in the formation of subpurposes and initiate the will efforts for the

realization of transforming actions new for the subject experience (Ivanova, 2016).

### **Foreseeing as a main sign of the solving problems skill**

Anticipation /prefeeling, foreseeing, presentiment, foresight, supposition for actions, events, results of experience, study, preliminary idea or a general notion of them/ is described as an “appearance in the mind before perceiving the separate concrete things; forestalling when by a mental motion a defined action may be executed before the appearance of the expected signal of it (Desev, 2003).

Lomov relates the anticipation to the capacity of taking different decisions and acting in time and space by “foreseeing” an expected future event. I.e. **anticipation may be considered as a sign of each activity form – as a foresight of the final purpose or subpurposes, of the action alternatives and stages, as a preliminary rationalization of the action consequences or of the activity effects by making a critical evaluation of the past experience**

The following levels of anticipation are known: subsensory, sensomotor, perceptive, conceptual /by generalizations, abstractions, calculating operations, acquired experience/ and verbal-mental one which is considered to be the highest level.

According to Zeltz each problem creates some idea of the purpose containing the decision in the form of an ”urging blank”. During an experiment of Luria the foreseeing is examined on the sensomotor plane in its quality of interpolating /complementing/ mechanisms which are a product of the structures transformation process similar to the already known ones by the subject (Lalov, 2003). During that experiment the significant role of the foreseeing in the heuristic aspects of the solving problems activity and the possibility of its purposeful formation is well visible. There is an analogical experiment through problems referring to the mounting and dismounting of parts (Piryov, 1969).

Key words and phrases of the description: manipulation, sight and foresight, generalization of the foreseeing mechanisms, spontaneity and entirety.

The given examples show the important role of the foreseeing when solving problems. Some authors add also the psychic models capacities functioning on the basis of the foreseeing mechanisms.

The development of the cybernetic ideas and methods when the main question is about the regulation and the self-regulation permits to see “insight” – deeply in the understanding of the foreseeing regulation functions as a sign of the capacity of solving problems and an element of its operational structure. The motives for that thesis are given by the

fundamental idea of Lomov and Surkov (1980) according to whom the hypothesis use efficiency when solving problems depends on those conditions which determine the balance between the prognostication processes and the control operations. Petrov (2013) defines as “*prognostication*” the foreseeing part which to a great extent is realized and verbalized. When solving problems the prognostication is examined as a process of anticipating information receiving in the form of probable deductions about the object based on scientifically motivated situations and methods.

60 students of the Faculty of pedagogy of the Trakia University, Stara Zagora, Bulgaria have participated in the study. They study in the specialties of Preschool and primary school pedagogy and Primary school pedagogy with a foreign language - Bachelor educational and qualification degree. In the methodological system of work applied in the scholar subject of Training in thinking by mathematical problems solving are included a series of problems. By their solving different elements of the students’ mathematical competency are built. Those problems are mutually complementing and create a “complex repeating situation” (Petrov, Temnikova, 2016). Examples of the different kinds of problems and some of their particularities are given below.

First kind of problems: In a given class there are 25 pupils. 14 of them play football, 15 practice swimming and 9 practice both sports. How many pupils practice neither football nor swimming?

At the first stage during the solving process the students understand the problem content and build a general hypothesis. At the second stage they generate a lot of ideas. In this concrete case – two ideas using the modeling method. During the first idea the line of natural numbers is used on which are consecutively marked the first 14 pupils who play football. The last 9 of them are marked as practicing both sports. On the axis are marked also the remaining 6 ones who practice swimming. That does not impede the reasoning because a number which does not depend on the objects layout is searched for. The number of the pupils who practice neither football nor swimming should be determined. During the second idea of solving the theoretical multiple approach and the diagrams of Oylar-Ven for the situation modeling presented in the problem are used. Both ways use heuristic approaches and modeling for the temporary situation simplification and the creation of conditions of making a problem solving plan.

When solving the second kind of problems the analytical approach /solving from the end/ is used. For example: From a plate with apples Anne has taken the half and one apple more. Then Pam has taken the half of the remaining apples and 2 apples more. In the end George has taken the half of the remaining apples and the last 3 apples. How many apples there were at

the beginning and how many apples has taken each of them? A number of ideas for the problem solving are related to the following important moments: to begin the solving from the end; to introduce suitably the variables and to solve the problem by an equation; the idea of substitution may be illustrated; the searching characteristics may be prognosticated and the decision may be found.

When solving the third kind of problems included in the series the method of the invariant is used. One of the problems is the following: Two baskets contain 8 peaches each one. Nora has taken from the one a couple of peaches. Lili has taken from the other as many apples as the remaining quantity in the first basket. How many apples totally have remained in both baskets?

When solving the problem two trials are done on the basis of which the following supposition is formulated: no matter how many apples has taken Nora in the beginning 8 apples remain totally. The supposition is supported examining one case more and thus it is well-founded to a greater extent. When describing the decision finding the following terms are used: supposition, reasons for the supposition formulation, additional argument, thinking in the form of “if..., so”. The decision may be presented in a table where all cases are examined, i.e. different invariants. The situation simplification in this problem is made by its visual presentation combined with the algebraic expressions modeling.

The following general conclusion concerning these problems may be made:

- the foreseeing as a main characteristic of the solving problems skill expressing its active nature is manifested mainly in two modi: sensomotor modus and a prognostication by solving methods and ideas;
- the approach prognostication /multiple ideas/ is the main moment in the heuristic searching for strategies.

The observation made by us of the process of the *decision searching for* shows the particularities of its different stages and reveals some possibilities of purposeful formation of the trainees' anticipation capacities.

### **I stage. Problem understanding and a general hypothesis building**

The problem solving begins by its understanding. As a result of the analysis of the condition and the searching for in the problem a general hypothesis arises in its quality of an initial idea. In the content aspect it includes a prognostication of the relations between the groups of objects under the given conditions and some general ideas of the solving way. The general hypothesis determines the searching field and becomes the initial point of the second stage.

## **II stage. General hypothesis development and formation of a multitude of solving ideas**

The heuristic approaches are applied partially at the first stage but mainly at the second one, such as: temporary situation simplification, problem “specialization” by examining the different private cases, reformulation of the search in the problem, solving “from the end” and various analogies use. The cognitive activity is regulated by them but the observations show that this is to a certain extent. The operations become less chaotic.

## **III stage. Obtaining the main /specified/ hypothesis**

At this stage an evaluation of the multitude of solving ideas is made and the most perspective one is chosen. It becomes detailed on the basis of the characteristics of the objects in the different groups. A decision projection follows.

The experimental work done shows the following: if one admits that a comparison regulatory mechanism functions, about its two phases /hypotheses building and their resulting evaluation/ may be said that they are characteristic of each stage of the search. The following conclusion may be made: the prognostication by hypotheses building is the main part of the self-regulation at each stage of the search.

The different kinds of heuristic procedures create conditions for the development of the comparison of the hypotheses with the results of the operations especially at the initial search stages when the information is insufficient.

It is known that the two main heuristic characteristics are “directing” to the solving idea and “shortening” of the choice of the different possible ideas. The direction to the solving idea is observed at the first and the second stages /when formulating likely hypotheses/. The search shortening is realized by the creation of likely hypotheses, through their confirmation and by the elimination of ideas from the multitude. These actions lead to the two following conclusions:

- a relation between the solving efficiency and the number of ideas in the multitude of alternatives can not be searched;
- the solving idea may be the only one but with a higher degree of likeliness and it may lead to the effective decision.

**For that model of the decision search activity it is characteristic that the main actions included in it give possibilities of realizing the prognosticating, directing and shortening heuristic functions.**

### **Conclusion**

Theoretical formulations and some practical aspects of the anticipation problem on the basis of the developing training particularities through the solving problems process are derived and systematized.

By the created methodological work system **combining productive and reproductive strategies, approaches, methods and means the student** is put in the center of an active cognitive process during which he constructs his ideas for mathematical problems solving on the basis of his available knowledge and past experience.

By its application during the lessons of Training in thinking by solving problems the students achieve higher levels of the inner purposeful orientation providing efficiency when forming the anticipation capacities having the trend toward a transfer in the ages and the activities.

The students' anticipation development contributes to the following: creation of their transversal competencies and realization of the knowledge and skills transfer by solving a limited number of problems in close fields, formation of the style of work generating the inner motivation for the non standard mathematical problems solving.

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# Geoquest Project Implementation and Experimentation of a Computer Classroom Role Playing Game: Final Results

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## Abstract

The GeoQuest Project started as a PhD research project in Teaching and Learning Processes in Science Education. It aims to answer to both students and teachers' needs in an ever-changing world. Today, in particular, students need teaching tools that use different communication codes, as they are less accustomed to abstraction. An increasingly interconnected and technological world requires students to have specific skills: knowledge of the disciplines founding cores in an interdisciplinary key is required, along with technical and technological skills, mastery of foreign languages, flexibility, attitude to team working, creativity and entrepreneurship. Scientific subjects, such as Science, Technology, Engineering and Mathematics (STEM subjects) need to be strengthened and studied through a laboratory approach. On the other hand, teachers need user-friendly teaching tools, which allow and promote teamwork, which allow the laboratory teaching and the CLIL (Content and Language Integrated learning) approach. We have therefore developed a Computer Classroom Role Playing Game (CCRPG), GeoQuest, which has already been described in some international publications; a multi-phase experimentation was carried out for two years.

In this paper, we illustrate the phases of experimentation, the excellent results achieved and the quantitative statistical analysis.

The final outcome is how GeoQuest Project matches the students and teachers' needs.

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**Keywords:** Digital Game, Learning on Gaming, Science Education, Earth Sciences, Teaching Methodology

## **Introduction**

Nowadays, globalisation in an increasingly interconnected and technological world requires people to have specific skills: knowledge of the disciplines founding cores in an interdisciplinary key is required, along with technical and technological skills, mastery of foreign languages, flexibility and ability to reconvert, attitude to team working, creativity and entrepreneurship.

Furthermore, there is an education inequality, in Europe and in the world, especially in scientific topics, which has required repeated interventions to promote the STEM disciplines and a suitable training in Science and Technology. Therefore, teachers training and renovation efforts were also necessary to support the methodological change and to obtain the foreseen results. However, these interventions have not always achieved their goal: on the one hand, teachers seem to be resilient to change, on the other hand they ask for innovative yet convenient tools.

The aim of this work is to prove that it is possible to reconcile the needs of teachers to have user-friendly teaching materials to the needs of students to have effective training. GeoQuest Project can be a good solution, not only for teachers, but also for students, as it is able to guarantee an effective acquisition of the key competences and the disciplinary ones of Science and Technology. The results obtained confirm this is actually possible.

## **Theoretical Background and State of the Art**

The education guidelines, focused by the EU Commission, are perfectly in line with the world's leading educational instances: innovative teaching, Information and Communications Technology (ICT), hands-on activities, lab activities, etc. An innovative teaching technology combines ICT, traditional and modern media, and social networks, where gaming is a key element. (Maraffi, Paris & Sacerdoti, 2017). Chapman and Rich (2017) claimed that games might encourage students to spend more time studying, be more engaged, and as a result, learn more. This new way of learning offers new opportunities to use collaborative tools, allowing the students to co-construct knowledge efficiently (González et al., 2016). Results indicate DGBL (Digital Game Based Learning) increases student motivation to pursue geoscience learning (Bursztyn et al., 2016). "The innovative practices are driven by champion teachers, those that are willing to go one step beyond in the benefit of their students. School's strategies are, in general, very exam oriented and have to handle lots of bureaucratic work." (Doran et al., 2016). Therefore teachers need to improve their ICT (Information and Communication Technologies) skills and their mastering of interactive teaching applications; they are also aware that the actual availability of

structured teaching materials is poor and unsatisfactory (Maraffi & Sacerdoti, 2016 b).

### **Identification of teachers' needs**

#### **Preliminary step: impact of the methodological reform**

In the initial phase of the research, interviews were conducted with teachers to collect the actual and perceived needs for the implementation of innovative teaching methods. The sample interviewed consisted of 120 teachers: 40 from primary schools, 40 from secondary schools (first grade, consisting of 11-14-year-old students) and 40 from high schools. The questions expected an affirmative or negative answer. Questions posed and the results, expressed as a percentage, are summarised in Table No. 1. While an in-depth analysis of all answers we can summarise the obtained results as follows:

- In general, teachers consider positively the incentive towards methodological innovation, though with some reservations. They believe this innovation could require teacher training through refresher courses, but not all of them would be available to undergo the update voluntarily. Here a series of factors intervene, among which the workload to which the teachers are subjected and the attitude to question themselves.
- Regarding new technologies, teachers feel adequately prepared themselves to provide students scientific skills required by modern society. Given the choice, they would not undergo refresher courses on ICT (Information and Communication Technologies); majority of them do not use computer tools, neither for professional updating, nor for communications (email, etc).
- Teachers, as for requests to use a new methodological approach, such as CLIL (Content and Language Integrated Learning) and as teaching planning and skill assessment, believe they are not appropriate to support them. They assert that, especially for the CLIL, although prepared and certified by MIUR refresher courses, foreign language learning requires the linguistic mastery exclusive to mother tongue teachers, or at least to the teachers dedicated to this professional purpose.

Table 1. First step teachers' survey: interview about innovative teaching implementation.

	Questions							Ave	Ave
		Yes	No	Yes	No	Yes	No	Yes	No
	Do you think the propulsion towards a methodological innovation in teaching is positive?	72	28	65	35	57	43	64,7	35,3
	Do you feel adequate to use of new teaching methods?	16	84	29	71	34	66	26,3	73,7
	Do you think that with the teacher training courses you can change the way they teach?	75	25	61	39	52	48	62,7	37,3
	Are you willing to take refresher courses to improve your professional skills?	66	34	55	45	41	59	54,0	46,0
	Are you willing to take refresher courses to improve your students' learning outcomes?	66	34	53	47	31	69	50,0	50,0
	Do you consider your preparation adequate to provide your students with the scientific skills required by the current world?	45	55	69	31	83	17	65,7	34,3
	Are you willing to update yourself to effectively use IT tools in teaching?	32	68	29	71	18	82	26,3	73,7
	Are you willing to update yourself to effectively use IT tools in your professional practice?	25	75	20	80	13	87	19,3	80,7
	Do you regularly use your email for your work communication?	15	85	33	67	41	59	29,7	70,3
	Do you regularly use the web to keep yourself professionally updated?	19	81	26	74	61	39	35,3	64,7
	Do you think you are able to apply the CLIL approach to your teaching?	5	95	11	89	18	82	11,3	88,7
	Do you think that the linguistic competence of a teacher of other discipline can be effective in learning a foreign language?	2	98	3	97	7	93	4,0	96,0
	Do you think work in the classroom with more teachers in team working is effective?	69	31	24	76	19	81	37,3	62,7
	Would you like innovative learning materials that are easy to use?	85	15	83	17	86	14	84,7	15,3
	Would you like innovative teaching materials that provide the possibility of an authentic evaluation?	91	9	88	12	72	38	83,7	19,7

- Among the issues discussed with the teachers, it was decided to focus on three questions, results of which are shown in the diagrams in Figure No. 1. Teachers believe that they are poorly suited to the use of new teaching methods (Figure No. 1a, b, c), but are not willing to voluntarily undergo

refresher courses, especially on use of ICT in teaching (Figure No. 1d, e, f). On the other hand, they would rather appreciate innovative teaching material already structured and easy to use (Figure No. 1g, h, i).

Data collected in this first research step were used to calibrate technical-methodological characteristics of GeoQuest Project, taking the main teaching and educational needs perceived by teachers into account. Keep in mind that GeoQuest Project was born as an educational innovation tool, to improve Science students' learning (Maraffi & Sacerdoti, 2017), Science and Technology skills obtainment (Maraffi & Sacerdoti, 2016 a), and to enhance key competences of citizenship (Maraffi, et al., 2016). In fact, teaching materials must be adapted to teachers needs and must be user friendly, to obtain more effective learning results.

*Intermediate step: innovative methodologies mastery*

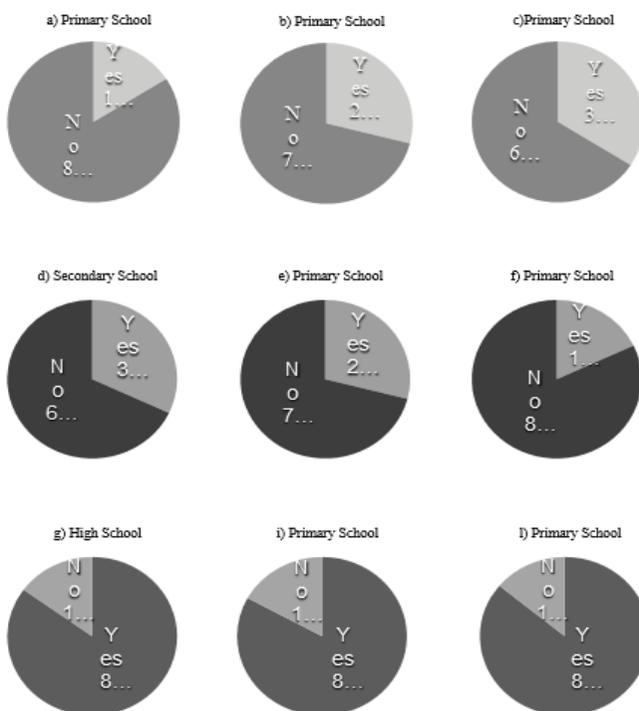


Figure 1. Answers of teachers (a,d,g: primary school; b,e,h: secondary school; c,f,i: high school) to three significant questions. a, b, c: "Do you feel adequate to use of new teaching methods?"; d, e, f: "Are you willing to update yourself to use IT tools in teaching?"; g, h, i: "Would you like innovative learning materials that are easy to use?".

In a second research step, a sample of 22 teachers (all grades of school, teaching different subjects) was analysed. Teachers voluntarily participated in a refresher course in "Innovative teaching methodologies and

digital teaching". In this case, to participants were asked to express a numerical evaluation - on a scale of 1 to 10 - about 20 questions. Results are collected in Table No. 2, and show that:

Table 2. Second step teachers' survey: perception of teachers' teaching skills.

Questions	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Ave
Own pedagogical skills satisfaction	8	7	8	5	7	7	5	5	7	5	5	8	6	6	7	6	7	7	8	6	6	8	<b>6,5</b>
Knowledge of modern teaching methods	7	7	9	5	6	7	5	5	7	5	5	7	5	5	5	5	8	8	8	5	5	7	<b>6,2</b>
Use of varied teaching methods	7	7	9	5	6	8	6	6	6	6	6	7	7	7	7	7	7	7	7	7	1	7	<b>6,5</b>
Easy to find educational materials on the web	6	7	7	5	8	7	6	7	7	6	6	8	8	8	8	9	9	9	9	7	4	5	<b>7,1</b>
Use of web educational materials	7	6	7	7	9	8	5	7	7	6	6	9	8	8	8	9	10	10	10	5	4	6	<b>7,4</b>
Use of a Multimedial Blackboard as projector exclusively	7	6	5	7	5	6	5	2	7	2	2	6	8	7	7	9	1	1	1	4	4	7	<b>5,0</b>
Multimedial Blackboard software mastery	5	6	5	5	7	5	5	5	6	2	2	7	5	5	5	8	1	1	1	5	5	5	<b>4,6</b>
Use of PC for teaching	5	6	9	5	8	6	5	6	6	6	6	8	4	4	8	9	10	10	9	5	5	5	<b>6,6</b>
Use of tablet for teaching	5	6	9	2	7	6	6	2	6	6	2	9	2	3	8	4	10	10	9	5	4	5	<b>5,7</b>
Need to change teaching method	8	7	5	5	6	7	6	6	7	6	6	9	7	7	8	6	7	7	7	6	5	8	<b>6,6</b>
School website easy use for institutional purposes	8	8	8	4	6	7	6	6	7	6	5	7	9	9	8	6	8	8	10	7	5	8	<b>7,1</b>
Email easy	7	8	8	4	8	8	7	7	7	6	6	7	9	9	7	9	10	10	9	6	7	7	<b>7,5</b>

Table 2. Second step teachers' survey: perception of teachers' teaching skills.

Questions	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Ave	
use for institutional purposes																								
Riesco a conservare facilmente il materiale didattico da me preparato	5	6	7	7	8	6	7	7	8	6	6	9	8	8	8	9	9	9	9	7	7	5		<b>7,3</b>
Mi servo di vocabolari, dizionari, traduttori disponibili in rete	7	7	9	7	9	6	7	7	7	7	6	9	10	10	8	9	9	10	10	8	7	6		<b>8,0</b>
Prediligo le presentazioni multimediali	5	7	7	5	8	5	6	7	6	6	6	9	5	5	6	5	9	10	9	5	4	4		<b>6,3</b>
Mi servo spesso di materiale audio e/o video per la didattica	7	7	7	5	7	6	6	5	5	7	6	8	5	5	8	9	10	10	10	5	5	7		<b>6,8</b>
Sento la necessità di mantenere sempre un approccio laboratoriale	5	8	9	5	7	5	6	6	6	6	6	9	5	5	7	7	9	9	9	7	5	7		<b>6,7</b>
Utilizzo i social network	8	8	5	5	7	5	6	7	6	6	6	6	9	9	7	8	10	10	9	8	7	8		<b>7,3</b>
Utilizzo l'approccio ludico nella didattica	7	8	10	5	7	8	6	7	7	7	7	8	5	5	7	9	10	10	9	9	7	7		<b>7,5</b>
Mi è facile valutare le competenze	8	7	10	5	6	7	8	6	7	6	6	7	7	7	6	8	8	7	8	8	7	8		<b>7,1</b>

- among few teachers who would train themselves to innovate their teaching methodologies (Figure No. 2), the web and teaching materials are used rather frequently (votes around 7/10). Web in particular is mostly used for translators and vocabularies (8/10). The perception of teachers' pedagogical skills and the mastery of innovative teaching methods is only sufficient (6/10), while laboratory approach is somewhat higher (6.7/10). The

use of technological tools in teaching is mediocre, such as multimedia blackboards (5/10) and tablets (5.7/10), while the mastery of software utilisation is definitely insufficient (4.6/10).

Table 3. Third step teachers' survey: interview about innovative teaching implementation.

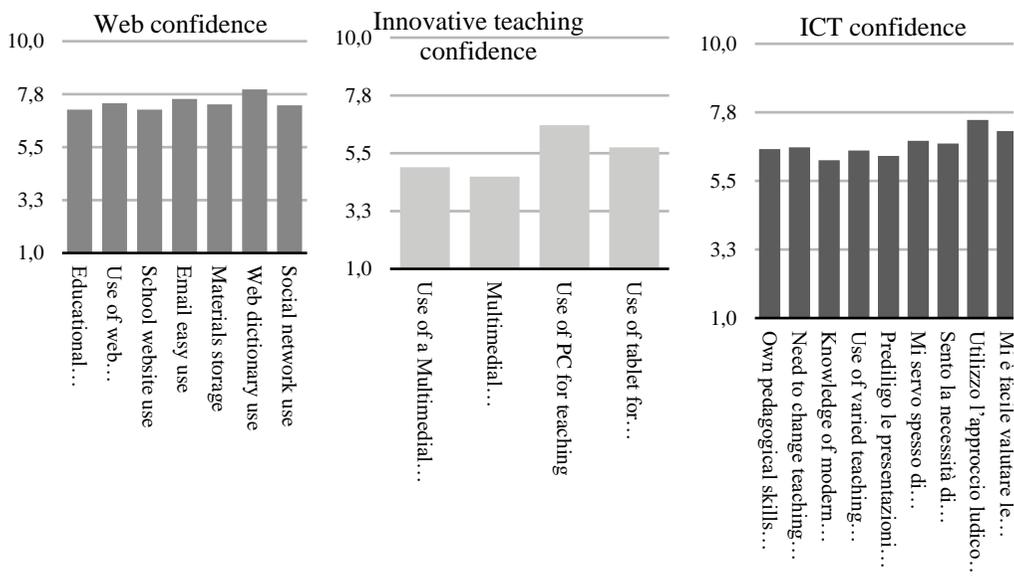


Figure 2. Web confidence, Innovative teaching confidence and ICT confidence, measured on teachers sample of survey 2.

### Final step: teachers' needs

Questions	Yes	No
Do you feel adequate to use of new teaching methods?	27,4	72,6
Are you willing to update yourself to effectively use IT tools in teaching?	19,1	80,9
Would you like innovative learning materials that are easy to use?	89,3	10,7

Subsequently, a third phase of investigation with teachers was carried out. In this case, the survey sample consisted of 439 teachers participating in the compulsory refresher courses required by the three-year MIUR update plan<sup>1</sup>. Within this sample 154 teachers followed the refresher courses in

<sup>1</sup> National Plan for teacher training 2016/2019, D.M. 797 of 2016

Didactic Planning of Sciences for Skills, and 285 teachers followed the course of approach to CLIL. Results of the third survey are summarised in Table No. 3. We can note that the needs of the teachers less interested in updating and professional improvement are the same as those of the first survey (Figure No. 3), as the requests of the Ministry of Education, of society, of the whole

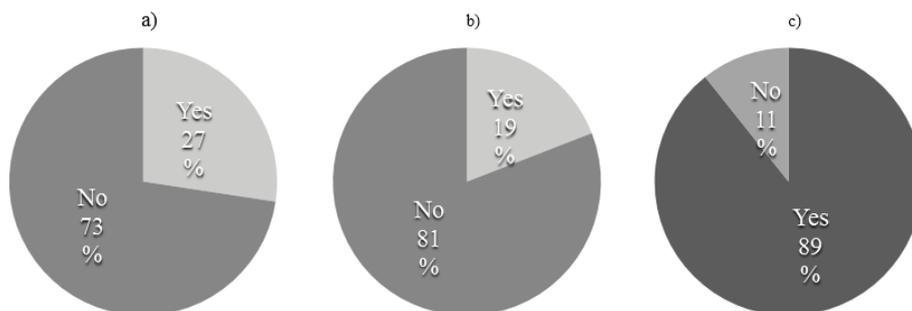


Figure 3. Adequacy of teachers about new teaching methods (a), will to attend refresher courses (b), innovative teaching materials need (c), measured on teachers' sample of survey 3.

world, force them to apply teaching methods consistent with a changing world. Summarising, from our surveys, we can highlight these specific teachers' needs (Table No. 4):

Table 4. Teachers' needs: to have teaching materials with specific features

	Features
<b>1</b>	Structured
<b>2</b>	User-friendly
<b>3</b>	Innovative
<b>4</b>	Interdisciplinary
<b>5</b>	Multilingual
<b>6</b>	Immersive learning environment
<b>7</b>	Skills authentic assessment
<b>8</b>	ICT provided
<b>9</b>	Engagement

- to have well-structured, user-friendly teaching materials available. These innovative teaching materials must also allow an interdisciplinary and multilingual approach (CLIL approach), and must develop a learning environment allowing an effective skill assessment.

- to have teaching materials that use ICT (to enhance the digital competence) and that ensure an effective student engagement.

## Methodology

Table 5. GeoQuest'Project features	
Characteristics	CCRPG
Immersion	Narrator speaking voice, sounds effects, photo, original designs, and musics, create a totally immersive environment.
Engage	Thanks to storytelling, mystery, and suspense.
Changing environments	Adventure pathways change depending on the players' choices.
Mystery	Each path may have a different finish andfantasy is blended with real world.
Shared experiences	All players follow game on the same multi-medial whiteboard or other screen.
Cooperative learning	Shared experiences foster cooperative learning.
Lab	Possibility to have lab activities or watch related videos.
Immediate feedback	Game engine indicates immediately whether the answer provided by the player is correct or wrong. In the latter case, the exact answer is indicated.
Interactivity	Players interact with the game trough their own smartphones or tablets, using a LAN.
Inter-disciplinarity	Science topics are treated with humanities.
Multi-language	Adventures pathways available in any language.
Inclusion	Accessible design creates an inclusive educational environment: different communication codes (video and audio), notebooks
User friendly	Software is specific for this CCRPG and it can also be used by non-experienced teachers.

As already mentioned above, we have taken into account the specific needs of teachers, as we consider essential for them to be able to work in fulfilling conditions, in order to maximise the effectiveness of the teaching action. We have therefore developed a Computer Classroom Role Playing Game (CCRPG): GeoQuest (Maraffi, Paris & Sacerdoti, 2017), the characteristics of which are summarised in Table No. 5. For a detailed description of the GeoQuest Project (disciplines, languages, learning paths,

etc.), please refer to the bibliography. Table No. 6 indicates the educational goals and the corresponding strategies adopted in the GeoQuest game.

Table 6. Educational goals and corresponding CCRPG (Computer Classroom Role Playing Game) strategies

Educational Goals		CCRPG Strategies	References
Engaging		Digital storytelling	Maraffi, S., Scamardella, A. (2016).
		Use of smartphones and tablets	Sacerdoti, F.M. & Maraffi, S., (2015).
		Sound effects, videos, etc	Maraffi, S., Pennesi, D., Acqua, A., Stacchiotti, L., Paris, E. (2016).
Immersive learning environment		Photos, videos, pictures, sounds	Maraffi, S. & Sacerdoti, F.M. (2017).
Key competences improvement	Communicating in a mother tongue and Communicating in a foreign language	Multilingual	Maraffi, s. & Paris, E. (2017).
	Scientific and technological competence	STEM <sup>1</sup> topics	Maraffi, S. & Sacerdoti, F.M. (2016a).  Maraffi, S., Paris, E. & Sacerdoti, F.M. (2017).
	Digital competence	Digital tool	
	Learning to learn	Inquiry approach and immediate feedback	
	Social and civic competences	Team working and cooperative learning	
	Sense of initiative and entrepreneurship	Problem solving	
	Cultural awareness and expression	Interdisciplinarity STEAM <sup>2</sup> & SSH <sup>3</sup>	Maraffi, S., Scamardella, A. & Sacerdoti, F.M. (2016).
Authentic skills assessment		Interdisciplinarity	Maraffi, S., Sacerdoti, F.M. (2016b).
		STEAM <sup>2</sup> approach	Maraffi, S. & Sacerdoti, F.M. (2017).
		Achievable tasks	Maraffi, S., Marinelli, A.L. (2016).
CLIL approach		Multilingual, with virtual mother tongue voices	Maraffi, S., Ercolino, I. & Sacerdoti, F.M. (2017).
BES		Notebooks, as compensatory tools; audio, video subtitles as dispensative measures	Maraffi, S. & Sacerdoti, F.M. (2017).
<sup>1</sup> Science, Technology, Engineering & Math <sup>2</sup> Science, Technology, Engineering, Art & Math <sup>3</sup> Social Sciences and Humanities			

The aim of the experimentation is to demonstrate that GeoQuest match the desired characteristics: improving learning and satisfying the teaching needs.

### Experimentation

*First experimental test: calibration (Maraffi, Paris, & Sacerdoti, 2017)*

A first experimental test (Maraffi & Sacerdoti, 2016 b) was carried out with the aim to:

- A. Calibrate and evaluate the impact and effectiveness of our CCRPG methodology in order to make all the necessary changes to the learning environment: software characteristics, player interactions, game features, and enhancements to the stories already completed (processing and improvement step);
- B. Verify applicability in different situations, school types, class types, and student ages;
- C. Develop a rigorous experimental protocol to be used in the final phase of the experimentation;
- D. Perform a first qualitative experimentation.

	Adventure pathway	Students' age	References
1	SoilQuest	8-12	(Maraffi et al., 2016a, 2016b)
2	GeoQuest Hawaii	10-18	writing
3	Geoquest Phlegrean Fields	13-18	(Maraffi, Scamardella, & Sacerdoti, 2015)
4	GeoQuest Vesuvius	17-21	(Maraffi, Sacerdoti, & Scamardella, 2016)
5	CrimeQuest	17-21	(Maraffi, Ercolino & Sacerdoti, 2017)

A first interesting result is highlighted by the pie graphic

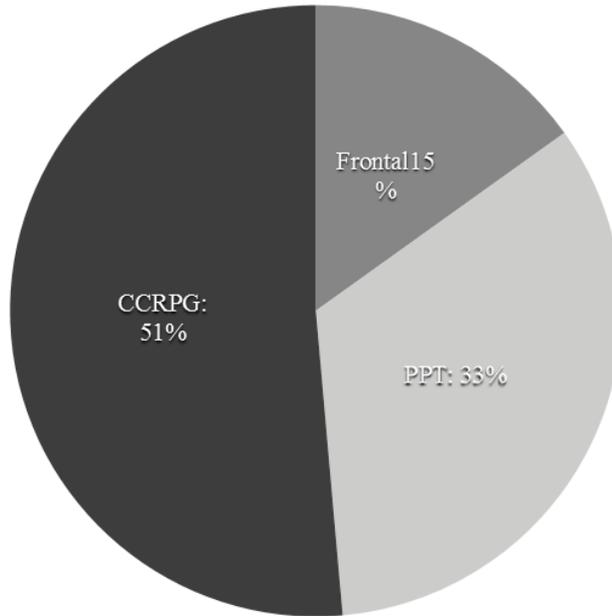


Figure 4. Students approval of three different teaching methodologies: CCRPG, PPT supported lesson, and traditional (frontal) lesson.

representation of the overall student approval average in Figure No. 4 about teaching methodologies. In the evaluation, we considered participation, comprehension, ability to convey complex topics and ability to learn a foreign language (Maraffi & Sacerdoti, 2016 b). Five different adventure pathways have been realised, related to different students' ages (Table No. 7). GeoQuest Project experimentation with younger students was evaluated based on authentic evaluation tests and was definitely satisfying. Students, aged 8-10 and 11-12 years, experimented the SoilQuest pathway; while students, aged 13-14 years, the GeoQuest Phlegraean Fields one. For an accurate description, refer to the bibliography (Maraffi et al, 2016; Maraffi & Sacerdoti, 2016 b).

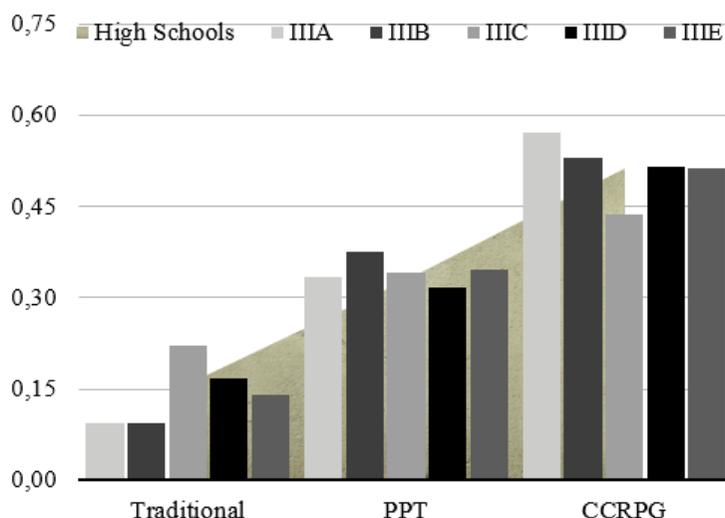


Figure 5. Teaching methodologies' outcomes of 5 secondary school's classes and of high school's average

In Figure No. 5 we showed the adventure outcomes results of five secondary school classes (13, 14-year-old), compared to high school classes average result. We can see that results obtained are in line with those of high school students, sometimes even higher. Yet the proposed adventure path was rich in elements of mineralogy, as well as of volcanology and geology.

Figure 6a. Students' engagement about GeoQuest Project.

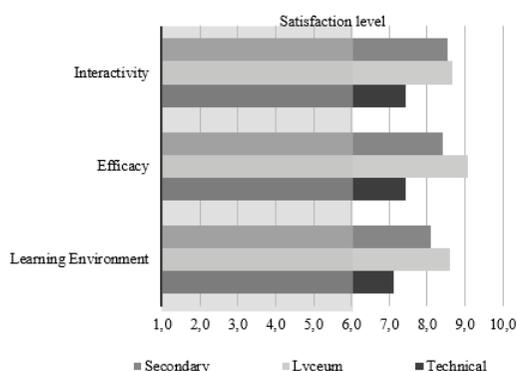
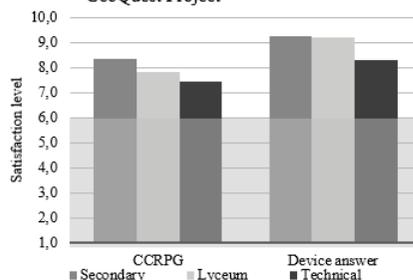


Figure 6b. Customer satisfaction about GeoQuest Project



This means that the mixture of scientific and humanistic elements (myth, history, etc.), conveyed by digital storytelling, is even able to acquire skills in complex subjects. Figure No. 6 shows the GeoQuest Project, Phlegraean Fields pathway appreciation results. This path is the richest in terms of mineralogy and crystallography elements. Phlegraean Fields is a volcanic Campania area site and it is unique in the world as it is rich in volcanological and geological elements consistent with the rich mythology of the place. It is

evident that the feedback is quite above sufficiency, regarding both interactivity and experience effectiveness, both for learning environment (Figure No. 6a). In particular, students' satisfaction exceeds the "Good" evaluation of Computer Class Role Playing Game (CCRPG) and answer devices (smartphones and tablets), as shown in Fig. No. 6b.

Experimental observation evidences show that CCRPG seems to be one of the most effective game based learning typology to improve student learning. Digital storytelling enhances student engagement, in agreement with Akkerman, Admiraal, and Huizenga (2009) which found that storifying history using mobile games had a positive effect on student engagement. Figure No. 7 (Maraffi & Paris, 2017) showed that attention rate for frontal lesson and the one related to the multi-media lesson are similar. Multi-media activities (PPT supported) allow only a degree of attention slightly larger. This may be multi-media tool contribution, which increases the perception. Student's perception increases but it has same small attention duration and same drop out. Instead, the CCRPG allows a significantly greater attention, with a persistent attention during the whole game.

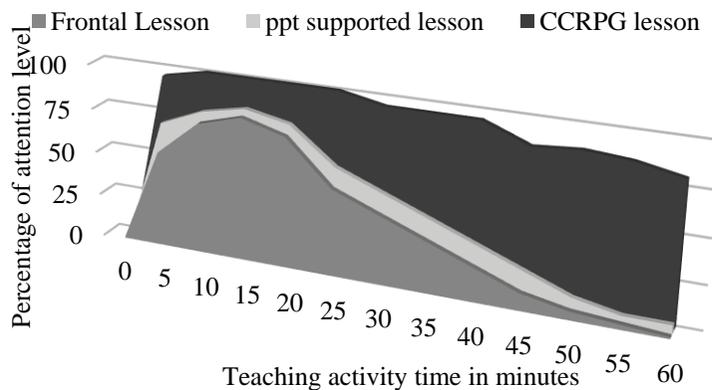


Figure 7. Percentage of attention level measured after frontal teaching activity (grey), after multimedia teaching activities supported by Power Point (light grey) and after GeoQuest teaching activities (dark grey). Average calculated on 26 classes.

### Final experimental test: definitive quantitative experimentation and data analysis

In a second step a definitive quantitative experimentation is been executed, followed by the data analysis. CCRPG GeoQuest has been experimented in different classes, using a personal computer and a multimedia Interactive Whiteboard (IWB). Students were able to interact with the game through their own smartphones or tablets with a simple

browser connected to game via LAN (Local Area Network). The total research sample consisted of 40 classes, from primary schools to university, for a 914 total students. Within this sample, 32 classes (731 students) have experimented with the CCRPG and 8 classes (183 students) had a traditional lesson: frontal lesson, supported by interactive multimedia whiteboard, with photos and videos. The control groups' lessons had same duration and same contents as those of corresponding experimental samples. Research population's features are summarised in Table No. 8. In Table No. 9 classes submitted to second experimentation step are indicated. These experimental groups have performed the definitive quantitative experimentation, for a 380 total students (303 students with CCRPG, 77 students as control group).

Table 8. Research population's features						
Classes	Students' age	School's kind	CLIL approach	Special Educational Needs	Adventure pathway	Note
4	8-10	Primary		X	SoilQuest	
1	8-10	Primary				Control group
3	11-14	Secondary		X	SoilQuest	
1	11-14	Secondary				Control group
5	13-14	Secondary		X	GQ Phlaegrean Fields	
1	13-14	Secondary				Control group
2	16-18	High		X	GQ Phlaegrean Fields	
1	16-18	High				Control group
4	14-16	High	X	X	GQ Phlaegrean Fields	
6	16-18	High	X	X	GQ Vesuvius	
1	16-19	High	X		GQ Vesuvius	Iceland group
1	14-19	High	X			Control group
2	16-18	High			GQ Vesuvius	
1	16-18	High				Control group
2	17-18	High	X		CrimeQuest	
1	17-18	High	X			Control group
2	14-17	High		X	GQ Hawaii	
1	14-17	High	X			Control group
1	20-22	University			GQ Vesuvius	
40						

Table 9. Quantitative experimentation sample's features						
Classes	Age	School's kind	CLIL	SEN	Adventure pathway	Note
6	16-18	High	X	X	GQ Vesuvius	
1	16-19	High	X		GQ Vesuvius	Group from Iceland
1	16-19	High	X			Control group
2	16-18	High			GQ Vesuvius	
1	16-18	High				Control group
2	14-17	High		X	GQ Hawaii	
1	14-17	High				Control group
1	20-22	University			GQ Vesuvius	
15						

### Recent findings

*Data processing* To evaluate the learning outcome, students were given a pre-test and a post-test, with same questions. Ten questions referred to the main contents conveyed by didactic activity in order to test both knowledge and skills. Furthermore, post-test surveys were conducted on students and teachers, about customer satisfaction.

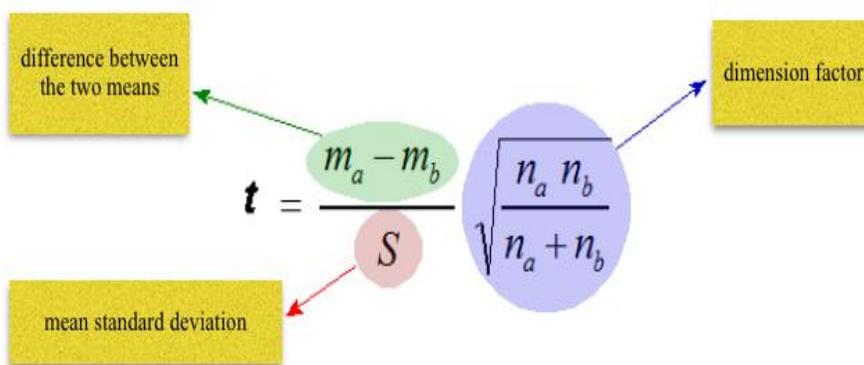


Figure 8. Formula for calculating the value t

The data obtained were submitted to student test (Figure 8), to determine if the two sets of data were significantly different from each other. First data set was pre-test results, the second one was post-test results. The t-test also tells us how significant differences are; in other words it lets us

know if those differences could have happened by chance only or not. Every t-value has a p-value to go with it. A p-value is the probability that results from your sample data occurred by chance. P-values are from 0% to 100%. They are usually written as a decimal number. For example, a p-value of 5% is 0.05. Low p-values are good; they indicate our data did not occur by chance. For example, a .01 p-value means there is only a 1% probability that the results from an experiment happened by chance. In most cases, a 0.05 (5%) p-value is accepted to mean data is valid (Park, 2005).

Table 10. P-values for experimental samples

Class	Dataset	1	2	<i>t</i>	<i>P-value</i>
<b>Comenio IV I</b>	<b>Media</b>	1,3333	3,6667	<b>5,4377</b>	<b>0,0000083929</b>
	<b>Standard dev.</b>	1,2344	1,1127		
<b>Comenio IV G</b>	<b>Media</b>	2,1818	3,8636	<b>3,9474</b>	<b>0,0002952798</b>
	<b>Standard dev.</b>	1,5318	1,2834		
<b>Mazzini V D</b>	<b>Media</b>	0,2500	3,0625	<b>6,5733</b>	<b>0,0000002843</b>
	<b>Standard dev.</b>	0,5774	1,6112		
<b>Mazzini V A</b>	<b>Media</b>	2,2083	5,0833	<b>7,2091</b>	<b>0,0000000044</b>
	<b>Standard dev.</b>	1,5030	1,2482		
<b>Mazzini V I</b>	<b>Media</b>	2,4800	4,1200	<b>5,2352</b>	<b>0,0000036020</b>
	<b>Standard dev.</b>	0,7141	1,3940		
<b>Mazzini V C</b>	<b>Media</b>	0,9600	6,0400	<b>11,0020</b>	<b>0,0000000000</b>
	<b>Standard dev.</b>	0,7895	2,1695		
<b>Comenio V H</b>	<b>Media</b>	1,9130	4,8261	<b>5,9053</b>	<b>0,000000465</b>
	<b>Standard dev.</b>	1,6491	1,6963		
<b>Comenio V E</b>	<b>Media</b>	1,0526	3,7368	<b>6,7160</b>	<b>0,0000000777</b>
	<b>Standard dev.</b>	1,1773	1,2842		
<b>Kvennaskólinn í Reykjavík</b>	<b>Media</b>	1,5000	4,3333	<b>5,5241</b>	<b>0,0000035797</b>
	<b>Standard dev.</b>	1,2948	1,7489		
<b>Galilei</b>	<b>Media</b>	0,6000	6,1333	<b>13,1235</b>	<b>0,00000000000017</b>
	<b>Standard dev.</b>	1,2984	0,9904		

In Table No. 10 the P-values calculated for the experimental groups are indicated: it is clear that our experimental data are more than acceptable, as the probability that the obtained results are due to chance is practically nil.

### Experimental results

In Figure 9 pre-test and post-test results of the last experimentation phase are shown. Figure 9 a-g refers to the class groups that have experimented CCRPG with CLIL approach, while figures 9 h,i and 9 l,m show results of groups that have experimented with the CCRPG in their mother tongue (Italian). It should be noted that these quantitative results refer to a measure and not to an evaluation, so that no other parameter of

evaluation may diminish, invalidating the comparison. We compared the number of correct answers provided to the

Table 11. Media, median and mode values for relative frequency of exact answers provided in the pre-tests and post-tests.		
	Pre-tests	Post-tests
Media	1,6	4,4
Median	1	4
Mode	1	5

same test, to questions proposed both immediately before and immediately after the experience with the CCRPG GeoQuest. The measurement of learning level is indicated on the Y-axis while on the X-axis student's order numbers are indicated, i.e. those corresponding to class diary. It is evident in all class groups post-test measurements are clearly higher than pre-test measurements.

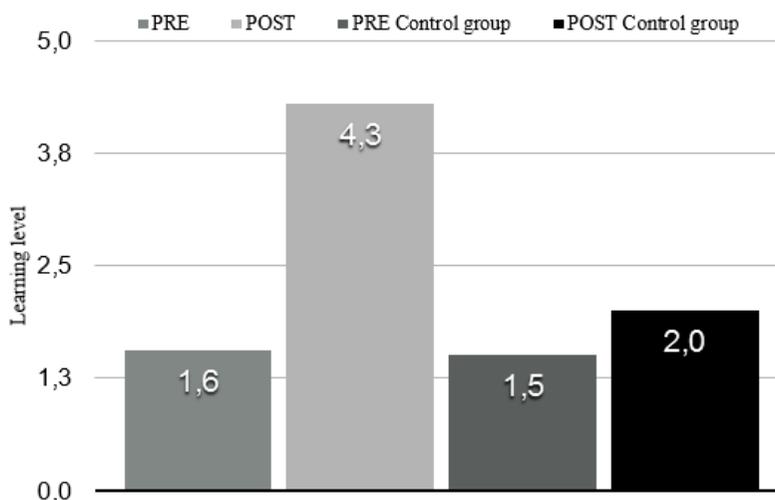


Figure 10. Difference between average values measured in pre-tests and post-tests, compared with control sample's results.

In Figure 10, the average of results is compared with control sample; in Figure 11 the CLIL approach data relative are compared with those of the mother tongue experimentation. We can notice no substantial difference exists between learning experience carried out in one's mother tongue and one carried out in a foreign language (CLIL approach).

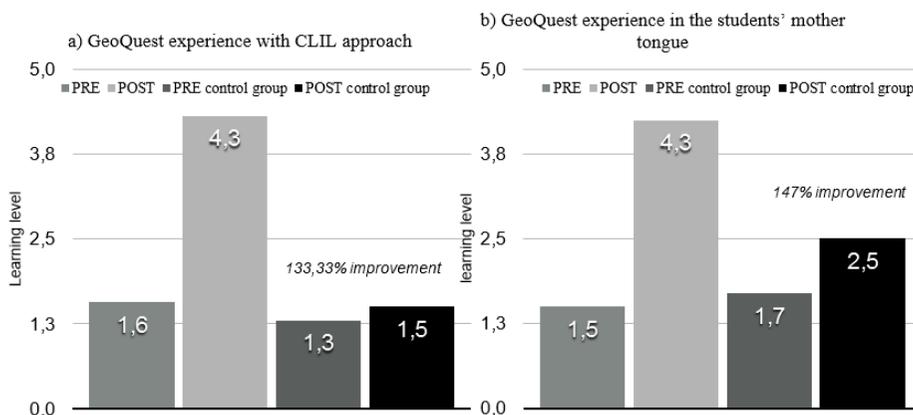


Figure 11. Difference between average values measured in pre-tests and post-tests for GeoQuest experience with CLIL approach (a) and with mother tongue (b).

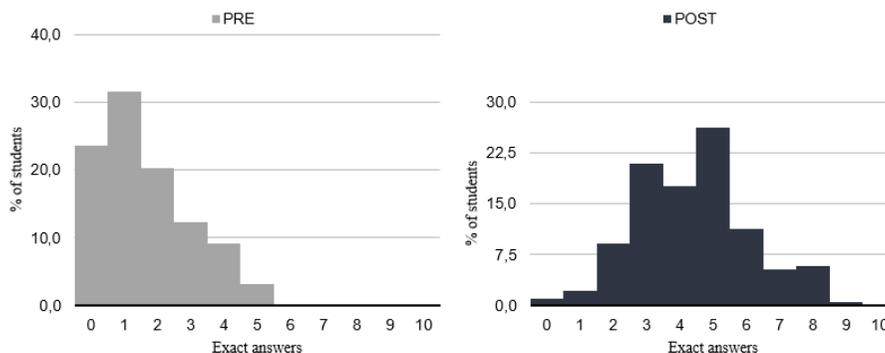


Figure 12. Percentage of relative frequency of correct answers provided in the pre-tests and post-tests.

Figure 12 shows the relative frequency percentage of correct answers provided in pre-tests and post-tests. The relative frequency percentage histogram of answers given to the pre-tests, shows (Table No. 11) that, on average, students answered correctly once every 10 times (media = 1,6). Students majority provided only one correct answer or none at all (median = 1); the number of correct answers provided by majority of students is 1 (mode = 1). The relative frequency percentage histogram of answers given to the post-tests shows that students answered 4,4 correct answers out of 10 on average (media = 4,4). Students majority provided up to 4 answers (median = 4); 5 (mode = 5) is the correct answers number.

### **Iceland-Italy teachers exchange**

One of the authors won a teachers exchange (2017) funded by Science on Stage Europe. It aimed at the development of a Joint Project

between two European countries (Iceland and Italy): the chosen project was GeoQuest, so that a class from an Icelandic high school experimented with the Vesuvius path of CCRPG. In Figure 13 learning outcomes are shown, before and after the CCRPG. We chose to consider the mineralogy questions data (Figures 13 A, B, C, D) as they are among the “hardest” topics for students. Figures 13 E and F refer to same question: In one case (Fig. 13 E), question included four choices, which were the names of four different volcanoes. In the second case (Fig. 13 F), in the four choices were the volcanoes images, without their corresponding names.

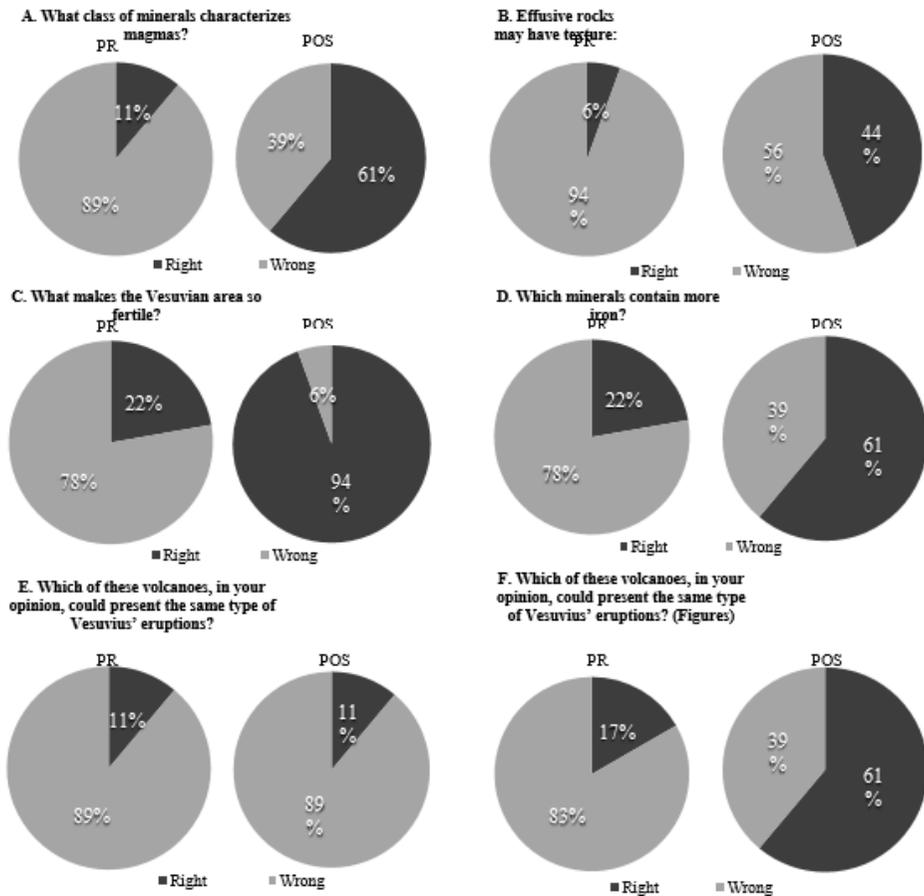


Figure 13. Pie charts for learning outcomes of Icelandic students, respectively before and after CCRPG. In red the wrong answers, in green the right answers.

## Customer satisfaction

Table 12. Media, median and mode values for students' satisfactions.

Students Satisfaction	GeoQuest finding	Immersive environment	Smartphone use
Media	8,2	8,2	9,1
Median	8	8	10
Mode	8	7	10

Figure 14 points out: - the students' satisfaction, regarding overall experience

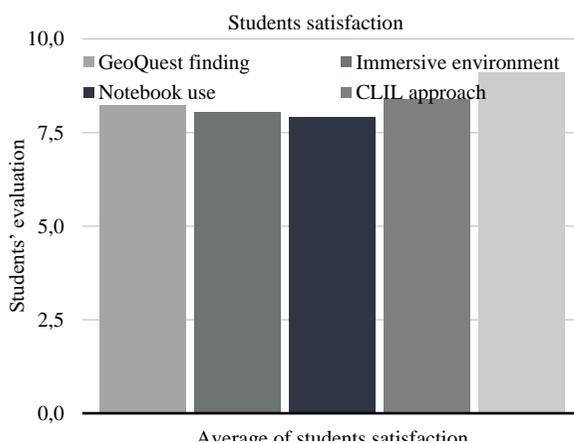


Figure 14. Students satisfaction.

with GeoQuest, - the learning environment, - the use of aids (notebooks), - the CLIL approach and the smartphones use. In this case, students were asked to express an evaluation from 1 to 10. The evaluations are fully positive ( $> 6$ ). A more detailed analysis (Table No. 12) shows the overall experience with the CCRPG GeoQuest is evaluated by students with average rating of 8,2 (media = 8,2); students majority provided a 8 (mode = 8) value. The immersive environment is judged effective by all students (media = 8; mode = 7); more than half of students evaluate smartphones use with a value higher than 9, majority giving a 10 rating (Figure 15).

Students of L’Orientale University	GeoQuest finding	CLIL compliance	Smartphone use	Interdisciplinary
Media	8,7	9,4	9,6	9,2
Median	9	9	10	10
Mode	9	10	10	10

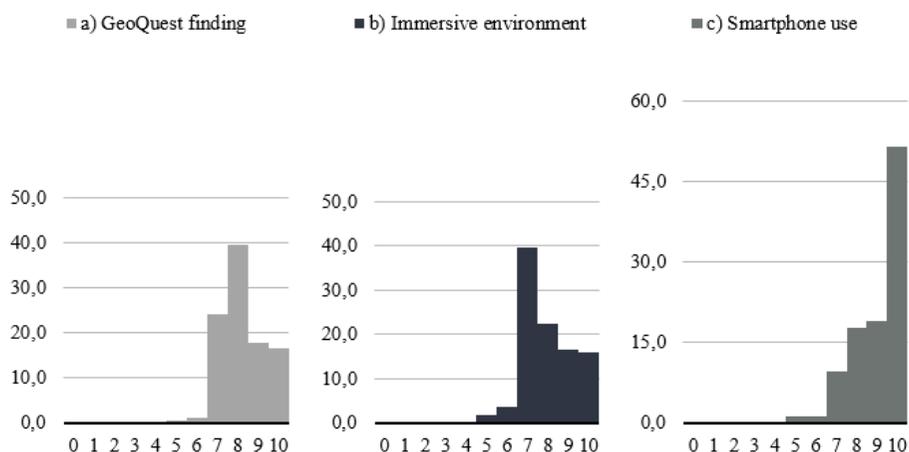


Figure 15. Percentage of relative frequency for students satisfaction.

The experimentation carried out with the "L’ Orientale" University class group aimed at having a technical evaluation of experience with the CCRPG. In fact, university students had an Applied Linguistics training background in the Education Degree Course.

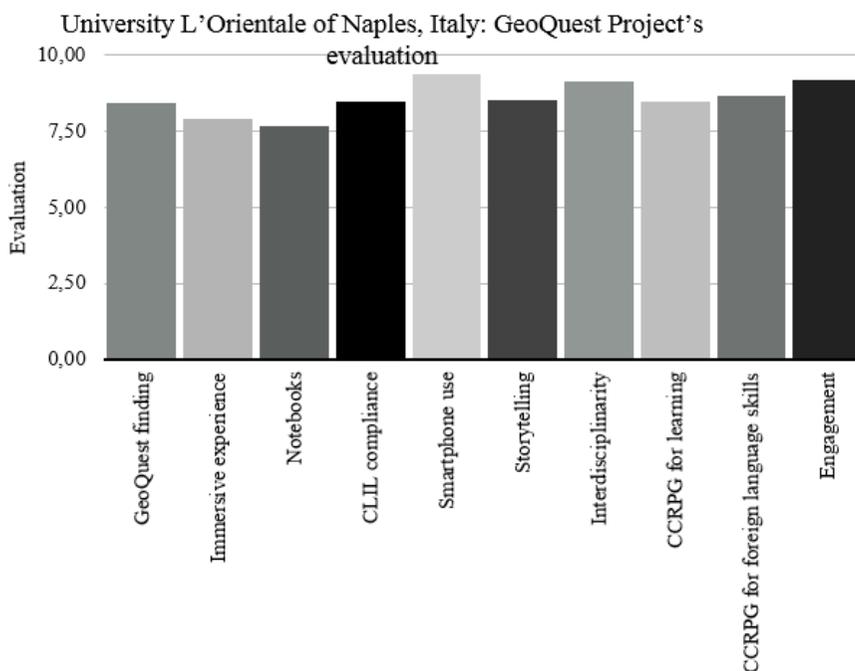


Figure 16. Students satisfaction measured in Education degree course by L'Orientale University of Naples, Italy.

In Figure 16 we can see evaluation average by “L’ Orientale” University’s students: all values are higher than 8,5. For a more detailed analysis we put together the evaluations concerning the same topic, and we calculated the relative frequency percentage of evaluations. Table No. 13 summarise media, median and mode values from evaluation by “L’Orientale” University undergraduates, while in Figure 17 we represented relative frequency of values in percentage. The technical opinion of the Education university course’s students is very flattering: GeoQuest gets an average appreciation of 8,7 (media = 8,7); more than half of the students expressed an appreciation higher than 9 (median = 9). They considered brilliant the interdisciplinarity between scientific and humanistic topics, as well as the smartphone use to interact with the CCRPG (median = 10 and mode = 10). The most satisfying result is the evaluation of CCRPG GeoQuest for CLIL compliance (median = 10; mode = 10), being the university course specific for Education and applied linguistics.

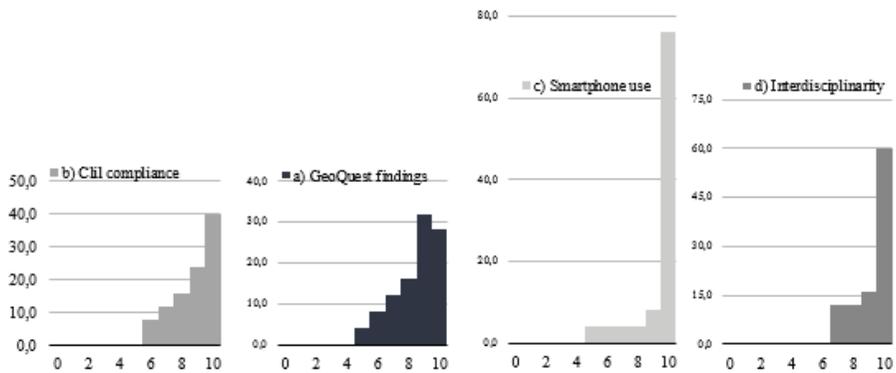


Figure 17. Percentage of relative frequency for students satisfaction, measured in Education degree course by L'Orientale University of Naples, Italy.

### Teachers' satisfaction

Teachers were asked to rate some features of GeoQuest as well, on a scale of 1 to 10 (Figure 18). All ratings are very high; watching relative frequency (Figure 19), we can see that GeoQuest teaching experience got an evaluation higher than 9: more than half of evaluations are 10 (median = 10 in Table No. 14). The same opinion was expressed about interdisciplinary approach, laboratory teaching with the CCRPG and CLIL compliance.

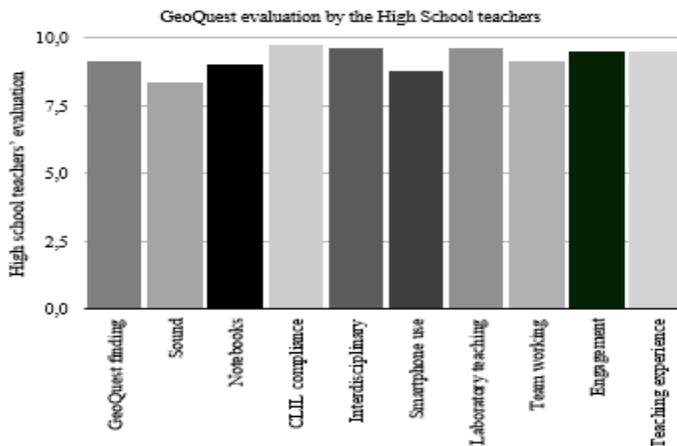


Figure 18. GeoQuest evaluation by the High School teachers.

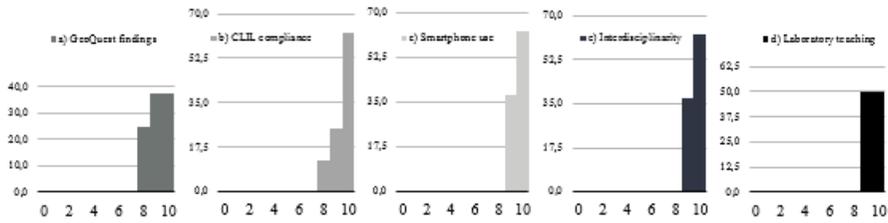


Figure 19. Percentage of relative frequency for students satisfaction, measured in Education degree course by L'orientale University of Naples, Italy.

High school teachers	GeoQuest finding	CLIL compliance	Smartphone use	Laboratory teaching	Interdisciplinary
Media	9,1	9,8	8,8	9,6	9,6
Median	10	10	10	10	10
Mode	9,5	10	10	9,5	10

Furthermore, teachers of survey No. 2 (see teachers' needs in Table No. 2) had a learning experience with GeoQuest, as a tester of the innovative teaching tool, and evaluations about it, are summarised in Figure 20. Results are brilliant: see Table No. 15 and Figure 21.

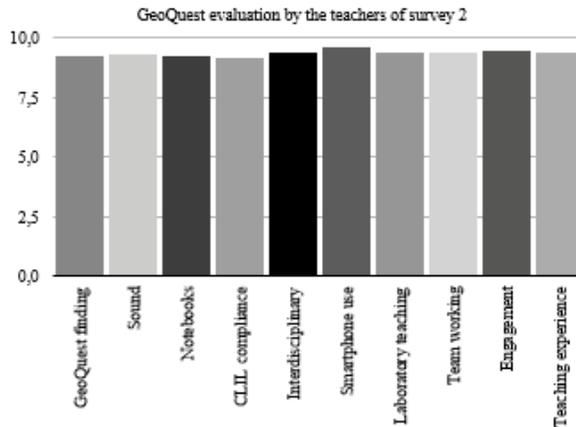


Figure 20. Percentage of relative frequency for students satisfaction, measured in Education degree course by L'orientale University of Naples, Italy.

Teachers survey 2	GeoQuest finding	Team working	Smartphone use	Laboratory teaching	Interdisciplinary
Media	9,2	9,4	9,6	9,4	9,4
Median	10	10	10	10	10
Mode	10	10	10	10	10

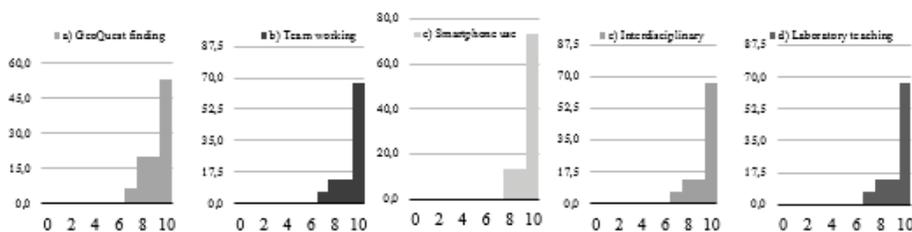


Figure 21. Percentage of relative frequency for students satisfaction, measured in Education degree course by L'Orientale University of Naples, Italy.

## Discussion

We stated the experimentation of the GeoQuest project was divided into several phases, with the calibrating aim of project and then analysing its effectiveness in every school order. Satisfactory learning outcomes with the CCRPG in primary (up to 10-year-old students) and secondary (11-14-year-old students) schools have been illustrated in previously published works (Maraffi & Sacerdoti, 2016 b; Maraffi & Paris, 2017; Maraffi, Paris & Sacerdoti, 2017). Results obtained in technical high schools, where Science is only studied during the first two years, were also analysed (see References). We have concentrated the final phase of quantitative data analysis on high schools' students because their curricula contemplate the Earth Sciences study for five years. We have emphasised before, in the most recent analysis, Earth Science data, as the GeoQuest Project was developed as a doctoral project in Earth Science Education.

Results analysis referring to single classes (Fig. 9) shows that students' knowledge possessed before experimenting with the CCRPG, was extremely poor, if not null (Fig. 9c). We must bear in mind that these are classes for which topics covered in the CCRPG are part of curriculum program. Furthermore, six out of the nine classes examined are senior classes, for which game's topics are compulsory for the final exam (Figures. 9c, d, e, f, h, i, l). We can have a more detailed general idea if we analyze

percentages of the relative frequencies of correct answers (figure 12). In Figure 12a the values of mean, of median and mode are very close to each other: students' knowledge and skills in Earth Sciences, as they emerge from the pre-tests, are extremely disappointing, despite reforms, environmental issues awareness or the prospect of the final exam. Figure 12a histogram has a positive skewness: values distribution is shifted downwards. Although there are students more or less predisposed to study in the individual class groups, or differently interested, little or nothing is done in the field of Earth Sciences. The Figures 12b histogram presents a mode of 5, i.e. in the post-tests following the CCRPG there is a 400% improvement. Results are poorly dispersed (media = 4.4; median = 4; mode = 5); distribution is quite symmetrical, with a tail of higher results, compared to the lower ones (slight negative skewness). As already mentioned, such satisfying results can not be due to chance (Student test value). The excellent learning result obtained with the CCRPG GeoQuest is even more evident from comparison with control sample (figure 10). The CCRPG sample and the control sample started at the same level: improvement in learning levels measured after the CCRPG is 268.75%, while control sample after traditional lesson checks an improvement of 133.33%. Since traditional lesson followed by control sample had the help of multimedia and PowerPoint tools, we can conclude that it is not the multimedia tool itself to give a more profitable learning environment, but the CCRPG engaging and interactivity.

### **CLIL approach**

The learning improvement get with CCRPG GeoQuest is the same (more than 268%), both with CLIL approach (Figure 11a) and with mother tongue CCRPG (Figure 11b). Control sample outcomes remain lower, but those of the CLIL approach are worse (133% improvement, Fig. 11a) than those obtained with the mother tongue (147% improvement, Fig. 11b). Therefore the CLIL approach reduces disciplinary learning results, if conveyed by lessons supported by multimedia tools; instead with the CCRPG you can obtain a foreign language learning (fluent understanding) without decreasing the contents and competences, proper of various subjects, learning.

### **Iceland-Italy teachers exchange**

The Figure 13 shows that even the most difficult topics can be successfully learned through the CCRPG. A separate consideration must be done for Figure 13 E and F. In GeoQuest pathways no information is provided to answer these questions. Yet in the post-test of Fig. 13 F there is an improvement in the responses of 286.7%. Why? Because in the first case, answers made up only of names requires knowledge of names themselves: if

answers are not provided, they can not be invented. Instead, in the second case images require concepts that, although not provided, can be recovered thanks to skills acquired with the CCRPG activity.

### **Students and teachers satisfaction**

While not being able to reproduce frequency charts for each of the proposed questions, for reasons of space as it would weigh down this paper, we chose to show frequency charts for topics considered most important. The evaluations requested to the students have all had excellent results. The Notebook use and the CLIL approach are teaching matters more than learning matters; therefore, we focused students' satisfaction on learning experience with the CCRPG. It should be noted that student judgments are not dispersed, but homogeneously concentrated in an excellence area. Naturally, technological tools use constitutes an engagement for students and in fact appreciation is highest (median = 10; mode = 10).

To the university students of Linguistics in Education a more technical evaluation, typical of their specific research studies, was requested, based on ten questions, as shown in figure 16. All evaluations are highly positive, so we have chosen to develop the relative frequency charts for 4 topics, which are the same on which evaluations analysis by other groups has been focused. Brilliant results here again, concentrated in an excellence area (figure 17).

Finally we summarise teachers results. High school teachers (Figures 18 and 19) have experimented the CCRPG GeoQuest with their students, the teachers of survey No. 2 (Figures 20 and 21) have personally experienced the CCRPG, evaluating its teaching and learning characteristics. The analysis of the data (Tables. 14 and 15) shows that teachers give an excellent evaluation to the teaching experience with GeoQuest and to the interdisciplinary approach, to the CLIL compliance, to the team working and laboratory teaching with CCRPG, to the use of ICT.

### **Conclusion**

The final outcome is that GeoQuest Project effectively matches the needs identified by students and teachers. Carrying out the experimentation in several phases allowed us to calibrate and improve our product, GeoQuest project, in itinere and allowed us to obtain rigorous and certainly reliable results. This allows us to assert that we have been able to meet students and teachers' needs, with a teaching tool that perfectly complies with modern society demands. Above all, the project answers our research questions in teaching and learning processes in Science Education: "to create an educational tool that ensures students build knowledge of the disciplines founding cores in an interdisciplinary key". This goal allows students

acquire: - technical and technological skills, - mastery of foreign languages, - flexibility, - creativity and entrepreneurship.

At the same time our teaching tool, the CCRPG GeoQuest, favours teachers' teamwork and students' cooperative learning, allows teachers to apply the innovative teaching approaches needed today, in a user-friendly and satisfying way. The most important feature for us is that GeoQuest takes the Teaching and Learning Processes in Science Education (but not only) into account, at the same time. Until today, teaching products appreciated by the students were judged by the teachers either ineffective or too challenging. Teaching products pleasing to teachers, on the other hand, proved either ineffective for students or too obsolete. The Computer Classroom Role Playing Game GeoQuest, instead, ensures much higher learning outcomes than those obtained with other teaching tools, favouring scientific, interdisciplinary and digital skills acquisition (easy to evaluate, as well). It also meets students liking of both the game and the use of modern technology. On the other hand, teachers can use our CCRPG in an easy and quick way, they do not have to undergo specific training to manage it. GeoQuest allows: - a laboratory teaching, - the CLIL approach, - an application of the Inquiry methodology, - students engagement and authentic skills assessment. We consider it important to point out that experimentation results show that the CCRPG brings a significantly higher focus, with a persistent attention during whole game. We can conclude that it is not multimedia tool itself to give a more profitable learning environment, but the CCRPG engaging and interactivity.

Since the beginning of first experimentation step and as a result of the disclosure of our work, the requests to try the game have multiplied. The five already existing pathways will soon be joined by others already requested. Some schools, in different Italian regions, have placed GeoQuest at base of school projects to support learning or development of scientific and digital skills (Projects with Ministry of Education funds). GeoQuest was chosen to teach Science as a Joint Project between European countries by the executive board of Science on Stage Europe, which deals with the spread and sharing of innovative methodologies. They funded the exchange between Italy and Iceland for CCRPG methodology diffusion. A further exchange between Italy and Greece is foreseen and a moment of final sharing and results presentation is coming soon.

Another very important result is that in these projects the CCRPG tool sharing allowed other teachers to implement new adventure paths, working together with their students, both in Italy and abroad. This is really interesting because the creation of new adventure pathways activates useful skills in students (as digital and technological skills). Furthermore the practice of storytelling improves students' learning and search for various

building blocks game stimulates different channels of communication and learning (images, videos, audio, etc).

Finally, the positive experience with GeoQuest Project attracted a series of further related projects. We have already developed some education Apps to correct behaviour during emergencies, diversified by age and subject (seismic emergencies and volcanic emergencies in particular), and others App have already been requested. We have also been requested to apply the CCRPG to tourism: with adventure pathways creation that allow the Italian and foreign natural and artistic heritage fruition.

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## Motivation of Employees 50+

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### Abstract

In recent years, employees older than 50 years of age represent a significant work force and companies have become aware of their importance. They have to be managed in a specific way by motivating and encouraging them in achieving extraordinary performance. However, in the literature, there is a lack of empirical research about older employees. Because of that, the aim of this paper is to explore the motivation of employees 50+. This paper is based on the large empirical investigation conducted within the project InCounseling 50+ co-funded by the European Commission through the Erasmus+ Programme. The research in Croatia was conducted in 2017 in 6 Croatian companies. The research instrument was a specially designed questionnaire with 30 questions. The questions relevant for this paper were about employees' general characteristics, employees' competencies and motivational factors. These questions were completed by 141 employees. The collected data was analyzed by the usual statistics methods supported by SPSS program. The research results showed that employees 50+ consider that they have sufficient or even higher competencies required for their job position. Regarding motivational factors, good atmosphere at work is the most important motivational factor for employees 50+, followed by the respect and recognition and safety and stability of the employment. Career development is the least important motivational factor for employees 50+. Additionally, research results showed that there are no statistically significant differences in motivational factors of employees 50+ regarding their gender, educational level and job position.

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**Keywords:** Motivation, theories of motivation, employees 50+

### Introduction

In recent years, there has been an increase in the participation of people 50+ in working and social life. They represent a significant work

force and companies have become aware of their importance. Those employees have to be managed in a specific way by motivating and encouraging them to achieve extraordinary performance. However, in the literature, there is a lack of empirical research about employees 50+. Therefore, the aim of this paper is to explore the motivation of employees 50+. According to this, the research questions of this paper are:

- (1) Do employees 50+ have enough developed competencies for their job positions?
- (2) What are the motivational factors that employees 50+ consider as important?
- (3) Are there any differences in motivational factors related to gender, level of education or job position for employees 50+?

This paper is organized in the following way. After the introduction, there is a theoretical overview that explores the definition of motivation and theories of motivation, as well as the motivation specifics of older adults. The third section provides information about research methodology. The fourth section presents research results. Concluding remarks are done in the final section. At the end of the paper, there is a list of references.

## **Theoretical overview**

### **Definition and theories of motivation**

Motivation is defined as forces within the individual that account for the direction, level, and persistence of a person's effort expended at work. Direction refers to an individual's choice when presented with a number of possible alternatives (e.g., whether to pursue quality, quantity, or both in one's work). Level refers to the amount of effort a person puts forth (e.g., to put forth a lot or very little). Persistence refers to the length of time a person sticks with a given action (e.g., to keep trying or to give up when something proves difficult to attain) (Schermerhorn et al., 2012). Several theories offer explanations of motivation. Most of them can be separated into two groups: content theories and process theories.

Content theories are based on the premise that humans are motivated primarily by deficiencies in one or more important needs or need categories. The important content theories are: Hierarchy of Needs Theory and Two-Factor Theory.

### **Hierarchy of Needs Theory**

One of the most popular motivation theories, frequently referred to as the hierarchy of needs theory, was proposed in the 1940s by Abraham Maslow. According to Maslow, people are motivated by their desire to satisfy specific needs. Maslow arranged these needs in hierarchical order, with physiological needs at the bottom, followed by safety needs, social and

belongingness needs, esteem needs, and, at the top, self-actualization needs. In general, lower-level needs must be substantially met before higher-level needs become important.

1. Physiological needs include basic survival needs—for water, food, air, and shelter. Money is one organizational award that is potentially related to these needs, to the extent that it provides for food and shelter.
2. Safety needs include the need for protection from physical or psychological harm. People at this level might consider their jobs as security factors and as a way to keep what they have acquired.
3. Social needs involve interaction with and acceptance by other people. These needs include the desire for affection, affiliation, friendship, and love.
4. Esteem needs relate to feelings of self-respect and self-worth, along with respect and esteem from peers. The desire for recognition, achievement, status, and power fits in this category. Money and financial rewards may also help satisfy esteem needs, because they provide signals of people's "worth" to the organization.
5. Self-actualization needs represent the desire to realize personal potential, self-fulfillment, seeking personal growth and peak experiences.

According to Maslow's theory, each need is prepotent over all higher-level needs until it has been satisfied. A prepotent need is one that predominates over other needs (Hitt et al., 2011).

### **Two-Factor Theory**

The two-factor theory is based on the work of Frederick Herzberg. It has some similarities to the other need theories, but it focuses more on the rewards or outcomes of performance that satisfy individuals' needs. The two-factor theory emphasizes two sets of rewards or outcomes - those related to job satisfaction and those related to job dissatisfaction. This theory suggests that satisfaction and dissatisfaction are not opposite ends of the same continuum but are independent states. In other words, the opposite of high job satisfaction is not high job dissatisfaction; rather, it is low job satisfaction. Likewise, the opposite of high dissatisfaction is low dissatisfaction. It follows that the job factors leading to satisfaction are different from those leading to dissatisfaction, and vice versa. The factors related to job satisfaction have been called satisfiers, or motivators. These are factors that, when increased, will lead to greater levels of satisfaction. They include: achievement, recognition, responsibility, opportunity for advancement or promotion, challenging work, potential for personal growth. The factors related to dissatisfaction have been called dissatisfiers, or hygienes. When these factors are deficient, dissatisfaction will increase. However, providing greater amounts of these factors will not lead to satisfaction—only to less dissatisfaction. Hygiene factors include: pay,

technical supervision, working conditions, company policies, administration and procedures, interpersonal relationships with peers, supervisors and subordinates, status, security (Hitt et al., 2011).

Process theories of motivation generally focus on the cognitive processes in which people engage to influence the direction, intensity and persistence of their behavior. Three important process theories are: Expectancy theory, Equity theory and Goal-setting theory.

### **Expectancy theory**

Vroom in his Expectancy theory suggests that the motivation to work depends on the relationships between the three expectancy factors:

- Expectancy - a person's belief that working hard will result in a desired level of task performance being achieved (this is sometimes called effort-performance expectancy).
- Instrumentality - a person's belief that successful performance will be followed by rewards and other potential outcomes (this is sometimes called performance-outcome expectancy).
- Valence - the value a person assigns to the possible rewards and other work-related outcomes.

In the expectancy theory, motivation (M), expectancy (E), instrumentality (I), and valence (V) are related to one another in a multiplicative fashion:  $M = E \times I \times V$ . Mathematically speaking, a zero at any location on the right side of the equation (that is, for E, I, or V) will result in zero motivation. This multiplier effect has important managerial implications. The advice is to: (1) maximize expectancy - people must believe that if they try, they can perform; (2) maximize instrumentality - people must perceive that high performance accomplishments will be followed by desired work outcomes; (3) maximize valence - people must value the outcomes.

### **Equity Theory**

In 1963, John Stacey Adams introduced the idea that fairness and equity are key components of a motivated individual. Equity theory is based in the idea that individuals are motivated by fairness, and if they identify inequities in the input or output ratios of themselves and their referent group, they will seek to adjust their input to reach their perceived equity. Adams suggested that the higher an individual's perception of equity, the more motivated they will be and vice versa: if someone perceives an unfair environment, they will be de-motivated.

These equity comparisons are especially common whenever managers allocate things like pay raises, vacation schedules, preferred job assignments, work privileges, and office space. The equity comparisons may

be with co-workers in the group, workers elsewhere in the organization, and even persons employed by other organizations.

An individual who perceives that she or he is being treated unfairly in comparison to others will be motivated to act in ways that reduce the perceived inequity. And when perceived negative inequity exists, Adams predicts that people will try to deal with it by: changing their work inputs by putting less effort into their jobs; changing the rewards received by asking for better treatment; changing the comparison points to make things seem better; changing the situation by leaving the job (Schermerhorn et al., 2012).

### **Goal-Setting Theory**

The goal-setting theory described by Edwin Locke focuses on the motivational properties of task goals. The basic premise is that task goals can be highly motivating if they are properly set and if they are well managed. This theory states that specific and challenging goals along with appropriate feedback contribute to higher and better task performance.

The important features of goal-setting theory are: Goals give direction to people in their work. Goals clarify the performance expectations in supervisory relationships, between co-workers, and across subunits in an organization. Goals establish a frame of reference for task feedback. The willingness to work towards attainment of goal is main source of job motivation. Clear and specific goals are greater motivating factors than general and imprecise goals and they lead to greater output and better performance. Goals should be realistic and challenging. This gives an individual a feeling of pride and triumph when he attains them, and sets him up for attainment of next goal. The more challenging the goal, the greater the reward is generally and the greater the passion for achieving it is. Better and appropriate feedback of results directs the employee behavior and contributes to higher performance than absence of feedback. Participation of setting goal makes goal more acceptable and leads to more involvement. And finally, goals also provide a foundation for behavioral self-management.

### **Motivation of older adults**

The work motives of older workers fit into explained motivation theories. Although there are many stereotypes about older employees, especially in direction of their ability, performance, motivation and change acceptance, the fact is that there is an increase in the percentage of employees over 50 years in many companies. This fact demands, in the context of work motivation, that these employees should be observed equally and fairly compared to younger employees, that is, aligned with the equity theory of motivation.

Lord (2004) found out that the primary reasons for older workers to remain active in the workforce are that they enjoy working, derive satisfaction from using their skills, gain a sense of accomplishment from the job they perform, and enjoy the chance to be creative that is align with Herzberg two factor theory. Higgs et al. (2003) highlight that older employees work because of financial reasons, the work itself, or their traditional work ethic. Leviatan (1992) pointed out that older workers prefer jobs that satisfy higher order needs (Maslow's theory). Lord (2002) found out that older engineers with insufficient income to retire, work to satisfy the first and second level needs in terms of Maslow's hierarchy, which in Herzberg two factor theory represent hygiene factors; whereas older engineers with sufficient income to retire are primarily motivated by needs that correspond to the third and fourth levels of Maslow's hierarchy, and in Herzberg two factor theory represent motivators. Similarly, Ng and Feldman (2010) in their meta-analysis found out a significant correlation of age with intrinsic work motivation (motivators in Herzberg's theory).

Regarding the goal setting theory that suppose that goal specificity, goal difficulty, and goal commitment enhance task performance, it should be pointed out that older workers' motivation decreases when they compare their performance to the performance of their younger colleagues (Warr, 2001). But, their performance and their goals should be observed differently compared to younger employees. Ng and Feldmans (2008) found out that older workers show high performance on organizational citizenship behaviors, suggesting that older workers should be engaged in discretionary behaviors to compensate for any losses in technical core performance. People adapt to ageing by seeking to maximize social and emotional gains. Older people care more about experiencing meaningful social ties and invest more in the quality of social relationships. They experience a greater need for passing on knowledge and skills to younger workers through training and supervising. To summarize, older adults tend to prioritize emotion-regulation goals. Social activities and a sense of belonging in the social environment become a greater source of their satisfaction (Stamov-Robnagel and Biemann, 2012). To enhance work motivation among older workers, Kanfer and Ackerman (2004) proposed that performance goals for older workers could include responsibility for others, job dedication, training effectiveness, problem-solving, and project management. They further proposed that performance rewards for older workers could include opportunities for positive affective events and/or strengthened sense of identity. Specific motivators may be performance goals and rewards such as autonomy, participation in training, transfer of their competence, and taking up relevant roles in work teams (Kooij et al., 2008). And finally, regarding the expectancy theory, older employees will invest effort if they perceive that

this will lead to performance. Also, they tend to believe that the achieved performance will be followed by satisfactory rewards. So, this theory should be observed in the context of motivation factors proposed by Maslow's theory and Herzberg theory, as well as propositions of the goal setting theory.

## Methodology

This paper is based on the large empirical investigation conducted within the project InCounseling 50+ co-funded by the European Commission through the Erasmus+ Programme. The research in Croatia was conducted in 2017 in 6 Croatian companies. The research instrument was a specially designed questionnaire with 30 questions divided in four parts. The questions relevant for this paper were about employees' general characteristics, employees' competencies and motivational factors. These questions were completed by 141 employees. The collected data was analyzed by the usual statistics methods supported by SPSS program.

## Research Results

The presentation of the research results will start with the respondents' characteristics. The respondents were employees older than 50 years. So, the average age of respondents is 55 years. Additionally, Table 1 represents distribution of respondents by gender, education level and position in the company.

Table 1 Distribution of respondents by gender, education level and job position

		Frequency	Percent	Cumulative Percent
<b>Gender</b>	Male	69	49.6	49.6
	Female	70	50.4	100.0
	Total of respondents	139	100	-
	<i>Missing</i>	2	1.4	-
	Total	141	-	-
<b>Level of education</b>	Basic education	6	4.3	4.3
	Secondary education/Vocational education	74	52.5	56.7
	Higher education (University education)	61	43.2	100.0
	Total of respondents	141	100	-
<b>Position</b>	Un/Semiskilled employees	8	5.9	5.9
	Skilled employees	41	30.4	36.3
	Officials	20	14.8	51.1
	Experts	27	20.0	71.1
	Managers	39	28.9	100.0
	Total or respondents	135	100	-
	<i>Missing</i>	6	4.3	-
	Total	141	-	-

Regarding the gender, in Table 1, it can be perceived that 50.4% of respondents are women, while 49.6% are men. The majority of respondents (52.5%) have secondary or vocational education, 43.2% is highly educated, and 4.3% of them have just basic education. Concerning the position in the company, the majority of respondents are skilled employees, 30.4% of them. Managers are 28.9%, 20% are experts, 14.8% are officials and 5.9% are un/semiskilled employees.

Since employees' competencies are foundation for the employees' motivation, the empirical research of this paper was focused on the employees' opinion about their competencies in comparison with the job requirements. Namely, if employees do not have sufficiently developed competencies, the process of motivation is restricted or even obstructed. Table 2 represents the opinion of respondents about their competencies.

Table 2 Respondents' opinion about their competencies in comparison with the job requirements

	Frequency	Percentage	Cumulative percentage
My competences are higher than the requirements of my job	33	23.9	23.9
I have sufficient competences to perform work at the position held	96	69.6	93.5
I do not have sufficient competences to work in the position held	7	5.1	98.6
I have no opinion	2	1.4	100
Total of respondents	138	100	-
<i>Missing</i>	3	2.1	-
Total	141	-	-

The great majority of employees (93.5%) considered that they had sufficient or even higher competencies required for their job position. Only 5.1% of employees thought that they did not have sufficient competencies to work in the position that they held. Therefore, it could be concluded that prerequisites for motivation process were satisfied.

Table 3 represents which motivational factors are important for employees 50+.

Table 3 Motivational factors for employees 50+

	N	Mean	Std. Deviation
Financial factors	141	3.89	.942
Safety and stability of employment	140	4.13	.794
Career development	137	3.28	1.064
Self-development	139	3.65	1.041
Good atmosphere at work	141	4.33	.761
Respect and recognition	141	4.25	.911

Respondents were asked to evaluate the motivational potential of 6 motivational factors using Likert’s scale from 1 to 5, where 1 represents “not motivating”, 2 represents “hardly motivating”, 3 represents “undecided”, 4 represents “motivating” and 5 represents “very motivating”. From Table 3, it could be noticed that good atmosphere at work is the most important motivational factor for employees 50+ with the highest mean value of 4.33. Very close to good atmosphere at work is the respect and recognition (mean value 4.25); followed by safety and stability of employment (mean value 4.13). Career development is the least important motivational factor for employees 50+, with the mean value of 3.28, which is logical because these employees, during their career experienced different promotions and development. Now, they are preparing for the process of transition to retirement, they try to slow down, and they are not so preoccupied with their career development. So, in that context, it is understandable that they prefer a good atmosphere at work and stable employment.

This paper has also examined the existence of differences in motivational factors in relation to employees’ gender, level of education and job position. Table 4 represents the result of Mann-Whitney test of differences in motivational factors regarding employees’ gender.

Table 4 Mann-Whitney test of differences in motivational factors regarding employees’ gender

	Motivation- Financial factors	Motivation- Safety and stability of employment	Motivation- Career development	Motivation- Self- development	Motivation- Good atmosphere at work	Motivation- Respect and recognition
Mann- Whitney U	2340.000	2331.000	2243.000	2320.500	2206.000	2162.000
Wilcoxon W	4755.000	4746.000	4589.000	4735.500	4621.000	4577.000
Z	-.343	-.233	-.162	-.118	-.982	-1.169
Asymp. Sig. (2-tailed)	.731	.816	.871	.906	.326	.242
a. Grouping Variable: Gender						

Based on the data from Table 4, given that  $\alpha > 0.05$ , regarding all observed motivational factors, it could be concluded that, there is no statistically significant difference in motivational factors of employees 50+ regarding their gender.

Table 5 represents the result of Kruskal-Wallis test of differences in motivational factors regarding employees’ level of education.

Table 5 Kruskal-Wallis test of differences in motivational factors regarding employees' level of education

	Motivation- Financial factors	Motivation- Safety and stability of employment	Motivation- Career development	Motivation- Self development	Motivation- Good atmosphere at work	Motivation- Respect and recognition
Chi-Square	2.996	1.809	2.973	2.291	.502	.770
df	2	2	2	2	2	2
Asymp. Sig.	.224	.405	.226	.318	.778	.681
a. Kruskal Wallis Test						
b. Grouping Variable: Level of education						

From Table 5, it could be observed, that there is no statistically significant difference in motivational factors of employees 50+ regarding their level of education, since  $\alpha > 0.05$  in terms of all observed motivational factors.

Table 6 represents the result of Kruskal-Wallis test of differences in motivational factors regarding employees' level of education.

Table 6 Kruskal-Wallis test of differences in motivational factors regarding employees' position

	Motivation- Financial factors	Motivation- Safety and stability of employment	Motivation- Career development	Motivation- Self development	Motivation- Good atmosphere at work	Motivation- Respect and recognition
Chi-Square	1.770	.976	3.461	1.124	.179	.717
df	2	2	2	2	2	2
Asymp. Sig.	.413	.614	.177	.570	.914	.699
a. Kruskal Wallis Test						
b. Grouping Variable: Position						

Kruskal-Wallis test, presented in Table 6, suggests that there is no statistically significant difference in motivational factors of employees 50+ regarding their job position, since  $\alpha > 0.05$  in the case of all observed motivational factors.

## Conclusion

Ageing of population, especially in highly developed countries brings into contemporary companies increased percentage of employees older than 50. Therefore, human resource management in these companies should focus particularly in the process of motivation to the age cohort of the employees 50+. Since, there is a lack of empirical research about this issue, this paper

gives makes a contribution in this context by exploring the motivational factors relevant for employees 50+.

The research results showed that employees 50+ consider that they have sufficient or even higher competencies required for their job position. By this, the preconditions for their motivation are satisfied. Regarding motivational factors, good atmosphere at work is the most important motivational factor for employees 50+, followed by the respect and recognition and safety and stability of the employment. Career development is the least important motivational factor for employees 50+. Additionally, research results showed that there are no statistically significant differences in motivational factors of employees 50+ regarding their gender, educational level and job position.

These results support Maslow's and Herzberg's motivation theories, as well as the research of Levitan (1992), Lord (2004) and Ng and Feldman (2010), by suggesting that companies in the motivation process of employees 50+ should be primarily focused on higher order needs and hygiene factors of motivation.

Additionally, this research showed that safety and stability of employment is also an important motivational factor to employees 50+. So, in the process of motivation, companies should connect these findings by providing employees 50+ stable employment, engaging them in different social interactions which are so important to them. In this context, in order to be motivated, the older employees should be involved in the process of employees' orientation and mentoring. This is in line with previous studies following by Kanfer and Ackerman (2004), Ng and Feldmans (2008), Kooij et al. (2008) and Stamoj-Robnagel and Biemann, (2012).

Related to goal setting theory, the goals of employees 50+ should be knowledge sharing, transfer of competence, coaching, mentoring and similar behaviors. Those elements are not exactly measurable performances, but they are behaviors with significant positive influence on overall organizational performance. So, the companies should utilize the experience and motivation of employees 50+ in direction of achieving the positive outcomes of this kind of behaviors.

Those conclusions should be taken with some reservations because of the research limitations. The first limitation is the small sample. Only 6 Croatian companies participated in the research which significantly limits the generalization of the conclusions. So, further research should expand the research sample. Additionally, the analysis of motivation is very narrow, so suggestion for future research could be to apply a broader analysis of motivational factors and other elements related to the work motivation, such as performance, job satisfaction, organizational commitment, etc. And finally, it could be interesting and meaningful to compare the employees 50+

to other employees, in the context of their work motivation, in order to develop efficient motivation strategies for each group.

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## **Tobacco Taxation in Croatia – Comparison Within EU Context**

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### **Abstract**

In order to instigate the smoking cessation various international initiatives highly recommend increased tobacco taxation as significant tool of tobacco control. This study examines tobacco taxation and its effects in Croatia comparing to the other EU Member States. The analysis is focused on taxation of cigarettes because the other tobacco products (like cigars, cigarillos, fine cut smoking tobacco) have low market share. The other reason for exclusion of the other tobacco product is lack of taxation harmonisation since Member States can choose between a specific duty or an ad valorem duty, or may apply a mixture of the two which prevents a valid comparability of taxation effects between EU countries. Research results show that there are great differences in amount of specific excise duty between EU countries. The other component of excise tax, ad valorem, varies between 1% (in Denmark and Sweden) and 52% of tax included retail selling price (in Finland). When total tax burden is considered, it was found that it varies from 69.39% of weighted average cigarettes price in Luxembourg to 89.57% in Estonia. The retail price of cigarettes in Croatia is among the lowest in EU despite the total tax burden of 81.1%. Tobacco control activities in Croatia are showing progress but needing more effort in order to induce serious smoking cessation.

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**Keywords:** Tobacco taxation, excise duty, MPOWER

### **Introduction**

Smoking is one of the leading causes of illness and mortality so the governments from all around the world put much effort on breaking this bad

habit among the citizens. In order to assist in country-level implementation of the WHO Framework Convention on Tobacco Control (WHO FCTC), WHO introduced in 2008 the 'MPOWER' package of six evidence-based tobacco control demand reduction measures:

- **Monitor tobacco use and prevention policies**
- **Protect people from tobacco smoke**
- **Offer help to quit tobacco use**
- **Warn about the dangers of tobacco**
- **Enforce bans on tobacco advertising, promotion and sponsorship**
- **Raise taxes on tobacco.**

MPOWER has been developed to help countries build their capacity to implement these provisions. The successful implementation of these measures will ultimately play a key role in reducing the cancer burden in these countries. The importance of demand reduction strategies as well as supply issues is asserted and thus WHO FCTC established a framework for an integrated multi-sectoral response to a grave public health issue (Mackay et al, 2012, p. 77). Raising taxes on tobacco products is one of the most cost-effective measures to reduce cigarette consumption and, on the other hand, to increase domestic revenue which can be used for improving health and other programmes for the benefit of entire population. Tax policy is among the most common and relevant instruments in the toolkit of policy-makers when thinking about promoting growth (Canavire-Bacarreza, Martinez-Vazquez and Vulovic, 2013, p. 1). According to World Bank Group Tobacco Control Program assessments there are indications that higher tobacco tax rates could save millions of lives each decade, reduce poverty, and boost public resources for development investment. The World Bank Group Tobacco Control Program promotes introducing huge tobacco excise rate at once to attack affordability of tobacco products especially in low and middle income countries and among youth. Most of the countries have some form of tobacco taxation but the greatest effect is achieved with an excise tax since it applies exclusively to tobacco products and raises their prices making those products less affordable. The effectiveness of tax and price policies in the control of tobacco use and improvement of public health is studied and supported (Chaloupka, Straif and Leon, 2011). For tax policies to achieve the effect of reducing consumption, attention should be paid to the following (Zelenka, 2009, p. 468):

- the special tax should be increased so much that the price of tobacco products is raised above the average rate of inflation and increase in income, in order to ensure a constant reduction in the ability of people to afford tobacco products,
- prohibition of all customs and tax free sales of tobacco products,

- redirecting a significant amount of government revenues, including those from tax on tobacco, into financing tobacco control programs,
- alignment of taxes and prices of all tobacco products to prevent exchange of one tobacco product for another.

Although the increased taxes are identified as single most effective tobacco control measure, the tax structure is what really matters. A cross-country study (Shang et al., 2015) estimated how tax structures, including specific uniform, specific tiered, mixed uniform, mixed tiered, ad valorem uniform and ad valorem tiered structures, are associated with price variability measured by price ratios derived from the price distribution. The results show that complicated tax structures that depart from a specific uniform structure are associated with greater price variability. The findings (Shang et al., 2015, p. 5) suggest that switching to a simpler tax structure would significantly reduce price variability and thus reduce opportunities for tax avoidance. Specific uniform tax system is the most effective tax structure in reducing price variability and likely the most effective in reducing tobacco use and its consequences.

Besides mentioned, harmonisation of tax policies is required in order to mitigate certain types of illicit trade in tobacco products by reducing the incentives and opportunities to avoid and evade excise taxes. Blecher and Drope (2015, p. 7) explained that a smoker has the opportunity to purchase cigarettes in a lower tax jurisdiction and consume them in a higher tax jurisdiction (tax avoidance, which is legal). Also, smuggling cigarettes is common when neighbouring countries do not have harmonised tax policies. Tax harmonisation thus reduces the incentives and opportunities for tax avoidance and evasion and EU is good example when tobacco products are being considered.

This paper examines the effects of tobacco taxation harmonisation (in Croatia) with EU regulations. Also, the estimation of tobacco control trends using MPOWER measurement and Tobacco Control Scale (developed by Joossens and Raw, 2006). The research objectives are threefold:

- to analyse the specific and ad valorem excise taxation in EU,
- to provide an insight in total tax burden (as percentage of weighted average price) of cigarettes in Croatia comparing to the other EU Member States,
- to assess the efforts made in Croatia to reduce tobacco consumption.

The paper is organized as follows. Next section presents regulation regarding tobacco control in Croatia. The third section gives an insight in tobacco taxation in Croatia comparing to the rest of EU countries as well as an assessment of tobacco control activities in Croatia. Concluding remarks are made in the final section.

## **Tobacco control policies in Croatia**

Croatia joined the EU on July, 1<sup>st</sup> 2013 so the taxation harmonisation process continued. In terms of tobacco products, EU members have among the highest cigarette taxes and prices in the world (Blecher and Drope, 2015, p. 9). The EU Directive 2011/64 defines the tobacco product categories, structure and minimum rates for excise duties on manufactured tobacco. EU excise duty rules broadly differentiate between cigarettes and other tobacco products. According to the mentioned EU Directive, excise duty on cigarettes must consist of two components:

- a specific component i.e. a fixed amount per 1000 cigarettes.
- an ad valorem component i.e. a percentage of the retail selling price

These two components must be the same for cigarettes of all price categories. The Directive prescribes the minimum rates which Member States must respect but they can set the greater rates as well. For the other tobacco products (cigars, cigarillos, fine cut smoking tobacco) Member States can choose between a specific duty or an ad valorem duty, or may apply a mixture of the two. Minimum rates for cigars, cigarillos and fine cut smoking tobacco are set out by the same Directive and Member States are free to apply national rates above these minima.

Member States have to levy a minimum rate of excise duties on cigarettes and this minimum rate must consist of:

- A specific component of between 7.5% and 76.5% of the total tax burden (TTB) - expressed as a fixed amount per 1000 cigarettes
- An ad valorem component - expressed as a percentage of the maximum retail selling price

In addition, the overall excise rate must be:

- At least EUR 90 per 1000 cigarettes
- At least 60% of the weighted average retail selling price

It must be pointed out that EU Member State that applies excise duty of EUR 115 or more, however, does not need to comply with the 60% criterion mentioned above.

Taxation of tobacco products in Croatia is regulated by Excise Duty Act (Official Gazette, No. 22/13, 32/13, 81/13, 100/15, 120/15 and 115/16) and Ordinance on excise duties (Official Gazette No. 1/17 and 14/17). Those regulations mainly incorporate European excise institutes into the legislation of the Republic of Croatia and harmonise Croatian excise duties with the minimum amounts of excise rates prescribed in EU directives.

According to the Act, excisable products and amounts of excise duties on tobacco products in Croatia are:

- Cigarettes - Specific excise: approx. €41 (310 HRK) /1,000 items + Ad valorem excise: 34% of retail selling price; Minimum excise approx. €93 (696 HRK)/1,000 pieces.<sup>2</sup>
- Cigars and cigarillos – Specific excise: approx. €80 (600 HRK) /1,000 items
- Fine cut smoking tobacco and other smoking tobacco - Specific excise: approx. €80 (600 HRK) /1 kg of product

All tobacco products that have been taxed are marked with fiscal control stamps of the Ministry of Finance (MF). The printed stamps are kept in the main vault of the MF in the Central Office of the Tax Administration and are delivered to the auxiliary vaults of the producers or directly taken over by the taxpayers. The person who took over the stamps is excise taxpayer and is obliged to pay the calculated excise amount to customs within a period of 30 days.

Although it is not in compliance with EU *acquis*, the following tobacco products are subject to excise duties from the beginning of 2017 in Croatia:

- E-liquids - Specific excise: approx. €0 (0 HRK) /1 ml of product
- Heated tobacco products (e.g. IQOS-heat sticks, Ploom tobacco capsules) - Specific excise: approx. €80 (600 HRK) /1 kg of product
- New tobacco products (e.g. Hookah Squeeze steam paste, Ice Rockz steam stone, Ice Frutz Hookah gel) - Specific excise: approx. €80 (600 HRK) /1 kg of product.

Besides taxation, Croatian legislation gives framework for protection of population from the harmful effects of tobacco smoke. Smoking at work is forbidden by the Occupational Health and Safety Act. However, companies and organizations have the right to establish through internal acts in which rooms smoking is permitted, taking into account the right of non-smokers not to be exposed to tobacco smoke from their environment, as well as the danger of smoking in certain work processes (danger of fire etc). The Act on Health Quality and Health Inspection of Food and Items for General Consumption prohibits direct advertising of tobacco and tobacco products and regulated the quantity of tax and nicotine in cigarettes (Zelenka, 2009, p. 467). From the end of 1999 the use of tobacco products has been primarily regulated by the Act on the Limitation of Use of Tobacco Products (OG 128/99, 137/04, 125/08). This Act prescribes precise health warnings on tobacco product packages. Direct and indirect advertising of tobacco

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<sup>2</sup> Note: In the calculation of the specific excise, a cigarette is deemed to be a role of tobacco the length of which exclusive of tip or filter is up to 8 cm, two cigarettes will be deemed to be constituted by cigarettes from 8 to 11 cm, and three from 11 to 14 cm, i.e. every additional 3 cm of length of a roll of tobacco without a filter will represent an increase of one cigarette.

products is forbidden in Croatia. Also, it is forbidden to sponsor events, activities or individuals with the purpose, effect or potential effect of direct or indirect advertising of tobacco products or the use of tobacco.

### **Research methodology and results**

The study is focused on taxation of cigarettes due to their prevailing market share comparing to the other tobacco products (Figure 1 and 2). Bearing in mind that the EU Directive 2011/64 clearly prescribes the tax structure and a minimum rate of excise duties on cigarettes we based this study on five research questions:

RQ1: Are there the differences in specific excise duties on cigarettes between EU Member States?

RQ2: Which EU countries have the greatest ad valorem excise duty component?

RQ3: How great is the tax burden on cigarettes in Croatia comparing to the other EU Member States?

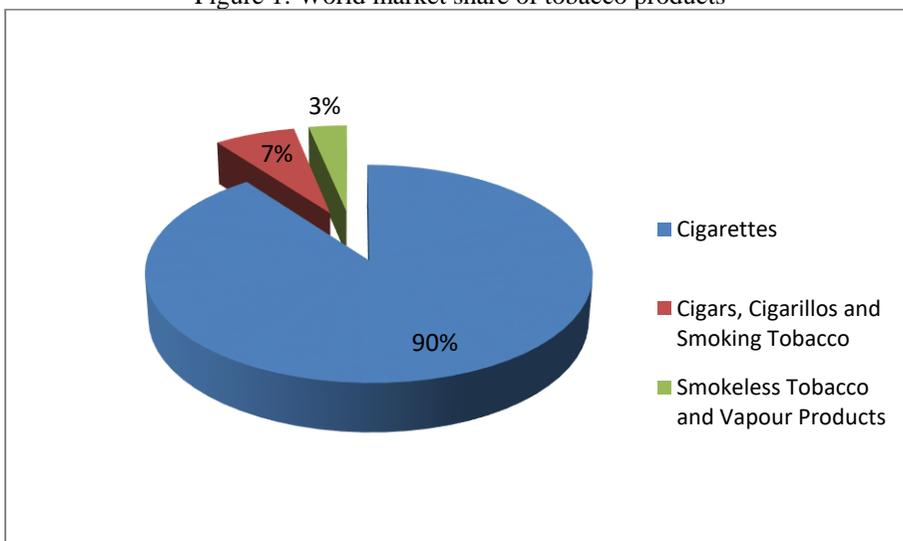
RQ4: What are the weighted average prices (WAP) for cigarettes across EU in the context of possibility of excise duty increase in Croatia?

RQ5: What are the trends of tobacco control in Croatia?

The secondary analysis of existing data is employed as the main research methodology. Publically available tobacco related data was selected from Euromonitor International and World Bank databases and retrieved from European Commission – Taxation and Customs Unit (Indirect Taxation and Tax administration). Data was used for the analysis performed in SPSS and MS Excel.

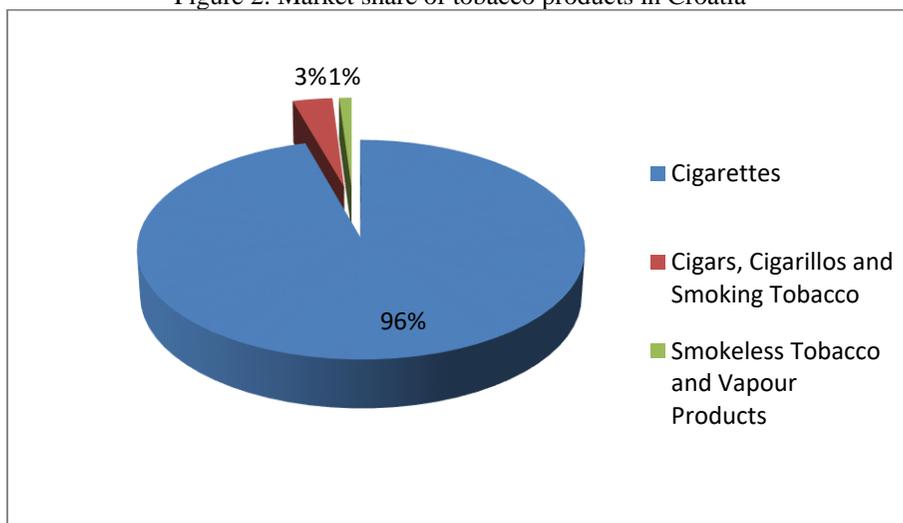
As illustrated in Figure 1, cigarettes are the most consumed type of tobacco products in the entire world and even more in Croatia where the market share of cigarettes is 96% (Figure 2) according to the data Euromonitor International on tobacco retail volume in 2016.

Figure 1: World market share of tobacco products



Source: Data compiled from Euromonitor International (2018)

Figure 2: Market share of tobacco products in Croatia



Source: Data compiled from Euromonitor International (2018)

As stated earlier, excise duty on cigarettes in EU consists of two components: specific (fixed amount per 1000 cigarettes) and ad valorem (percentage of tax included retail selling price). According to the most recent European Commission data (for the year 2017), the lowest amount of specific excise duty on cigarettes is in Luxembourg (18.89 EUR) followed by Italy (19.28 EUR) while the highest amount is recorded in Ireland (309.04 EUR). As shown in Table 1, mean value of specific excise (per 1000 cigarettes) in EU is 86.16 EUR while the median is 63.20 EUR. The specific

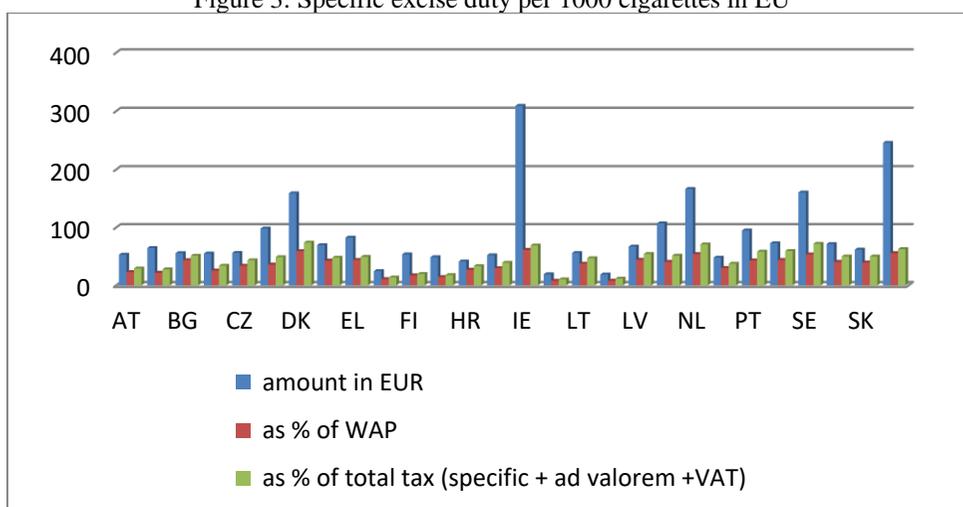
excise duty on cigarettes in Croatia is 41.35 EUR which makes it bellow the EU average. Since the standard deviation is 66.61 EUR (per 1000 cigarettes) it can be stated that the differences among Member States in the value of specific excise are huge.

Table 1: Descriptive statistics – specific excise duty

N	Valid	28
	Missing	0
	Mean	86,1605
	Median	63,1996
	Std. Deviation	66,61123
	Variance	4437,056
	Minimum	18,89
	Maximum	309,04

Source: Authors' calculation according Excise Duty Tables - European Commission (2018)

Figure 3: Specific excise duty per 1000 cigarettes in EU



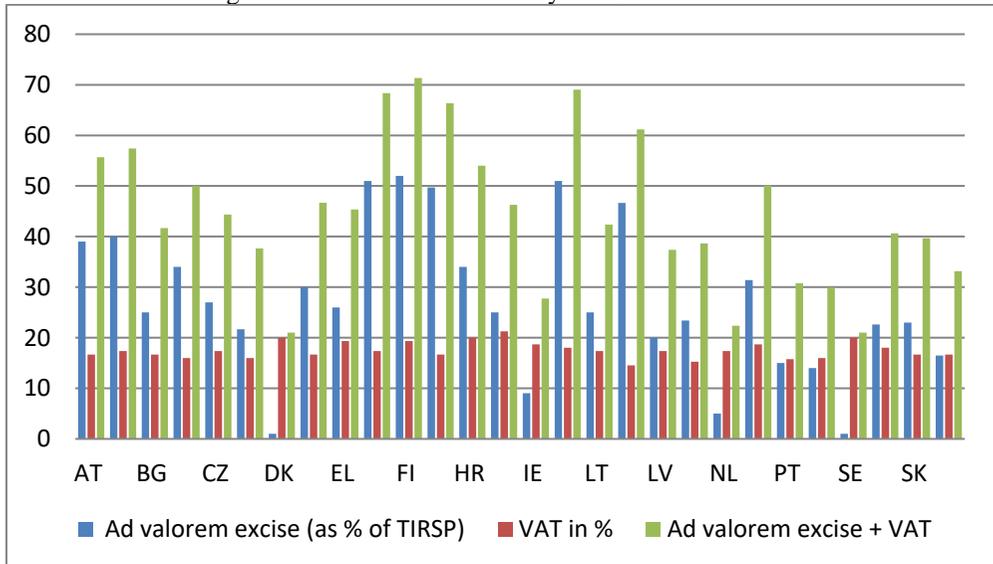
Source: Data retrieved from Excise Duty Tables - European Commission (2018)

Italy has the lowest percentage of specific excise in weighted average cigarettes price which is 8.1% while the greatest share is recorded in Ireland (61.38%) followed by Denmark (59.28% of WAP). The registered specific excise as percentage of weighted average cigarettes price in Croatia is 27.1%. Absolute and relative specific excise duty on cigarettes considerably varies between EU countries as illustrated in Figure 3.

Ad valorem excise duty on cigarettes in each EU country is shown in Figure 4. The lowest percentage of ad valorem excise in tax included retail selling price (TIRSP) is in Denmark and Sweden (only 1%) while in Finland this duty is 52% followed by Italy and Spain where ad valorem excise is 51%

of TIRSP. Croatia recorded 34% of ad valorem excise on cigarettes in tax included retail selling price. Since standard rate of value added tax (VAT) in EU varies from 17% in Luxembourg to 27% in Hungary, the tax burden that derives from it is reflected on total tax on cigarettes (Figure 5).

Figure 4: Ad valorem excise duty in EU Member States



Source: Data retrieved from Excise Duty Tables - European Commission (2018)

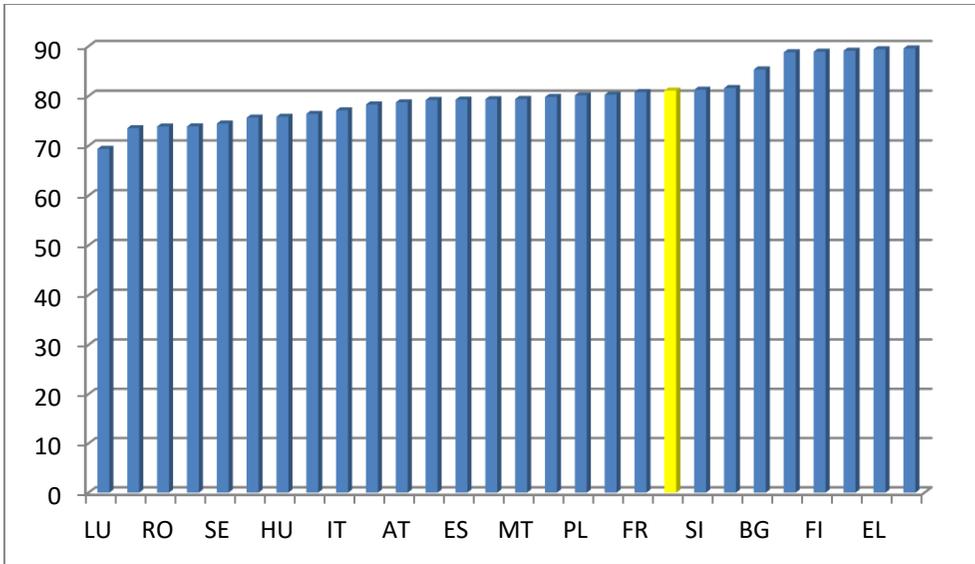
Total tax burden on cigarettes as a percentage of WAP varies from 69.39% in Luxembourg to 89.57% in Estonia (Table 2 and Figure 5). The mean value of total tax burden in EU is 80.03% and the median is 79,39% of WAP (Table 2) which puts Croatia (with 81.1%) among the high taxation countries when tobacco products are considered.

Table 2: Descriptive statistics – total tax burden on cigarettes

N	Valid	28
	Missing	0
	Mean	80,0275
	Median	79,3850
	Std. Deviation	5,36707
	Variance	28,805
	Minimum	69,39
	Maximum	89,57

Source: Authors' calculation according Excise Duty Tables - European Commission (2018)

Figure 5: Total tax burden as a percentage of weighted average cigarettes price



Source: Data retrieved from Excise Duty Tables - European Commission (2018)

On the other hand, total tax burden, opposite to the expectations, does not significantly affect the retail price of cigarettes in EU as shown in Table 3.

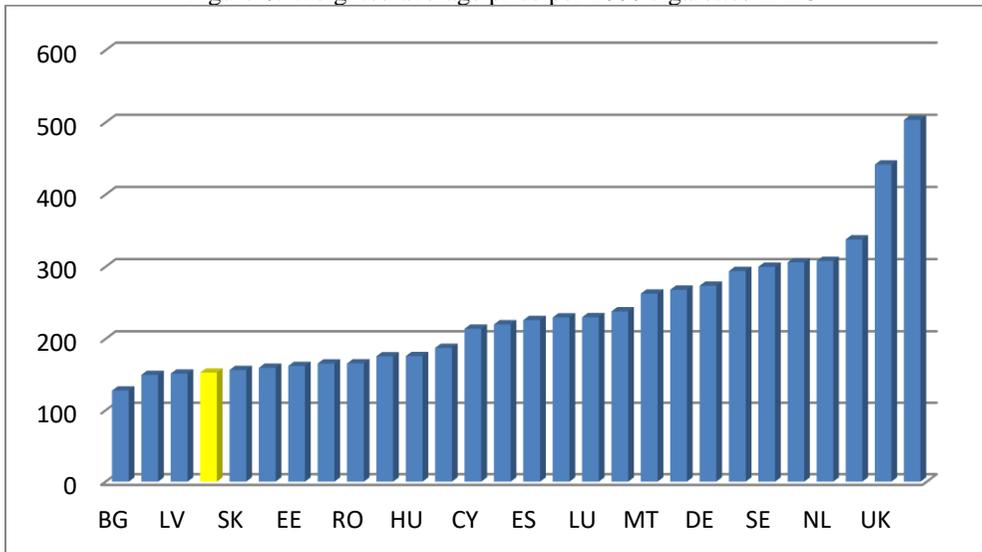
Table 3: Correlation between total tax burden (as percentage of WAP) and WAP

		Total tax burden	WAP
Total tax burden	Pearson Correlation	1	0,242
	Sig. (2-tailed)		0,214
	N	28	28
WAP	Pearson Correlation	0,242	1
	Sig. (2-tailed)	0,214	
	N	28	28

Source: Authors' calculation according Excise Duty Tables - European Commission (2018)

Although EU strengthened the tax requirements for Member States in 2010 and consequently reduced variation in cigarette prices was expected (Blecher, Ross and Stoklosa, 2014), weighted average price per 1000 cigarettes in 2017 is in range from 127.57 EUR in Bulgaria to 503.50 EUR in Ireland (Figure 6). Croatia is among those EU countries with affordable prices of cigarettes though total tax burden is relatively high. According to the results presented in Figure 6, Croatia can increase excise duty on tobacco products but the question remains if it will significantly affect the retail price making cigarettes and other tobacco products less affordable (which leads to smoking cessation).

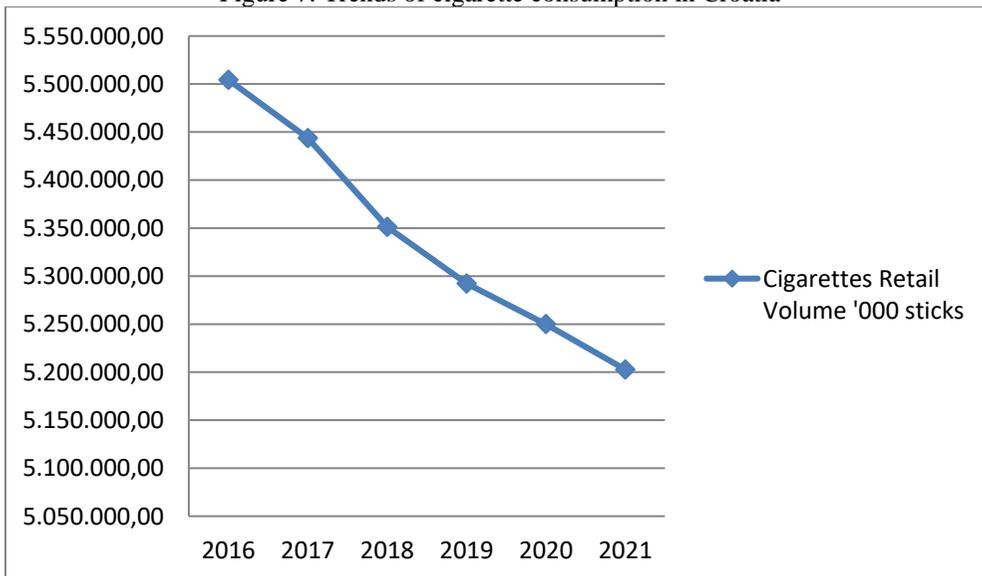
Figure 6: Weighted average price per 1000 cigarettes in EU



Source: Data retrieved from Excise Duty Tables - European Commission (2018)

The cigarette consumption in Croatia is slowly decreasing and according to Euromonitor forecast by the year 2021 that trend is continuing as illustrated in Figure 7.

Figure 7: Trends of cigarette consumption in Croatia



Source: Data retrieved from Euromonitor International (2018)

Tobacco control efforts made in Croatia to reduce smoking can be assessed in various ways. For the purpose of this study, two well framed international measures which quantify the implementation of tobacco control

policies at country level: MPOWER and Tobacco Control Scale (TCS) are used. The most recent available data of MPOWER and TCS are for the year 2016. According to MPOWER report, Croatia has excelled in monitoring (by providing representative and periodic data on tobacco consumption of adults and youth) and in taxation (since more of 75% of retail price is tax). Much effort is made for treatment of tobacco dependence (cessation programmes) and enforcing bans on tobacco advertising, promotion and sponsorship but Croatia has to do more regarding policies on smoke-free environments, health warnings on tobacco packages, organizing national anti-tobacco campaigns. Summary of Croatian achievement according MPOWER requirements is graphically illustrated in Figure 8.

Figure 8: Summary of MPOWER measures for Croatia

M	P	O	W	E	R		
MONITORING	SMOKE-FREE POLICIES	CESSATION PROGRAMMES	HEALTH WARNINGS	MASS MEDIA	ADVERTISING BANS	TAXATION	CIGARETTES LESS AFFORDABLE SINCE 2008
							YES

Source: World Health Organization Report on the Global Tobacco Epidemic (2017)

The TCS is based on six policies described by the World Bank:

- Price increases through higher taxes on cigarettes and other tobacco products;
- Bans/restrictions on smoking in public and work places;
- Better consumer information, including public information campaigns, media coverage, and publicising research findings;
- Comprehensive bans on the advertising and promotion of all tobacco products, logos and brand names;
- Large, direct health warning labels on cigarette boxes and other tobacco products;
- Treatment to help dependent smokers stop, including increased access to medications.

When first introduced in the TCS report (for the year 2013), Croatia gained TCS score of 40 and in 2016 that score was 45 so the progress was detected. According to the TCS report in 2016, first ranked was United Kingdom with score of 81 (maximum is 100 points). Among 35 European countries that were assessed, Croatia was ranked 23<sup>rd</sup> (Joossens and Raw, 2016). The analysis shows that tobacco control spending per capita by the government, expressed in Power Purchasing Standards, is quite low in Croatia (scoring 1of 15). Large direct health warnings are also low rated (scoring 1 of 10). According to this methodology of assessing tobacco

control activities, Croatia is best rated when comprehensive bans on tobacco advertising and promotion are concerned (scoring 12 of 13). The weighted average price for cigarettes, taking into account Purchasing Power Standards, gained 16 out of 30 points. Croatia has much to do regarding treatment to help smokers to stop smoking (scored 4 out of 10 points). Also, smoke-free public places, especially bars and restaurants as well as work place need to be more regulated in order to comply with the European Council Recommendation of 30 November 2009 on Smoke-free Environments (2009/C 296/02). To sum up, tobacco control activities are in progress and Croatia should be able to improve its tobacco control score in the coming years (Joossens and Raw, 2017, p. 12).

Although those two measurement systems of tobacco control at country level share the same framework and ultimate goal, the methodology is different so the mentioned results for Croatia seem conflicting (at least on surface) at some points. Good example of the mentioned dissimilarity is treatment of tobacco dependence which is assessed in the TCS by: recording of smoking status in medical notes, legal or financial incentive to record smoking status in all medical notes or patient files, brief advice in primary care, family doctors reimbursed for providing brief advice, quitline and national quitline (or quitlines in all major regions of country). On the other hand, MPOWER methodology is based more on availability of nicotine replacement therapy, accessibility of Bupropion and Varenicline and smoking cessation support.

## **Conclusion**

Although tobacco control relies on several factors, taxation forms significant part of an overall strategy of prevention and dissuasion of tobacco consumption. Taxation of cigarettes in EU is harmonised but Member States can decide whether to apply a specific duty on the other tobacco products or an ad valorem duty, or may prescribe a mixture of the two. Harmonised taxation did not result in similar retail prices of cigarettes in EU. The weighted average price per 1000 cigarettes in 2017 is in range from 127.57 EUR (in Bulgaria) to 503.50 EUR (in Ireland). Croatia has high level of total tax burden (81.1% of weighted average cigarettes price) but the retail price remained among the lowest in EU. If Croatia introduces larger amount of specific excise maybe it would make cigarettes less affordable for Croatian citizens and encourage them to stop smoking. According to the MPOWER and TSC reports, Croatia is making progress but still has much to do in order to achieve better results in smoking cessation and tobacco consumption prevention.

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# Deconstructing Marketing: How Should We Approach Marketing in the New Economy?

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## Abstract

As a business function, marketing generates strong resistance within both consumers and companies that favour sustainable consumption and development, so we want to figure out how marketing should evolve to fit into this new economic scheme. In this article, we will analyse the experiences and main conclusions of a focus group about how should business approach marketing in the new economic models. For this, we will first conceptualize both the new economic models and the marketing criticism, as well as the focus group as a qualitative research tool that can help us to frame broader research.

We want to highlight the methodology of doing a focus group during a conference as well as the benefits of conducting such a group. The discussion of the focus group brings up two important issues: (a) the *green gap* in consumers, and (b) the fundamental differences between green and sustainable consumption and, consequently, between green and sustainable marketing.

We will analyse the main territories opened during the research, which will help us define a marketing model aligned with the new economies during further research. Our analysis will explore the importance of vocabulary for the perception of marketing, the fact that marketing should be created within the community, or the necessity to create a marketing model using a systemic consensus.

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**Keywords:** Marketing, compnies, consumers

## Introduction

In this article, we will scrutinize the experience and main conclusions of a focus group with the caption: “how should we approach marketing in the new economy models?” For this purpose, we will firstly conceptualize the new economy models and the marketing criticism, as well as the focus group

which will be utilized as a qualitative research tool that can provide assistance in framing a broader research.

Therefore, in order to start an in depth research about how companies can approach marketing with the intention to regain the consumer's trust and build a more sustainable economy, a plan was hatched. We organized a focus group inside the congress called NESI forum, which is a Global Forum on New Economy and Social Innovation that was celebrated in Malaga (Spain) in April 2017.

We would like to highlight the methodology constrains that emerges as a result of implementing a focus group during a conference as well as the benefits. We would also like to highlight the main territories that are set in motion during the research. This will equip us with the assistance we need to define a marketing model that is aligned with the new economies when carrying out further researches.

One of the major points of discussion that is evidently noticeable is the difficulties that the consumer and the self considered sustainable consumer is faced with to purchase, considering their value due to the missing integration of societal macro-level contemplation with the organization's micro level practice.

## **Theoretical Framework**

### **New Economic Movements**

We included our research in the academic trend that affirms that capitalism, as the main economic system in the occidental world, is exhausted and in deep crisis (Boltanski & Chiapello, 2005; Doogan, 2013; du Gay & Morgan, 2013; Mander, 2013; Žižek, 2014). With this idea in mind, it has become a matter of critical concern, both theoretically and substantively, within a range of disciplinary fields. Different studies and theories have come to light that we can qualify as neo capitalists, anticapitalists or post capitalists.

The self defined New Economic Models (NEMs) are a group of socio economics theories, movements, and organizations that express the current economic model as a model that is not working for the majority of the people. Thus, this comprises of our social and environmental spheres and endeavours to demonstrate that other economic models are feasible. Diego Isabel (2017), promoter and director of the New Economy and Social Innovation Forum, states on the New Economy Forum website:

“Models such as Social and Solidarity Economy, Economy for the Common Good, Sharing Economy (based on values), Circular Economy, Fair Trade, Social Enterprises, Transition Town or Degrowth are demonstrating both theoretically and practically that there are alternatives.”

As we can deduce from the quotation, there are several manifestations of this new economy. However, they all have one thing in common, which is an urge for a sustainable development. This therefore puts a demand on the economic actors such as consumer, companies and government, and it takes into consideration not only the financial profit but also the social and environmental effects of their economical activity. It also reflects on the economic activity as a means of enduring equitable and enhanced quality of life.

Additionally, these movements also have institutional support such as the European Economic and Social Committee (2017). The EESC calls for society to begin an economic transition from over-exploitation of resources, and a throw-away culture to a more sustainable job-rich era. This should be solely based on quality rather than quantity in a document titled “Opinion of the European Economic and Social Committee on the functional economy.” According to the same document, it discloses that “the EESC would very much like to see Europe take the initiative in devising new economic models.”

In a previous opinion document of the EESC, evaluating the Common Good Economy, it enunciates that “the Europe 2020 framework proposes the transition towards a European Ethical Market which will foster social innovation”. The main characteristics of these models are (Mandel, 2013):

- nature comes first
- localization and globalization
- experiments in corporate values and structure
- hybrid economic models

Consequently, the EESC also organized an event in 2017 titled “New economy models and social innovation; an opportunity for a better Europe” and this quote was included in the presentation;

“In the last couple of years, the combination of opportunities brought about by digital revolution and the emergence of new consumer behaviours and aspirations have triggered radical change in the way we buy, exchange or even value goods and services, also known new economy models.”

These new economies can be defined as postcapitalist schemes. All of them have a common root. They consider that the current economical system is not working towards the collective interest of human beings and the ecosystem. Therefore, there is a necessity to carry out an inquest into other models and show their feasibility, centering the economy in the financial, social, and environmental pillars.

The main causes of these post capitalist ideas are (Archibugi, 2008, p.511):

- The extension of the non-market area and the decline of capitalist production and profitability;
- The spread of small and medium non-capitalist firms, even in the sector that is aimed at making profit;
- The emergence and growth of the “third sector” or “non-profit sector”;
- The qualitative rise and the quantitative decline of the state.

We define the new economy models (NEMs) as postcapitalist economic models that attempt to find sustainable development for human beings, the environment and the society as a whole, including future generations. In these models, the benefits turn out to be a means to guarantee sustainability.

### **Marketing Criticism**

The common belief system among these new economies is that marketing is an essential part to discover what is wrong with the economic system. In the words of Varey (2010, p 114), “The growth goal of laissez-faire capitalism has not produced continually greater happiness, but there is much evidence of resulting manipulation by marketers, obsessive materialism, environmental degradation, endemic alienation, and loneliness.”

According to Philip Kotler (2015), an economist and marketing guru, he stated; “marketing is the enabler of capitalism. It is the Engine of Capitalism. Without marketing, capitalism would collapse.” Kotler says that capitalism is the best economic system for producing the greatest volume and diversity of goods and services, and it needs marketing that will make available enough buyers for all the goods and services that it is capable of producing. Furthermore, according to Kotler, “Marketing jobs today is to sell materialism and consumption. Tomorrow’s marketing will be totally different.”

In the prologue of the book "Generación Marketing" by Victor Molera (2006), Federico Mayor Zaragoza states that “although marketing has achieved outstanding achievements as an instrument to understand people's lives and conceive solutions of value, nevertheless it has shown inability to give response to the great challenges faced by the society and companies.”

According to project “Reconnect”, from the World Federation of Advertisers (WFA, 2011), consumer scepticism is growing with 62% in United Kingdom and 54% in United States. As a result, consumers voice out that corporations are only interested in selling products. Another conclusion from the WFA project is that people assume marketers don’t listen, they are skeptical to the companies’ motives, they pass blames to marketing for problems and always want to regulate it. However, nowadays, consumers are in control of evaluations that are given about brands.

Back to our research, the goal of this focus group is to define how we feel marketing should help the new economy and how it can be different. When we try to redefine the business practices inside the new economies paradigm, organizations find it often difficult to sell products or services. This is because they have the impression that the marketing tools are not consistent with their values. Often times, Marketing is seen as a vital part of the consumerist society, but its basic principles and techniques can be used by new economy corporations, in order to be economically sustainable and make a difference.

## **Methodology**

### **The Focus Group**

A focus group is a technique involving the use of in-depth group interviews in which participants are selected. This is because they are a purposive, not necessarily a representative sampling of a specific population. Thus, this group is focused on a given topic. This definition is extracted from Lederman (as cited in Thomas et al., 1995), which states that “a focus group is a technique involving group interviews in which participants are selected because they are a purposive, although not necessarily representative sampling of a specific population.” The most important feature is that this group is being focused on a given topic.

This is the situation in our focus group. Therefore, the participants are already sensitive to the new economies as they have attended an event about this topic. Hence, they make a decision without been coerced or manipulated to join a session related to marketing among other activities, showing keen interest in the discussion. The proposed challenge was presented as a focus group with the title: “Deconstructing marketing: How should we approach marketing in the new economy?”

Consequently, it had three (3) main goals:

1. To define our feelings about current marketing practices and vocabulary;
2. To share good marketing practices;
3. To create the basis for marketing we feel comfortable with.

The focus group is dynamic in nature to explore a different way, and their findings will be used to precede other qualitative and quantitative procedures. However, our main purpose with this focus group is to discover territories and ideas that can be utilized for future quantitative and qualitative procedures. The uniqueness of a focus group is its ability to generate data based on the synergy of the group interaction (Green et al., 2003 as cited in Rabiee, 2004, p. 656). Hence, that is why after much consideration and deliberation, we had a clear opinion that a focus group was a good first step in our qualitative research. This research is, however, aimed at understanding

how we should address marketing in an economy for the collective benefit of all.

Nonetheless, we are aware of the main downsides of this technique. It is susceptible to bias from the moderator's point of view, and discussions may be diverted or dominated by a participant. As a result of this, the information can bring difficulties for analysis and generalizations. Therefore, we are using these data only as tracks, and they will be interpreted in the context of the group and its particularities and will be complemented in future research. In addition, data will be collected through other instruments, such as secondary research, personal interviews, and quantitative research.

On the other hand, this technique allows us to explore the subject associated with the feelings that emerge on both the participants and investigator. This provides a collective data full of meanings that can make allowances for the visualization of the perspectives around the object of the investigation.

Table 1  
**Headings to help in the interpretation of focus group data**

Krueger (1994)	Krueger & Casey (2000)	F.Rabiee recommendation
Words	Frequency	Words
Context	Motion	Context
Internal consistency	Specificity of responses	Internal consistency
Frequency and extensiveness	Extensiveness	Frequency
Intensity of comments	Big picture	Intensity of comments
Specificity of responses		Specificity of responses
Big Ideas		Extensiveness
		Big picture

Source: adapted from Rabiee, 2014.

### **Further Considerations and Limitations**

In this case, there was no role of recruiter. All the people attending the event called “NESI Forum” were invited to be part of the focus group. Participants share similar socioeconomics characteristics, and so they appear very comfortable talking to the interviewer and to each other. Also, they have an opinion about the topic, an important point for focus group according to Richardson and Rabiee (2001). The conversation was done in English. Although some of the participants had a limited fluency in English,

some of their comments were in Spanish. The moderator also acted as the translator when needed.

### **Research Objectives**

The objectives of this focus group are:

- To collect exploratory marketing information in the new economies.
- To identify arguments and counter arguments regarding marketing ethics.
- To develop hypotheses and territories to continue the research.

We will try to define collectively how we believe that marketing should help the new economy (and why). When we try to redefine business practices, we often find it hard to sell our products or services. Therefore, marketing is seen as a vital part of the consumer society, but its basic principles and techniques can be used by corporations in the new economy to be sustainable and make a difference.

### **Participant Profile**

The participants were those who voluntarily wanted to attend a meeting called *Deconstructing marketing: How should we approach marketing in the new economy?* This, however, was viewed as a collective challenge in the forum programme. A token was given to the participants in order to establish the profiles. The questions were as follows; name and surname, profession, country, and city and age.

They were 12 participants and one observer, and they have a common socio economic profile. Their interest could clearly be seen on the new economies and they considered themselves as critical consumers. The average age was 35, the youngest participant was 20, and the oldest 49. Furthermore, 9 of them were males and there were 3 females too. Even with this common background, they do not belong to the same circle of friendship or work. We have a mixture of consumers, marketing and community professionals, people with their own business, and thinkers.

### **Results**

The session took place around a conference table, where the participants sat freely in a semicircle to avoid assigning the seats. The moderator was in front of the group, taking notes in some paper sheets on the wall.

The focus group had 3 parts and a maximum duration of 60 minutes:

- Presentation: The relationship with the new economy and marketing.
- Body: Define our feelings about current marketing practices and vocabulary used in the industry.

- **Conclusion:** Share marketing practices that make us feel good or to give our opinion about marketing.

During the presentations, some of the participants expressed their feelings regarding marketing and the new economies:

*I am currently working on developing a new business model in agriculture. One of the issues that I detect so far working with some partners is that they don't want to sell their products, they have a big barrier about selling. (Female, 32)*

*I think marketing is the origin of many problems because marketing puts people in a position to consume more. (Female, 26)*

We spoke at length about what do the participants feel is wrong with the current marketing approach and practices. The feelings were mostly negative and we can group the critics in four main groups:

Table2

**Main marketing critics and concerns**

Consumerism	Focus on artificial needs Creates a "no" necessity It convinces people they need something-> consumerism Confusión need/want
Practices	Color of labels and packaging is more important than products Black friday. 2x1 Telepizza Influencing perception using tricks & not ethical values to sale products/services Appearances are more important than contents It often promotes quantity over quality Not ecological packaging
Consumers treatment	It makes me feel irrelevant because it expects nothing from me excepting for my money Harass Big data:non respect confidentiality Its aggressive It "assumes" too much about the person that I am. It impoverishes communication and it treats people like stupid ones.
Meaning	Lies It does not sound true It cannot be transparent Manipulate people and change culture (for bad?) It oversimplifies complex topics It cares about environment or quality or social impact only if it gives profit. Meet quarter sales is more important than return orders next month

Source: Compilation based on the participants' contributions

If we compare these with the marketing critics defined by Kotler and Armstrong (1999) we can find some similarities:

Table 3  
**Marketing critics**

Regarding its effects in society	For its effects on competition	By its effects on the individual consumer
Materialization of society: manipulation of demand	Anticompetitive practices	Increase the price
Contempt for goods and social costs	Anti-competitive absorption	Poor customer service
Contempt for goods and social costs	Entry barriers	High pressure on sale
Excessive political power		Defective or unsafe products
Cultural pollution		Scheduled obsolescence
		Deceptive practices

Source: Adapted from Kotler and Armstrong (1999)

We can see that the effects in competitors are not as important for consumers. Obviously, the effects in the society and the environment, as well as the materialization of society, turns citizens into consumers. This creates a major concern.

In the next part of the session with the focus group, we analyzed several terms related with marketing in order to analyze the feelings that they created. We worked on one term at that time. The first question asked was “how do you feel about the word itself?”. Then, we tried to find some substitutive term or idea that they think is more respectful with regards to customers and the society as a whole. We reproduced here the main conclusions regarding each word:

- **Competitors:** The participants agree that they need to be competitors. Here, the word is not inappropriate. In the new economy, we should consider them as partners, cross-collaborators, alternatives... In a purpose-driven world, competition is not so important, as everyone will have a different purpose and position in the world. Currently, there are too many big companies, and this makes competition aggressive.

- **Target Group:** We have to incorporate the world as a whole (including next generations) into this concept of target. One of the participant’s suggestions was audience or boss. Then we discuss if in the new economies we will like a term such as boss. Other suggestions were: focus, community or dialogue group.

- **Advertising:** There is an assimilation of marketing and advertising. Although it doesn't generate hard feelings, it is a way to add extra-price to products and cheapen the message. Too often, there is nothing to sell. As a result, advertising sells smoke and it is too short-termed. We should change advertising with the attitude to communicate reality and put people at the center of attention. There is no company to mass; thus it should be seen as me to you.
- **Consumer:** The word is masculine and utilitarian. We should speak about users, active choosers, the citizens and not only consumers. Moreover, the person who chooses our products should be a changemaker person.
- **Needs:** This word implies a sense of emergency and requires urgent attention. It creates an awareness of wants. New economies are working towards attaining contentment and sufficiency.
- **Social Corporate Responsibility:** This term sounds old school and only negligent companies need it. A true social responsibility shouldn't be philanthropic, and it is in the majority of companies. This implies a market based on corporates, when they can have different types of agents.
- **Market:** The problem is not with the term, but with the meaning. We need to empty it of significance and refill it with a different term that includes people as citizens and not only as consumers. Plaza (Main Square) can be an alternative and more suitable word for it.

To sum it all up, some of the terms are not intrinsically wrong but they are contaminated by inauspicious practices. Therefore, if we want to make marketing for the new economy have the desired result, and we want to keep using these terms, we need to empty them from their current meaning and replace it with a more human, co-created, and sustainable meanings.

Another interesting finding from this part was the use of the "systemic consensus". The essence of this finding was to evaluate the feelings provoked by the marketing argot, instead of asking if the word is acceptable. The question here changes and we evaluated the resistance that provokes the word. With one hand up, you can show certain resistance. On the other hand, with the two hands up, you can show that you have a stronger resistance.

During the last part, the group spoke about wholesome practices and what they would consider as a positive marketing. The answers focused on the purpose and values behind marketing more than its beneficial practices.

We have created a word cloud with the terms used:

Image 1  
Word cloud about the good marketing



Source: Compilation based on the participants' contributions

From this we can see three main topics: authenticity, community, and purpose-value. Among the three main topics, “community” was the most repeated word. The participants consider it right that marketing should create a community, taking into account their needs and feelings, and creating value for the consumers and citizens.

Furthermore, we had a contribution that explains a radical feeling about marketing. “Marketing should exist in the transition period to the new economy in order to sensitize people. An economy based on sufficiency doesn’t need marketing.” (Male, 35)

Also, another person in the group that works in Patagonia (a B-certified sport apparel company) told us about their campaign during Black Friday in 2011. They decided to dissuade consumers from buying anything under compulsion, with a clear message showing “Don’t buy this jacket. We ask you to buy less and to reflect before you spend a dime on this jacket or anything else.”

## Discussion

There is something fascinating in the critics and the comments about how the new marketing should be. It is the priority on *the big picture*, and the values concealed in marketing are more than the current practices and representations.

The participants have taken in cognizance that companies invest in social responsibility and sustainable practices, but they believe that it is done

for the wrong reasons such as; thinking about their benefit with no intention in mind to change their values and market orientation. It is known as greenwashing or social washing. Greenwashing or social washing is the selective disclosure of positive information without full disclosure of negative information, so as to create an overly positive corporate image (Lyon & Maxwell, 2011).

Analyzing the comments of the participants in the focus group, that was represented in a word tag (image 1), we can describe three traits of new marketing:

- Firstly, marketing needs to be long term. This means it should have a purpose and a responsibility towards the society. Furthermore, it should help towards building the community and bring about happiness that is aimed at guiding the company to its mission.
- Secondly, it is about citizenship. Our participants give companies a role to play in the society with words like community, relationship and people centered, which is different from the current customer centered approach.
- Thirdly, it needs to regain the certitude of the society. It needs to be ethical, positive, honest, and clear. Much more, it should be easy to demonstrate that marketing is creating something real.

Apart from bringing up some new territories for research and sketching out some fundamental traits of marketing in the new economy, this focus group had two main underlying topics which were: the consumer's dilemma when trying to be responsible and the difference between green and conscious consumption, as well as green and conscious marketing.

### **The Green Gap or Consumer's Dilemma**

As we earlier stated, one critical topic underlying all the conversation is that consumers and business have to put in a great effort if they want to produce or consume in a way that is balanced with their values and what is considered sustainable. We can see in several studies that a great percentage of consumers state that they are willing to buy from companies that have a positive impact. According to the study, Superbrands 2016 of the communication agency Havas Worldwide stated that:

- 73% of consumers think that companies have a responsibility beyond profit.
- 78% of consumers feel that it is important for companies to be transparent.
- 53% avoid buying from companies that have negative social or environmental impact.
- 63% are afraid of the possibility that the big companies have more power than the countries.

According to the report “The consumer against corporate social responsibility of brands” prepared by the consultancy firm Nielsen (2014):

- One in three Spaniards takes into account the social commitments of the brands.
- 40% of Spanish consumers would pay more for products of socially responsible companies.

The Forética report (2015) elaborates on these conclusions:

- One in every two consumers in Spain claims to have made consumption discrimination based on elements of CSR.
- 49.9% say that they have bought products because they are aware that a company is socially responsible.
- 44.6% of consumers have stopped buying a brand because of their inappropriate practices regarding society and the environment.

Although these and many more studies affirm that customers value and look out for sustainable and value-based businesses that links this behavior to the so-called “millennial generation”, there are still few consumers who act consistently with this thought they express. It is what is called the “green gap” and this has different causes. Although the main one is what Deloitte defines as “the consumer dilemma”, which is a situation where a consumer confronts each act of resolving a conflict between his *consumer self* that is mainly pragmatic in nature and his *citizen self*, that is idealistic and aspirational (Redondo, 2013).

According to the same study, the citizen would be willing to pay more for a socially responsible product “if there is a consistent justification for the price increase through a clearly demonstrable added value.” Our focus group arrived at the same conclusion, but they are suspicious about the real reasons behind the company's behaviour (referring to their marketing): “It is hard to believe that it cares about environment, quality or social impact, unless, of course, it gives profit.”

As Adela Cortina rightly says in her book titled “Ethics of Consumption” (2002, p. 125): “More and more people are becoming aware that they are citizens and not just subjects of politics, and are also consumers with the right to quality and not consumers who are fraudulent with anything in economic terms. Economic citizenship, which weaves an economic audience and not a mere mass, is becoming a reality that needs to be strengthened.”

As Cortina (2002) and Martínez Navarro (2005) point out, “in order for this citizenship that requires an ethical behaviour to exist, it is necessary to enjoy a certain degree of negative freedom (of non-interference) and positive freedom (political participation), as well as economic, social and cultural rights.” This provides a reasonable explanation to why the green gap has increased in times of crisis. However, this is because more consumers

lack the freedom and the rights to prevail their citizen-aspirational behavior against the consumer-pragmatic.

However, there are more causes that express in words that the purchase behaviour in the end is not consistent with what has been stated in the surveys. In recent years, this aspirational tendency of the citizen to responsible consumption has resulted in a myriad of websites, blogs, experts, and listings. Obviously, this claims to improve the double asymmetry of information between the consumer and the companies, as well as "discover" companies and initiatives. According to Steen-Olsen (2015, p 131), "one challenge for the consumer is the plethora of information they are exposed to from media, official agencies, commercial actors, friends and family. Even from those who are motivated to do so, changing behaviour on environmental grounds takes cognitive effort, which consumers economize."

On the other hand, as we can see in the speaking of companies, cases have been brought to light that reveal actions aimed at sustainability to be superficial at its best. Alternatively, it is directly seen as marketing Strategies that seek to hide behaviors that are inconsistent with values declared as greenwashing or social washing.

Therefore, these two reasons, the fragmentation of information and the disrepute to the communication both from business and the media itself (it is nowadays a broadly accepted myth that we are in a *post-truth* era), make the search cost increase. This makes it difficult to choose a responsible consumption, knowing for sure that the price increases (including all costs such as; the cost of exchange or the cost of search) and it is unequivocally justified by a clearly demonstrable added value.

In addition, cases in which it is proved that companies that communicate social or environmental values, and betray them in their day to day activities, produce an effect of defenselessness learned from the consumer. Their perception of lack of control over the outcome of a situation becomes a make believe with the saying; "My effort is useless, they are all the same." Although as a conscious consumer, we would like to demand a greater social and ecological commitment from the companies. Also, there are opportunities to do so, but we will give up because of the feeling that it will not make a difference.

Rafael Silvela, CEO of Havas Worldwide, comments in an interview in *Compromiso empresarial* (2016): "The consumer has grown older and has grown more in the last five years than in the last five decades. Every day, his self-awareness and power is increasing, to believe more in his ability to change things with the power of his purchasing decisions than with the power of his vote, and is that we consume every day and at the polls they summon us every four years."

## **Differences between Green and Conscious Consumption**

Another issue that underlines the conversation is the difference between green consumption and sustainable consumption that goes far beyond semantics. In their strict meaning, green consumption is an oxymoron. However, the sustainable consumption can be traced back in the times, at least from Toureau in the 19th century. It was in 1992, at the Rio Earth Summit, that sustainable consumption became a policy concept in its own right. As we can see in the final world, leaders acknowledged that “the major cause of the continued deterioration of the global environment is the unsustainable pattern of consumption and production, particularly in industrialized countries, which is a matter of grave concern, aggravating poverty and imbalances.” (UN, 1992, x4.3)

Green consumption, on the other hand, has been historically a concept of the market to the producer. Being green strategically provides a market for its products and to the customer (again, relegated from their citizen self). It provides a warm glow from acting in an altruistic manner (Akenji, 2013, p. 4). Marketing is focused on consuming different green, social, fair, but not less.

According to Akenji (2013, p. 2), “Green Consumption, although incorporates environmental considerations, is at best at the periphery of sustainable consumption and, even worse, provides an illusion of progress which distracts the urgent structural changes needed in order to achieve sustainable development (SD).

It is interesting to note here the rebound effect (Herring & Sorrell, 2009) that illustrates the problem with green consumption and green marketing. Although our electrical household appliances have become more efficient and “green”, savings per unit have implied that people buy even more. Therefore, the absolute amount of consumption has increased.

Nowadays, there are three different approaches of sustainable consumption that go from the mere green to a radical downsizing (Geels et al., 2015):

1. The ‘reformist’ position, which focuses on firms pursuing green eco-innovations and consumers buying eco-efficient products, represents the political and academic orthodoxy.
2. The ‘revolutionary’ position, which is a radical critique of the mainstream, advocates the abolishment of capitalism, materialism, and consumerism, and promotes values such as frugality, sufficiency, and localism.
3. The ‘reconfiguration’ position, which focuses on transitions in socio-technical systems and daily life practices, accommodates new conceptual frameworks.

Conclusively, new economies are aware of this distinction between sustainable and green or weak sustainability. This is attributed to the fact that some authors such as Fuchs and Lorek (2005) have named it. The strong sustainable consumption is based on sufficiency while the weak sustainable consumption or green approach is based on efficiency. The intention of the green consumption is to modify the production processes and the products that are consumed, but not to reduce consumption or change the system. In addition, they can also lead to a green consumerism. Strong sustainable consumption looks for sufficiency as we said previously. Hence, “this sufficient condition requires changes in infrastructures and choices, as well as a questioning of the levels and drivers of consumption” (Fuchs, 2005).

To wrap it all up, Fuchs and Lorek argued that the lack of commitment to strong sustainable consumption can be explained by the existence of strong opposing interests among consumers and business actors. That’s why the emerging new economic models consider that we need deep systemic changes and not the current model of peripheral activities (Jackson, 2009).

## **Conclusion**

This focus group with self-considered conscious consumers has brought up several conclusions and yielded clues that can help us define a marketing model for the new economies. We have three different sets of conclusions, ranging from the very specific (i.e., regarding the focus group itself), to further research lines, then to realities that we should consider when approaching marketing in the new economy.

If we evaluate the focus group according to the F. Rabiee recommendation (Table 1), we can outline further conclusions:

- **Words:** When the participants talk about the term *marketing*, it becomes evident that their actual experiences, mostly as consumers, identify marketing with advertising and/or with sales.
- **Context:** The way the questions are presented and the comments made by others in the group influences the context. The participants speak mostly with generalities and abstractions, and criticize the mainstream marketing. The participants also include their experience as consumers and how, although they believe in a new economy and consider themselves conscious consumers, marketing appeals to them; they feel bad because of this appeal.
- **Internal consistency:** Participants changed their point of view a bit when we opened the meaning of marketing, including all the processes of meeting the demand—not only advertising and sales. In a broader sense, the participants see it easier to use marketing on the benefit of NEMs.

- Frequency: Words related negatively with needs and consumerism and positively with ethic and community were the terms most used by participants.
- Intensity of comments: There is a deep feeling of anger in general when the participants describe marketing effects. Some expressions (e.g., ‘manipulates’, ‘It’s aggressive’, ‘It makes me feel irrelevant’) show strong feelings against the current marketing practices.
- Specificity of responses: The answers are mostly hypothetical situations, as opposed to responses referring to personal experiences. They relate the effects to the people or the community. There are some exceptions (e.g., ‘It makes me feel irrelevant because it expects nothing from me excepting for my money’; ‘It assumes too much about the person that I am’).
- Extensiveness: All participants talk at length about their feelings and considerations, especially about the common ground found in the topics of creating needs and lying. The participants who work in marketing or in their own businesses spoke at length about their challenges to be both ethical in the way they sell and competitive in the market. As we stated previously, one of the experiences was from a well-known American sports apparel company, Patagonia, that defines itself as ‘the activist company’.
- Big picture: There were several big ideas or concepts that emerged from the conversation: how marketing makes society more consumerist, and that trust and value for the community should be the pillars of marketing in the new economy.

There are several conclusions from the focus group that we should use in further research about positive marketing for post capitalist economies. We can say that the focus group has opened these new territories for our research:

- A methodological conclusion states that we do not need unanimity to find consensus. We can use systemic consensus as a methodological tool; thinking about what provokes our resistance instead of what is our favourite option helps us find consensus.
- A key criticism is that marketing is about creating needs and promoting the consumerist society that threatens the environment.
- The pillar of the new marketing should be a relationship with the community based on trustworthiness.
- Language is key for significance, and we should reconfigure the marketing vocabulary.
- A social conclusion states that if we want a new marketing approach to have a real impact, we should provide a solution to the consumer ‘green gap’.

Going back to the main goal of the building of the new marketing, if we want to create a new paradigm it need to focus on community and put the

add-on of the AMA's definition of marketing (2013) "(...) creating, communicating, delivering, and exchanging offerings that have value for (...) society as a large" in the center. We have sketch out a marketing model based on a social purpose, citizenship and collaboration and honesty. Taking into account that marketing is *just* a business tool, we need a different organizational paradigm that includes new cultural theories, economic theories and social responsibility theories.

Following Robledo (2017) we can say that we already have several theories and models in this line: cultural theories like Cultural transformation and Value assessment (Richard Barrett), Managing by values (Dolan, García and Richley), Deliberately developmental organizations (Robert Kegan); economic theories such as Economy for the Common Good (Christian Felber), Memenomics (Said Dawlabani) or Conscious capitalism (John Mackey and Raj Sisodia); and social responsibility theories liB Corps (Be Labs) or Economy of communion (Chiara Lubich). There are also holistic or integral theories, we can name Teal Organizations (Frederic Laloux) or 3D Management (Marco Robledo).

Finally, there are two realities that participants feel we need to consider when approaching marketing in the new economy. First, it is difficult for the people to be loyal to their values when buying due to the conflict between the *consumer self* (i.e., pragmatic) and the *citizen self* (i.e., idealistic and aspirational). This is called the *consumer green gap* or *consumer dilemma*, and it has several causes, among them the fact that in a crisis period, people lack the freedom and the right to impose their citizen-aspirational behaviour against the consumer-pragmatic self, or the high price of searching for and identifying the sustainable companies due to discredited business communication and the huge amount of information available.

The second reality is that most of the marketing efforts towards sustainability are not holistic or integral; the marketing is toward soft sustainability based on efficiency and technology. This green marketing is sometimes counterproductive for sustainability, and it just creates a placebo effect in the consumers, who feel that they are doing the right thing.

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## Relationship Between Gender and Entrepreneurship of Small and Medium-Sized Companies in Mexico

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### Abstract

This paper focuses on determining the relationship between gender and the entrepreneurship of small and medium-sized companies in Mexico. The research was quantitative, and it uses the database of the National Institute of Statistics and Geography. The analysis was conducted during the period from October 2017 to February 2018. The variables considered were: independent variable such as gender; dependent variables, entrepreneurship by economy sector (manufacturing, commerce and private non-financial services); and control variables, hourly income and average schooling. Descriptive statistics, linear regression models, analysis of variance, and Pearson correlation coefficients were obtained. The main results indicate that there are differences related to gender which is based on the type of small and medium companies undertaken by economy sector in Mexico. Women undertake more in the trade sector, while men also undertake more in the manufacturing sector. Based on the female gender where lower average schooling is, there is a greater entrepreneurship of small and medium-sized companies. On the other hand, considering the male gender where higher average schooling is, there is more entrepreneurship in the commerce sector. The variation in the entrepreneurship of small and medium-sized companies is 43% higher than in the female gender. Also, in both genders, the higher the schooling is, the higher would be the income.

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**Keywords:** Companies, women, men, income, average schooling

### Introduction

The economy of a country potentiates with entrepreneurship, which is a key factor to the integral development of the society. The generation of new companies contributes to the economic development of countries, which

bring benefits such as the increase in productivity and the generation of jobs among others. This, therefore, is of significant importance in Latin American countries.

Small and medium companies (SMEs) have a great importance in the economy of any country. In Mexico, there are only more than four million, which have generated 72% of employment and have contributed 52% of the Gross Domestic Product (GDP). This type of business is what makes a country competitive; however, these are businesses that attract investments and also strengthen the industries (Carriedo, 2017).

Within Latin America, small companies have contributed to productive development. They create employment opportunities and they also constitute of a significant number of all the companies. In addition, they also contribute to the gross domestic product (GDP). Its production is strongly linked to the domestic market, meaning that a significant part of the population and economy of the region depends on this activity (Ferraro & Stumpo, 2010).

In relation to gender for entrepreneurship, in the case of women entrepreneurs, the promotion of more training can improve the vision of their business. Hence, this will also provide them with greater skills and abilities to help them in making decisions. Therefore, an investment in education tends to generate a positive significant effect on labor productivity. Consequently, it can be stated that if women entrepreneurs have a high level of training, they will contribute more to the competitiveness of their company (Escandón Barbosa & Arias Sandoval, 2011).

The fundamental factor of the system entails the generation of goods and services. Its company, which has a great economic importance, results to the manifestation of the creativity and the legal freedom of the people. The company also provides, among others, work and management skills where one can achieve certain economic purposes. In the business field, global trends recognize micro, small and medium companies, as a fundamental part of any nation's economy. In large number of countries, more than 90% of the universe's formal and informal companies are located in this group. Here, they participated significantly in total sales, exports, the Gross Domestic Product, and employment. Any difficulty of a general nature in these small-sized enterprises has a negative effect on the macroeconomic and social indicators of any country (Valdés & Sánchez, 2012).

Subsequently, the times of great economic boom and economic recession has to do with when the capacity of response of the population of a country is put to test. As a result, it is important based on the capacity and the entrepreneurial spirit. By this way, new companies can be developed by taking advantage of the new markets and available business talent. This is done without losing sight of the fact that even in depressed markets, new

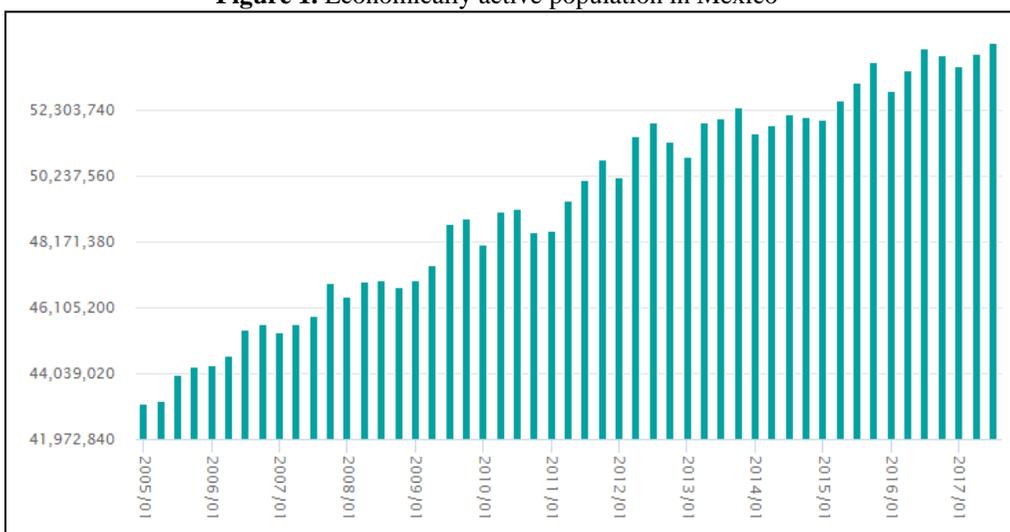
companies can be created. In both cases, it is necessary to have public policies that encourage business development in an inclusive manner. Thus, this means it rewards the innovative capacity of medium and large national companies, as well as foreign ones, which is always under clear processes of social arbitration. It also includes micro and small companies which were regarded to be an efficient option in creating jobs. Nevertheless, it majorly helps to consolidate their development through training, access to financing, and linkage with larger companies that would help strengthen their growth and development (Mungaray, Osuna, Ramírez, Ramírez, & Escamilla, 2015).

A series of norms must be considered, where special attention is paid to vulnerable groups, for which companies must be aware of them. Thus, this is because of the respect for the human rights of people belonging to certain specific groups. The United Nations has detailed the rights of women, among others, in relation to what has already been described (ONU, 2011).

Furthermore, there is currently a generational transition, according to the growth of educational levels in women (Torres Velázquez, 2011). Therefore, the expectations of women have changed since it is regarded as the power to form a company. In the world economy, it has been emphasized that micro, small and medium companies, are of great importance since they represent the highest percentage of business in the country (Jiménez, Argueta, & Espinoza, 2014).

Mexico has a current population of 123,518,272 people, with a high percentage of economically active population. Out of this population, 37.59% of women and 35.92% of men own a small or medium-sized company, with 100 or fewer employees (INEGI, 2017). The growth of the economically active population in Mexico is shown in Figure 1 below.

**Figure 1.** Economically active population in Mexico



Source: (INEGI, 2017)

### **Problem of the Study**

Within the economy of a country, it is important to promote the entrepreneurship of new companies. Here, most of them are generated as small and medium enterprises, which contribute to local, regional, and national development.

Given that the lack of employment is a factor that worries Latin American countries, including Mexico, the generation of new companies will contribute to reduce the percentages of unemployment in any country.

At the end of 2016, the International Labor Organization (ILO) reported that the unemployment rate in the Latin American and Caribbean region had reached the highest percentages of the last decade. This rate went from 6.97% in 2015 to 8.05% in 2016, which shows two years of increase in the number of unemployed people, according to ILO data by the World Bank. According to this organization, the figures are due to the economic contraction experienced by the region (World Economic Forum, 2017).

### **Justification**

The growth of a country's economy is very important. This, therefore, has contributed positively to the level of development and progress for its citizens. One of the ways to boost economic growth is through the creation of companies. This boosts the generation of new jobs, which is regarded as an axis of development for any country.

In Mexico, where the number of entrepreneurs has gradually grown in recent years, mainly in micro, small and medium-sized companies, entrepreneurship plays a fundamental role via its contribution towards the development of the country. As a consequence, the Federal Government founded the National Institute of the Entrepreneur (INADEM) on January 14, 2013. This is a decentralized administrative body of the Ministry of Economy, and their main objective is to implement, execute, and coordinate the national policy of inclusive support for entrepreneurs of micro and small and medium-sized companies. These companies intends to promote innovation, competitiveness, and projection in national and international markets, contributing to greater economic development and social welfare; in addition, it also contributes to the development of policies that promotes culture and business productivity (INADEM, 2017).

It is important to note that there should be an equal participation of genders in the development of the various economic sectors of a country. The generation of companies is important for the promotion of the economy where the benefit obtained will be of great impact at all levels, mainly local and national. Gender roles in Mexicans generally have stereotyped behaviors based on culture. As a result, they can be modified since they are tasks or activities that a person is expected to perform because of the sex to which

they belong to as indicated in 2014 by the National Institute of Women (CEDOC-INMUJERES, 2017). It is important to determine which factors most influence the generation of small and medium-sized companies, and also what strategies can be formulated for the creation of new companies.

## Materials and Methods

The objective of this research was to determine the relationship between gender and the entrepreneurship of small and medium-sized companies in Mexico. The research was quantitative, and was carried out based on the database of the National Institute of Statistics and Geography (INEGI). This database is therefore a census of the Mexican population with data obtained from the period of 2013 to 2015. The unit of analysis was the economically active population, which was made up of 54,369,915 people as at the third quarter of 2017. The research was conducted during the period from October 2017 to February 2018. The database presented is based on percentages, shown by each of the 33 states that make up the country. The variables considered were:

*Independent Variable:* Gender

*Dependent Variables:* Entrepreneurship by sector of the economy (manufacturing, commerce and private non-financial services)

*Control Variables:* Hourly income and Average schooling

Descriptive statistics, linear regression models, analysis of variance, and Pearson correlation coefficients were obtained.

## Results and Discussion

The results obtained based on the analysis of the database, divided into percentages of the 33 states of Mexico, was presented as shown below.

Table 1 shows the participation of women in the entrepreneurship of small and medium companies within the total Mexican economy, with 37.53% participation. The largest share is in the commerce sector (43.46%). This is in contrast with the manufacturing sector, which has the lowest percentage (26.17%) of participation and the one with the largest variation (45%).

**Table 1.** Descriptive statistics of the participation of women in the entrepreneurship of small and medium companies

	Average	Standard deviation	Coefficient of variation
Women Total Economy	37.5342	5.37427	14.31
Women Manufacturing	26.1773	11.78180	45.00
Women Trade	43.4633	5.43006	12.49
Women Private Non-Financial Services	33.8585	4.19799	12.39

What is presented in Table 1 reflects what Arboleda (2014) indicates. Arboleda (2014), however, mentions that the entrepreneurial potential, currently, is immersed in a problem that impedes their progress. For instance, the participation of women in productive work has been little favored and recognized. Over the years, consequently, women had no option but to face institutional barriers and sociocultural obstacles that have hindered their entry into the business labor market.

**Table 2.** Analysis of variance for the female gender

Model	Sum of squares	Degrees of freedom	Average quadratic	F	Significance
1					
Regression	916.131	3	305.377	1090.819	.000 <sup>b</sup>
Residue	8.119	29	.280		
Total	924.249	32			

Table 2 presents a table of analysis of variance for the female gender, which shows that there is a statistically significant difference in the three sectors where women in small and medium enterprises in Mexico undertake.

Table 3 shows the participation of men in the entrepreneurship of this kind of companies within the Mexican economy, with a 35.54% of total participation in it. The largest share is in the manufacturing sector (48.29%), being the one with the highest standard deviation (7.68). This is in contrast with the commerce sector, which presents the lowest percentage of male participation. Male entrepreneurship in private non-financial services is regarded as the one with the least variation.

**Table 3.** Descriptive statistics of the participation of men in the entrepreneurship of small and medium enterprises

	Average	Standard deviation	Coefficient of variation
Men Total Economy	35.5439	2.87069	8.07
Manufacturing Men	48.2985	7.68712	15.91
Men Trade	28.5418	2.81641	9.86
Men Private Non-Financial Services	40.7715	3.16306	7.75

Table 4 presents a variance analysis table, which shows that there is a statistically significant difference in the three sectors where men in small and medium-sized companies in Mexico undertake.

**Table 4.** Analysis of variance for the male gender

Model	Sum of squares	Degrees of freedom	Average quadratic	F	Significance
1					
Regression	258.653	3	86.218	494.559	.000 <sup>b</sup>
Residue	5.056	29	.174		
Total	263.708	32			

These companies are key factors to increase the potential growth of Latin America. Also, these companies are characterized by great heterogeneity in their access to markets, technologies and human capital, as well as their linkage with other companies, factors that affect their productivity, export capacity, and growth potential. Therefore, the result obtained is shown in the previous tables. Also, they constitute a fundamental component of the productive network in the region, since they represent around 99% of the total number of companies and employ about 67% of the total number of workers (CEPAL, s/f).

In regards to obtaining a multiple linear regression model in the case of women, the sector that generates majority of the weight in entrepreneurship, related to the global participation in the economy, is the trade sector (0.430). However, this shows the standardized beta coefficients; in addition, all three sectors show a statistical significance of zero, which can be seen in Table 5.

**Table 5.** Linear regression model of women entrepreneurship by economic sectors

Model	Non-standardized coefficients		Standardized coefficients	Significance
	B	Standard error	Beta	
1 (Constant)	-.578	.873		.513
Women Manufacturing	.149	.011	.327	.000
Women Trade	.426	.035	.430	.000
Women Private Non-Financial Services	.463	.040	.362	.000

**Table 6.** Men's entrepreneurship linear regression model by economic sectors

Model	Non-standardized coefficients		Standardized coefficients	Significance.
	B	Standard error	Beta	
1 (Constant)	-.638	1.000		.529
Manufacturing Men	.130	.011	.349	.000
Men Trade	.417	.034	.409	.000
Men Private Non-Financial Services	.442	.027	.487	.000

In regards to the multiple linear regression model in the case of men, it was stated that the sector that generates more weight in entrepreneurship, related to the global participation in the economy, is the private non-financial services sector. However, this is shown by the standardized beta coefficient (0.487); in addition, all three sectors show a statistical significance of zero, which can be seen in Table 6.

There is an hourly income of the Mexican woman of 33.47 pesos per hour, with a coefficient of variation of 17.75%. Also, the average of schooling in years is 9.036 years. Thus, it has a lower coefficient of variation of 9.23%, which can be seen in Table 7.

**Table 7.** Income per hour and average of schooling of women

	Average	Standard deviation	Coefficient of variation
Women Hourly Income	33.4712	5.94286	17.75
Women Average Schooling in Years	9.0364	.83427	9.23

It is necessary to emphasize that sometimes it is not just about correcting the wage gap. Nevertheless, the lack of opportunities in the labor market and the obstacles to entering into it can influence a woman's decision to become an entrepreneur. This was mentioned in a report by the World Bank and the Inter-American Development Bank (2010).

There is an hourly income of Mexican men of 33.50 pesos per hour, with a coefficient of variation of 19.51%. Also, the average schooling in years is 9.26 years, which can be seen in Table 8. It should be noted that the coefficient of variation in income per hour is higher in the male than in the female, while the average of schooling is greater in the female gender.

**Table 8.** Income per hour and average of schooling of men

	Average	Standard deviation	Coefficient of variation
Men Income per hour	33.5070	6.53967	19.51
Men Average Schooling in Years	9.2655	.79431	8.57

Based on the differences in income and schooling in the genders, it is convenient, as indicated by the OECD / CEPAL / CAF (2016), to adopt an approach to entrepreneurship policies that includes diverse instruments. This aims to support at the same time the increase in productivity and gender equity, whereby support for entrepreneurship must be broad and multidimensional.

The Pearson correlation coefficient between entrepreneurship by sector, income per hour, and years of schooling was determined for women in Mexico. This can be seen in Table 8 which shows that in the three sectors of the economy where it was undertaken, manufacturing, commerce and non-financial private services, there is an inverse correlation with statistical significance related to hourly income, being higher in the case of private non-financial services, with -0.621. Also, in the three same cases, an inverse correlation with statistical significance was observed to be related to the average of schooling in years, being the highest in the commerce sector (-0.785). It also shows a statistically significant correlation (0.538) between

the income and the average of schooling in women, which is indicated in Table 9.

**Table 9.** Correlation between entrepreneurship by sector, income, and years of schooling

		Women Manufacturing	Women Trade	Women Private Non- Financial Services	Women Hourly Income	Women Average Schooling in Years
Women Manufacturing	Pearson correlation	1	.663**	.518**	<b>-.534**</b>	<b>-.601**</b>
Women Trade	Pearson correlation	.663**	1	.829**	<b>-.576**</b>	<b>-.785**</b>
Women Private Non-Financial Services	Pearson correlation	.518**	.829**	1	<b>-.621**</b>	<b>-.660**</b>
Women Hourly Income	Pearson correlation	<b>-.534**</b>	<b>-.576**</b>	<b>-.621**</b>	1	<b>.538**</b>
Women Average Schooling in Years	Pearson correlation	<b>-.601**</b>	<b>-.785**</b>	<b>-.660**</b>	<b>.538**</b>	1

\*\* . The correlation is significant at the 0.01 level (bilateral).

The Pearson correlation coefficient between entrepreneurship by sector, income per hour, and years of schooling was determined for men in Mexico, which can be seen in Table 9. Therefore, Table 9 shows that in none of the three sectors of the economy where it was undertaken, manufacturing, commerce and non-financial private services, there is a significant correlation related to hourly income. In the case of the commerce sector, a correlation with statistical significance (0.457) is observed to be related to the average of schooling in years. There is also a statistically significant correlation (0.496) between the income and the average of schooling in men. Thus, this is indicated in Table 10.

**Table 10.** Correlation between entrepreneurship by sector, income, and years of schooling

		Manufacturing Men	Men Trade	Men Private Non- Financial Services	Men Income per hour	Men Average Schooling in Years
Manufacturing Men	Pearson correlation	1	.501**	.304	.227	.229
Men Trade	Pearson correlation	.501**	1	.527**	.178	<b>.457**</b>
Men Private Non-Financial Services	Pearson correlation	.304	.527**	1	.108	.046
Men Income per hour	Pearson correlation	.227	.178	.108	1	<b>.496**</b>
Men Average Schooling in Years	Pearson correlation	.229	<b>.457**</b>	.046	<b>.496**</b>	1

\*\* . The correlation is significant at the 0.01 level (bilateral).

What is presented in tables 9 and 10 leads to a reflection based on the study of Rosery and Molina (2008). They indicated that entrepreneurship and entrepreneurs must be considered in the context of complexity in terms of the context, relationships, little factors, as well as in the same way like those of structural type. Therefore, this is because they are decisive for its emergence, constitution, and entrepreneurial development.

## **Conclusion**

Based on the results analyzed from the database of the economically active population by gender in Mexico, the following was concluded.

There are differences related to gender which is based on the type of small and medium companies that are undertaken by sector of the economy in Mexico. Women undertake more in the commerce sector, while the manufacturing sector is the lowest. Unlike men, they undertake inverse to a greater extent in the manufacturing sector and finally in the trade sector. In both genres, the sector that showed the greatest dispersion was the manufacturing sector.

According to the linear regression model, both in the female and male gender, the three sectors where it is undertaken in small and medium enterprises have a statistical significance in the economy in general. In the female gender, it influences to a greater extent the commerce and the male gender based on the non-financial private services.

In Mexico, hourly income is very similar based on gender, being slightly higher in men. In turn, they have a greater variation in income. The average of schooling in men is a little higher than in women. Thus, in this area, the variation is greater in women.

According to the Pearson correlation coefficient, the higher degree of entrepreneurship of small and medium enterprises in women, in the three sectors of the economy, has an inverse income. This, however, indicate that women with higher income in Mexico are not necessarily entrepreneurs of these companies. In the same way, the correlation with the average of schooling is reversed. This indicates that the lower the average of schooling, the greater the entrepreneurship of these companies based on the female gender. In addition, there is a direct relationship between income and average schooling. Here, the higher the income, the higher the average schooling.

In the case of men, no significant relationship was found between the sector in which they undertake small and medium enterprises that are related to income. The average of schooling has a direct positive relationship with the entrepreneurship of small and medium companies in the commerce sector, being the sector where it is undertaken to a lesser extent based on the male gender. A direct relationship exists between the level of income and the

average of schooling in men. Thus, as the level of schooling increases, the income in the male gender increases too.

Also, it can be affirmed that in both genders, the higher the level of schooling, the higher the income. The variation in the entrepreneurship of small and medium-sized companies is 43% higher in the female gender than in the male on average. Also, the sector with the greatest variation is the manufacturing sector. Here, it is 64.64% higher in women entrepreneurs.

Globally, it is expected that in 2018 and 2019, growth will remain stable at 3.0% (UN, 2018). Nevertheless, in Mexico for the first time in two years, the variation of the PIB registers a negative rate of 0.3 tenths, if seasonally adjusted values are considered (CESLA, 2018). Therefore, it is advisable to continue promoting entrepreneurship in small and medium-sized companies in the three sectors of the Mexican economy. Thus, this will have a positive impact on the economy of the country. In addition, support and training programs should be encouraged, mainly for women, given that entrepreneurship in small companies in women has a high rate of variation.

The limitations of this work set the tone for future research lines. Due to the fact that it is a transectional study, a longitudinal study would be allowed to give a greater support to the results of this research.

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## **From Unmovable Points to Structural Drift: An Introduction to Enactivism**

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### **Abstract**

This essay examines possibilities for a reflexive understanding of knowledge attainment that is grounded in the enactive capacities of living systems. Appreciating the enactivist agenda requires a dislodging of obstructions created by an accumulated history of transcendental abstractions that have sought to provide a Cartesian “unmovable point” against which knowledge claims are veridically judged. This essay traces some long-held philosophical and scientific assumptions that have limited the attainment of knowledge in exchange for the banishment of epistemic anxieties that result from a loss of absolute certainty. A brief history of this problem is presented as context for the present advocacy of an enactive approach to the pursuit of cognitive outcomes. It is hoped that enactivism may offer a stable, yet evolving, understanding of how data, information, and knowledge intersect to constitute living and learning. Implications, both moral and scientific, are shared.

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**Keywords:** Enactivism, embodied cognition, self-organized systems

### **Introduction**

Enactivism (Varela, Thompson, and Rosch, 1991; Clark, 2008; Thompson, 2010, 2017) and its older close cousin, embodied cognition, comprise a collection of philosophical and scientific developments that challenge the paradigmatic underpinnings of thought systems and methodologies derived from Platonism and its Neo-Platonic and Christian variations in philosophy, science, and the humanities. Though recently emerged as a systematic body of theory and practice, enactivism owes much to the 18<sup>th</sup> Century Italian philosopher, Giambattista Vico, who challenged the new Cartesian hegemony in ascendance at the time of Descartes’s death in 1650. Enactivism offers an immanent alternative to the primacy of absolutist dogma in its many guises, whether religious or scientific. Enactivism seeks to comprehend and interpret the nature and relations of

being and knowledge without various and persistent transcendental abstractions or materialistic reductions. It aims to offer a compelling alternative to the widely accepted view that knowledge is derived from a pre-given world, which is accurately reproduced as internal representations within individual minds and/or bodies. Enactivism challenges the veracity, nay existence, of any such representations that rely upon reception of data, whether impressed through the senses or revealed or uncovered by ideational processes, which are acted upon, reflected upon, or are, otherwise, stored and retrieved for some later purpose.

## I.

*Every reaction against Platonism is a restoration of immanence in its full extension and its purity, which forbids the return of any transcendence.* –Gilles Deleuze

The various manifestations within enactivism share a central skepticism toward prevailing certainties of either rationalists or empiricists that remain largely unshaken by generations of intellectual challenges, from Hobbes to Gassendi and from Vico to Nietzsche and from Foucault to Deleuze. Both Hobbes and Gassendi offered an alternative to Cartesian rationalism, notably focusing on the role of the sensually grounded imagination as an “absolutely indispensable step between sensual perception and more abstract cognitive faculties and was in this capacity a necessary means of understanding” (Ricken, 1994, p. 18). If Descartes’ theory of transcendental abstraction is to be replaced by a science and philosophy of “pure immanence,” as Deleuze (2001) would have it, it will be due significantly to Vico’s early challenges to Descartes’ scientism, his disdain for the humanities, and the Cartesian argument for innate ideas, which Vico dismissed with principle, *verum ipsum factum* (the truth is the made). In the translator’s introduction to *On the Study Methods of Our Time*, Gianturco points out that Vico’s opposition was not leveled so much at Descartes and the scientific spirit as it was against the “degeneration and dogmatizations of Cartesianism, as exemplified by Malebranche, Lamy, Arnauld, etc” (Vico, 1990). Gianturco quotes Maria Goretti (Lemonnier, 1958) from her introduction to Vico’s *De nostri*: “. . . Vico . . . appear to us, not so much the adversary of the Cartesian spirit, as, rather, the enemy of the intellectualistic schema: a schema which forces tumultuous, contradictory human nature into the straightjacket of an absolute truth, of a truth excogitated, dreamt of, but never to be actually met with in reality.”

The Platonic and Cartesian dominance of the philosophy of mind and knowledge has continued, nonetheless, despite many challenges since the 18<sup>th</sup> Century. Michael Peters (2004) points out that those writing in the critical tradition that Nietzsche inspired toward Cartesian dislodgement have

not so much dislodged Platonism and its many variants as they have more often inverted it, thus making way for a body-based credo that often defines itself by rejecting what it is not. Such either-or arguments for an alternative embodiment, Peters suggests, attempt to roust the mind to make room for the domination of the body, rather than healing the Cartesian rupture between mind and body, subject and object, self and other. Merleau-Ponty's embodied phenomenology, for instance, offers a profound and detailed alternative to Cartesianism, and yet Foucault saw phenomenology's embodied search for meaning and affirmation as an inverted Platonism, whereby the body becomes inscribed with the same relations of power that were previously deployed to establish control by mind.

It will take an expanded conception embodiment to loosen the pull of the Cartesian gravity that has drawn theoretical and applied disciplines toward a conception of knowledge as disembodied abstraction, wherein the learning self is viewed as a fixed, abstract quantity engaged in mental gymnastics based on reductive analysis, memory work, and self-control. Historically, this cognitive training regimen has relegated the physical, purposeful, and emotional aspects of personhood to the level of annoying distractions that require the further exercise of mental discipline to keep them properly contained by the intellect. As with so many of our philosophical traditions and intellectual fixities, this conception of knowledge can be traced to Plato, who located the epistemological Holy Grail beyond mutability, physicality, or even time, itself. Plato placed the fundamental laws that govern our universe within the reach of mathematical thinking, which offered an independence from the mutable world that earned it the closest proximity to eternal and unchanging verities for which the gods only had full access, and toward which humanity must concentrate its intellectual efforts to attain approximations. The light of Truth, thus hidden from human experience, requires the exercise of reason and intuition to locate its remaining glimmers. The sensate aspects of living in the world of change are, thus, relegated to that metaphysical ghetto, wherein the imagination and the expressive arts may, to some extent, purge the unruly passions.

Neo-Platonism, then, came to have a prominent presence in the molding of early Christian thought and in the shaping of Augustine's theological views in the further separation of soul and mind and body, views that were fueled, too, by religious dogma regarding the carnal origin of human sin. By the time we get to Descartes twelve hundred years later, the disembodiment of knowledge and goodness is quite complete, the physical only surviving as motion and extension (and thus quantifiable), and the human body hanging on as an automaton directed by the mind and tenuously connected at the pineal gland.

Following the conviction of Galileo by the Inquisition, Descartes was most interested in ingratiating the Jesuits who controlled the Sorbonne and, thus, the center of learning. And so it was that Descartes found a prominent place for God in his, otherwise, secular science; his philosophical system would be guaranteed by God's ultimate goodness and rational purpose. Weaving his way through a theological minefield that could explode at any misstep (Schmaltz, 1999, p. 39), Descartes appropriated for his thought system an omnipotent and omniscient deity as a basis for what, otherwise, may have been viewed as a doubtable world of bodies and other mutable objects. In short, the casting of a mind-body dualism, with God as bridge between the two, offered Descartes a way to fully pursue secular certainty, while handing to God the credit that the Church demanded. Cartesianism, then, provided a way to fully pursue the enlightened subjectivity of human reason through science, while offering to God the ultimate veridical authority for the conclusions of human reason, which, in turn, were used to logically demonstrate the existence of the same God who could be counted on, in circular fashion, to substantiate the veracity of the argument.

For Descartes and all who inherited his method, God provided the bridge that reliably connected the subjective indubitability of analytical and reductive thought that were represented in the mathematically decipherable puzzles of the physical world. As modern science gained confidence and drew away from the acceptance of Descartes' theological guarantee for subjective certainty, one might say the reduction took over as the individual subjective truth yielded to a higher need to extract the subjectivity for which God could no longer vouch in the methodologies of science. In the process, the preeminence of the modern individual of the Enlightenment that Descartes helped to create began to vanish. The scientific reductionism that resulted left science with a detached perspective that Nagel (1989) referred to as "a view from nowhere." And as Bourguin and Varela (1992) would pithily note in regards to the advance of reductionism, "the Cartesian commitment to reduction that was meant to justify the replacement of the collective by the individual as the locus of actions annihilates the individual on its march toward the quark" (p. xvi).

By the end of the 19<sup>th</sup> Century, Descartes' conception of mind had become a ghostly apparition on its way to being banished entirely by a new scientific psychology of timed human reflexes and conditioned behaviors. And despite reservations by John Dewey, William James, and others regarding the behaviorists' abstracting of human experience on the one hand and the objectifying of human purpose on the other, the new physical psychology brushed aside their protests as arcane residues of philosophical thinking, which had no place in the new experimental psychology, specifically, or the new social sciences, generally.

When the mind finally reappeared on the scientific stage, it was largely due to an interdisciplinary confederation of geniuses and luminaries that assembled in New York for the first Macy Conference in 1946, with the immodest goal of creating a new interdisciplinary scientific study of control mechanisms and communication in biological and physical systems (Conway and Siegelman, 2005). Core members included Ross Ashby (psychiatrist), Gregory Bateson (anthropologist), Julian Bigelow (electro technician), Heinz von Foerster (biophysicist), Lawrence K. Frank (social scientist), Ralph W. Gerard (neurophysiologist), Molly Harrower (psychologist), Lawrence Kubie (psychiatrist), Paul Lazarsfeld (sociologist), Kurt Lewin (psychologist), Warren McCulloch (chair) (psychiatrist), Margaret Mead (anthropologist), John von Neumann (mathematician), Walter Pitts (mathematician), Arturo Rosenblueth (physiologist), Leonard J. Savage (mathematician), and Norbert Wiener (mathematician).

Given the name *cybernetics* by Norbert Wiener, the new scientific search for endogenous control mechanisms and information patterns quickly exposed basic differences among the participants of the Macy Conferences, which were convened 10 times between 1946 and 1952. There were those who supported a hard science research agenda and those who advocated a research programme inspired more by the biological and social sciences. Whereas the former focused on a mathematical approach to the modeling of mind based on data processing, transfer, storage, and manipulation, the latter sought an analog model of cognition aimed at understanding the processes of control, communication, and information in living systems. Consistent with the earlier development of social science in the U. S., a hard science approach dominated the emergence of the new science during in 1950s, which came to be known as cognitive science.

Unable as they were to unlock the actual workings of the brain, the new cognitive scientists used the architecture of the early modern computer as an opportunity to model the thought process and problem solving processes that would undergird a new rigorous science of mind. However, it did not take long for some deep-seated problems to emerge. Intended to model the operations of the human mind, the new computer design embedded the limitations of long-held rationalist assumptions into what came to be known as the von Neumann architecture. These philosophical assumptions, however, remained quite invisible to the architects themselves until the problems they set in motion could no longer be ignored.

Early computer design was based on the Cartesian model of mind as a sequential, logical calculator that manipulates a rules-based symbolic language whose correlates represent aspects of the pre-given world. The computer is charged with solving problems posed to it in its rules-based

language of if-then statements by sifting through a stored repertoire of data that may be retrieved and configured to represent a solution.

Two problems quickly became apparent: Any disordering in the smallest local element of the coded language caused major malfunction in the whole system, and the sequential processing of data created a bottleneck when the system encountered large amounts of data to process, store, and retrieve. The new digital model of mind, then, was quite incapable of feats achieved by simplest beings found in the living world:

. . . the most ordinary visual tasks, done even by tiny insects, are done faster than is physically possible when simulated in a sequential manner; the resiliency of the brain to damage without compromising all of its competence, has been known to neurobiologists for a long time (Varela, 1992).

In short, cognitive scientists discovered that the central processor computer model of mind/brain, which required vast sequentially accessed programs to accomplish the simplest of tasks, did not resemble at all the way the living things in the experiential world operate.

Over the years, these unresolved problems inspired the next generations of cognitive scientists who included, ironically perhaps, the theoretical descendents of the losing faction from the original Macy Conferences, those who looked to the life sciences and social world to inspire and inform cognitive modeling. Representing mathematics, neuroscience, biology, technology, philosophy, economics, and linguistics, the more recent iteration of interdisciplinary cognitive science pursues an agenda aimed at modeling and understanding the self-organizing, distributed, and emergent behavior of natural living systems based on simple interaction rules and without central control units.

So it is with no small dose of irony that cognitive science, which was responsible for the simplistic and incorrect metaphor of the brain as an information processing device, is at the forefront of efforts by neurophenomenologists (Rudrauf, et al, 2003) to model thought processes as enfolded and unfolding, distributed, and self-organizing emergent phenomena that operate beyond any pre-established repertoire of strategies. As a further irony, recent developments in modeling of computer-based artificial intelligence and artificial life are based on biological and social models with self-organizing principles.

At the cutting edge of cognitive science, then, is the realization that any life-based system maintains autonomy, embodies change (learns), and enacts logics derived from its own history of intra-actions of its components while interactively coupled with the larger environment (Barandiaran, 2017):

Autonomy emphasizes the self-organized, holistic, dynamic interdependence within self-sustaining organizations, it challenges

representationalist realism as a way to approach agent-environment relationships by highlighting the dialectic codependence between the identity of a system and the habitat it selects, shapes and brings about through its specific mode of coupling (p. 427).

Because the conceptual basis of enactivism enshrines a relational epistemology that extends beyond individual minds or bodies to enfold and unfold an ecology of interactions by all that is living, these insights embody an ethic of being that will be crucial to sustaining a shared world of mutuality for both individual and collective.

In the remainder of this essay, I will share some of the basic assumptions and concepts that are foundational to enactivism (Varela, Thompson, and Rosch, 1991; Thompson, 2007), and I will offer some suggestions as to how this “naturalized epistemology” (Varela, 1979) may offer tools for a more productive and sustainable future of life on Earth.

Even though science in many respects has moved beyond the limitations imposed by Descartes’ method, there remains with us a psychological frailty as old as our philosophical schemes to assure objectivity and to locate an invariant Archimedean point from which to operate. Varela, Thompson, and Rosch (1991) refer to this problem as arising from a “Cartesian anxiety,” one that

. . . is best put as a dilemma: either we have a fixed and stable foundation for knowledge, a point where knowledge starts, is grounded, and rests, or we cannot escape some sort of darkness, chaos, and confusion. Either there is an absolute ground or foundation, or everything falls apart (p. 141).

However, Varela (1979) has pointed out that there is no independent access from which “to stand outside our own experience . . . and see ourselves as a unit in an environment” (p. 274). Epistemological schemes that ignore this limitation make it possible to avoid the Cartesian anxiety, but at the cost of bowing to the Janus-faced idol of absolute objectivity or absolute subjectivity. Either remedy, however, offers a false Archimedean point for cognition that is based on a cut “between the cognizing subject and the object to be known.” (Varela, *Principles of Biological Autonomy*, 275)

This bifurcation has the undesirable effect of isolating human knowers from the worlds they would know, which, in effect, sets human experience against that which is essential to defining itself. Besides putting humans at odds with the ecologies for which they depend upon to be properly constituted, the capture or discovery of accurate representations depends upon the successful elimination of subjectivity and the freezing of experience into “controlled” conditions that supposedly represent the stable givenness of a world unadulterated by temporal and localized elements. In

effect, Plato's search for that which is immutable lives on in these failed efforts, as does Descartes' search for the "unmovable point."(

This objectivist conception sets into motion many faulty distinctions that follow from it. In choosing an Archimedean vantage point or ultimate ground that we may label God, mind, cogito, body, or even DNA, we attribute certainty when, in fact, there is none that is not grounded by the "praxis of living as a primary experiential condition" (Maturana, 1988, 5.2). The fault lines beneath Cartesian "unmovable points" become visible as we consider that the 'knower' and the 'to be known' are components of a co-determinative process for "effective action of a living being in its environment" (Maturana and Varela, 1998, p. 29).

When enactivism is, thus, conceived as "bringing forth a world" by autonomous intra-actions and interactions of individual actors, describers, knowers, learners (Horn and Wilburn, 2005) within an environmental medium that influences and is influenced by those interactions, the separation of out-there and in-here may be seen as an unneeded and misleading distinction for a process that is beyond our ability to know it without a human knower or to describe it without a human describer.

Enactive cognition could not occur without its bodily biological grounding that, at its most fundamental level, is constituted by cells (first-order unity) that are autopoietic, i.e., self-organized by the interactions of cell components within a membrane that is sustained through those interactions. These first-order cellular unities, then, comprise meta-cellular entities (second-order unities), whether ants, antelopes, or humans, which are, too, self-organizing. The self-organizing, adaptive activities of second-order unities are constituted by internal interactions that remain consistent with the limits and possibilities of environmental conditions. These individuals interacting through language acts, whether ant pheromone trails or human speech acts, create and sustain the information-communication domain (third-order unities) that, too, are self-generating and self-sustaining within the boundary conditions established by the system members' interactions coupled within the larger environment.

Within the organizational boundary that limits a self-organizing system to becoming and being itself, the structural components that operate within those boundaries are constantly engaged in intra-actions and interactions that maintain system identity, while initiating changes that are consistent with, though unspecified by, the larger environment. The environment provides perturbations from which a fluid repertoire potential actions define possibilities for change, or learning, within self-organizing unities, whether first, second, or third order.

It is correct to say that continued actions of cells, organs, humans, or social systems are contingent upon each successive unity's structural drift

within its environment, or “interaction domain” (Rudrauf, 2003, p. 34) to which it remains open, even though the specific actions of each unity is entirely structure-determined from within the organizational boundaries that define it. The autonomy, then, at each level of first, second, and third order unities negates the possibility of a biological reductionism, even though each level is imbricated with the level of unity from which it emerges as a distinct entity. Each level of an organic system is inextricably linked to others, even as the actions and behaviors at each level cannot be predicted by the organization and structures at other levels.

The import of these distinctions for the effort to reclaim a unified enactive embodiment for knowledge attainment (learning) is far reaching. First and foremost, it becomes clear that all that we know of first-order and second-order unities comes to us from our status as third-order unities. It is our languaged communications that provide descriptive accounts of operations that are essentially beyond our capacity to access them in any more direct fashion than our describer status as languaging observers allows. Even so, there is a great deal to know from descriptions of our experience, even without direct access to the biology of cognition at first or second-level operations.

We know, too, that the sources of our conscious descriptions are partially derived from sources beyond our awareness of them. Cognitive neuroscientists point out that conscious behavior that we normally refer to as “cognition” constitutes a small part of the enactive behaviors engaged in the bringing forth descriptions of our cognitive activities. Furthermore, and perhaps more disturbing to those still in the throes of the Cartesian anxiety, the conscious part of cognition is comprised entirely of a continuing series of transiently correlated neuronal ensembles, or microworlds (Varela, 1999) (Stanford, California: Stanford University Press, 1999), whose “transition between two distinct cognitive acts (such as face perception and motor response) should be punctuated by a transient undoing of the preceding synchrony and allowing for the emergence of a new ensemble. . .” (Rodriguez, 1999, p. 433).

Cognition, at its root, is a cellular behavior that begins with the bootstrapping of in-formation that occurs within an organism and its domain of intra-actions and interactions within an environment. In the enactive approach, information is defined in the “original etymological sense of *in-formare*, to form within” (Varela, 1979, p. 266). But rather than an imprinting of a representation from the environment, the environment supplies perturbations that initiate indeterminate sensori-motor actions that are, in fact, distributed throughout the body and modulate registered perturbations all along the various pathways to and from the brain in a recursive fashion. Furthermore, the registering of these perturbations is

influenced by the individual's history of interactions within its environment that produce repertoires of distributed neuronal paths and configurations, or ensembles, that remain plastic. It is the sensori-motor assembling at each moment that modulates inputs to register the distinctions that constitute observers' in-formational acts:

. . . the nervous system does not 'pick up information' from the environment, as we often hear. On the contrary it brings forth a world by specifying what patterns of the environment are perturbations and what changes trigger them in the organism. The popular metaphor of calling the brain an 'information processing device' is not only ambiguous but patently wrong (Maturana and Varela, 1998, p. 166).

The data field that comprises the surrounding environment becomes informative within the neurophysiology of the enacting agent that brings forth in-formation. This circularity between knowing and acting reflects an ontological condition that is grounded in the making of distinctions, or the foregrounding of certain elements of the ecological context that become in-formational and the backgrounding of others.

Cognition is always enactively embodied and dependent upon our status as observers, who are defined through our languaged communications as third-order unities and to which we attribute, individually, the identity of "I." (Varela, 1999, pp. 60-2). The apparent permanency of our identity as an "I" is due to the communicative capacity to narrate and describe an ongoing series of temporal neuronal ensembles at the operational level that would, otherwise, remain beyond the narrative reach of "I." The persistence of our story over time enhances the verisimilitude for a stable "I" that, indeed, masks the complex inhibitory and excitatory dance (Varela, et al, 2001) among the distributed neuronal and hormonal communications emerging and disintegrating on an ongoing basis within our embodied second-order and first-order unities. This stable "I," then, is a virtual person at the center of a first-person narrative, one who provides the link from the corporeal body (the selfless "I") to the larger social ecology comprised of other languaging humans. According to Varela, then, the virtual "I" constructs a bridge that is "neither public nor private, but partakes of both." (Varela, 1999, p. 62). This virtual self is, quite literally, the story of our both being and becoming, continuously refreshing or reloading itself like an updated web page at a dissolve rate that is entirely seamless.

Enactivism posits that cognition distinguishes itself as a story of the process that sustains it, which consists of a matrix of cognitive behaviors that are known to us only by our describing of them. The descriptions of our experiences, which may include poems, paintings, essays, and petri dishes, are artifacts of experiencing, rather than objects that can be set outside of our

having experienced them. The artifacts that our experiencing supplies then provide the settings and furniture in the story that our “I” shares.

## Conclusion

The enactive approach reframes cognition in a way that may heal some of the misplaced cuts that our past search for truth has wielded: cuts between mind and body, subjectivity and objectivity, individual and environment, self and other. Enactive cognition grounds knowledge in effective actions to “bring forth worlds” within dynamic environments that includes other humans and other life forms. This turn shifts away from the conceptualization of cognition from code breaking or problem solving within a repertoire of pre-given strategies, rules, individual virtues, or programs.

While re-inscribing the layered co-determinative unities of language, thought, and behavior that characterize the cognitive integrity of us human observers, the enactive approach locates humans within an ecological matrix that may achieve the ecological epistemology that is “not limited by the skin” (Bateson, 1972, p. 460). It moves us toward an epistemology of immanence that is no longer skull bound. The enactive turn may, perhaps, serve to animate a relational ethics that could produce a pragmatic side effect that benefits the planet’s, and thus our own, chances to survive with its biodiversity and cultural diversity intact. Bateson (1972) spoke of resulting ontological modesty that could result from a repositioned epistemology:

Freudian psychology expanded the concept of mind inwards to include the whole communication system within the body – the autonomic, the habitual, and the vast range of unconscious process. What I am saying expands mind outwards. And both of these changes reduce the scope of the conscious self. A certain humility becomes appropriate, tempered by the dignity or joy of being part of something much bigger (pp. 462-63).

When placed against a background of science conceived as a value-free discovery of elements from a known unknown, enactivism makes figural our constructed knowledge of knowing and “the transparency of our actions” (Maturana and Varela, 1998, p. 249). In so doing, we may hope that any remaining Cartesian anxiety that arises will not distract us further from accepting a moral accountability for the facts we value and the values that shape the facts to which we attend. Varela argued that “to the extent that we move from an abstract to a fully embodied view of knowledge, facts and values become *inseparable*. To know *is* to evaluate through our living, in a creative circularity” (emphasis in original) (Varela, 1992, p. 260). The enactive approach to embodied cognition offers no Archimedean point from which to begin this project, but it may offer a modest emplacement from which to pivot and move forward.

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## **Problem Base and Case Study Methodology in Medical Education**

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### **Abstract**

**Objectives:** EBM (Evidence-Based Medicine) and Case Study is a relatively new concept in medicine, and medical education, but one that is rapidly gaining acceptance as an important approach in assisting medical students, residents, and practicing physicians in their clinical decision-making.

Problem Base and Case Study learning in Medical Education has become a widespread and effective method of using the medical literature. It has four basic steps: the development of a clinical question, the literature search for the appropriate medical literature to address the clinical question, critical appraisal of the acquired paper, and application of the results of the research paper to the patient at hand.

**Goals:** Analysis of effectiveness of teaching methodology

**Methods:** Observational Study

**Results:** The use of PB(EBM) and CS should allow patient care that is the most effective, the most cost-effective, and the safest.

The skills to master in use the EBM approach include that of question formulation, literature searching, critical appraisal of articles, and application of evidence. The resources needed include computers and Internet for access to full articles, a printer, and functional use of the English language. Moreover, this is a lifelong endeavor, so practice and mentorship are useful. The PB and CS component in the Tbilisi State Medical University has the aim of assisting students in learning objectives. Training in the PB and CS learning method will be provided at the beginning of the Module.

Problem base and Case Study learning in education has become a widespread and effective method of literature use. It has four basic steps: the development of a clinical question, the Literature search for the appropriate medical literature to address the clinical question, critical appraisal of the acquired paper, and application of the results of the research paper to the patient at hand.

**Conclusion:** By the end of this course you should have demonstrated your capacity to: recognize, compare, and contrast the general "ways of thinking" of science (biology) and of philosophy (ethics).

Approach bioethical problems, break them into smaller component parts (analysis), and discuss those analyses through oral and written communication, both individually and in groups.

Approach bioethical problems and propose solutions to them that transcend the disciplines of biology and philosophy, solidly rooted in their respective ways-of-knowing.

Acquire and separate factual knowledge from opinion in the areas of science and philosophy. Demonstrate good critical thinking (that is, clear, logical (coherent and relevant), broad, deep, and discriminating) in bioethics through speaking and writing.

Outcomes of PBL and CS are the problem-solving skills, self-directed learning skills, ability to find and use appropriate resources, critical thinking, measurable knowledge base, performance ability, social and ethical skills, self-sufficiency and self-motivation, leadership skills, ability to work on a team, communication skills, proactive thinking, congruence with workplace skills.

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**Keywords:** PB, EBM, Case Study

## **Introduction**

PB, EBM (Evidence-Based Methodology) and case study is a relatively new concept in education, but one that is rapidly gaining acceptance as an important approach in assisting students, residents, and practicing physicians in their clinical decision-making.

Problem base leaning and case study in education has become a widespread and effective method of literature use. It has four basic steps: the development of a clinical question, the literature search for the appropriate medical literature to address the clinical question, critical appraisal of the acquired paper, and application of the results of the research paper to the patient at hand.

## **Materials and Methods**

Observational Study.

## **Results and Discussion**

The use of PB (EBM) and CS should allow the patient care that is the most effective possible, the most cost-effective, and the safest.

The skills to be mastered in use the EBM approach include that of question formulation, literature search, critical appraisal of articles, and application of evidence. The resources needed include computers and Internet for access to full articles, a printer, and functional use of the English language. Moreover, this is a lifelong endeavor, so practice and mentorship are useful. PB and CS, is a *rapidly changing* field, *Huge amount* of literature/research, *Slow dissemination* of new data.

The PB and CS component in the Tbilisi State Medical University has the aim of assisting students in learning objectives. Training in the PB and CS learning method will be provided at the beginning of the Module.

Characteristics of PBL and CS in teaching curricula in TSMU : Problems form the organising focus and stimulus for learning, problems are a vehicle for the development of problem-solving skills, new information is acquired through self- directed learning, learning is student centred, learning occurs in small student groups, teachers are facilitators or guides.

Problems form the organising focus and stimulate learning. Process of PBL : Students confront a problem, students work in groups to alleviate prior knowledge and attempt to identify the nature of the problem, pose questions about what they do not understand, design a plan to solve the problem and identify the resources they need.

Role of the tutor: facilitator, helps to conduct discussions, suggests avenues of investigation, sets problem in a meaningful context, suggests prioritising learning issues, intervenes in negative group dynamics, guides discussions in a group setting.

Objectives of individual or team research: Understand EBM- What it is, why it is important, apply EBM, teach EBM, access EBM resources, GOALS of EBM, Improve *outcomes*, improve *safety*, Improve *cost-effectiveness* .

Criteria or indicators of teaching concepts:

**WHY USE EBM-** Medicine is a rapidly changing field, huge amount of literature/research slow dissemination of new data.

**GOALS of EBM;** Improve patient's medical situation, improve patient's safety, improve cost-effectiveness;

**DOMAINS of EBM:** Diagnosis, Therapy, Prognosis, Harm / Etiology, Clinical Practice Guidelines, Systematic Reviews.

**How do we practice EBM?** Clinical Question, Literature Search, Critical Appraisal Application of Results, Self-Evaluation & Improvement.

**KEY to EBM PRACTICE:** Answerable, Searchable, Appraisable, Applicable.

**SPECIFICS:** Cases, Worksheets, Pre & Post tests, Inpatients, Outpatients, Journal Club, Group Sessions, Grand Rounds, Lectures.

Clinical Queries is a pre-set study design filter that is applied to a concept search entered by the searcher Caveats: Filters were validated for indexing applied 1991+ but PubMed automatically searches 1966+; results not always dependable;

Filters are based on assumptions that do not always apply e.g. randomized controlled trials for Harm q's are not included in a Harm filtered search;

Keep concept search as simple as possible, using MeSH terms, for better success

Write out your question → PIO;

Identify the key concepts from the question;

Consider/determine the standard medical terminology for each term and other related terms;

Group similar terms together (if necessary) using OR; search each concept independently;

Gather all concepts together using and evaluate and refine approach as necessary;

Understand the various study designs appropriate for therapy trials;

Understand the fundamental concepts in appraising a therapy trial;

Ability to appraise a therapy trial;

Types of Therapy Studies: Phase I: Safety study: novel intervention;

Phase II: Dose Finding: generally not randomized;

Phase III: Large Clinical Trial (e.g. Randomized Controlled Trial): comparison to either placebo or standard of care;

Meta-Analysis: A summary of individual studies (i.e. RCTs) with homogenous data that is pooled and upon which statistical analysis is performed;

Applying limits is useful as it can narrow down large results into a manageable number fairly easily. The following can be applied as limits: Publication type: randomized controlled trial, practice guidelines, reviews, publication date, age, human or animal studies, language.

Resources: Reviews or Clinical Practice Guidelines: PubMed, Cochrane Library, National Guideline Clearinghouse, various association websites;

Evidence-Based Resources: Cochrane Library, Clinical Queries filter in PubMed, Clinical Evidence Journals: citation databases such as PubMed. Types of literature :Primary - RCT, Secondary-synopsis, Tertiary-textbooks.

Teaching experience in TSMU include development of class activities, leading lab discussions, and grading classroom assignments (with preceptor review), implementation of holistic models. (Fig.1) .

Adherence to ethical norms, understanding and value the importance of the ethical implications of research, appropriately interpret and explain the research results, explain complex ethical concepts to peers. Identify original, research study questions that can advance scientific knowledge about a topic of significance to the ethics, review and synthesize a body of research literature.

Identify and apply interdisciplinary theoretical knowledge and conceptual models to the investigation, select appropriate research designs and methodologies to address questions of ethical importance, understand and appropriately apply analytical strategies used in ethical research.

Generally, the teaching requirements that are in effect at the time of a student's matriculation remain in effect for that student, regardless of changes that occur during the time of the student's progress through the program.

TSMU experience system include course development-classroom technique, student mentoring/guidance, grading development course objectives, selecting appropriate readings, developing classroom activities, developing evaluations, facilitating class discussion (e.g., staying on topic, eliciting input from all students, guiding discussion toward learning objective).



Fig. 1 Holistic Model

Discussion about implementation: Why should we focus our efforts on holistic & wellness?

Current Interventions for Holistic & Wellness, What are we currently using?

Why should we focus our efforts on holistic & wellness?

- Future Interventions for Holistic & Wellness
- What is the future?

Issues in Holistic & Wellness, Models: Efficiency, Networks, and Effectiveness.

EBM- Efficacy, standardized, accessible, accurate, scientifically-based information.

The Module Paper has the aim of assisting students in learning objectives. The annotated bibliography supports all learning objectives. Students are to select their own reading, in consultation with other students and faculty, amounting to at least 1,000 pages. Students are to maintain an annotated bibliography of their reading and submit it to the Module Director at the completion of the module. Seminars, practical lessons, individual work, discussions, critical analyzes of article, project presentation. (Fig.2), (photo 1);

Format: This is a 300-level IS course taught in an active learning format. Writing is presented as a way to make thinking visible; interdisciplinary thinking is approached through staged writing (see [hypertext link below](#)). Student preparation, therefore, should emphasize reading and thinking prior to class so that reasoned dialog in class occurs regularly.

### **Student Learning outcomes**

Students taking this course will learn to distinguish between theoretical ethics and applied ethics, communicate the major ethical theories and explain their assumptions, understand the general features (and limitations) of current bioethical discussion, evaluate common beliefs about ethics, conceptualize the nature of a medical relationship and understand the moral principles, identify the moral questions regarding medical practice and the health issues, identify the key values of medical decision-making, differentiate between ethically problematic or significant situations and situations which do not require ethical analysis, apply moral reasoning to specific situations and defend the conclusions of that reasoning, write clearly, eloquently and effectively about particular moral dilemmas, ethically evaluate the medical/health decisions and practices of others, direct and manage their own future learning about ethics.

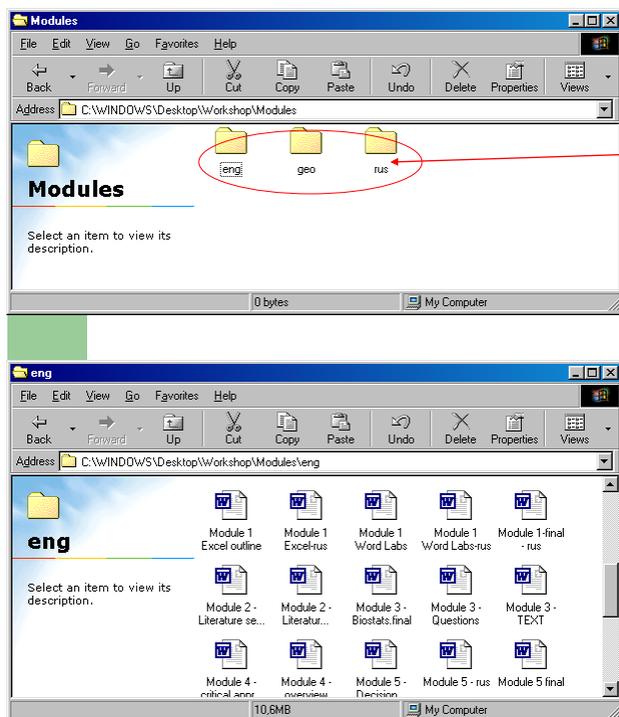


Fig.2 Teaching modules in different languages

## Conclusion:

By the end of this course you should have demonstrated your capacity to: recognize, compare, and contrast the general "ways of thinking" of science (biology) and of philosophy (ethics).

Approach bioethical problems, break them into smaller, component parts (analysis), and discuss those analyses through oral and written communication, both individually and in groups.

Approach bioethical problems and propose solutions to them that transcend the disciplines of biology and philosophy, yet are solidly rooted in their respective ways-of-knowing.

Acquire and separate factual knowledge from opinion in the areas of science and philosophy.

Demonstrate good critical thinking (that is, clear, logical (coherent and relevant), broad, deep, and discriminating) in bioethics through speaking and writing.

Outcomes of CS and PBL are the problem-solving skills, self-directed learning skills, ability to find and use appropriate resources, critical thinking, measurable knowledge base, performance ability, social and ethical skills, self-sufficiency and self-motivation, leadership skills, ability to work on a team, communication skills, proactive thinking, congruence with workplace skills.

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## **Evaluation of Alfalfa Plants Growth Irrigated with Arsenic Contaminated Water**

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### **Abstract**

The natural and anthropogenic process cause arsenic contamination of waters and creates serious environmental problems throughout the world. Due to the alfalfa is an important crop in diverse farming systems, it has been grown almost 33% of Turkey's cropland. In this experimental study, effect of As on the alfalfa plant growth and As accumulation in the shoot of the alfalfa was determined.

The accumulation of As in shoots as well as growth of alfalfa at various As contaminated water was evaluated. Alfalfa plants were grown in a greenhouse on a soil amended with different concentrations of As (control, 0.5–1.0–1.5–2.0–2.5–3.0–4.0–6.0–8.0 mg/L). In this study, data of two harvest samples were presented. Experimental results indicated that the irrigation with As-contaminated water of alfalfa cause dry weight increase compared to control pots. As accumulation in the shoots of alfalfa plant increase with increasing As concentrations in the irrigation waters. As accumulation in the shoots at the 2<sup>nd</sup> harvest samples were higher than the 1<sup>st</sup> samples. However, As accumulation differences between the 1<sup>st</sup> and 2<sup>nd</sup> samples decreased when the As concentrations in the irrigation water was higher than 4 mg/L.

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**Keywords:** Alfalfa, Arsenic, Irrigation water

## Introduction

Arsenic (As) is a naturally occurring element in the environment. Since ancient times, metalloid As has been known as a toxic element and widely distribute in the worlds (Dahal et al., 2008). As occurs in both inorganic and organic forms and inorganic As forms are about 100 times more toxic than organic forms (Jain ve Ali 2000). Inorganic forms of As occur in five oxidation states out of which the less toxic arsenates (+5) and more toxic arsenites (+3).

As contamination of groundwater has been reported in many countries and estimated that about 150 million people have been exposed to the high concentrations of As (Akinbile and Haque, 2012). The intake of As by humans occurs through drinking water, food and soil and contamination of drinking waters is considered a serious worldwide problem after the acceptable limit of As has been set to 10  $\mu\text{g/L}$  (Pokhrel et al., 2005; USEPA, 2017; WHO, 1993).

Water is one of the important inputs after fertilizer for crop production. When the plants are irrigated with water polluted by various chemicals, it may be dangerous for plants, animals as well as for human being.

High concentrations of As in soil and the use of irrigation water with high As may lead to elevated As concentrations in the agricultural products. If the As contaminated water is used for crop production, As accumulates in the soil and transferred to the plants.

Groundwater contains mainly inorganic forms of As and arsenate form comprises about 50% of the total As (Abedin et al., 2002). Due to the phosphate and arsenate have similar physicochemical behavior in soils; they compete for the same sorption sites on soil particle surfaces. Addition of phosphate to soil may enhance downward movement of As, leading to increased leaching from the topsoil or increase availability of As in the soil solution resulting in higher uptake by the plants. Arsenate also acts as a phosphate analogue with respect to transport across root plasma membrane with phosphate competing much more effectively for transport sites (Abedin et al., 2002).

Because of the natural and anthropogenic processes, As is present in waters and creates serious environmental problems throughout the world. The biotic and abiotic processes cause As release from the soils to the groundwaters (Corsini et al., 2014). Microorganisms play a key role in the speciation and mobility of As in the environment. In anaerobic environments, a biodiverse group of dissimilatory arsenate reducing bacteria use arsenate ( $\text{As}^{\text{V}}$ ) as a terminal electron acceptor and reduce it to arsenite ( $\text{As}^{\text{III}}$ ) (Sun et al., 2008). The oxidation states of As effect its mobility in groundwaters. While  $\text{As}^{\text{V}}$  forms under aerobic conditions,  $\text{As}^{\text{III}}$  form occurs

under anaerobic conditions. Due to the As<sup>V</sup> forms has greater affinity to oxyhydroxides and clay minerals, it is less mobile than As<sup>III</sup> (Corsini et al., 2014). In all plant species tested so far, it has been shown that arsenate is taken up via the phosphate transport systems (Chatuverdi, 2006).

As concentrations in the edible parts of plants have been reported in crops grown in contaminated soil and irrigated with As contaminated waters (Table 1).

**Table 2.** Accumulation of As in various plant tissues

Plants	Soil As Conc. (mg/kg)	As contaminat ed irrigation waters (mg/L)	Root (mg/kg)	Shoot (mg/kg)	Leaf (mg/k g)	Fruit (mg/kg) grain	References
Rice	7.31–27. 28	0.06–0.72	9.71	1.58	----	0.27	(Das et al., 2004)
Rice	2.01–12. 00	0.062–0.36 4	----	0.00–15. 8	0.52- 3.32	0.000–0.09 4	(Alam et al., 2003)
Rice			8.00–19.20	1.20–4.1 1	1.26- 3.60	0.06–0.33	
Potato	6.10–16. 70	0.005–1.01 4	0.20–0.79	0.08–0.2 4	0.05- 0.12	<0.01	(Dahal et al., 2008)
Cauliflow er			----	----	----	1.06–3.45	
Onion			----	----	0.55	1.02	
Eggplant			----	----	----	0.14	
Tomato	6230	0.50–2.00	2040	8.63	----	<3.00	(Beesley et al., 2013)
Tomato	----	1.00–5.00	1.91–3.61	1.16–2.8 3	----	2.47–4.06	(Burlo et al., 1999)
Tomato	----	5.00	1.00–20.00	7.00-20.00		2.00	(Marmioli et al., 2014)
Tomato			311.2–149 1.2	2.60–14. 70	2.70- 19.90	0.12–0.41	(Carbonell -)
Bean plants	----	0.00–10.00	30.40–43.1 0	14.70- 44.30	27.20- 40.60	3.30–4.40	Barrachina et al., 1997)
Tomato	----	----	----	----	----	0.0003–0.0 27	
Parsley	----	----	0.0037–0.0 30	0.0065–0.137		----	(Bronkows ka et al., 2008)
Potato	----	----	----	----	----	0.0008–0.0 58	
Wheat	----	----	----	----	----	0.025 0.093	
Bean plants	7.60	1–3	0.18–4.79	0.10–2.6 8		0.05–1.08	(Caporale et al., 2013)
Lentil		0.00–10.00	2–20 µg/g	0–12 µg/g			(Ahmed et al., 2012)

Alfalfa (*Medicago sativa L.*) is used to produce high-quality hay or haylage for dairy and beef cattle and grown as pasture. It is also included in crop rotations to help build nitrogen levels and maintain soil fertility (CBAN, 2013). Alfalfa is a flowering plant in the pea family Fabaceae. It is a cool season perennial legume from three to twelve years depending upon climate and variety. The plants grow to a height of up to 1 metre (3 ft), and have a deep root system sometimes stretching to 4.5 meters (15 ft), which makes it very resilient, especially to droughts, it has a tetraploid genome (Singh et al., 2009).

Alfalfa is an important crop in diverse farming systems. Alfalfa was grown on almost 33% of Turkey's cropland and it was approximately 34% of the total animal green feed crops produced in 2017 (Table 2).

**Table 2.** Alfalfa Production in Turkey (TSI, 2018)

Years	Area Sown (decare)	Green (tonnes)	Hay (tonnes)
2004	3 200 000	2 300 000	2 000 000
2005	3 750 000	2 100 000	2 400 000
2006	4 440 296	1 814 990	2 820 225
2007	5 348 965	1 697 645	3 513 945
2008	5 557 215	1 843 961	3 907 403
2009	5 692 958	1 747 676	4 037 132
2010	5 688 107	11 676 115	-
2011	5 585 525	12 076 159	-
2012	6 741 832	11 536 328	-
2013	6 286 419	12 616 178	-
2014	6 923 055	13 432 968	-
2015	6 620 459	13 949 958	-
2016	6 501 107	15 714 381	-
2017	6 594 319	17 561 190	-

Alfalfa is extremely resistant to high levels of contaminants and can be used as a bioaccumulator (Gardea-Torresdey et al., 1999; Gardea-Torresdey et al., 1997; Karimi, 2013; Peralta-Videa et al., 2004). Peralta-Videa et al., (2002) reported that the alfalfa plants are able to accumulate about 26.600 mg/kg of zinc, 8500 mg/kg of nickel, 12.000 mg/kg of copper, 6000 mg/kg of chromium, and 10.700 mg/kg of cadmium, individually. Nickel and chromium accumulation in the roots of alfalfa was also reported by Orman (2014). Pajuelo et al. (2008) reported that 25% of the total number of nodules of alfalfa plants decreases by applying sodium arsenite concentrations ranging from 25 to 35  $\mu$ M. Marin et al. (1992) reported that the As form is more important than the As level in solution in determining the phytotoxic effect of As to rice. When As was applied as DMAA form at levels of 0.05, or 0.2 mg As/L an increase in total dry matter was observed as compared to the control (Marin et al., 1992).

In this study, the alfalfa plants grown by using various concentrations of As-contaminated waters, was evaluated and As accumulation in the shoots of alfalfa plant was investigated. Experimental study is still proceeded, in this period, alfalfa plants were harvested four times, due to analyses of the last two samples were not completed, two harvest data are presented in this study.

## Materials and Methods

### Experimental methodology

The experimental study was conducted according to completely randomized design factorial with 3 replicates. Ten-kilogram soil samples each air-dried and sieved were placed in the pots after applying basic fertilization (100 mg N/kg, 100 mg/kg P, 100 mg K/kg, 2.5 mg Fe/kg) and also micronutrient mixture (B % 1.5 w/w, Fe % 3.0 w/w, Mn % 3.0 w/w, Zn % 4.0 w/w).

Alfalfa seeds were planted in each pot and the plants were grown in greenhouse conditions and the pots were equally watered during the growing period. The alfalfa seeds of 2 g were planted into each pot. The seeds amount was calculated according to the 3500 g/decare. At harvest, the shoots were collected separately, washed with tap and deionized water to remove impurities, and the fresh weight was determined.



Figure 1. Alfalfa planting

As was supplied as a solution of  $\text{NaAsO}_2$  in tap water in the concentrations of zero (control pot) 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 4.0, 6.0, and 8.0 mg As/L. The irrigation of plants was carried out by weighing the pot before each watering in order to maintain 70% water holding capacities.

The harvested shoots of alfalfa were separated into aboveground, dried in an oven between 65–75 °C for about 48 hours, and then dry weight was determined. After the plant samples were ground into powder, they were prepared for analysis. As analysis was carried out by using hydride generation atomic absorption spectrophotometer.

## Results and Discussion

Experimental study on the As accumulation in the alfalfa plants are ongoing. Because of the alfalfa is a perennial plant, experimental study will be carried out two years in order to evaluate As accumulation in the plant for first and second year. In the first year, alfalfa was planted in the clean soil and irrigated with As contaminated water. During the first year, alfalfa was harvested four times and the analysis of last two harvests and soil samples just have not been carried out. In this study, variations of As accumulation in the shoots and the size of alfalfa irrigated with various As contaminated waters was evaluated. Alfalfa plants grown in greenhouse are presented in Figure 2.



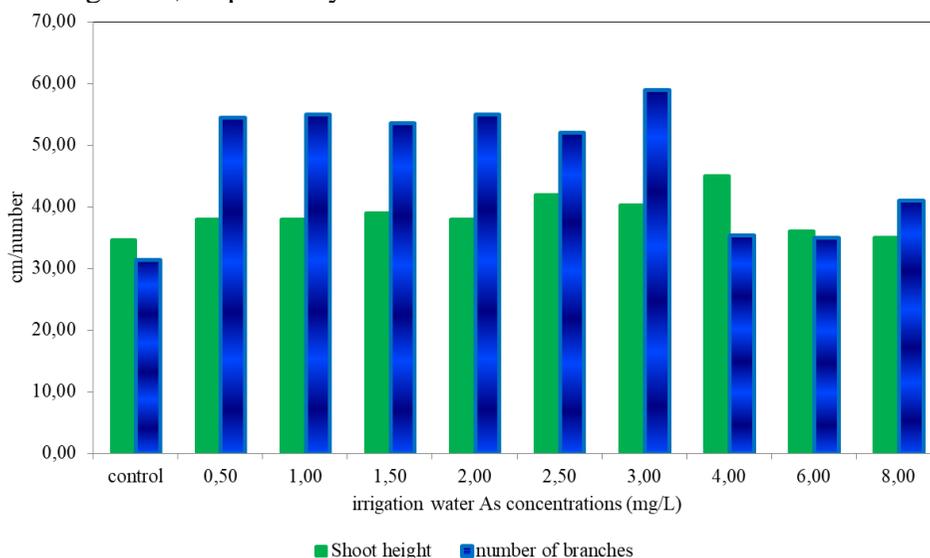
**Figure 2.** Alfalfa grown in the greenhouse

The data on the heights and numbers of branches at the first harvest is presented in Figure 3. As in irrigation water has a marked effect on the height of alfalfa plant. As can be seen from the figure that significance difference was found in height and numbers of branches growing with control and up to 3 mg As/L. However, differences were not observed for the As concentrations higher than 4 mg/L with the control unit. It was observed that the plant height slightly increased with increasing As concentrations in irrigation water. Plant height was about 35 cm for the control units. With the lower range of As doses (0.5–4.0 mg of As/L), plant height ranged between 38 and 45 cm, while with the As doses of 8.0 mg As/L, plant height decreased to about 35 cm. The number of branches and height of shoots for the As applied pots were higher that the control pots.

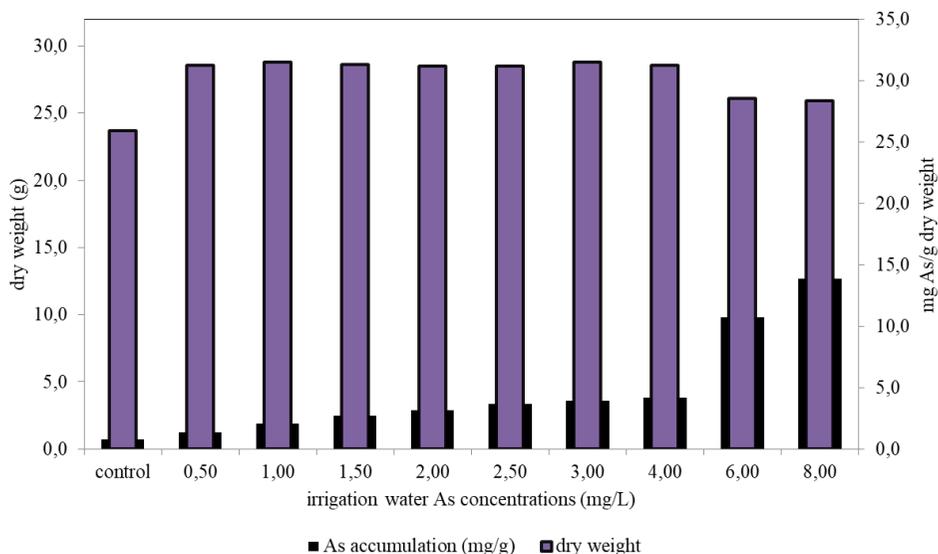
As adding into the irrigation water positively affects the alfalfa growth. About 20% increase of dry weight was observed for the applied As concentrations up to 4 mg/L compared to control units and it was slightly decreased by further increase of As concentrations in the irrigation waters (Figure 4). Although As is not considered as an essential plant nutrient, increased dry weight production was observed for tomato (Burlo' et al., 1998; Carbonell-Barrachina, 1995), red clover (Mascher et al., 2002), *Spartina alterniflora* and *Spartina patens* (Carbonell-Barrachina et al., 1998), onion (Sushant and Ghosh, 2010), rice (Marin et al., 1992). On the contrary, significant decrease of dry biomass was reported by applying As in some research (Abedin et al., 2002; Carbonell-Barrachina, 1997).

Accumulation of As in the shoots of alfalfa plant presented in Figure 4 was based on the dry weight basis of harvested plant material. The significant increase in level of As in shoots was found with increase in As concentrations in the irrigation waters. When the plant was exposed to 0.5 mg As/L, the As concentration was found to be about 1.07 mg/Kg in shoots. As accumulation in the shoots of alfalfa steadily increased with increase of As concentrations in the irrigation waters. The highest As accumulation of about 12.9 mg/Kg was observed for the concentration of 8 mg As/L.

Although significant alfalfa height variations were not observed between controls and As applied pots, numbers of the branches decreased steadily with increase of As concentrations in the irrigation waters at the 2<sup>nd</sup> harvest (Figure 5). The highest branch numbers were observed for the control pots and its number steadily decreased from 109 to 73 pieces for the control units and 8 mg As/L, respectively.



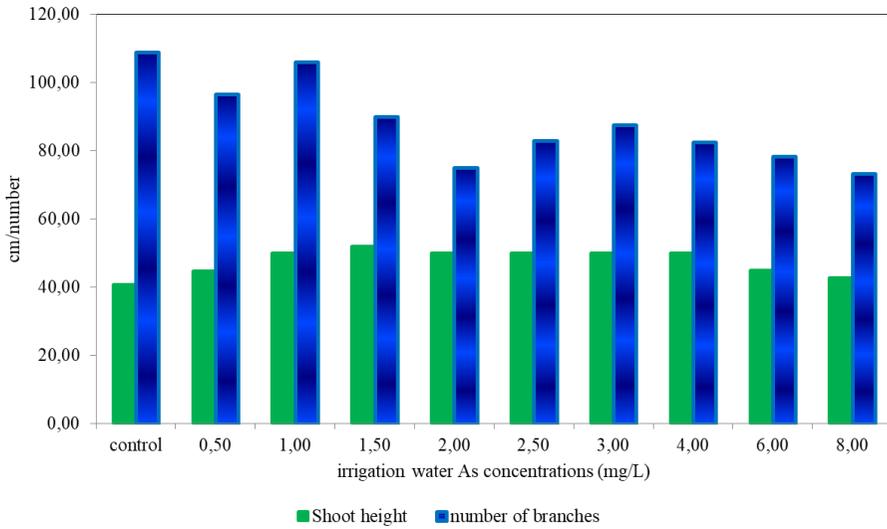
**Figure 3.** Variations of Alfalfa grown at the 1<sup>st</sup> harvest.



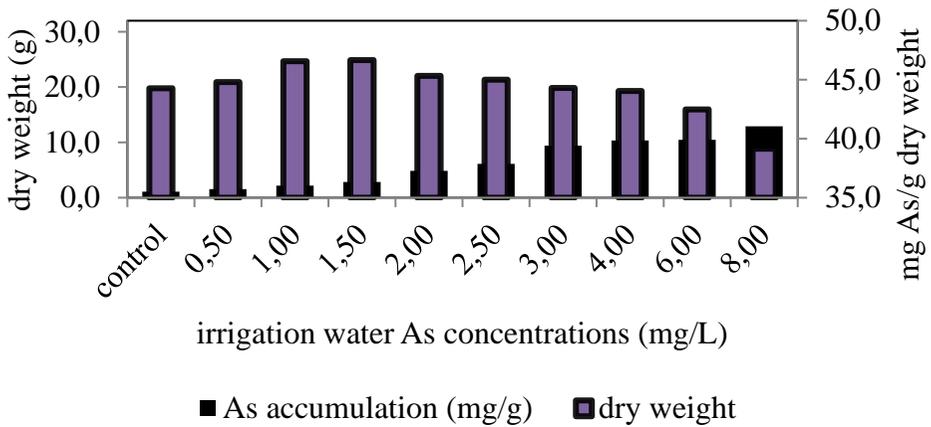
**Figure 4.** Variations of dry weight and As accumulation in the shoot of alfalfa plant at the 1<sup>st</sup> harvest.

Variation of shoots dry weight for the 2<sup>nd</sup> harvest by application of As contaminated waters is presented in Figure 6. Irrigation with As contaminated water resulted in negligible increase of shoot dry weight production than in the control plants. However, biomass production decreased about 11.7% when the concentration of 8 mg As/L was applied to the pots.

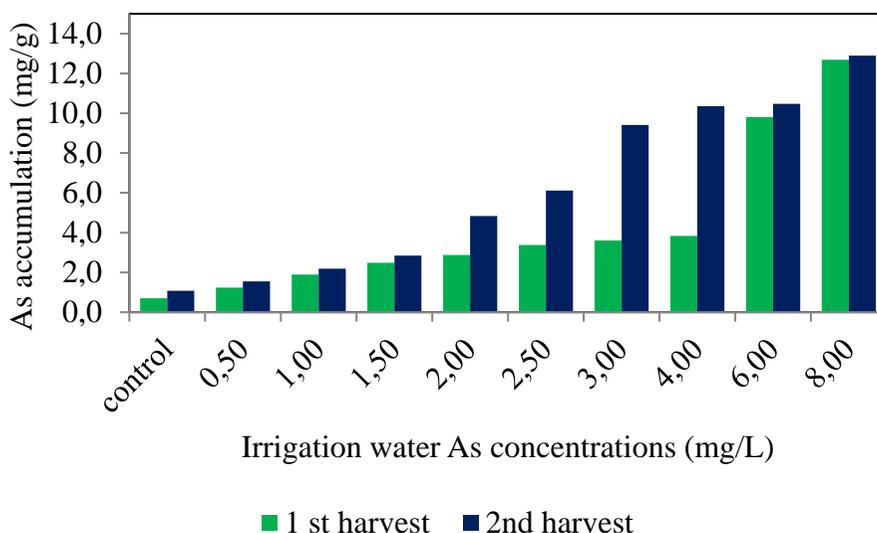
As in the irrigation water is transferred to the soil and accumulated in the root and shoots of plant. During the experimental study, maximum 153 mg As/pot was applied for the concentration of 8.0 mg/L up to the 1<sup>st</sup> harvest and total applied As amount was 208 mg/pot throughout the study. As can be seen from the Figure 7, As accumulation in the shoots of alfalfa plant increased with increasing As concentrations in the irrigation waters. As accumulation in the shoots at the 2<sup>nd</sup> harvest samples were higher than the 1<sup>st</sup> samples. However, As accumulation differences between the 1<sup>st</sup> and 2<sup>nd</sup> samples decreased when the As concentrations in the irrigation water was higher than 4 mg/L.



**Figure 5.** Variations of alfalfa grown at 2<sup>nd</sup> harvest.



**Figure 6.** Variations of dry weight and As accumulation in the shoot of alfalfa plant 2<sup>nd</sup> harvest.



**Figure 7.** Comparison of 1<sup>st</sup> and 2<sup>nd</sup> harvested for the As accumulation in the shoots.

## Conclusion

As is widely distributed in the environment and it is considered as a toxic metalloid at elevated concentrations. Human and livestock are being exposed to As via As-contaminated drinking water and consumption of food grown in As-contaminated soil or irrigated with As-contaminated water. As is not considered as an essential plant nutrient. However, it was observed that the dry weight of alfalfa increased when the plant was irrigated with As contaminated waters. Similar observations were reported for different plants. As accumulation in the shoots of alfalfa plant increased with increase of As concentration in the irrigation waters. Experimental study is still carried out and roots analysis is not completed yet.

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## **Impact of Excess Body Weight on Health-Related Quality of Life Among Adults in Lebanon**

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### **Abstract**

The objective of this study is to evaluate the impact of excess body weight on Health-Related Quality of Life (HRQoL). A convenience sample of 320 adults was recruited from different health centers in Lebanon. Body mass index ( $\text{kg}/\text{m}^2$ ) was calculated based on measured weight and height. Participants were divided into three groups: normal-weight (18.5-24.9), overweight (25.0-29.9) and obese ( $\geq 30.0$ ). HRQoL was assessed using the Short-Form health survey questionnaire (SF-36). The eight scales as well as the physical (PCS-36) and mental (MCS-36) component summary measures of the SF-36 were calculated and compared statistically among the three groups. The impact of Body Mass Index (BMI) on HRQoL was also examined through linear regressions, adjusting for sociodemographics, health behaviors and presence of chronic diseases. The results show that overweight and obese men reported reduced HRQoL on all physical scales, while overweight/obese women reported impairments on only two subscales: bodily pain and general health perceptions. PCS-36 showed lower scores in the obese and overweight subjects than the reference group. With regard to mental well-being, obese men and women displayed lower scores on vitality, social functioning and mental health subscales compared to the normal-weight group. Additionally, MCS-36 showed lower scores in obese subjects. Results from linear regressions revealed significant negative correlations between BMI and both PCS-36 and MCS-36. In conclusion, overweight adults experience significantly worse physical HRQoL, while obese adults suffer from reduced physical and mental HRQoL. This highlights the

importance of development and implementation of effective prevention strategies to improve HRQoL among adults with overweight and obesity.

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**Keywords:** Excess body weight, Health related quality of life, SF-36, Body Mass Index; Adults

## **Introduction**

Over the past few decades, health perception and quality of life in patients with chronic diseases have gained increasing interest for both researchers and decision makers [1-3]. The escalating prevalence of chronic diseases and the increase in human life expectancy [4] have imposed a new approach in evaluating health. This is based on looking beyond determinants of death and morbidity to examine the impact of health status on an individual's quality of life. This approach is referred to as "health-related quality of life (HRQoL)" [5].

Although there is no universally accepted definition for the term "quality of life", there is agreement in the literature that HRQoL is a multidimensional construct that encompasses five generic health concepts: physical health, mental health, social functioning, role functioning, and general health perceptions [6]. Subjective measures of HRQoL have been widely used as indicators of health status in population surveys [7], and in routine clinical practice [8-10]. These measures are now recognized as important components of public health surveillance [11] and as valid outcomes in clinical trials [11, 12]. As a result, HRQoL is considered an important tool in the assessment of the impact of diseases on patients as perceived by the patients themselves.

In the context of chronic diseases, obesity is considered a complex prevalent condition emerging as one of the major factors in increasing morbidity and mortality, [13] as well as decreasing life expectancy [14] and as such has dramatic influence on the overall HRQoL [15, 16]. Indeed, previous studies provide evidence to support a strong relationship between excess body weight and poor physical HRQoL [17-20]. With regard to mental HRQoL, findings were inconsistent. Whilst some studies have reported that obesity is associated with significantly impaired mental HRQoL [16, 18], others have found insignificant or no differences on psychological functioning in obese individuals when compared to their normal weight counterparts [17, 19, 21, 22]. As these findings of the impact of excess weight on HRQoL are limited to studies from western populations and given the increasingly alarming rates of overweightness and obesity among adults in the Middle East [23], it is worth investigating the relationship between these two constructs in these populations. Better knowledge on this issue can help professionals in developing and

implementing effective health care management plan for adults suffering from excess body weight.

Giving this background, the aim of the present study is to evaluate the impact of excess body weight on HRQoL among adults in Lebanon. It is hypothesized that Lebanese adults with excess body weight have lower scores on HRQoL domains as compared to their normal weight counterparts.

## **Materials and Methods**

### **Study design and participants**

This is a cross-sectional descriptive study targeting Lebanese adults (age  $\geq 18$  years). Participants were recruited through convenience sampling from different health centers. Lebanese adults of both genders aged 18 years and above were included. Exclusion criteria were as follows: pregnant or lactating women, individuals undergoing current weight loss treatment or those who had accomplished a significant weight loss during the last six months.

The study was designed to detect a difference in the mean scores of the SF-36 domains and its summary components across BMI categories (normal-weight, overweight and obese subjects). Sample size was computed on the basis of results obtained from previous study [20] with an assumed two-sided significance of 5% and a power of 80%. This produced a total minimal sample size of 192 participants (64 subjects in each group). Sample size calculations were performed using G-Power version 3.1.9.2 Kiel, Germany.

### **Study procedures**

Due to the observational nature of the study, the Institutional Review Board (IRB) of our university waived the need for an official approval, however, researchers and field workers conducted the study according to the research ethics guidelines laid down in the Declaration of Helsinki [24].

Participants were informed of the purpose of the study upon recruitment. Prior to their participation in this study, all individuals gave their written informed consent. Privacy and confidentiality were respected.

Data was collected using a self-administered questionnaire including information about socio-demographic characteristics (age, gender, marital status, family income per month, and levels of education), health behaviors (current smoking status and physical activity), presence of chronic diseases (including the presence of hypertension, diabetes Mellitus, coronary heart disease, cancer, and mental illness), quality of life and anthropometric measures.

## **Study Measurements**

### **Health-Related Quality of Life (HRQoL)**

HRQoL was assessed using the Short Form 36-item Health Survey (SF-36) [25]. An Arabic version of the Short Form 36-item Health Survey (SF-36) which was validated and culturally adapted for the Lebanese population was used in our study [26].

SF-36 is a valid and reliable generic measure that consists of 36 items measuring eight health domains: physical functioning (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE) and mental health (MH). For each domain, item scores are coded, summed, and transformed to a scale from 0 to 100 with higher scores indicating better functioning or better health status. The eight dimensions of SF-36 are grouped into two summary measures: the “Physical Component Summary (PCS-36)” which includes mainly the scales related to physical health (PF, RP, BP, and GH) and the “Mental Component Summary (MCS-36)” which encompasses mainly the scales related to mental well-being (VT, SF, RE and MH). PCS-36 and MCS-36 are scored using US norm-based methods where the mean is set to 50 and the standard deviation (SD) to 10 [27]. A between-groups difference in score of 5 points on any one subscale is generally considered as clinically significant [28].

### **Anthropometric measures**

Weight and height were measured by interviewers using a calibrated balance and a stadiometer (without shoes). BMI was calculated as weight in kilograms divided by height in metres squared. Consistent with the definitions set forth by the World Health Organization (WHO), students were grouped into three categories: ‘normal-weight’ (BMI 18.5–24.9 kg/m<sup>2</sup>) as a reference group, ‘overweight’ (BMI 25.0–29.9 kg/m<sup>2</sup>) and ‘obese’ (BMI  $\geq$ 30 kg/m<sup>2</sup>) [29].

### **Statistical Analysis**

Data were entered and analyzed using the statistical software SPSS (Statistical Package for Social Sciences), version 22.0. Descriptive statistics were reported using means and standard deviations (SD) for continuous variables and frequency with percentages for categorical variables. As the HRQoL may differ between males and females, all the analyses were stratified by gender. Baseline characteristics were compared using chi-squared test or Fischer Exact (when expected values were less than 5) for categorical variables and student *t*-test for continuous variables. Mean scores of the SF-36 domains and its component summary measures (PCS-36 and MCS-36) were compared among the three categories of BMI (normal-weight, overweight and obesity) by the analysis of variance (ANOVA) test

or the Kruskal–Wallis test, as appropriate. Bonferroni correction or Mann-Whitney U test on post hoc analysis was used for pairwise comparison. Pearson or Spearman correlation coefficients were used to assess simple correlations between the SF-36 subscales and summary component measures and BMI. To further investigate the relationship between HRQoL and BMI, multiple linear regression analyses adjusted for age, marital status, level of education, smoking status, physical activity and presence of chronic diseases were performed with PCS-36 and MCS-36 as dependent variables. All statistical tests were two-sided, and the significant level was set at 0.05.

## Results

Table 1 displays the baseline characteristics of the entire study sample and according to gender. Our sample consisted of 320 adults of which 61% were females. The mean age of the total sample was 27.7 years (ranging from 18 to 50 years). More than half (57.5%) of our population consisted of single adults, the majority (85.6%) had university or higher level of education, 9.3% of the participants were smokers and 7.3% suffered from chronic diseases.

The sample was either normal-weight (32.1%), overweight (37.2%) or obese (30.8%) by design. Age, marital status, family income per month and presence of chronic diseases did not show any statistical significant differences between males and females. However, male participants were less educated, more engaged in physical activity, more likely to be current smokers and less likely to be overweight or obese compared to females.

In table 2, mean scores for the eight subscales and the two summary components of SF-36 across BMI categories and according to gender are displayed. As shown, overweight and obese men rated their health worse than the normal weight group on all the physical health subscales (PF, RP, BP, and GH), while overweight and obese women claimed reduced HRQoL on only two subscales (BP and GH). Concerning PCS-36, overweight/obese subjects of both genders reported significantly lower scores than the normal weight (P-value for post-hoc tests < 0.001).

Of the four domains mainly related to mental well-being, obese men and women displayed lower scores than the reference group on VT, SF and MH, while no significant difference was found for RE subscale. Concerning overweight subjects, women reported lower scores for VT and SF, while only SF subscale was affected in men. With regard to MCS-36, obese subjects showed lower scores than the normal weight group (post-hoc test, p-value 0.003 and 0.012 for men and women respectively).

A correlation analysis was then performed to evaluate the association between BMI, and SF-36 subscales and the component summary scores (Table 3). For men, a negative association was found on all subscales of the

SF-36 except for RE, while for women PF, RP and RE did not show any significant correlations with BMI (P-value >0.05). Additionally, a significant negative correlation was found between the two component summary measures (PCS-36 and MCS-36) and BMI for both males and females.

Table 4 illustrates the unadjusted and adjusted effects of BMI on both PCS-36 and MCS-36. Results from simple regressions show that scores on both measures decrease with increasing BMI. In multiple linear regression analysis, with adjustments for age, marital status, level of education, smoking status, physical activity and presence of chronic diseases, the negative association between BMI and both PCS-36 and MCS-36 remained statistically significant for both males and females.

Table1. Baseline demographic and clinical characteristics of the study population by gender

Characteristics	All participants N=320	Male n= 125 (39%)	Female n=195 (61%)	P-value
Age (Mean ±SD)	27.7±7.0	27.8±7.0	27.6±7.0	0.7
Marital status n (%)				0.8
Single	184(57.5)	71(56.8)	113(57.9)	
Married	126(39.4)	51(40.8)	75(38.5)	
Other <sup>†</sup>	10(3.1)	3(2.4)	7(3.6)	
Family income per month n (%)				0.24
<1,000,000	62(19.5)	19(15.3)	43(22.2)	
1,000,000-2,000,000	119(37.4)	50(40.3)	69(35.6)	
2,000,000-4,000,000	93(29.2)	41(33.1)	52(26.8)	
≥4,000,000	44(13.8)	14(11.3)	30(15.5)	
Education level n (%)				0.02
Secondary or less	46(14.4)	25 (20.0)	21 (10.8)	
University or higher	274(85.6)	100 (80.0)	174 (89.2)	
Cigarette smoking n (%)				<0.001*
Non Smoker	272(90.7)	92(82.1)	180(95.7)	
Current smoker	28(9.3)	20(17.9)	8(4.3)	
Physical activity				<0.001*
No	176(56.1)	51(41.8)	125(65.1)	
Yes	138(43.9)	71(58.2)	67(34.9)	
Chronic disease n (%)				0.34
No	295(92.2)	113(90.4)	182(93.3)	
Yes	25(7.8)	12(9.6)	13(6.7)	
BMI Category n (%)				0.046*
Normal weight (BMI 18.5-24.9 Kg/m <sup>2</sup> )	100(32.1)	49(39.8)	51(27.0)	
Overweight (BMI 25-29.9 Kg/m <sup>2</sup> )	116(37.2)	38(30.9)	78(41.3)	
Obese (BMI ≥ 30 Kg/m <sup>2</sup> )	96(30.8)	36(29.3)	60(31.7)	

Note: n frequency, % percentage; SD standard deviation; † divorced or widowed; BMI Body mass index; \*p-value <0.05 is considered statistically significant.

Table 2. Mean SF-36 subscales scores for categories of BMI by gender

SF-36	Male (n=125)				Female (n=195)			
	Normal-weight	Overweight	Obese	P-value*	Normal weight	Overweight	Obese	P-value*
Physical function	95.5 (9.9)	90.5(16.6)**	86.5(14.1) ***	<0.001††	90.1(12.6)	86.2(19.4)	86.1(13.3)	0.13††
Role physical	91.8 (23.6)	85.5 (25.1)*	72.3(39.0)**	0.01††	87.5(26.9)	76.9(33.9)	79.1(32.0)	0.15††
Bodily pain	89.4(14.1)	67.8(25.5)***	61.3(22.3)***	<0.001††	77.3(22.0)	56.9(24.6) ***	59.9(21.4)***	<0.001††
General health	74.1(16.0)	62.8(17.3)**	55.9(18.5)***	<0.001†	69.6(17.4)	61.3(19.1)*	57.4(19.8)**	0.001†
Vitality	66.9(13.4)	57.9(21.8)	53.5(17.6)***	0.001††	58.4(22.3)	49.7(22.7)*	47.7(19.4)*	0.021††
Social functioning	84.5(15.5)	73.3(24.8)*	69.6(20.3) ***	0.002††	75.9(22.6)	64.7(27.1)*	61.3(27.0)**	0.009††
Role emotional	87.1(29.5)	74.8(35.5)	82.0(36.5)	0.08††	75.9(38.0)	71.6(37.9)	69.7(37.8)	0.55††
Mental Health	74.5(14.6)	65.2(23.0)	64.1(17.6) **	0.019††	66.7(17.5)	60.3(22.0)	56.4(16.7)*	0.018†
Physical Component Summary (PCS-36)	57.1 (6.9)	50.6(8.3)***	46.4(10.2)***	0.002††	53.0(7.9)	47.0(9.7)***	46.9(7.9)**	<0.001†
Mental Component Summary (MCS-36)	56.8(8.1)	50.6(12.8)	50.4(9.4)***	0.003††	51.6(11.1)	47.2(12.0)	45.5(9.7)*	0.012†

Note: Results are expressed as means and Standard Deviations.

Abbreviation: SF-36, Short-Form-36 Health Survey, PCS-36: Physical Component Summary of the SF-36; MCS-36: Mental Component Summary of the SF-36; PCS and MCS are standardized with a mean of 50 and a standard deviation of 10.

All the tests are scored from 0-100 with higher scores representing better functioning or better health status.

\*Differences between BMI categories were assessed using ANOVA or Kruskal-Wallis test.

† ANOVA tests, followed by Bonferroni's adjustment as *post hoc* analysis for pairwise comparison.

††Kruskal-Wallis tests, followed by repeated Mann-Whitney tests as *post hoc* analysis for pairwise comparison.

\*P <0.05 compared with the normal-weight group (18.5 – 24.9 kg/m<sup>2</sup>).

\*\*P <0.01 compared with the normal-weight group (18.5 – 24.9 kg/m<sup>2</sup>).

\*\*\*P <0.001 compared with the normal-weight group (18.5 – 24.9 kg/m<sup>2</sup>).

Table 3 Correlations between BMI and SF-36 subscales and summary components scores

SF-36	Male (n=125)		Female (n=195)	
	BMI	P-value	BMI	P-value
Physical function (PF)	-0.45	<0.001†	-0.13	0.11†
Role physical (RP)	-0.25	0.005†	-0.09	0.23†
Bodily pain (BP)	-0.56	<0.001†	-0.28	<0.001††
General health (GH)	-0.43	<0.001†	-0.24	<0.001†
Vitality (VT)	-0.38	<0.001†	-0.20	0.005†
Social functioning (SF)	-0.35	<0.001†	-0.17	0.016††
Role emotional (RE)	-0.07	0.41	-0.11	0.12†
Mental health (MH)	-0.25	0.006†	-0.20	0.005†
Physical Component Summary (PCS-36)	-0.56	<0.001†	-0.20	0.005††
Mental Component Summary (MCS-36)	-0.32	<0.001†	-0.17	0.02††

Note: Results are expressed as correlation coefficients.

Abbreviation: SF-36, Short-Form-36 Health Survey, n frequency

† Spearman test, †† Pearson test, P-value <0.05 is considered significant.

Table 4 Linear regression analyses of the association between BMI and the SF-36 component summary measures (PCS-36 and MCS-36)

	PCS-36			MCS-36		
	Unstandardized Beta	Standardized Beta	P- value*	Unstandardized Beta	Standardized Beta	P- value*
<b>Male (n=125)</b>						
<b>Model 1</b>						
BMI	-0.88	-0.50	<0.001	-0.66	-0.34	<0.001
<b>Model 2</b>						
BMI	-0.76	-0.43	<0.001	-0.39	-0.20	0.038
<b>Female (n=195)</b>						
<b>Model 1</b>						
BMI	-0.35	-0.20	0.005	-0.36	-0.17	0.022
<b>Model 2</b>						
BMI	-0.39	-0.22	0.002	-0.35	-0.16	0.03

Abbreviations: BMI Body Mass Index, SF-36 Short-Form-36 Health Survey, n frequency, PCS-36 Physical Component Summary of the Short-Form-36 Health Survey, MCS-36 Mental Component Summary of the Short-Form-36 Health Survey .

\*p-value <0.05 is considered statistically significant.

Model 1: no adjustment

Model 2: adjusted for socio-demographic variables (that is age, marital status (coded as single or other), level of education (coded as secondary or less/University or higher), health behaviors (that is smoking status (coded as no/yes), and physical activity (coded as no/yes)), and presence of chronic diseases (coded as no/yes), which included the presence of hypertension, diabetes Mellitus, coronary heart disease, cancer, and mental illness.

## Discussion

The aim of the present study is to evaluate the effect of excess body weight on HRQoL in a sample of Lebanese adults. Our findings highlighted the effect of overweightness and obesity on the physical as well as the mental aspect of HRQoL by gender. We found that overweight and obese adults of both gender experience significantly worse physical HRQoL, while only obese men and women claimed reduced mental HRQoL as compared to the normal weight group. Our results also showed that excess weight, as measured by BMI, was inversely correlated with both the SF-36 physical and mental health summary measures scores.

The results of our study support the existing literature by showing the considerably impairment of the physical HRQoL in overweight and obese adults [17-20]. When looking at the physically oriented domains, we found that overweight and obese men reported reduced HRQoL on all the scales (PF, RP, BP and GH), while overweight/obese women reported statistically significant impairments on only two scales namely BP and GH. Compared to normal weight, the PF and RP score deviations in overweight/obese women approached or exceeded what is considered meaningful change from the clinical perspective ( $\geq 5$  points) but these deviations did not reach statistical significance. The aggregate summary measure (PCS-36) revealed a clear poor physical HRQoL in both genders for overweight and obese adults. In fact, the majority of the studies that measured HRQoL using SF-36 found that being overweight or obese resulted in a statistically significant reduction in physical HRQoL summary measure component (PCS-36); this has been observed in representative samples of adults from both the United States [16] and the United Kingdom [30]. As would be expected, the high prevalence of comorbidities associated with bodily pain and the limited physical activities in the adult with excessive body weight could partly explain the impairment in the physical aspect of quality of life in this population.

Our analyses show that the results of the mental aspect of HRQoL differ strongly between overweight and obesity. Among overweight subjects, women reported lower scores for VT and SF domains, while only SF subscale was affected in men. Negative effects were found in the mentally oriented domains (VT, SF and MH) among obese participants. The aggregate summary measure (MCS-36) revealed impairment in the mental health aspect of obese men and women, whereas no differences in mental health HRQoL were found in overweight compared to normal weight. In fact, several potential biological and psychological mechanisms influencing the course of the association between obesity and mental health have been addressed in the published literature [31, 32]. Obesity may be linked to poor psychological health through biological pathways by the activation of

systemic inflammation [33] and the dysregulation of the hypothalamic–pituitary–adrenal (HPA) axis [34].

In our sample, an inverse relationship between BMI and both PCS-36 and MCS-36 was found suggesting that increased BMI has a significant negative impact on physical as well as the mental aspects of HRQoL. Of note, along with previous report [35], we found that increased BMI was most prominently correlated with bodily pain particularly among males; this relationship should receive more attention in clinical care.

Our regression analysis provided further evidence for the negative relationship between excess body weight, as measured by BMI, and both PCS-36 and MCS-36 even after adjusting for potential confounders. Indeed, a substantial number of studies have examined the relationship between BMI and HRQoL using SF-36. A consistent finding across these studies has been the negative impact of BMI on the physical functioning and mental health summary components of the SF-36 [19, 36].

Strengths of the study include the use of a well-validated psychometric scale to screen for HRQoL (SF-36), the weight and height measurements of the participants, the consistency of the findings with other studies and the adjustment for several important covariates. However, the results of this study need to be considered in light of several methodological limitations. The relatively small sample size and the risk of selection bias due to the lack of randomization might have restricted the capacity to generalize our findings among the adult population. The study was also limited by its cross-sectional study design because causality or temporal relationship cannot be ascertained. For example, though it is possible that excess weight may affect HRQoL, it is also possible that impaired HRQoL may lead to gain excess weight. Longitudinal population studies would be extremely valuable to assess causal pathways between obesity and HRQoL and differences of certain sub-groups within the general population.

In conclusion, Lebanese adults with excessive body weight experience poor physical and mental health related to the quality of life. This highlights the importance of HRQoL assessment in the adult population with excess body weight. Strategies should be directed toward the development and implementation of effective prevention strategies and social support to improve HRQoL of overweight and obese adults.

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## **Traditions of the Russian Popular Science Journalism in the Socio-Cultural Context**

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### **Abstract**

The article is devoted to the historically established dominants of the science mediatization in Russia. As the main channel of the popular knowledge, the popular science press was segregated. The historical experience of the popular science journalism development shows it's steadily focused on the commonwealth of the sciences, and audience worldview formation.

From the modern terminology point of view, the very model of the Russian popular science press should be determined as a trans-media, or hybrid media, with an organic combination of the educational, enlightenment and entertainment functions.

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**Keywords:** Science communication, popular science journalism, Russian science and culture

### **Introduction**

At present, the issues of the science mediatization seem to be among the most urgent. Science is capable of successfully developing exclusively in a global context. The globalization of scientific knowledge contributes to awareness not only common threats, but also the desire to bring science closer to the interests of society. But along with the global trend "science with and for society" a stable negative phenomenon, such as rejection of science, or resistance to science, clearly manifested itself.

Knowledge at all times is a value. The problem of science popularization exists as much as the science itself. Historically, considerable experience of the science mediatization has been accumulated. Russia is such a country with a rich history. Traditionally science held a high position in Russian society, has been included in the public sphere. But, at the same time, it's important to take into account the differences between Russian and the Western traditions and mindset.

Among universal traditional forms of the science mediatization are: scientific societies, museums, libraries, educational films and lectures, the sphere of non-formal education and enlightenment. Media are the decisive factors in the spread of science enlightenment. Science and popular press is an intellectual resource, which should satisfy the need for knowledge about the world. On this way the popular science magazine is crucial. It's appropriate to recall that the magazine as a type of edition originated precisely as a popular science magazine (such as "Journal des Scavans", which began to publish in 1665 in Paris). This communicative channel is extremely significant for the performance of science, if the agenda is the dissemination of knowledge about reality, the struggle against pseudoscience. Popular science magazine in Russia should focus on the integration of sciences, synthesis of science and human knowledge. This is the key difference from its Western analogues, showing greater specialization.

To date, there are certain signs of the Russian popular science journalism revival. It is obvious that the popular science press should rely not only on Western analogues, but also the rich domestic tradition of science popularization.

However, there are no fundamental studies on the history of science mediatization, and not only in the Russian, but also in the English-speaking scientific community.

## I.

### Research question

What are the national features of the science mediatization in Russia? What are the main channels and their significance for science communication in the global world?

### Methodology

As is known, science originated in natural philosophical views. Up to the New Time, carrying out logical boundaries between objects and phenomena, different fields of knowledge (philosophy, mathematics, physics, poetics, and rhetoric) were perceived as a single knowledge of the world as a whole.

The search for a universal scientific methodology was also characteristic for others, later methodological schools, such as semiotics.

In the modern scientific environment, there is a constant talk about a "new evolutionary synthesis": *Many believe that the development of biology is constrained by the lack of an adequate theoretical basis, a comprehensive new theory that could make the search for new knowledge more meaningful and constructive* (Markov 2015, 18–19).

The famous science popularizer Richard Dawkins extrapolates biological processes to the cultural information dissemination (dichotomy: “gene / meme”), and defined science as the “magic of reality” (Dawkins, 2011). The noted positions, based on the concepts of convergence of knowledge, are conceptually fundamental to the present study.

As specific research methods cultural-historical and comparative historical method were used.

## **Discussion**

Model of the knowledge in the West is based on the separation of science / art. Max Weber made a distinction between universal and narrowly specialized knowledge in the definitions: “science as a vocation and profession” (Weber, 1946). In such logocentric and metaphysical country, like Russia, these dichotomies are not entirely justified. The very type of national consciousness tends to traditionalism and syncretism. In addition, Russia has not had the historical preconditions for the narrow specialization formation. One of the most significant cultural reasons was not as consistent, as compared with the Western Europe, a Russian classic hierarchy development (Kondakov and Sokolov and Hrenov 2011). However, the humanitarian component was placed in the foundation of the Russian system of science mediatization (Lazarevich 1981). So, in Russia, the understanding of science popularization is wider than in the West.

Other main feature: Russian science has never been separated from the public life. Russian classical universities, as well as the whole system of education, were based on the German model, named “Humboldt model”, never aspired to be a “state within a state” (Andreev 2009). In the aspect of interaction: science – society, biography of Dmitry Mendeleev is representative. Recognized scientist, ruler of the minds of young people studying at 1880s, Mendeleev also acted as public person. He was the author of scientific and journalistic book “To the Knowledge of Russia: Treasured Thoughts”; he was also the active member of the various societies. In 1890, he retired from the St. Petersburg Imperial University at the reason that he tried to defend the student’s rights. The story was that Mendeleev agreed to transfer to the Minister of education the student’s petition demanding university autonomy (which once again was canceled). The Minister refused to accept the petition, and in response Mendeleev did not consider the opportunity to continue serving in the Ministry of Education. He left university, despite the fact that the Council of the university turned to him with a request not to commit this act.

We could give another example. In Russia, even methodological schools, maintained themselves through the journalistic discourse. On the way of magazine controversy, Russian mythological school positioned itself

at the turn of the 1840s – 1850s. Russian formalism school laid the foundation of accurate literary criticism in the 1920s also tended to various forms of publicity. It is also significant that in Russia was formed a unique socio-cultural type, such as “intelligentsia”. The basic quality of the Russian “intelligentsia” is realization moral obligation to society. The implementation of this debt occurred to the widespread enlightenment (the organization of schools, educational societies, and so on). At the turn of the nineteenth and twentieth centuries, enlightenment initiatives targeted at various social strata became common. At that time, the main organizers of cultural and enlightenment activities were patrons, having different social status, who established worker’s enlightenment societies, people’s universities and people’s houses. Many Russian intellectuals (professors, pedagogues, lawyers, doctors, etc.) took an active part in the different enlightenment activities, thus realized the moral and ethical concept of “the intelligentsia’s duty to the people”. A somewhat different approach to enlightenment and popularization of science was established in the Soviet time (more precisely, in the second half of the twentieth century), when outstanding Soviet scientists (not just enlighteners or “intelligentsia”) participated in the work of an extensive network of various scientific societies and associations (for instance, the “Knowledge” (‘Znanie’) society).

Traditionally, Russian science was public-oriented to society. And a special role in this way still belongs to the popular science journalism (Akopov 2002).

Scientific topics have always been presented in the different types of media, and in the context of the different historical periods. In terms of the civil society development, science coverage represented an ideological niche. In some epochs, exactly in the popular science journalism social and political polemics were concentrated (under the typical Russian conditions of the current political discourse reduction); in others (as in Soviet times), this sphere was less loaded with inevitable propaganda. Traditionally, scientific and popular science media were censored much more mildly than socio-political ones. During the Soviet era, the presenter of the famous television program “The Obvious – the Unbelievable” (‘Ochevidnoe – Neveroyatnoe’) Sergey Kapitsa often allowed polemical style of the discussion. This was not typical to the dogmatic Soviet press as a whole. The Soviet press paid much attention to the scientific life, but during the periods of liberalization (“ottepel”, “perestrojka”), problems and shortcomings of science life were also discussed. Even in Soviet times, the Academy of Sciences often independently made decisions that contradicted Communist party directives.

It is usually believed that the constructive model of scientific enlightenment was typical for the Soviet era, but its essential features were formed in the pre-revolutionary time.

In the nineteenth-century Russia, popular science works were published on a regular basis first in encyclopedic and then in the classical large-volume magazines. The idea of the commonwealth of sciences was central to the whole tradition of the national popular science journalism. In the classic Russian 19<sup>th</sup> century “thick” magazines (“Contemporary”, “Fatherland Papers”), departments of politics, science and literature were mixed. The first issue of the most famous Russian popular science magazine was published in 1890. We are talking about “Science and Life”, positioned itself as a “literary, artistic, social and popular science magazine”. All subject areas were representative in terms of cognition; pre-revolutionary “Science and Life” was opened by the mixed department “Science and art”. The subsequent rise of the magazine popularity already in Soviet time, was determined by the fact that its audience was formed as Soviet intelligentsia, wanted to learn how things were going in the other areas of knowledge. In the popular science magazine science was presented as knowledge of the whole world. Approach to the understanding scientific knowledge as universal knowledge was typical to the classical Russian popular science magazines.

This trend was manifested in the early twentieth century too, despite the fact that large-volume magazines lost their leading positions. One of the best Russian pre-revolution magazines: “The Russian Wealth” (1876 – 1918) – was a literary, scientific and social magazine. At that, science was combined with criticism, for instance, in “The Scales”, a symbolist scientific and literary and critical monthly magazine, edited by famous poet-symbolist Valery Bryusov. The life-changing era of the early twentieth century featured a scientific and technological breakthrough that affected not only the global landscape, but also the daily life of people.

In the popular science press of the culturally ornate era of the early 20<sup>th</sup> century, natural sciences could be interpreted as a component of the cultural process (as in the magazine: “The World of Discoveries, a two-week popular illustrated magazine of new discoveries and inventions in all fields of engineering and natural science” (Saint Petersburg, 1912–1913). Accordingly, the enlightenment and entertainment of the audience through travelogues or adventure literature were perceived as an integral part of the voluminous near-scientific picture of the world formation.

The prototypes of the Russian popular science magazines included British illustrated magazines. Novelties of foreign science and literature were brought to the notice of educated modern readers on a regular basis. A symptomatic fact was the emergence of the “Science and Civilization News”

segment in the popular small-volume illustrated magazine titled “Vsemirnaya Illyustratsiya” (‘World Illustrated’) (1869 – 1898), which in combination with its supplements had a significant influence on the further popular science magazines development. In the early twentieth century, newspapers started featuring the scientific society chronicler (reporter) position. Mass newspapers began using scientific agenda to form newsbreaks in terms of sensationalism (the circumstances, in which a whale was caught, etc.). Mass periodicals generally gravitate towards the popular science element. For instance, “Top-Secret”, one of the first Russian tabloids that was launched during the Gorbachev “perestrojka” (restructuring), still considers itself as a popular science newspaper. This is additional evidence of the Russian general audience latent interest in science, which should be explicated. The Russian audience traditionally interested in acquiring scientific knowledge, which gives ample opportunity for popularizing science, which is insufficiently implemented at present.

From the dynamics of development point of view, popular science press is a unique segment of the Russian press. It has changed little in history. The Soviet model of popular science press was essentially borrowed from the pre-revolutionary times. In this sense the system and typological features of popular science publications late XIX – early XX centuries should be considered classical for the following stages.

After the revolution of 1917, in many spheres of public life the cultural succession continued to function paradoxically. In the culture area, modernist trends were clearly preserved until about the middle of the 1920s, which was determined by the most powerful culture potential of the century. At the same time, scientific continuity explicitly manifested itself in the Soviet Union during the longer period of time than the cultural or institutional one. The cardinal change of the scientific paradigm occurred in the Soviet period only after the World War II, and science in the USSR in the 1920s – 1930s developed under the direct influence of the breakthrough, advanced science of the turn of the XIX – XX centuries. This kind of specific continuity (which took place, despite the middle level scientific staff departure, mostly successfully settled in the West), in our opinion, is explained by the following main factors.

First, in the young Soviet state at the beginning was no own scientific policy, and, as in the case of the construction of other state institutions (for example, the censorship body), the model used in the Russian Empire was taken as a basis. Secondly, the international pathos of the Russian revolution at first helped to actualize interest in the Western culture and science. Such, in particular, was a large-scale series “World Literature”, created on the initiative of A.M. Gorky. And, finally, thirdly, in accordance with the ideological guidelines of the Soviet state, the level of mental folk

development has to be brought closer to the scientific experience, since, as we know, Marxism was interpreted as a purely scientific worldview. It should be noted that significant positive results were achieved along this path (one of the first and most important was the successful campaign to eliminate illiteracy).

The designation was accompanied by an active and original development of scientific communication. Throughout the Soviet era, popular science journalism was closely connected with Soviet science and, at the same time, represented, as we mentioned, a certain ideological niche. From the total propaganda it was protected by the entrenched and largely fair idea that prerevolutionary popular science magazines were served as a legal channel for the spread of Marxism. That is why some publishers-educators of the previous era, such as P.P. Soikin, got the opportunity for more or less unhindered activity in the USSR. Throughout the Soviet period, there was a quantitative growth of the popular science press. By the end of the existence of the USSR, at that time the most reading power in the world, every 20<sup>th</sup> published book belonged to the category of popular science.

Thus, in a short historical period, the revolutionary reorganization of society actualized paradigms change and the “projects of the future”. In the long perspective, the successes of many branches of Soviet science (not only cosmonautics, but also, at a certain stage, one of the most authoritative in the world Soviet philological school) were provided both by state support, and by the specific action of the scientific continuity mechanisms. In the USSR, science was respected, partly in the ancient, magical sense (in this sense, the fate of the Nobel Prize winner in physics Peter Kapitsa was indicative).

## **Results**

As a reference point in the history of the science promotion in Russia, the boundary of the nineteenth and twentieth century stands out. At that time, the model of the popular science journalism was formed. This model was included openness of the knowledge, and the commonwealth of sciences, as well as the audience self-education. This model has been taken by the Soviet popular science press as the basis. The Soviet system of science communication was based on the desire to raise the level of the Soviet folk to the scientific level. That is in many ways determined the USSR power.

## **Conclusion**

From the modern terminology point of view, the very model of the popular science press, formed before Russian revolution, should be determined as a trans-media, or hybrid media, with an organic combination of the education and entertainment. Probably, such a model can be considered optimal. It is produced by well-coordinated work of the most

important social institutions of society: education, enlightenment, journalism. Thus, it seems productive to form several types of the science mediatization historical models based on three main factors of influence: 1) the level of development and publicity of the science itself, 2) the general processes taking place in the press, and the degree of its social responsibility, and 3) the activities of other educational institutions of society.

The convergence of science and society requires adapting historical mechanisms to the current situation, and their implementation in practice. Identified trend towards hybridization, and convergence of sciences is fully characteristic for the modern projects in the field of popular science. Now popular science is actively developing not only in traditional, but new media, understood in the broadest sense. And this tendency is global. Popular science located on the cultural and educational portals (such as Russian “Arzamas”), in the format of intellectual battles (such as ‘Science Slam’), in various educational clusters (“Ohta Lab” in Saint Petersburg). In many ways, these projects continue the central idea, typical to the whole Russian science mediatization tradition, of the different sciences commonwealth. Implicitly following tradition, these projects also in principle retain a dominant setting not so much on promoting science itself, but the development of the audience worldview. And this is the most important feature distinguishing the process of science mediatization in Russia from the specialized Western practice.

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## Liberty in Wordsworth's Sonnets

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### Abstract

Wordsworth once declared that for an hour thought given to poetry, he had given twelve to the state of society. However true this declaration might be, it helps to remind us that some of Wordsworth's noblest verse and prose was inspired by political passion.

The most prominent fact about Wordsworth's politics is that he was a trueborn Englishman, and his roots struck deep into English soil. He was country-born and country-bred. Besides, he belonged by birth to the middle class. Thanks to this middle class, upbringing. A sense of moderation governed his course in life and kept him away from committing himself to any definite party throughout his life.

Wordsworth reached maturity without meeting anyone who claimed priority on the account of rank. It is because of this moderate temper coupled with impatience of restrictions that Wordsworth's mind seemed to be a productive soil for the revolutionary notions of Liberty, Equality and Fraternity. His interest in public affairs was motivated by the consequence of the American War as well as by the French Revolution. He had been too young, thoughtfully to consider the American War while it was going on. Therefore, when it ended, disbanded men began to return to the lakes. There he met some of these men and heard about others; and from what he saw and heard, he could conceive a horrible sense of war with all the suffering and evils it inflicts on the poor.

On the other hand, in summer 1790, Wordsworth, accompanied by his friend Jones, set off for a walking tour in France and Switzerland – a tour that had significant consequences. Wordsworth landed at Calais on July 13<sup>th</sup>, 1790 – the eve of the day on which the king was to swear fidelity to the new constitution, and over-whelm people by a great tide of joy. In November 1791, Wordsworth went off again to France where he visited Paris, Orleans, and Blois in the main. In Blois, he made friendship with Michel Beaupey, a Republican officer in a mess of Royalists. The misery Beaupey witnessed among the extremely poor peasantry converted him not only to a

Revolutionary citizen, but also to a patriot of the world. His heart was very much devoted to the cause of the common people and the poor. No other man, says Coleridge, had as great an influence upon Wordsworth as this benevolent and magnanimous patriot did.

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**Keywords:** Liberty, equality, human nature, French Revolution, politics, physical imprisonment, individual conscience, sonnets

When the poet wrote “The character of the Happy Warrior”, he had Beaupey in his mind. With his more systematic philosophy, Beaupey came to Wordsworth’s support and turned his unclear idealism into solid faith. Beaupey, a student of Jean Jacques Rousseau, showed much concern in social interests as well as in awakening Wordsworth's consciousness in as far as these interests are concerned. He presented to him the history of humankind in the form of an organism. In October 1792, Wordsworth came back to Paris not deciding whether he should join the Girondins. He says, however, that in his second stay in Paris, he was introduced to a member of the Girondins, the sentimentalists among the revolutionaries. The Girondins lived largely in a world of dangerous idealism, which was soon to bring them to utter destruction after they had fled their country to war. Wordsworth also visited the Jacobins whose going to extremes horrified and disillusioned him. He also witnessed in Paris the scene of horrible massacres but fortunately, he was recalled to England due to lack of funds.

The year he spent in France, therefore, was probably the most exciting in the period of the revolution. It was marked by the defeat of the monarchy, the declaration of the republic, and the September massacres.

While he was in London in 1793, Wordsworth got in touch with Radicals who were followers of William Godwin. Godwin was regarded as the one he might now call a philosophical anarchist. “His ideal was a loose federation of states each so tiny that everyone in it should know everyone else, since argument would be the sole instrument of government, all men being naturally free, rational, perfectible, and (in essentials) equal”, says J.C. Smith (70). Besides, he was a determinist and a believer in experience as the source of all knowledge. Justice, he asserts, is the whole duty of man, and reason is that it is the only organ by which men can discover what is just. Morality is a matter of knowledge, and “utility, as it regards percipient beings, is the only basis of moral and political truth,” says George McLean Harper (255). It is obvious that a society maintaining such views rejects most of the essentials of government. Harper believes that Godwin insists on the fact that “the government is evil, usurpation upon the private judgment and individual conscience of mankind” (256). To many practical political leaders, as well as to Rousseau and Godwin, it seemed that unique function

of government was to secure liberty of action to the individual. Wordsworth was prepared for this conviction of Godwin by his earlier acceptance of Rousseau's doctrine that every individual is by nature independent. Through Wordsworth, this idea was handed on to the American Federalists and to J.S. Mill in particular.

While falling under the spell of Godwin and his followers, Wordsworth wrote his first essay in political thought in the form of a letter to the Bishop of Liandaff. In this essay, Wordsworth defends the cause of the French Revolution and the execution of the King. Turning to Britain, he points out the evils that monarchy and aristocracy bring on. These years were in reality crucial in Wordsworth's life. He was torn between his natural love for his mother country and his newborn passion for the cause of France. He considered the rulers of his country as sinners, as they joined the enemies of the young Republic. Soon his ideal of France was distorted and shaken by the terror, and in 1798, it was completely shattered by the invasion of Switzerland. He came to the conviction that reform must start with the individual.

With the death of Robespierre in 1794, Wordsworth's hopes for France were born anew; his mind resorted to a teacher whose influence upon him had been strong, especially when he wrote his "Descriptive Sketches". This teacher was Rousseau. Rousseau wrote the most powerful work ever penned upon the supreme duty of political obligation: "The Social Contract". This work, as John Herman Randall suggests, "takes as its fundamental problem the attainment of liberty which the middle class so much desired through political government by temperament and his irresponsible life; Rousseau was not prepared to define liberty" (352), with Montesquieu and his followers as obedience to perfect law. He insisted that the actual desires of men must also be taken into consideration. Consequently, he defined "liberty as obedience to law, but to law that the individual freely accepts for himself" (352). In the state of nature, man is free; there is no law, no conditions for social welfare.

Rousseau taught Wordsworth that the corruption of the society is an outcome of man's abuse of his free will, that nature despite this corruption preserved the goodness she had been given by her Creator, and that the way to find happiness was through return to nature. Though some scholars such as Emile Legouis and Mclean Harper declare that Wordsworth was a son of Rousseau, this declaration falls short of making us believe that Rousseau's influence on Wordsworth was lasting and eternal. Wordsworth, nevertheless, preserved the "Rousseau-tic conviction of the need to 'draw out' human nature, the equality of human rights, and the common brotherhood of man", says Melvin Rader (57). Rousseau, concerning his preference of the rustic

and the innocent, as opposed to the sophisticated and the urban, might also have affected Wordsworth.

Among the number of persons who had their marked influence on Wordsworth, Samuel Taylor Coleridge may be mentioned. In 1797, and at Alfoxden in Somerset, Wordsworth's acquaintance with Coleridge ripened into a warm friendship – a friendship that left its impression on the works of the two poets. Both sympathized with the political moments of the time in favor of a large liberty for Man and against unjust and tyrannical class privileges and distinctions; both showed a common sympathy with the essential tenets that underlay the French Revolution. In brief, they, more or less, imbued each other with the Republican spirit in their political views, reflective thought, and comprehensive vision of life.

Furthermore, John Locke may still be regarded as another influence that affected, to some extent, the political thought of William Wordsworth. Locke stands as the prophet of human nature and the heir of the great Seventeenth century struggles for constitutional liberties, rights, and toleration. He was a convinced Newtonian, for he believed in the methods of scientific rationalism and in the world machine that was their outcome. To him, religion was not an activity of the human soul, but essentially a science like physics. Its value and purpose are solely to provide a divine sanction for a satisfactory human morality, an advantageous and effective motive for the achievement of good. For Locke, the purpose of government is purely secular, to enforce men's rights; it is by no means related to the saving of man's soul.

A church is only a liberal and voluntary society. In other words, Locke's purpose was to defend free action of the rich middle class against absolute monarchy. Locke's natural rights justified constitutional restrictions on government while Rousseau's popular sovereignty supported an actual revolution in what would establish the rule of the majority. Wordsworth's appeal to many of Locke's ideas is well shown in Basil Willey's comprehensive saying that "Locke's doctrine which derived all our knowledge from sensation was capable of serving Wordsworth". Rader believes Wordsworth was working in the spirit and tradition of Locke. Rader says that "Wordsworth rejected Gandy and Inane phraseology and devoted his power to the task of making verse deal boldly with substantial things!... Above all, there was required the conviction that the Inane mate cold worlds of the mechanical philosophy was not the whole reality, that there was a closer bond between the mind and nature than the old dualism could conceive ... and that truth was constituted by the whole soul of man ..." (48-49).

Another significant step in Wordsworth's political career was taken when he went to Germany in the winter of 1798 – 1799. There, his passion for France was utterly dead, and his love for England was extremely intense. However, the England that he loved was that which his eyes had seen, the dear native England of his earliest verse, and not that of history. Moreover, his visit to France in 1802 made his disillusionment with it, which comes with a full circle. The liberator had turned tyrant. Napoleonic France was the enemy and England was, despite all of its faults, the last hope of freedom. Thus, the sonnet became in Wordsworth's hands, as earlier in Milton's, a trumpet to awaken England from her deep sleep and give her strength for the struggle against the tyrant.

Wordsworth wrote about liberty in the form of the sonnet, which, owing to its definite length and rhythm, is regarded as a restrictive form. This restriction, however, coincides with the poet's intrinsic nature to be enclosed with a kind of womb that keeps him living among little farmers, farmers who have their own local government and village community. It is because of this that Wordsworth liked to spend the major part of his life in the Lake District, for it cut him off from the rest of England. Yet in the mountains of the Lake District, in particular, and in all mountains, in general, Wordsworth found a great deal of liberty. His passionate love for nature, especially that manifested in the Lake District, made him stand firmly against all that tried to spoil its purity, beauty, and liberty. Thus, he wrote poems against railways coming to the Lake District.

Wordsworth's success in expressing the theme of liberty in the sonnet form, a theme big enough to be touched on even long dissertations and theses, has much to do with his own belief that sonnets should deal with a variety of subjects. For this reason, in sonnet I of Part II of his "Miscellaneous Sonnets", Wordsworth asks critics not to scorn the sonnet. He believes that it is a key with which Shakespeare could express his personal feelings; a lute in the hands of Petrarch, a pipe in those of Tasso, a cheerful myrtle leaf in the brow of Dante, and means of consolation in the view of Camoens and Milton.

Wordsworth's desire to express the theme of liberty in the limited form of the sonnet springs from his own conviction that too much liberty makes him feel uneasy and agoraphobic. Hence, he asks people whose souls are over-loaded with liberty to find their relief and consolation in the sonnet - the narrow area where the poet in various moods can enjoy himself and lessen his grief, if there were any grief. In Sonnet I of part I of "Miscellaneous sonnets", Wordsworth says:

In Sundry woods, 't was pastime to be bound  
Within the sonnet's scanty plot of ground  
Please if some soul (for such these needs must be)

Who have felt the weight of too much liberty,  
Should find brief Solace there, as I have found.

In his sonnets, especially those “Dedicated to National Independence and liberty”, Wordsworth expresses his fears of the power of Napoleon as well as his anxiety about the threatened liberties of the people, especially the individual. These political sonnets, which he started to write in 1802, evoke the heroic spirit of a man whose hopes rested, through a period of public danger and disaster, on a firm faith in human goodwill, and on the principle of liberty for both nations and individuals. In these sonnets, Wordsworth deplors the un-natural richness and prosperity generated by the war, which weakened the force of the moral and spiritual life of the upper classes and made them blind to the great values of life. These sonnets reflect the poet's disillusionment with France.

With the change in his feeling about France, there grew a feeling of fear about political and social questions at home. The Wordsworth of 1793 had been an enthusiastic and serious minded republican, a convert to the principles of Beaupey and French political philosophers. The rise of Napoleon, coupled with the dictatorship of Robespierre, modified, but did not destroy, severe judgment of his own country. The sonnets are not republican; and after 1794, the voice of republicanism is no more heard in Wordsworth's writings. Yet he was looking for a new approach in politics. This approach happened to be Miltonic in its severity and hopefulness, patriotic individualistic and human in its field of discourse.

Sonnets I , II , X and XVI of part I of the collection of poems: "Dedicated to National Independence and liberty" are the best representative of Wordsworth's patriotic cry of freedom to fill the ears of his country-men with national consciousness, an echo of its glorified past and hope for a better future. In sonnet I, Wordsworth manifests a natural return of the mind to one's own country, the country whose white cliffs by day and lighthouses at night reminded him that she was still unconquered. Wordsworth feels a newborn pride in his country, a pride that urges him to call his country “Fair star of evening, splendor of the west.” There is no doubt that the “fair star of evening” is just the same one of the morning. Thus, it symbolizes in its dual appearance the perpetual glory of England; for if it sinks a little bit at one time, it will inevitably go up at another. The poet adds that this star is the bearer of light to the whole continent because England is the land of liberty. The sonnet ends with Wordsworth's expression of his strong attachment to England, the country that the French do not love. This expression shows that the rule that France had so long held in his heart was broken. France no longer seemed to him as the champion of liberty. England, in comparison, was a land of freedom. Consequently, he founded his affections upon his own country.

For my dear country, many heart-felt sighs,  
Among men who do not love her, linger here.

[Sonnet I, lines

13-14]

Sonnet III, “composed Near Calais, on the Road leading to Ardves,” contrasts the high hopes, the songs, the garlands mirth, banners, and happy faces of the time “when faith was pledged to new born liberty” with the disheartened state of the French. Wordsworth clearly declares that he himself has not surrendered. In despair, he sings:

Touches me not, though pensive as a bird  
Whose vernal coverts winter hath laid bare.

[Lines 13 – 14]

The theme of his poem is that the hope or faith for national liberty has been destroyed. This destruction has much to do with the reign of Terror at the hands of Robespierre.

Sonnet X, “composed in the valley near Dover, on the day of landing, Aug.30, 1802,” is full of patriotic feelings. Seeing some of the boys in his country engaged in a Cricket-Match, and reflecting upon the waves that break “on the chalky shore”, Wordsworth feels extremely happy. This great happiness satisfies him a great deal, for never before has he felt such happiness while looking “round with joy in Kent’s green vales”. The freshness of the scene Wordsworth appreciates and experiences most joyfully is better understood in the light of the following lines of the sestet:

Europe is yet in bonds; but let that pass,  
Thought for another moment, thou art free,  
My country! And ‘t is joy enough and pride  
For one hour’s perfect bliss, to thread the grass  
Of England once again...

[Lines 9 – 13]

Thus, the scene the poet sees and the sound of waves he hears evoke in his vision of the image of a captivated continent as opposed to that of a free country, namely England.

Wordsworth breathes a stronger faith and hope in sonnet XVI, beginning with “It is not to be thought of that the flood”. Wordsworth declares that it is unthinkable that British liberty should perish in “bogs and sands”. In the sestet of the poem, he enthusiastically affirms that the British people, who speaks the language of Shakespeare and hold the faith and morals of Milton, should choose between freedom and death.

We must be free or die, who speak the tongue.  
That Shakespeare spoke; the faith and morals hold  
Which Milton held.

[Lines 11 – 13]

This change in mood on the part of the poet as regards his support of the British cause is subject to the sensitive soul of Wordsworth, the soul that is full of a strong love for liberty. In other words, Wordsworth means to say that from the very earliest times of English history, there has been a very great river of freedom in England. Yet as soon as this river transcends its ordinary boundaries, it becomes dangerous and ineffective. Wordsworth, however, prefers evil liberty to no liberty at all.

The sestet of the sonnet is a clear example of jingoism – an extreme chauvinism or nationalism. Wordsworth says that the English must live up to their ancestors, to their great heritage and ideals. This is because they are the best people in the world, and they have the finest blood.

..... In everything we are sprung  
Of Earth's first blood, have titles manifold

[Lines 13 – 14]

Sonnets XI and XII that open with “Inland, within a hollow vale, I stood” and “Two voices are there” may be classified among the group of sonnets described as universally human, in one sense, and nationally patriotic in another. In the former, while sitting upon the Dover cliffs and looking upon France with tender thoughts and sad feelings, the poet and his sister could see the shores as if they were an English lake or a bright river. Having described the sea with its calm water, clear air and power, Wordsworth concludes that though winds blow and waters roll and power exists, one edict remains to give laws to them: it is that by means of the soul only, all nations can be free and noble.

..... Winds blow, and waters roll,  
Strength to the brave, and power, and Deity;  
Yet in themselves are nothing! One decree  
Spake laws to them, and said that by the soul  
Only, the Nations shall be great and free.

[Lines 10 - 14]

Thus, the tone of a new type of freedom is heard in this sonnet, namely spiritual freedom. This type, however, will be better shown in other sonnets, especially those related to the last period of Wordsworth's life.

In sonnet XII, entitled “Though of a Briton on the subjugation of Switzerland”, Wordsworth shows that liberty has two voices: one of the sea and another of the mountain. Liberty has rejoiced in both of these voices through the ages. Napoleon, who by 1802 has conquered practically the whole continent, continued to be a source of trouble to Wordsworth. In this sonnet, Wordsworth draws the attention to the great country of mountains, namely Switzerland, and he seems to be hinting at the barren efforts of the Swiss in their struggle against the invader. Though liberty has been deprived of the powerful voice of the mountain, she is invited by the poet to stick to

the remaining powerful voice of the sea, the voice that is evocative of the great country of the sea-Britain. Thus, the image of liberty represented in the sonnet is based upon a kind of dichotomy, for the image of the sea and that of the mountain symbolize two different kinds of liberty.

As regards the individual type of liberty dealt within the collection of sonnets devoted to national independence and liberty, Wordsworth's Sonnets IV, V, VI, VII, VIII, and XIII was the first to engage our attention in this respect. Sonnet IV, which is a self-questioning sonnet, revolves round the axis of power and wisdom of a good governor. In it, Wordsworth suggests that Napoleon is a kind of mystery; he could not understand him. He asks what kind of good Napoleon did possess. Was he from childhood filled with ambition for power? What knowledge and culture could he gain? Then Wordsworth says that it is not in the battle that a wise governor is trained; a true governor must have not only masculine temper, but also feminine feelings and thoughts. In other words, the poet throughout this sonnet seems to be emphasizing the point that true wisdom is not divorced from affection or family life with its simple human passions and emotion.

Besides, a good ruler must also resort to books, leisure, and not limit his experience to the soldier's barracks.

On the occasion of Napoleon's birthday on August 15<sup>th</sup>, Wordsworth composed sonnet V that begins with "Festivals have I seen that were not names". In this sonnet, a comparison was drawn between the poet's absence of sympathy and his indifference to the occasion, on the one hand, with the noble, though senseless, joy he had witnessed in a prouder time, on the other hand.

My youth here witnessed, in a prouder time;  
The senselessness of joy was then sublime!  
Happy is he, who caring not for Pope,  
Consul, or King, can sound himself to know  
The destiny of man, and live in Hope'

[Lines 10 - 14]

In sonnets VI, VII, and VIII, Wordsworth's revolt against Napoleon's tyranny reaches a higher stage. In sonnet VI, entitled "On the Extinction of the Venetian Republic", Liberty is related to its "eldest child", namely Venice. Yet, through the individual character of this great city, human feelings and various connotations of liberty may be perceived. After telling us something about the glorious history of Venice such as its independence of the greatness of sea power and its being "the safe guard of the west", the poet concludes that he and his countrymen must have sympathetic hearts and human feelings toward Venice, the city which was for long a city state and not a mere city. In sonnet VII, "The King of Sweden" is addressed and glorified. "The crowned youth" is King Gustavus IV who had tremendous

hatred for Napoleon and great respect and support for England. Similarly, in sonnet VIII, an individual figure is the sphere of all talk - Toussaint L’ouverture, the governor of St. Domingo and head of the African slaves enfranchised by the edict of the French convention (1794). Here, Wordsworth hints at the story of his leader who, as result of his opposition to Napoleon’s decree concerning the reestablishment of slavery in St. Domingo, was arrested and sent to Paris in 1802. At the beginning of the sonnet, the poet suggests that the ploughman who tends his plough within the hearing of L’ouverture while in prison makes him feel the bitterness of his captivity. The theme of this sonnet, however, is related to the freedom of slaves to mystical participation between human liberty magnified in the image of an individual, and the liberty of elements such as air, wind, and earth.

Having thus considered sonnets VI, VII and VIII through the double perspective of individual and human liberty simultaneously, we may however bring into play some sonnets that are confined in their spirit to the former type of liberty. At the top come sonnets XIII and XIV. Wordsworth’s fear of the power of Napoleon and his anxiety about the threatened liberties of people reaches its climax when he sees that social conditions in England are deteriorating. In sonnet XIII that opens with “O Friend! I know not which way I must look”, Wordsworth shows how the accumulation of wealth has become the sole measure of superiority. He also shows how individual liberty has been enslaved by a commercializing and materializing tendency. People no more find any magnificence or delight in nature or books; they have become worshippers of greediness, plunder, and expense. Simplicity in living has been replaced by complexity, and noble thought by a mean one. In brief, the fortune of England is lamented, and a feeling of sorrow is prevalent on the part of the poet, for the march of wealth, which generates mischief, and is the characteristic note of the sonnet.

In sonnet XIV, entitled “London, 1802”, the famous one on Milton, Wordsworth is also seen in a desperate mood, desperate over the things at home. In 1802, he was discouraged by the “vanity and parade” of England as contrasted with the desolation caused by the French Revolution in France. He saw a vision of what seemed to him a worthier England, whose heroes were the leaders of the puritan revolution and their Whig successors. Far above all the revolutionaries towered the figure of John Milton.

Thy soul was like a star, and dwelt a part  
[Line 1]

Compared with that heroic part of simple living and noble thinking, England has now become a bag of stagnant waters. This is because its people have been selfish. Wordsworth is calling on Milton to come back to earth. For in him, the poet sees a Christ like figure, a savior from the stagnant state

in which England has been shrouded. The soul of Milton was pure, and his voice Majestic and free. So, Wordsworth wants Milton to come back to England to teach her people how to be virtuous, free of complexities of living, and be spiritually happy.

In sonnet XXXIII of part I of Miscellaneous sonnets titled “The world is too much with us,” the same wish for a spiritual power, to come and redeem England from the evils of materialism, is also expressed. In this sonnet, Wordsworth shows the inability of people to respond to nature, the inability that has been an outcome of man’s loss of spiritual freedom. People no more feel any intimacy with nature amidst the business and activity of the modern world; they have lost their connection and sympathy with nature because all of their efforts have been dedicated to materialism. The sea and the winds are like sleeping flowers, and people are in need of faith in a spiritual power to give nature its proper status. Wordsworth wish for worshipping any god is well-shown in the sestet, where he suggests that it’s better to believe in gods that are unreal than not to believe in the true God at all. Thus, he prefers standing on an open grassy area, seeing the mythological Greek sea gods, Proteus and Triton, than remaining away from nature and belonging to no creed at all.

Taking into consideration the second part of Wordsworth’s poems “Dedicated to National Independence and Liberty”, we noticed that they fall into three main categories: spiritual, patriotic, and individualistic. As far as the first category is concerned, sonnets V and VII may be regarded as a good case in point. In sonnet V that starts with “Clouds, lingering yet, extend in solid bars” that was composed in 1807 by the side of Grasmere Lake, Wordsworth touches on the theme of spiritual liberty by seeking a kind of spiritual holiday for himself. The time is evening and the atmosphere is full of tranquility, tranquility that is associated with the calm water of Grasmere Lake. In this atmosphere, the stars are seen at happy distance and free from incessant wars, for they are away from the foolishness of the earth. Wordsworth is dedicating himself totally to the freedom of the stars, and the whole sonnet seems to echo the note prevalent in the poet’s sonnet “The World is too much with us”.

In the latter sonnet, Wordsworth calls for the Greek mythological gods of changeability, Proteus and Triton, to provide his spirit with some spiritual relief and insight. In the former sonnet, he listens to the whispering of Pan, the Greek god of forests, pastures, flocks, and shepherds. Wordsworth seems to be eager to go back to live in the Classical Age, the age that had no machinery and sophistication. He wants to retire a little bit, forgetting all about independence, liberty, enslavement of nations, and the troubles of the whole world at large. Thus, sonnet V is considered a piece of

escapist literature through which the poet tries to seek a kind of spiritual holiday for himself.

Sonnet VII was written in 1808 after Napoleon's victory in Germany, the Low Countries and Italy, the victory that had been achieved against governments. His plans in the Iberian Peninsula were firmly opposed by the Spanish and Portuguese people. Hence, Napoleon was now clearly depicted as the enemy of liberty. England sent an army under Sir Arthur Wellesley, later the Duke of Wellington who in August 1808 defeated the French under Junot at Vimiero. After this Battle, the convention of Cintra was signed.

According to this convention, the French, though defeated, were allowed to come back to France with their arms and booty. These favorable conditions, granted to the French Army, aroused great fury and indignation in England. The sonnet (sonnet VII), therefore, considers the fate of Spain in the light of Napoleon's ambitions. Wordsworth weighs "The hopes and fears of suffering Spain" not in the middle of a slavish, selfish, human world, but in the sublime school of Nature. The sonnet is but antithesis between the world on the one hand, and Nature on the other hand. Wordsworth suggests that whatever defeat of liberty may be in the world, the world that he despises, he can nevertheless triumph. This he can do through exploring ways in the human heart, in nature, and away from the troubles of the world, the world that spoils the purity of a freeborn soul.

Not' mid the World's vain objects that enslave  
The free born-soul.....  
.....

Here, mighty Nature! In this school sublime  
I weigh the hopes and fears of suffering Spain;  
.....

And through the human heart explore my way;  
And look and listen. Gathering, whence I may,  
Triumph, and thoughts no bondage can restrain!

Wordsworth's sonnets on national independence and liberty, especially those composed in 1809, are but a reflection of his beliefs in his Cintra pamphlet. The pamphlet on the convention of Cintra was inspired by two passions: hatred for foreign tyranny and love for national independence and freedom. It stands for the second uprising Wordsworth's heart had against the action of his own country. The first had been in 1793, when his country went to war with the French Republic. Throughout the Cintra pamphlet, Wordsworth seems to be an honest defender of patriotism and humanity. The Spanish war in the eyes of Wordsworth was not only a

political and national war, but also one that involved the destiny of all nations or rather of humanity itself.

In addition to its being an invocation to the nations of Europe and particularly a celebration of Spanish patriotism, the Cintra pamphlet is a lament for England. The voice of lamentation heard in this pamphlet is the same one heard in Wordsworth's sonnet on Milton. In the pamphlet, Wordsworth says:

“O sorrow! O misery for England, the land of liberty and  
courage and peace;  
the land trustworthy and long approved; the home of lofty  
example and benign precept....  
O sorrow and shame for our country;  
for the grass which is upon her fields, and the dust which is in  
her graves; - for her good men who now look upon the day,  
and her long train of deliverers and defenders, her Alfred, her  
Sidney, and her Milton;  
whose voice yet speaketh for our reproach; and whose actions  
survive in memory to confound us, or to redeem!”

In 1809, Wordsworth wrote fourteen sonnets from IX – XXII, which belongs to the class “Dedicated to National Independence and liberty”. They show how intensely interested he was in the political conditions of the time, and how restlessly his heart and mind were related to the freedom of those who were the scapegoats of Napoleon's campaign of subjugation. Six of these sonnets are a celebration of the Tyrolese resistance against the French. The first of them is dedicated to Hofer, the main leader of the Tyrolese, and commemorates the leadership of the “Godlike warrior,” and the courage of his fearless men. The second, starting “Advance-come forth from thy Tyrolem ground,” is a lively address to liberty to move forward through the long chain of the Alps. The third, “Feeling of the Tyrolese,” makes the most of the firm belief of these courageous people that is their duty, “with weapons grasped in fearless hands,” to emphasize their noble character and “to vindicate mankind”. The fourth, starting “Alas! What boots the long laborious quest,” questions the advantage of knowledge “to elevate the will,” and make the passion subject to reason, in view of the fact that wise Germany, despite all her great schools of learning, must lie depressed under the barbarian and savage the sword of Napoleon. In contrasting her action with that of the Tyrolese, he says:

A few strong instincts and a few plain rules  
Among the herds men of the Alps, have wrought  
More for mankind at this unhappy day  
Than all the pride of intellect and thought

[Sonnet XII, Lines 11 – 14]

The fifth sonnet, “On the final submission of the Tyrolese,” is a fine tribute to the moral end that instilled life in those bold shepherds in their struggle against the invader. In the Sixth sonnet, “The martial courage of a day is vain,” the poet reproves Austria for her action in giving up the Tyrol to France.

The remaining sonnets, belonging to the year 1809, all treat the political issues of the time. Most of them glorify heroes who would not surrender to Napoleon; heroes such as Palafox and his group who are the great defenders of Saragossa; Schill, the bold Prussian who tried his utmost best to liberate Germany from the threatening danger of the French; and Gustavo’s IV, The Swede, who “never did to Fortune bend the knee.” The latter noble behavior in this respect is contrasted with Napoleon’s in another sonnet, beginning with “Look now on that adventurer who hath paid.” The last of these sonnets, beginning “Is there a power that can sustain and cheer”, is concerned with the theme of individual liberty as viewed in isolation of relationships. This sonnet probably refers to a political active leader, Palafox, who has famed for his stubborn defense of Saragossa. He was taken prisoner and sent to Vicennes where he was imprisoned for about five years; yet this sonnet deplors his imprisonment. It is a sonnet of relationships. Palafox cannot have liberty without relationships – relationships with his friends, acquaintances, and country issues and activities. Solitary confinement is viewed as the worst kind of imprisonment; it may lead people to madness. Palafox prefers being at the stage in keeping away from it, where he can do nothing. In other words, Wordsworth means to say that one of the worst features of deprivation of liberty is when man is cut off from his natural function.

In the light of this study of Wordsworth’s sonnets composed in 1809, one may perceive the gradual change in Wordsworth’s attitude towards life and humanity at large. It was mainly through the French Revolution that he became especially interested in Man. Thus, the revolution was not only a local movement, it had meaning also for humanity. It was a movement in the interest of a greater liberty for the race, which would prove a tremendous advantage to human progress. It carried with it larger rights for the masses, and less authority for the classes. The essential rights of man were to be gained and maintained.

Wordsworth was born along by his enthusiasm and hopes yet he was steeped in republicanism, “despite his natural conservatism and the form of government under which he was born and reared” (56), claims E Hershey Sneath. However, Sneath adds that after the collapse of his ideals that relate to the cause of the Revolution, and after the state of stagnation that he witnessed in his own country, Wordsworth came to the conclusion that “morality is the fact of supreme worth for human nature; it, above all things,

unifies, dignifies, and exalts the human soul” (61). On the contrary, the early Wordsworth was more sensational, less rational, and moralistic. Bernard Blackstone describes the Wordsworth's responds without judgment, "with a choice less awareness; 'he feels, and nothing else'; he dwells in depths among the existential roots of things" (201). At this period, Wordsworth would have agreed with Blake, as Blackstone explains, "the notion that man has a body distinct from his soul (or soul distinct from his body) is to be expunged; many passages in the pre- 1809 verse suggest a naïve pleasure in pure sensation" (201).

In sonnet XXXIII composed in 1811 and beginning "here pause: the poet claims at least this praise," Wordsworth sums up all the sonnets he has considered. This sonnet is a kind of apologia. At its beginning, the poet declares that the liberty, which he is now concerned with is virtuous. His song is pure, and the flame of the hope of life is still sustained. In reality, Wordsworth is congratulating himself, for he refuses to give way to despair. Hope, which is one of the three evangelical virtues – faith, hope and charity – is viewed by Wordsworth as a 'paramount duty'. The poet is asking man to keep in mind the truth that loss of hope makes him less human. He also asked weak people not to be impressed by the success of tyrants, but to keep up their sense of liberty because it is on the weakness of the common person that the power of the tyrant is raised.

Since infancy, flowing water had been for Wordsworth the most beloved of all natural objects. It is because of this that in his poetry, it is constantly used as the image and symbol of the noblest things, especially liberty. "The River Duddon" flows through a series of thirty three sonnets, ending with the beautiful piece, "I thought of thee, my partner and my guide." The series is a description of a rambling walk down through the Duddon, from its obscure origin on Wrynose fell, on the confines of west more land, Cumberland, and Lancashire, until it glides splendidly, silently, and freely into the open Irish Sea. In these sonnets, we discover the true spirit of Wordsworth's capacity to animate nature. The source of their beauty derives from the attributes of humankind that the reader may discern in herbs, plants and flowers, and even in stones. It is no wonder then that Wordsworth follows the stream from its mountain source down to its mixing with the sea, recording in his memory the image of all incidents that strike his attention. Each incident has the completeness and unity essential to a sonnet – to a bead– while the stream is the linking bond or rather the rosary string that unites and harmonizes the whole.

In sonnet I of part I, Wordsworth declares that the theme of his "River Duddon" series of sonnets is "Duddon, long-loved Duddon". In his sonnet, Wordsworth's jingoism was clearly shown. He suggests that of all springs all over the world, he is primarily attached to only one spring,

namely the Duddon. The river, in the main, is the symbol of time; it carries people on the surface of its eternity. This symbol evokes two aspects: the state of being in the river and the state of being on the bank of the river. In the former, time may be viewed as a river taking everything away from us as we are standing on the shore; everything seems to be going into the past. In the latter, time may be viewed as a river carrying us to eternity, to the future – with all that this future connotes and hopes and ideals. Thus, the river may be regarded as a symbol of freedom as well as of purity, vigor, and brightness.

In sonnet II, River Duddon is called “child of the cloud”, and in sonnet IV “Nursling of the mountain”. Hence, the Duddon sonnets may be considered a kind of sustained reflection on human life. In sonnet V, Wordsworth shows how following the course of the river is symbolic of the course of human life. Nature is solitary, and so is he. This insertion of the human elements into his poetry is better shown in sonnet VIII, where we find the historical Wordsworth. The savage or ancient man is the sphere of talk in this sonnet. Wordsworth refers to the nasty [and] religious rites of the Druid religion – the old religion of Britain; he asks how we can associate the calm beautiful river with these hideous practices. The thought of “hideous usages and rites” in which the primitive man had probably been brought up brings him back to the peaceful stream whose

..... Function was to heal and to restore,  
To soothe and cleanse, not madden and pollute.

[Lines 13 – 14]

In other words, the poet contrasts the wicked man, with the restrictions and rites that governed the course of his life, with the purity and freedom of nature that are an integral part of the river. Thus, Wordsworth ends the sonnet with the suggestion that whatever wicked deeds were done on the banks of the river, the river was to heal them.

In sonnet X, the river, after having passed through mountains, valleys and fields, is coming now into a wilderness. The Duddon has to leave pleasant scenes to go into a wilderness. It is again seen as a symbol of human life. In sonnet XX, the river has gotten into the plain, and in sonnet XXXIII, it is shown moving silently into the sea just as human life flows at the end into eternity. Though the Duddon is a small river, its end is inevitably similar to that of the Thames and all other great and mighty rivers all over the world and they all have to flow into the sea.

Ending the course of the river with its entire vicissitudes, in human terms, the reader of the River Duddon sonnets may easily perceive the political connotations that these sonnets evoke. By and large, all that hinders the free course of the river – whether it be growing thorns, herbs or shrubs on the banks of the river or blocks and wilderness inside it – may well coincide

with the restrictions and traditions of human life that threaten its liberty as revealed in the Duddon sonnets which manifests itself in several ways. In sonnet XXVI, for example, it is shown in the evil force of sex.

In this sonnet, Wordsworth suggests that he was able to remain happy on his own. He can climb up to the source of the river because there is no love in his life that excels that of nature. Had the object of his love been a girl, he would not have been able to go up the hills and mountains. Wordsworth owes two different rewards to these mountain streams. The first is that at the age of puberty, the boys' minds are still vague. So instead of having their minds obsessed by sex and its joys, they can avoid falling into such an evil obsession by resorting to nature. Nature keeps boys away from this evil obsession through making them lovers of mountains, rivers, and streams. The second is liberty, which the poet gets because of his mature imagination. From the impetuous, revolutionary thoughts were not endured in earlier times.

In sonnet XXXIII, the river becomes more identified with human life; it is not proud for it follows its course humbly and smoothly. In the ninth line, the poet turns to himself to declare that the functions of the river as it enters the sea are similar to those of Man as he dies and all are free. Death means freedom in the sense that it makes people free from the troubles of life. The tumultuous working of the human spirit is no more heard, nor is the sweets of earth. All sink into peace and mingle with eternity. As Wordsworth is about to reach the end of his journey, watching the river Duddon as it comes out from its narrow defiles, he tries to identify himself with infinite liberty.

And may the poet, cloud-born stream! Be free  
The sweets of earth contentedly resigned,  
And each tumultuous working left behind  
At seemly distance – to advance like thee;  
Prepared; in peace of heart, in calm of mind  
And soul, to mingle with eternity!

[Lines 9 - 14]

It is because of this identification between man and the river that Wordsworth's Duddon sonnets are said to be devoted to the theme of liberty. Mary Moorman explains that their beauty springs not only from being a tapestry into which are woven pictures of ever changing landscape, but also from their being. This is "an indication of Wordsworth's own consciousness of the historic and prehistoric past of man; and of his private affections, memories, and hopes as they were called forth by this progress down the vale. The constant presence of the river unifies and blesses all" (376).

Sonnet XXXIV, the last in the Duddon series, may be regarded as a transitional sonnet in the sense that it links this series to that of ecclesiastical

sonnets. In this sonnet, spiritual ideas are tackled. Wordsworth thinks of the river “as being passed away”, yet he still sees the ever sliding stream. Though men have thoughts and souls, they die, but the river does not. Even with the thought of death, there remains to be a room for hope and reconciliation:

And if, as toward the silent tomb we go,  
Through love, through hope, and faith’s transcendent dower  
We feel that we are greater than we know.

[Lines 12-14]

In this sonnet, Wordsworth seems to be a devoted Christian; he speaks about faith in the after-life. He suggests that, in man, there is something greater than that he ever knows with reason.

Enough, if something from our hands have power  
To live, and act, and serve the future hour;

[Lines 10-11]

“The Ecclesiastical sketches” are composed of a series of sonnets on the main incidents and most significant vicissitudes of fortune, “which have befallen the Church of England and form the grove of the druids down to the late act of Parliament, for the building of new places of public worship”, Elsie Smith suggests (349). In this respect, Wordsworth himself says, “My purpose in writing this series was, as much as possible, to confine my view to the introduction, progress and operation of the Church of England; both previous and subsequent to the reformation” (Moorman 391).

Smith admits that rarely does Wordsworth leave “one subject of magnitude in the ecclesiastical history of England, on which we didn’t find a thought that breathes or a word that burns” (346). It is obvious, therefore, that so important a subject as liberty will occupy a large space within the range of this group of religious sonnets. In this group, the poet once more resorts to the image of the river – the image that holds together in his thought all the great sonnet series, which he had written in a period of twenty years, starting with the “Poems dedicated to National Independence and Liberty.” For him, there was no chasm or incompatibility but rather a natural unity between the primal love for nature, his love for liberty, and his more recently perfected love for the Church. This Unity, Moorman thinks, seen in poetic imagery as a River, was set forth in stately sentences in the introductory sonnet to the “Ecclesiastical sketches” (390).

I, who accompanied with faithful pace  
Cerulean Duddon...

[Lines 1 – 2]

I, who essayed the nobler stream to trace  
Of Liberty

[Lines 5 - 6]

Now seek the heights of Time the source  
Of a Holy River, on whose banks are found  
Sweet Pastoral flowers and laurels that have crowned  
[Lines 9 – 11]

Thus, in sonnet I of part 1 of “Ecclesiastical Sketches”, Wordsworth speaks of three different streams: the real River Duddon, the stream of liberty, which is nobler than Duddon, and the Holy River of Religion. He also deals with the negative theme of liberty. On the banks of the river, one can find not only “sweet pastoral flowers,” but also Laurels that contain poisonous seeds. In other words, religion is double faced: on the one hand, there is the innocent and pure face of religion while, on the other, there is the evil face of religion – the face that has very often given its stamp of approval to ambitious men and wicked conquerors. Religion, there upon, has supported evil men as well as good ones.

In sonnet VI, entitled “Persecution”, Wordsworth deals with a different aspect of the theme of liberty and faith. The sonnet is concerned with those who sacrifice their lives for the sake of their religious principles and freedom.

Diocletian’s (245 – 313), the Roman Emperor, wanted to impose his religion on Christians, who, because of their adherence to faith and opposition to despotic rulers, showed their sacrifice in different ways:

... Some are smitten in the field –  
Some pierced to the heart through the ineffectual shield  
Of sacred home; with pomp are others gored

[Lines 6 – 8]

As regards the theme of liberty, in part II of “Ecclesiastical sonnets”, Sonnet XIII is the best representative. In his sonnet, the flow of liberty is connected with that of the river. Just as rivers find their own ways by themselves, so does liberty. To Wordsworth, mountains an example of which the Alps are mentioned, are an abode of freedom. This theme of liberty, that is the characteristic of some of the “Ecclesiastical sonnets,” were mainly derived from Milton’s theme of liberty. Piety is like a bird that has been disturbed, yet it can now fly in the cavern and move its wings.

Praised be the rivers, from their mountain springs.  
Shouting to Freedom, “Plant thy banners here!”  
To harassed piety, “Dismiss thy fear,  
And in our caverns smooth thy ruffled wings!”

[Lines 1 – 4]

Wordsworth goes as far as to say that even cities – low – built cities like Venice – can be symbols of liberty. However, the founders of Venice were physically imprisoned in the sense that they were surrounded by lagoons, they were, nevertheless, spiritually free. Hence, in this sonnet, we

may distinguish three different species of liberty: liberty of the mountain, liberty of the river, and that of the spirit.

In Sonnet X of Part III of Ecclesiastical sonnets, the sonnet entitled “Obligations of civil to Religious liberty”, Wordsworth exhorts the nation to cling to spiritual ideals and not to deviate from the divine message of Heaven. Besides, he brings his old heroes, Sidney and Russell, Martyrs for ‘Civil rights’, into line with his celebration of religious liberty. They would have died in vain,

Had not thy Holy Church her champions bred  
And claims from other worlds inspirited the  
Star of liberty to rise.

[Lines 6 - 8]

The Love for liberty, says Moorman, “with all that meant of toleration and justice for minority opinions conscientiously held, is the watch word of ‘Ecclesiastical Sketches’. Religious persecution is never excused, whether it is of early Christians in Roman Britain... of the victims of Henry VIII, Edward VI, represented as a reluctant persecutor, and many of ‘those un-conforming’ who were driven out of their parishes after the restoration of Charles II...” (398).

As regards the last part of Wordsworth’s life, the part that followed the year 1821, in which most of his Ecclesiastical sonnets were written, Wordsworth continued to be conservative. This is well shown based on the fact that he shows no major concern in writing sonnets on the themes of liberty.

To sum up, Wordsworth’s “Sonnets Dedicated to National Independence and Liberty”, as well as those related to the theme of liberty in “The River Duddon” series and “Ecclesiastical sonnets” show Wordsworth as the poet of Man at his best. His association with the republican office and patriot Beaupey, William Godwin and his followers, the radicals, his teacher Rousseau and John Locke owe his success. Wordsworth, in his early years, defended the equality of human rights and the common brotherhood of man. In later years, he was torn between the Love for his mother country and his newborn passion for the course of France.

Soon his ideal of France was distorted and shaken by the terror. In 1798, it was completely shattered by the invasion of Switzerland. He concluded that reform must start with individual. His visit to France in 1802 made his disillusionment, and with it comes a full circle. The liberator had turned tyrant, and Napoleonic France was the enemy. Consequently, England was the last hope of Freedom. Thus, the sonnet became in Wordsworth’s hands, as earlier in Milton’s, a trumpet to awaken England from her deep sleep and to provide her with power for struggle against the tyrant.

In his “Sonnets Dedicated to National Independence and Liberty”, Wordsworth expresses his fears of the power of Napoleon, as well as his anxiety about the threatened liberty of Man. These political sonnets evince the heroic spirit of a man whose hopes rested, through a period of public danger and disaster, on a firm faith in human goodwill and liberty both for nations and individuals. These sonnets reflect Wordsworth’s disillusionment with France and the feeling of fear that occupied his thought for long about political and social questions at home. The Wordsworth of 1793 has been a zealous republican, a convert to the principles of Beaupey and the French Encyclopedists. The rise of Napoleon in conjunction with the dictatorship of Robes Pierre modified, but did not annihilate Wordsworth’s severe judgment of his own country. After 1794, the voice of republicanism is no more heard in Wordsworth’s sonnets. This double and paradoxical attitude of the poet towards liberty is exemplified in various types of sonnets: patriotic, individualistic, spiritual, and human. Also, it is shown not only in “sonnets dedicated to National Independence and liberty” but also in “The River Duddon” sonnets-composed between 1806 and 1820 – and in “Ecclesiastical sonnets” – composed in 1821.

The first of these three types of sonnets, especially those composed in 1809, reflect Wordsworth’s hatred of foreign tyranny and love for national independence and liberty. In the view of these sonnets, Wordsworth’s attitude towards life and humanity becomes clearer to him. In addition, the revolution is no more a local movement; it has meaning for all humanity at large.

In the second and third types, namely “The River Duddon” sonnets and “Ecclesiastical sonnets”, the great river of freedom that existed in England from the earliest times of history is still traced, but this time with more moralistic and rational emphasis and less sensational approach. “In the River Duddon” sonnets (1806 – 1820), the poet traces the course of the River Duddon from its origin in the mountains to the sea. Along this course, he follows the life of the individual and that of the nation.

The conventions and restrictions that hinder the progress of a nation and limit its liberty are likened in these sonnets to thorns, herbs, shrubs, and stones that limit the liberal and spontaneous flow of the river.

In relation to “Ecclesiastical Sonnets”, Love for spiritual liberty seems to be their paramount landmark. In these sonnets, the flow of liberty is compared to that of the River Duddon and the holy river of religion simultaneously.

Though the archetype of “The River” seems to be the common denominator to all of these types of sonnets, humanity remains to be considered the higher keynote that shows Wordsworth at his best as the poet of Man.

There is sanity in his patriotic enthusiasm. An exuberant ethical spirit overwhelms his political sonnets, and moral ideas dominate his views and feelings. A deep love for the country is tempered by a noble sense of duty, which makes him bold enough to point out the weakness and defects of his own nation. Wordsworth raises his voice against evil, tyranny, and injustice wherever he finds them. His patriotism is not always provincial, but sometimes universal. Thus, in most of these sonnets, Wordsworth seems to be a citizen of the world, and all men are regarded as brothers.

We end up repeating Sneath's words: "Early he became a patriot of the world, and remained such despising injustice and tyranny wherever found, he was champion and defender of the rights of men regardless of nationality."

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# Environmental Assessment of Water Quality in the Qarraoun Lake: The Investigation of Physico- Chemistry and Microbial Properties

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## Abstract

The Qarraoun Lake is the largest artificial reservoir in Lebanon, which is located along the Litani River in the Bekaa plain. It represents the connecting point between the Upper and Lower Litani River Basins. Water collected in the lake is used for multipurpose, and mainly for irrigation, fisheries, power generation, and domestic water use. Recently, the Lake has been witnessing severe deterioration in water quality due to uncontrolled liquid and soil waste disposal in the Upper River Basin. As a result, the pollutants accumulate into the Lake water. Apart from laboratory analysis for water quality, the pollution is obvious through direct observations, smells, and water color and patterns. This paper focuses on assessing the level of pollution in the Lake. Therefore, the physico-chemical and microbiological properties of water were investigated on 15 selected sampling on the representative sites of the Lake. Microbiological and physico-chemical analyses were performed in accordance with the European Standard Methods and World Health Organization (WHO). Multivariate statistical methods (Hierarchical Clustering Analysis: HCA, and Principal Component Analysis: PCA) were applied to figure out the influence of pollutants disposal in Qarraoun Lake. PCA was used to identify a reduced number of four principal components, which demonstrated 67.46 % of both temporal and spatial changes. CA shows that the Lake is divided into four clusters, where the central represent the most favorable one. Pollution index was used to classify the level of pollution of different sites in the Lake.

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**Keywords:** Contamination, river water, reservoir, Lebanon, clusters, pollution index

## **Introduction**

Water quality is considered the main factor controlling health and the state of disease in all aspects of life, including man, animals, and vegetation. However, surface water quality is often subjected to contamination since it is uncovered and is in direct touch with human. Pollution as a primary problematic surface water issue is largely controlled by natural processes (weathering and soil erosion) and anthropogenic inputs (municipal and industrial wastewater discharge). The anthropogenic discharges constitute a constant polluting source, whereas surface runoff is a seasonal phenomenon that is largely affected by climate within the basin (Singh et al., 2004; Vega et al., 1996).

The Litani River is the largest of its type in Lebanon with about 2180 km<sup>2</sup> basin area and 178 km from a hydrologic point of view. The basin of the Litani River is divided into two hydrologic units, the Upper and Lower Basins, which are joined together at the Qarraoun Lake. This Lake is an artificial construction that was established in 1956 to harvest water for several purposes such as hydropower and irrigation.

The lake of Qarraoun is a typical example of surface water pollution in Lebanon. This is because it feeds more than 200,000 people downstream the Litani River. Recently, water supply has been extended to the neighboring upstream region. Hence, Water pollution in the Lake became a common visible criterion and it has been exaggerated in the last few decades as a result of population growth and the changing climatic conditions. Therefore, the physical, chemical, and biological properties have been strongly affected either directly or indirectly caused by human activity and their derivatives. This has been evidenced by several applied studies in Lebanon (Dia, 1993; IDRC, 2007; Shaban & Nassif, 2007; Jurdi et al., 2010; Korfali et al., 2010; ELARAD/UNDP, 2011; Slim et al., 2011).

Lately, the Qarraoun Lake has been given attention by decision makers in Lebanon. This is because water from the Lake is oriented within a national project for water supply entitled as Project-800m. Here, all villages below 800m will be provided water from the Lake. Nevertheless, great caution would be taken since the water in the Lake is polluted. Therefore, there is the need to determine the aspects of pollutions as well as their levels. Moreover, identifying sources of pollution is another need in order to apply appropriate future plans.

The present study aimed at evaluating the water quality of the Qarraoun Lake at 18 selected sites. The samples were collected in the month of September 2012, which was a typical timing between summer and winter. The resulting data set was manipulated using the PCA and CA multivariate techniques to evaluate information about the similarities. In addition, dissimilarities exist among the different sampling sites. However, this is used to

identify water quality variables for spatial dissimilarity, as well as to ascertain the sources where contamination impact is derived from.

## Material and Methods

### Sample Collection and Analytical Procedures

Water samples from 18 sites (Figure 1 and Table 1) were collected at 0.5m depth on September 2012 from the Qaraaoun Lake. The samples were kept in 2 L polyethylene plastic bottles which were previously cleaned with metal free soap, rinsed repeatedly with distilled water, soaked in 10% nitric acid for 24 h, and finally rinsed with ultrapure water. All water samples were maintained at 4°C before they reached the laboratory, and then later for processing and analysis.

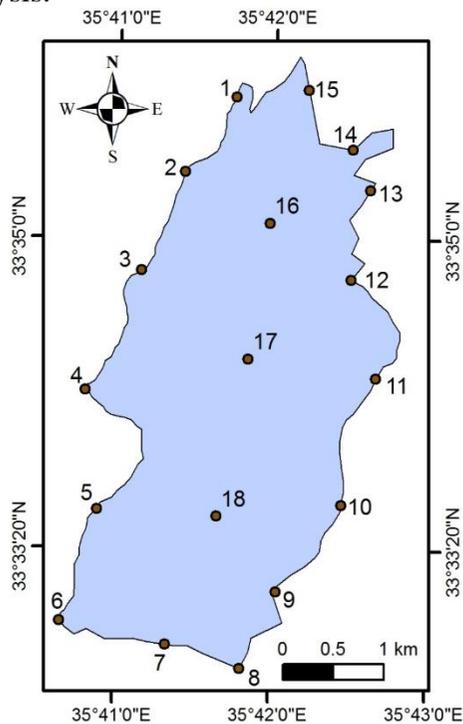


Figure 1. Selected sites

Table 1. Sites of the collected sample from the Qarraoun Lake

Site No.	Samples Lat/Long		Site Description
	Latitude	Longitude	
1	33° 35' 32"	35° 41' 44"	<b>A littoral site between water and land, facing fruit tree and vineyards</b>
2	33° 35' 16"	35° 41' 30"	<b>Site facing fruit tree and wild open field</b>
3	33° 34' 42"	35° 41' 12"	<b>Site facing sand dunes, fruit and olive tree</b>
4	33° 34' 15"	35° 41' 00"	<b>Site facing herbaceous vegetation, vineyards and olive tree</b>
5	33° 33' 35"	35° 41' 01"	<b>Site facing bare dune and fruit tree</b>
6	33° 33' 01"	35° 41' 02"	<b>Near the equipment and industrial site</b>
7	33° 32' 54"	35° 41' 15"	<b>In the middle of the dam</b>
8	33° 32' 51"	35° 41' 50"	<b>Opposite to the forest and olives tree</b>
9	33° 32' 59"	35° 41' 52"	<b>Opposite to the fruits and horticulture</b>
10	33° 33' 29"	35° 42' 17"	<b>Opposite to the low urban activity</b>
11	33° 34' 06"	35° 42' 25"	<b>Site facing horticulture, fruits and few little urban</b>
12	33° 34' 47"	35° 42' 34"	<b>Opposite to horticulture and herbaceous vegetation</b>
13	33° 34' 57"	35° 42' 30"	<b>Site facing Vineyards</b>
14	33° 35' 25"	35° 42' 44"	<b>Opposite to herbaceous vegetation and fruits tree</b>
15	33° 35' 43"	35° 42' 11"	<b>Site facing vineyards and Horticulture</b>
16	33° 35' 09"	35° 41' 59"	<b>In the middle of the lake</b>
17	33° 34' 07"	35° 41' 45"	<b>In the middle of the lake</b>
18	33° 33' 49"	35° 41' 41"	<b>In the middle of the lake</b>

Consequently, 21 variables were analyzed and reported in this study. As shown in Table 2, the measurements of water quality parameters are summarized on the basis of standard methods established for surface water monitoring in Lebanon. The temperature, pH, electrical conductivity (EC), TDS, and DO of each water sample were measured in-situ using a mercury thermometer, digital pH, EC and DO, respectively. All water samples were analyzed for the physico-chemical parameters within 48 hours of collection. SO<sub>4</sub> was determined spectrophotometrically by the Barium Sulfate Turbidity Method. In addition, NH<sub>4</sub>-N was measured with Nessler's reagent. NO<sub>3</sub>-N and NO<sub>2</sub>-N were analyzed by phenol disulfonic acid colorimetry and N-(1-naphthyl)-ethylenediamine colorimetry, respectively. TN and TP were analyzed by absorption spectrophotometry after decomposition with potassium peroxodisulfate (K<sub>2</sub>S<sub>2</sub>O<sub>8</sub>).

The acid-treated water samples were analyzed for the determination of major cations (Ca, Na, and K) which were measured by flame photometry. Mg was determined by the Flame Atomic Absorption Spectrometer (FAAS). For trace and toxic elements, the volume of water samples was reduced by heating at 60°C on an electric hot plate. Thus, this was determined using Hydride Generation Atomic Absorption Spectrometer method (HGAAS). On the other

hand, Pb was analyzed by using the Electrothermal Atomic Absorption Spectrometer (ETAAS), and Cr<sup>+IV</sup> by using the Dinitrodiphenyl Carbazide Spectrophotometric (DCS) method.

Table 2. Water quality parameters, their units and analytical methods used

Parameters	Unit	Method	Analytical Methods
pH	<b>pH</b>	<b>pH</b>	<b>pH Meter Model HI 98103</b>
Temperature	<b>T</b>	<b>°C</b>	<b>Thermometer</b>
Specific Conductivity	<b>Ec</b>	<b>mS/m</b>	<b>Electrometric Hach Model 44600 ( 0.1<math>\mu</math>S cm<sup>-1</sup>)</b>
Total Dissolved Solid	<b>TDS</b>	<b>mg/L</b>	<b>Electrometric Hach Model 44600 (0.1 mg L<sup>-1</sup>).</b>
Nitrate Nitrogen	<b>NO<sub>3</sub>-N</b>	<b>mg/L</b>	<b>Spectrophotometer Method: EPA 352.1</b>
Nitrite Nitrogen	<b>NO<sub>2</sub>-N</b>	<b>mg/L</b>	<b>Spectrophotometric method : EPA 354.1</b>
Ammoniacal Nitrogen	<b>NH<sub>4</sub>-N</b>	<b>mg/L</b>	<b>Spectrophotometric</b>
Phosphates	<b>PO<sub>4</sub></b>	<b>mg/l</b>	<b>ISO 6878:2004</b>
Sulphate	<b>SO<sub>4</sub></b>	<b>mg/L</b>	<b>Spectrophotometric: AOAC 973.57.</b>
Calcium	<b>Ca</b>	<b>mg/L</b>	<b>Flame Photometer</b>
Magnesium	<b>Mg</b>	<b>mg/L</b>	<b>FAAS</b>
Chloride	<b>Cl</b>	<b>mg/L</b>	<b>Titrimetric</b>
Potassium	<b>K</b>	<b>mg/L</b>	<b>Flame Photometer</b>
Sodium	<b>Na</b>	<b>mg/L</b>	<b>Flame Photometer</b>
Lead	<b>Pb</b>	<b>mg/l</b>	<b>ETASS</b>
Metals Analysis	<b>Fe, Zn, Cu, Cr, Al, Ba, k, Ni, Mn</b>	<b>mg/l</b>	<b>Atomic Absorption Spectrophotometer (AOAC 974.27).</b>

- In total coliform (TC) counts, and after the necessary dilution was carried out in the water samples, 10 mL of the sample was put into three tubes each with double strength. 1mm was put into each of first three single-

strength tubes, and 0.1 mL sample was put into each one of the other three tubes. Thus, all these samples contain Brilliant Green Lactose Bile Broth (BGLBB, Oxoid) medium. The tubes were incubated at 37 °C for 24 to 48 h. During this period, the gas accumulation in Durham tubes was observed and The Most Probable Coliform Number index was determined using the MPN (Finstein, 1972; Collins & Lyne, 1987; Veissman & Hammer, 1993).

- In the faecal coliform (FC) counts, the same process was followed as in the total coliform (TC) counts, but the tubes were incubated at 44.5 °C. The Most Probable Faecal Coliform Number was determined from MPN index considering the gas accumulation in Durham tubes (Finstein, 1972; Collins & Lyne, 1987; Veissman & Hammer, 1993).

### **Statistical Procedures**

Statistical parameters of physico-chemical and microbiological analyses data were used to present the values of water quality characteristics. Pearson's correlation coefficient ( $r$ ) was used to show correlation between all parameters data using the SPSS Statistical Software 16.0 2007 (SPSS Inc.). GIC are used to put the data in graph. Multivariate analysis of data set for the lake water quality was performed using Principal Component and Cluster Analysis techniques.

In this research, the calculations were performed based on the correlation matrix of chemical components. Also, the PCA were obtained from the standardized analytical data. CA was used to detect spatial similarity for grouping sampling sites located within the monitoring network.

### **Results and Discussion**

Lebanon's water supply depends mainly on surface water sources with more than 60% of total available water. Lakes and ponds constitute a major portion of surface water. Thus, the largest artificial lake in Lebanon, the Qarraoun Lake, is considered as a fundamental water sources, especially for irrigation purposes. Even though the lake has been established since more than six decades, yet it is still utilized to compensate a large volume of water shortage in the Bekaa plain and a part of the coastal area as well.

Lately, the Qarraoun Lake is joined to a project at a national level. Thus, water from the lake will be conveyed to the areas below 800 meters. Nevertheless, water in the lake is being contaminated and this can be obviously observed. Therefore, conveying water to different regions will be harmful for human and crops. For this purpose, we were motivated towards applying this research. Thus, water from 18 different sites in the lake was sampled for detailed physiochemical and microbiological analysis. These parameters play a significant role in water quality, distribution, and the

abundance of aquatic organisms in the water. Also, it can be used for determining the water quality and productivity of the lake (Kara, 2004).

Table 3. Physical parameters of water in the Qarraoun Lake

Sites	Parameters				
	T(°C)	pH	EC ( $\mu\text{s cm}^{-1}$ )	TDS (mg/l)	DO
1	28.7	7.89	601	320	4.02
2	28.2	7.86	618	333	4.12
3	27.3	8.07	587	320	3.67
4	27	7.84	501	348	3.43
5	27.2	7.95	341	174	6.76
6	25.4	8.04	359	230	6.97
7	24.5	8.01	378	158	5.65
8	25.3	7.95	608	386	5.02
9	25.7	8.03	530	320	5.21
10	26.6	7.65	612	405	4.03
11	27.2	8	693	548	4.01
12	27.9	7.65	689	511	2.97
13	28.1	7.82	720	530	3.54
14	28.2	7.81	810	589	2.01
15	29.6	8.01	820	559	3.43
16	28.9	7.95	386	156	9.05
17	27.2	7.17	332	166	10.5
18	25.4	7.34	354	172	12.45
WHO (2006)	6.5-8.5	15.57-21.10	Max 1500 $\mu\text{s/cm}$	<500 mg/l	<10 mg/l

The temperature of the collected samples ranged from 24.6 to 28.7°C. According to Lawson (2011), these values were within the acceptable levels for survival (fish). Thus, the pH values of collected water samples ranged from 7.17 to 8.07, within the limit range of 6-9 allowed by the SEPAC for water quality.

In some sites, the alkaline (8.07) pH is a result of the presence of carbonates and bicarbonates in high concentration in Qarraoun Lake and this is due to the presence of Carbonate rocks. Thus, these results show that Qarraoun Lake is a favored environment for the living flora and fauna.

Dissolved Oxygen (DO) with a range between 2.01 and 12.45 mg/l is an important parameter of biogenic element, and it is also an important indicator of environmental health water (concentration of nutrients and organic matter). This level reflects the status of biological growth and water environmental pollution (WEI Qin-sheng, 2010). The DO concentration was depending on the changing of temperatures. The lower DO concentrations, the highest concentrations of decaying organic matter. In Qarraoun Lake, a clear decrease in DO (Table 3) levels was noticed in the sites 1-4 (at the effluent of the river in the Lake) as well as between the sites 10 and 14

eastern part of the Lake. This can be attributed to a higher concentration of organic matter there. The higher concentration of DO in sites 4 and 5 for examples is due to the different kind of pesticides used for agricultural activities. The highest DO was found at sites 16-18 at the center of lake.

Electrical conductivity is a tool to assess the purity of water. EC and TDS were found in the range 332- 820  $\mu\text{S}/\text{cm}$  and 156 – 589 ppm, respectively. According to WHO, they are in acceptable levels.

### Microbial Contamination

According to the microbial analysis, the results show that the range of Total Coliform (TC) is 4570 to 27500 col/100 ml. The Figure 2 shows that the northern part (sites 1-4) of lakes and the site 14 was more polluted. The less contaminated was the sites 15 to 18 (center).

The concentration of FC varies from 10 col /100 ml in the middle of the lake to 761 col/100 ml in the site 8. The contamination is also high in the site 1, which is the point of contact between the Lake and the Litani River effluents. The sites 9, 11, 12 are moderately polluted by FC. The distribution and the level of contamination by fecal and total coliform in the sites are different. As a result, according to the data, the sites 2, 4, 5, 6, 7, 10, 13, 14, 15 are moderate to less polluted by FC and severe to highly contaminated by TC.

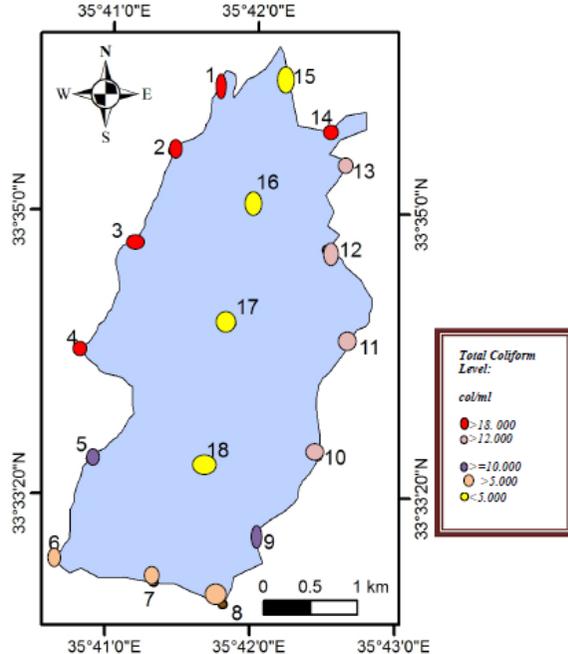


Figure 2. Distribution of Total Coliform in the Qarraoun Lake

Table 4. The mean values of nutrient

Parameter (ppm)	Values			WHO (2006)	Libnor (99)
	Min	Mean	Max		
NO <sub>3</sub> <sup>+</sup>	<b>0.87</b>	<b>4.93</b>	<b>9.95</b>	<b>Max 50 ppm</b>	<b>45 ppm</b>
NO <sub>2</sub> <sup>+</sup>	<b>0.01</b>	<b>0.95</b>	<b>1.89</b>	<b>Max 0.2 ppm</b>	<b>0.05 ppm</b>
NH <sub>4</sub> <sup>+</sup>	<b>0.01</b>	<b>1.065</b>	<b>3.09</b>	<b>Max 0.5 ppm</b>	<b>1 ppm</b>
Cl <sup>-</sup>	<b>0.91</b>	<b>25.15</b>	<b>38.1</b>	<b>Max 250 ppm</b>	<b>200 ppm</b>
PO <sub>3</sub> <sup>4+</sup>	<b>1.45</b>	<b>2.29</b>	<b>5.45</b>	<b>Max 1 ppm</b>	<b>1 ppm</b>
SO <sub>4</sub> <sup>2-</sup>	<b>25.7</b>	<b>32.09056</b>	<b>36.29</b>	<b>Max 250 ppm</b>	<b>250 ppm</b>
Na <sup>+</sup>	<b>8.1</b>	<b>8.98</b>	<b>9.7</b>	<b>Max 150 ppm</b>	<b>150 ppm</b>
Cd	<b>0.7</b>	<b>1.79333</b>	<b>3.8</b>	<b>0.003 ppm</b>	<b>0.005 ppm</b>
Cu <sup>2+</sup>	<b>0.02</b>	<b>0.04</b>	<b>0.076</b>	<b>1 ppm</b>	<b>1 ppm</b>
Fe <sup>3+</sup>	<b>0.01</b>	<b>0.15</b>	<b>1.78</b>	<b>0.3 ppm</b>	<b>0.3 ppm</b>
Mg <sup>2+</sup>	<b>1-6</b>	<b>2-9</b>	<b>2-7</b>	<b>50 ppm</b>	<b>50 ppm</b>
Br	<b>10.5</b>	<b>26.32</b>	<b>39.98</b>	<b>0.01 ppm</b>	<b>Not available</b>
Zn	<b>0.0037</b>	<b>0.06</b>	<b>0.16</b>	<b>25 ppm</b>	<b>5 ppm</b>
Cr <sup>6+</sup>	<b>0.005</b>	<b>0.03</b>	<b>0.07</b>	<b>0.05 ppm</b>	<b>0.05 ppm</b>
Mn	<b>0.002</b>	<b>0.02</b>	<b>0.09</b>	<b>0.05 ppm</b>	<b>0.05 ppm</b>

Table 4 shows that the mean values of nitrite, ammonium, and phosphorus were almost higher than the acceptable guidelines, while the concentration of nitrate, chloride, and sulfate were among the acceptable levels.

In order to describe the source of contaminants which are discharging in the reservoir, land cover, which is a land use component, must be identified. The map (Figure 3) covers the area that surrounded the Lake, and it includes mainly urban and industrial sites, bare soil, and vegetation cover. The map was extracted from Landsat ETM satellite image (30 m resolution)

of the year 2012, by using ERDAS-Imagine software for image processing. Thus, a supervised classification was applied for this purpose.

Furthermore, there are several sources of pollution that surrounded the Qarraoun Lake. They mainly imply: agricultural residue, farms, and different forms of industries, sewage network outlets, and municipal solid waste dumping. In order to detect the source and the efficiency of contamination, a table of correlation (Table 5) between analytic values was plotted. For example, industrial discharges (e.g. mineral and tanning processing, etc) can explain the significant association between Fe/Cd and Cd /Mn. Additionally, the association between Nitrate and fecal Coliform ( $r = 0.585$ ,  $p < 0.05$ ) and Nitrate/Total Coliform ( $r = 0.696$ ,  $p < 0.05$ ) are significant. Thus, this is due to the domestic wastewater effluents and sewage. Sodium/ chloride ( $r = 0.810$   $p < 0.05$ ) association are significant and Ammonium/iron are due to fertilizers and other agricultural sources.

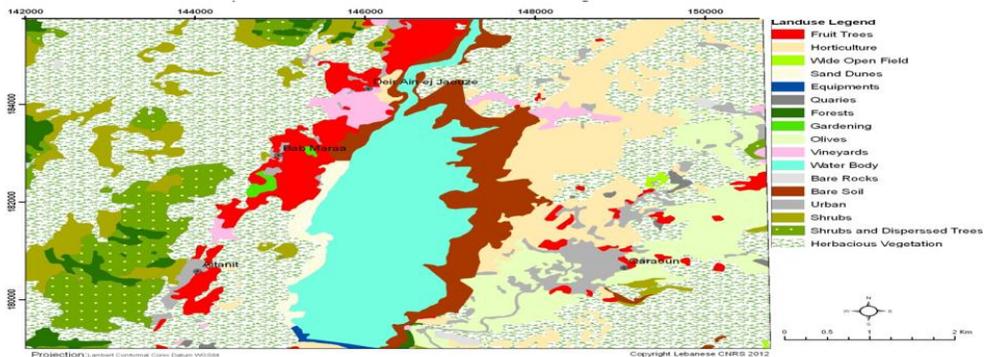


Table 5. Matrix of correlation

	T	pH	EC	TDS	DO	NO3	NO2	NH4	Cl	SO4	PO4	Br	Fe	Cd	Zn	Mn	Cu	Cr	Na
T	1.00																		
pH	0.04	1.00																	
EC	0.53	0.25	1.00																
TDS	0.44	0.19	0.96	1.00															
DO	-0.31	-0.55	-0.81	-0.77	1.00														
NO3	0.30	0.46	0.58	0.49	-0.66	1.00													
NO2	-0.04	0.52	0.04	0.12	-0.36	0.11	1.00												
NH4	-0.20	0.38	0.01	0.01	-0.27	0.28	0.38	1.00											
Cl	0.49	-0.37	0.63	0.59	-0.22	0.11	-0.34	-0.23	1.00										
SO4	0.38	0.06	0.24	0.19	-0.30	0.39	-0.16	0.04	0.04	1.00									
PO4	0.28	-0.66	-0.18	-0.15	0.46	-0.42	-0.42	-0.34	0.38	0.18	1.00								
Br	-0.26	0.49	-0.26	-0.33	0.00	0.12	0.25	0.48	-0.40	0.10	-0.22	1.00							
Fe	0.31	0.09	0.09	-0.04	-0.14	0.23	-0.07	0.51	0.02	0.03	0.00	0.12	1.00						
Cd	0.59	-0.22	0.37	0.27	-0.26	0.07	-0.03	0.19	0.46	0.15	0.15	-0.34	0.57	1.00					
Zn	-0.05	0.13	0.38	0.39	-0.50	0.30	0.01	0.23	0.18	0.03	-0.48	-0.18	0.16	0.24	1.00				
Mn	-0.46	0.18	-0.20	-0.09	0.10	0.05	0.33	0.48	-0.43	-0.19	-0.27	0.13	-0.19	-0.38	-0.02	1.00			
Cu	-0.17	0.05	0.43	0.41	-0.33	0.14	-0.34	-0.29	0.20	-0.02	-0.17	-0.21	-0.23	-0.29	0.35	0.06	1.00		
Cr	-0.55	0.11	-0.49	-0.49	0.36	-0.16	-0.08	-0.28	-0.48	-0.35	-0.18	-0.07	-0.33	-0.62	-0.27	0.26	0.11	1.00	
Na	0.54	-0.48	0.46	0.50	-0.08	0.01	-0.22	-0.46	0.81	0.15	0.59	-0.42	-0.23	0.26	-0.16	-0.37	0.10	-0.47	1.00

In order to simplify the evaluation of water quality, however, PCA was applied for physical-chemical nutrient and its correlation with the bacteria.

PCA provides information on the most significant parameters used to describe the entire data set, data reduction, and to summarize the statistical correlation among constituents in the water with a minimum loss of original information (Helena et al., 2000). PCA has been used to determine the structure of the underlying dataset and to identify the unobservable, latent pollution sources.

Projection of the original variables on the sub space of the PCs are called loading, and it coincides with the correlation coefficients between PCs and variables (Vega et al., 1998). Loading of four retained PCs are presented in Table 6.

Table 6. The four principal components of physical-chemical parameters of the Qarraoun Lake

Parameters	F1	F2	F3	F4
T	<b>0.23</b>	<b>-0.22</b>	<b>0.23</b>	<b>0.22</b>
pH	<b>0.12</b>	<b>0.34</b>	<b>-0.03</b>	<b>0.27</b>
EC	<b>0.38</b>	<b>-0.06</b>	<b>-0.16</b>	<b>0.10</b>
TDS	<b>0.35</b>	<b>-0.06</b>	<b>-0.19</b>	<b>0.13</b>
DO	<b>-0.36</b>	<b>-0.14</b>	<b>0.09</b>	<b>-0.14</b>
NO <sub>3</sub>	<b>0.29</b>	<b>0.16</b>	<b>-0.03</b>	<b>0.08</b>
NO <sub>2</sub>	<b>0.05</b>	<b>0.26</b>	<b>0.10</b>	<b>0.23</b>
NH <sub>4</sub>	<b>0.09</b>	<b>0.30</b>	<b>0.30</b>	<b>- 0.16</b>
Cl	<b>0.23</b>	<b>-0.31</b>	<b>-0.08</b>	<b>-0.16</b>
SO <sub>4</sub>	<b>0.14</b>	<b>-0.06</b>	<b>0.13</b>	<b>0.38</b>
PO <sub>4</sub>	<b>- 0.10</b>	<b>-0.36</b>	<b>0.13</b>	<b>-0.01</b>
Br	<b>-0.07</b>	<b>0.25</b>	<b>0.19</b>	<b>0.24</b>
Fe	<b>0.12</b>	<b>0.05</b>	<b>0.43</b>	<b>-0.23</b>
Cd	<b>0.22</b>	<b>-0.15</b>	<b>0.36</b>	<b>-0.25</b>
Zn	<b>0.21</b>	<b>0.11</b>	<b>-0.10</b>	<b>-0.25</b>
Mn	<b>- 0.09</b>	<b>0.25</b>	<b>- 0.11</b>	<b>-0.10</b>
Cu	<b>0.10</b>	<b>-0.02</b>	<b>-0.48</b>	<b>-0.03</b>
Cr	<b>-0.24</b>	<b>0.14</b>	<b>-0.29</b>	<b>-0.14</b>
Na	<b>0.14</b>	<b>-0.37</b>	<b>-0.08</b>	<b>0.13</b>
TC	<b>0.25</b>	<b>0.19</b>	<b>0.10</b>	<b>-0.28</b>
FC	<b>0.28</b>	<b>0.16</b>	<b>-0.10</b>	<b>- 0.08</b>
Eigenvalue	5.91	4.63	2.57	1.71
Variability%	26.89	21.09	11.69	7.80
Cumulative %	26.89	47.98	59.66	67.46

The four components of PCA analysis showed 67.46 % (Table 6) of the variance data set as the eigenvectors. However, this classified the 21 physico-chemical parameters into four groups. The first component (F1) accounts for 26.89% of the total variance which was correlated with T, TDS, Ec, NO<sub>3</sub>, TC, FC, Zn, Cd, Cu, Na, SO<sub>4</sub>, Cl<sup>-</sup> positives and with DO, Cr negatives.

The second component (F2) included NO<sub>2</sub>, NH<sub>4</sub>, pH, Mn, and Br. This component is accounting for 21.09% of the total variance measured that demonstrated strong positive loadings for major ions.

The third components (F3) is accounting for 11.69% of total variance. It was correlated positively with Fe, Cd, PO<sub>4</sub>, and negatively with Cu.

The fourth components (F4) included SO<sub>4</sub>, which demonstrated 7.80% of the total variance.

Subsequently, the analysis of the result shows that most of the variables highly contributed by F1, F2, and F3. The majority of information is explained by the first three factorial axes. As a result, we took it into consideration during this study.

### Cluster Analysis

It is usually used and it is defined as the classification of similar objects into groups, where the number of groups as well as their forms are unknown (Kaufman et al., 1990). This is with the primary purpose being the assembly of objects based on the characteristics they possess. Hierarchical agglomerative clustering is the most common approach, which provides instinctive similarity relationships between any sample and the entire data set. Hence, it is typically illustrated by a dendrogram (tree diagram). The dendrogram presents a picture of the groups and their proximity to one another, with a dramatic reduction in the dimensionality of the original data (Alberto et al., 2001).

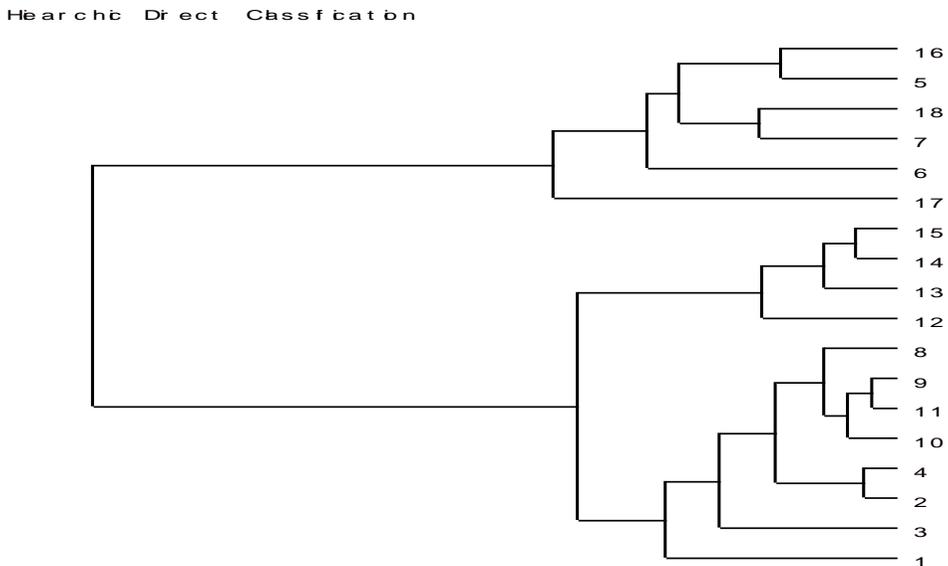


Figure 3. Agglomerative hierarchical clustering based on the PCA scores

A dendrogram of sampling sites obtained by Ward's method is shown in Figure 3. It was divided into:

- Cluster 1 corresponded to sites 1, 3, 2, 4, 10, 11, 9, 8;
- Cluster 2 corresponded to sites 12, 13, 14, 15;
- Cluster 3 corresponded to the site 17; and
- Cluster 4 corresponded to sites 6, 7, 18, 5, 16.

Cluster analysis revealed that water quality measured at these sites appeared to be affected by different pollutant sources, and thus describes the different properties at each site with respect to chemical and microbial variables. Therefore, we apply the pollution index  $P$  method to demonstrate the results of CA analysis. The details of the comprehensive pollution index are shown below:

$$P = \frac{1}{n} \sum_{i=1}^n Ci/Si$$

Where  $P$  is comprehensive pollution index,  $Ci$  is the measured concentration of the pollutant (mg/L),  $Si$  represents the limits allowed by the WHO for water quality, and  $n$  is the number of selected pollutants. Ultimately, the values determined for  $P$  could be used to classify the water quality level of the Lake (Table 7).

Comprehensive Pollution Index ( $P$ )	Water Quality Level
$\leq 0.20$	Cleanness
0.21-0.40	Sub-cleanness
0.41-1.00	Slight pollution
1.01-2.0	Moderate pollution
$\geq 2.01$	Severe pollution

Table 7. Standard of surface water quality classification (Zhao et al., 2012)

The values of the comprehensive pollution index (Table 8) were 2.72, 1.08, 1.25, 1.35, 1.09, 1.13, 1.37, 1.59, and 1.09 for the sites 1, 3, 2, 4, 10, 11, 9 and 8, respectively. This demonstrates severe to moderate pollution index. In sites 1, 2, 3, the quality of water was determined to have been influenced by the direct discharge from the Litani River. Also, it was characterized by high concentration of metals nutrients and bacteria. Figure 4 show that site 1 was characterized by severe pollution index, while sites 2 and 3 were characterized by moderate pollution index. Also, sites 8 and 9 were subjected to many tourist attractions, in addition to the presence of industrial activities that are characterized by moderate pollution. Site 11 is characterized by the presence of fruits and olive tree. All these sites are characterized by the presence of high levels of bacteria, nitrite, ammonium, potassium, and manganese. Therefore, this is due to the excessive fertilizers and animal wastes from the neighborhood.

Table 8. Single and comprehensive pollution index

Sites	P NO3	P NO2	P NH4	P Cl	P SO4	P PO4	P Na	P Fe	P Mn	P Cu	P
Site 1	6.89	3.8	6.14	0.10	0.12	2.4	0.05	5.93	1.8	0.03	2.72
Site 2	0.11	5.35	3.34	0.10	0.14	1.5	0.05	0.6	1.34	0.02	1.25
Site 3	0.197	4.66	2.02	0.10	0.12	1.89	0.05	0.4	1.34	0.03	1.08
Site 4	0.08	4.91	3.6	0.11	0.13	2.00	0.06	0.23	2.34	0.03	1.35
Site 5	0.10	6.76	0.02	0.00	0.13	1.56	0.05	0.2	0.77	0.02	0.96
Site 6	0.09	9.45	6.18	0.00	0.12	1.45	0.05	0.03	1	0.03	1.84
Site 7	0.02	3.35	1.34	0.02	0.12	1.65	0.05	0.06	1.52	0.07	0.82
Site 8	0.10	5.62	1.74	0.10	0.12	1.74	0.05	0.03	1.29	0.05	1.09
Site 9	0.11	5.97	4.62	0.10	0.12	1.93	0.06	0.29	1.3	0.04	1.59
Site 10	0.15	3.35	2.68	0.10	0.13	2.01	0.06	0.4	2.4	0.06	1.13
Site 11	0.09	5.24	4.02	0.10	0.12	2.64	0.06	0.4	1.04	0.03	1.37
Site 12	0.04	9.35	1.52	0.15	0.11	2.65	0.06	0.16	1.22	0.04	1.53
Site 13	0.10	5.02	0.3	0.13	0.13	2.1	0.06	0.06	3.31	0.05	1.12
Site 14	0.16	4.84	0.4	0.12	0.13	2.31	0.06	0.03	0.86	0.06	0.9
Site 15	0.13	1.15	0.12	0.15	0.13	2.31	0.06	0.1	1.12	0.07	0.53
Site 16	0.03	6.45	0.14	0.09	0.12	3.42	0.06	0.33	0.07	0.02	1.07
Site 17	0.02	0.05	0.04	0.12	0.14	5.45	0.06	0.03	0.07	0.03	0.60
Site 18	0.01	0.3	0.12	0.12	0.10	2.35	0.06	0.06	1.12	0.04	0.43

Cluster 2 corresponded to sites 12, 13, 14 and 15 and the comprehensive pollution indices of these sites are 1.53, 1.12, 0.9 and 0.53, respectively. This demonstrates slight to moderate pollution index. All these sites are characterized by the presence of nutrients such as phosphate, nitrite, and bacterial contamination. Also, these sites are adjacent to open areas, which are cultivated by fruits tree and important human activity.

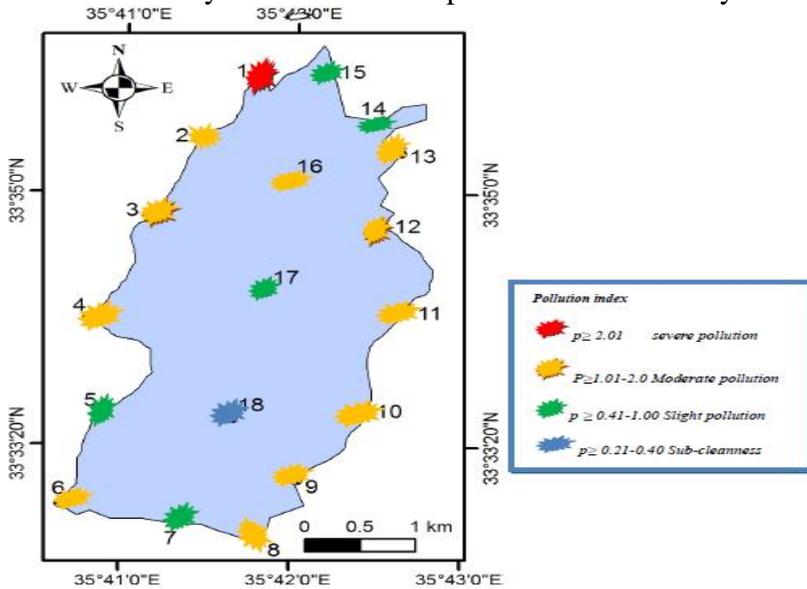


Figure 4. Level of pollution Index in investigated sites

Cluster 3 corresponded to the site 17 was determined to be slightly polluted, with a comprehensive pollution index value of 0.60. Whereas, cluster 4 corresponded to sites 6, 7, 18, 5, 16 with 1.84, 0.82, 0.43, 0.96, 1.07 pollution indices. Sites 6 and 16 were characterized by moderate pollution influenced by the presence of nitrite and phosphate which may be due to the inputs of fertilizers because it seems that the site 16 was cultivated by fruits. Sites 5 and 7 were characterized by slight pollution and the Sub-cleanness site is the site 18.

The spatial variation of water quality in the Qarraoun Lake showed that the water quality at the centre was better than all the sites surrounding the lake. Hence, it can be used for many purposes (irrigation, industrial activities).

### **Conclusion**

Different multivariate statistical techniques were used to evaluate variations in water quality of the Qaraaoun Lake. PCA helped to identify the sources responsible for water quality variations in the Lake. The main reason for quality deterioration in the Lake is found to be attributed to the discharge from the Litani River, the residues of agricultural, in addition to irrigated lands that relies on fertilizers and industrial activities, the domestic sewage, and pollution from the surrounding villages to the Lake.

Clusters showed that the Lake is divided into three parts. In the first part, there is a receiving site which is characterized by the river inflow where evaporation rate is high; thus, severe pollution exists. The level of contamination by bacteria (TC and FC) was high. The pollution index was severe to moderate in this part because the lake has recently become a wastewater collector. In addition, human activities that exist near the lake exaggerate the problem, especially along the eastern shore where settlements are found. Pollution index of nitrite and phosphate was high in the western and the eastern part of this site.

The second part is characterized by slight to moderate pollution where the dam induces sediments deposition that may cause anaerobic beds.

The third part is characterized by the presence of slight pollution and the sub-cleanness parts. In this part, water can be used for irrigation, livestock, and fisheries and it can be used in industries after treatment.

The lake is completely polluted and about 80 of the sites were moderately polluted in the western and eastern part. As a result:

- To use their water in irrigation, the concentration of salts in water must be low. In this study, the concentration of  $\text{Cl}^-$  and  $\text{Na}^+$  was very low (table). Additionally, the Bekaa plain soils do not yet suffer from a high salt content. For that, the reservoir water is fully suitable for irrigation use.

- The presence of bacteria (TC and FC) eliminated the concept of using this water for drinking and in food and drink industries. Additionally, WHO guidelines (WHO, 1996) require that all water intended for drinking must be free from bacteria (CF). However, filtration and disinfection treatment of water is necessary and preferable by ozone treatment based on the quality of odour and taste.

Study of sediment is necessary to the lake of Qarraoun.

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# A Survey on Quality of Service in the Voice Over IP Technology

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## Abstract

Voice services can be transmitted by circuit switched and packet switched networks (Internet). Voice over Internet Protocol (VoIP) is one of the most attractive and important service in telecommunication networks, current implementations of VoIP have two main types of architectures, which are based on H.323 and Session Initiation Protocol (SIP). However, when the voice traffic is transported over Internet, the packet based transmission may introduce impairments and it has influence on the Quality of Service (QoS) perceived by the end users. The voice quality of VoIP systems depends on many QoS parameters. Particularly, One Way Delay (OWD), jitter and Packet Loss Rate (PLR) have an important impact on voice quality. This survey presents the main concepts relating to the VoIP technology and quality of service issues.

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**Keywords:** Voice over Internet Protocol, Quality of Service, QoS parameters

## Introduction

In the last decades, voice transmission has become as one of the most attractive and important service in the telecommunications networks. Voice services can be transmitted by circuit switched and packet switched networks (Toral et al., 2013). The most common examples of circuit switched and packet switched networks are the Public Switched Telephone Network

(PSTN) and Internet, respectively (Kurose and Ross, 2005). Compared to traditional resource-dedicated PSTN, Internet is resource shared. Therefore, the conditions in the PSTN are totally different from those in the Internet, and this fact has influence on the voice quality (Toral et al., 2013, Toral et al., 2008).

VoIP is the real-time transmission of voice between two or more parties by using IP technologies, poised to replace the circuit switched telephony service in the future and carry voice packets transparently through the Internet (Toral et al., 2012, Toral et al., 2013). Current implementations of VoIP have two main types of architectures, which are based on H.323 ratified by International Telecommunication Union (ITU-T) (ITU-T Recommendation H.323, 2007) and SIP developed by working group of Internet Engineering Task Force (IETF) (Rosenberg, 2007). The above mentioned architectures do not provide QoS and they consist of three main logical components: terminal, signaling server, and GW (Toral et al., 2011, Toral et al., 2013).

A basic VoIP system consists mainly of three parts, the source terminal (sender), destination terminal (receiver) and the IP network (Internet) (Toral et al., 2011, Toral et al., 2013). The IP network is characterized by its random and complex nature, as result of the convergence of information and media transmission (voice, video and data) through the same communication channel. As there are a very high (and increasing) number of nodes (i.e., devices) connected to the network, and these are being added in a random, decentralized manner, the network is asymmetric and also practically random in both its topology and its usage. Additionally, the service provided by the Internet is generally a “best effort” type (Park, 2005), which means that the nodes, with some exceptions, do not differentiate between traffic types and there is neither resource reservation nor prioritization (Estrada et al., 2009-1, Estrada et al., 2009-2).

Congestion, due to the high demand of network resources, is a cause of the impairment of the quality of service, which consists of delay problems (i.e., the OWD and its variation, namely jitter) and PLR. For time-critical communications, such as VoIP, the above impairments can have high impact on the QoS (Toral et al., 2011-1, Estrada et al., 2009-1).

## **Telecommunication Networks**

In telecommunications networks there are many networks, in this survey two of them are studied, circuit switched and packet switched networks.

## **Circuit Switched Network**

The communication via circuit switched networks implies that there is a dedicated communication path between two or more terminals all through the communication session. Therefore, the resources (links and nodes) are reserved exclusively for information exchanges between source and destination terminals (Toral et al., 2011, Toral et al., 2013).

In this switching technology, the nodes do not examine the contents of the information transmitted; the decision on where to send the information received is made just once at the beginning of connection and remains during the connection. Thus, the delay introduced by a node is almost negligible. After the circuit has been established, the transmission delay is small and is kept constant through the duration of the connection (Toral et al., 2011, Toral et al., 2013). Therefore, in this network technology, the voice quality is guaranteed, while the bandwidth utilization is not efficient.

The most common examples of circuit switched network are the PSTN and Integrated Services Digital Network (ISDN) (Toral et al., 2011, Toral et al., 2013).

## **Packet Switched Network**

In the packet switched networks, the information is split up by the source terminal into blocks of moderate size, called packets. These packets can be autonomous, i.e., they are capable of moving on the network thanks to a header that contains the source and destination addresses (Fiche and Hébuterne, 2004).

The packet is sent to the first node (router), the router receives the packet, and it examines the header and forwards the packet to the next appropriate router. This technique of inspection and retransmission is called "store-and-forward", and it is accomplished in all routers of the path until the packet reaches its destination, unless the packet is lost. After reaching the destination, the destination terminal strips off the header of the packet to obtain the actual data that was originated at the source (Toral et al., 2011, Toral et al., 2013).

In this switching technology, the source sends packets and the network multiplexes the packets from various origins in the same resources to optimize their use. In this way several communications can share the same resources (Toral et al., 2011, Toral et al., 2013).

The packet switching enables a better use of the bandwidth than circuit switching because the resources are shared. However, the multiplexing of different connections on the same resources causes delays and packet losses, which do not happen with circuit switched technology (Kurose and Ross, 2001). In this network technology, the voice quality is not

guaranteed due to its shared nature, thus VoIP is susceptible to suffer impairments, which result in voice quality degradation (Jo et al., 2002).

## VoIP Architectures and Protocols

VoIP consists of a set of architectures and protocols for managing the transmission of voice packets through IP network, the most important are explained below.

### H.323 Architecture

H.323 is a set of protocols for voice, video, and data conferencing over packet switched networks, such as Internet, that do not provide a guaranteed QoS (ITU-T Recommendation H.323, 2007). The ITU-T H.323 recommendation describes the components of H.323 architecture, as can be seen in Figure 1. An H.323 terminal is an endpoint on the network, which provides real-time, two-way communications with another H.323 terminal, gateway, or multipoint control unit (MCU). The gateway is an H.323 entity on the network, which allows intercommunication between IP networks and legacy circuit-switched networks, such as ISDN and PSTN. The gatekeeper is an H.323 entity on the network, which performs the role of the central manager of VoIP services to the endpoints. The MCU is an H.323 entity on the network, which provides the capability for three or more terminals and a gateway to participate in a multipoint conference.

The H.323 architecture is partitioned into zones. Each zone is composed of the collection of all terminals, a gateway, and MCU managed by a single gatekeeper.

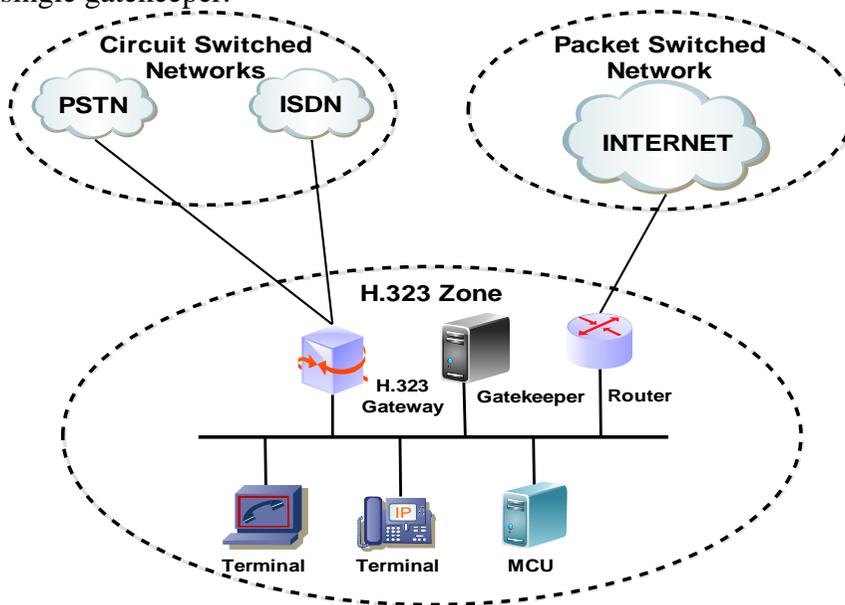


Figure 1: H.323 architecture

## SIP Architecture

SIP is an application layer control protocol that can establish, modify, and terminate multimedia sessions or calls. SIP was developed by IETF in reaction to the ITU-T H.323 recommendation (Rosenberg, 2007).

The two major components in a SIP network are the user agent (UA) and network servers (registrar server, location server, proxy server, and redirect server), as shown in Figure 2. The user Agent is an application that interacts with the user and contains both a user agent client (UAC) and user agent server (UAS). A user agent client initiates SIP requests, and a user agent server receives SIP requests and return responses on user behalf. The registrar server is a SIP server that accepts only registration requests issued by user agents for the purpose of updating a location database with the contact information of the user specified in the request. The proxy server is an intermediary entity that acts both as a server to user agents by forwarding SIP requests and as a client to other SIP servers by submitting the forwarded requests to them on behalf of user agents or proxy servers. The redirect server is a SIP server that helps to locate UAs by providing alternative locations where the user can be reachable, i.e., provides address mapping services. It responds to a SIP request destined to an address with a list of new addresses. A redirect server doesn't accept calls, doesn't forward requests, and doesn't it initiate any of its own.

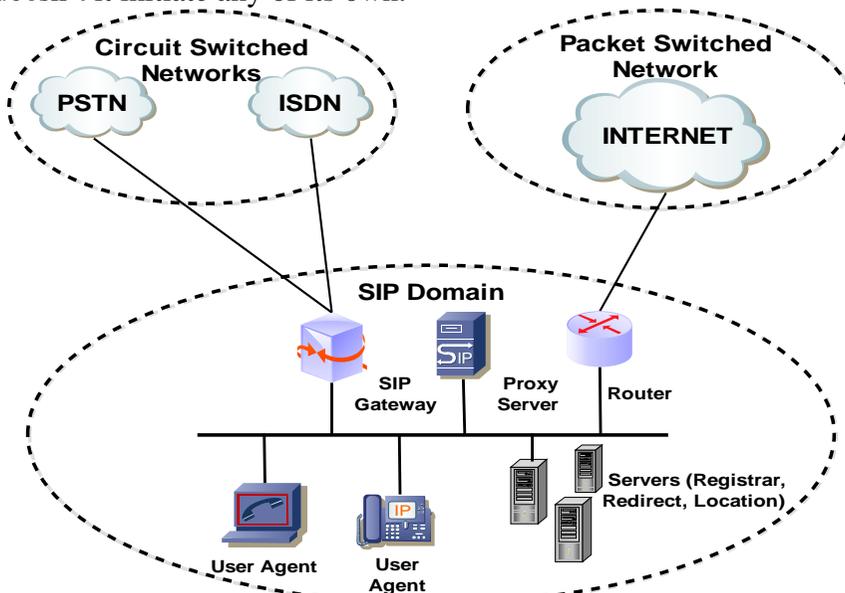


Figure 2: SIP architecture

## **QoS Parameters**

Several parameters influencing voice quality on IP networks, in particular OWD, jitter and PLR are the most critical (Sherif and Crossman, 1995).

### **OWD**

The delay experienced by a packet across a path consists of several components: propagation, processing, transmission, and queuing delays. The Internet metric one way delay (ITU-T Recommendation G.114, 2003) is the time needed for a packet to traverse the network from a source to a destination host.

### **Jitter**

When packets are transmitted from a source to a destination over IP networks, packets may experience variable delay, called delay jitter. The Inter-Arrival Time (IAT) on the receiver side is not constant even if the packet Inter-Departure Time (IDT) on the sender side is constant. As a result, packets arrive at the destination with varying delays (between packets) referred to as jitter.

### **PLR**

There are two main transport protocols used on IP networks: User Datagram Protocol (UDP) and Transmission Control Protocol (TCP). While UDP protocol does not allow any recovery of transmission errors, TCP include an error recovery process. However, the voice transmission over TCP connections is not very realistic. This is due to the requirement for real-time (or near real-time) operations in most voice related applications. As a result, the choice is limited to the use of UDP which involves packet loss problems.

Amongst the different quality elements, packet loss is the main impairment which makes the VoIP perceptually most different from the public switched telephone network. Packet loss can occur in the network or at the receiver side, for example, due to excessive network delay in case of network congestion.

## **Conclusion**

In telecommunications networks there are many networks, in this survey two of them are studied, circuit switched and packet switched networks. The most common examples of circuit switched and packet switched networks are the PSTN and Internet, respectively. In mid 1990's, the PSTN and Internet started to converge. As result of this merging, appears the convergence of voice and data networks. However, with this

convergence, a new technical challenge has emerged. The converged network (Internet) is based on the best effort service and it does not guarantee a quality of services level to meet requirements of real time applications, such as VoIP. VoIP is one of the most sensitive services of QoS and to compete with traditional service demands specific QoS levels. Current implementations of VoIP have two main types of architectures, which are based on H.323 and SIP. The above mentioned architectures do not provide QoS. Several parameters influencing voice quality on VoIP, in particular OWD, jitter and PLR are the most critical. The QoS is an important subject that takes a central place in the IP network technologies, it is a complex subject and its analysis involves mathematical disciplines such as: probability theory and stochastic processes.

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# **Pedagogy of Interiority as a Tool for Social-Emotional Education in the New Model of Public Education in Mexico: Scope and Limitations**

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## **Abstract**

Based on the essential characteristics of the New Model for Public Education in Mexico, which will begin to operate in August 2018 throughout the country, this paper focuses on the introduction of social-emotional education in the curriculum of primary and secondary levels. It is, however, regarded as one of the most outstanding changes established in the Model. It offers a brief analysis of the theoretical-pedagogical principles of social-emotional education, as well as the main challenges that it would have to face to be implemented. The objective of this paper is to analyze the challenges posed by the implementation of socio-emotional education in the basic education curriculum in Mexico, specifically the one that implies the adoption of an adequate pedagogical approach. For this purpose, a comparative analysis was undertaken between the educational proposal of the model and the proposal of the Pedagogy of Interiority. This was carried out through the revision of the main categories of both approaches to detect their compatibility and complementarity. The analysis concludes that the Pedagogy of Interiority can contribute to a better appropriation and implementation of the proposal of Socio-Emotional Education in the Mexican Model.

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**Keywords:** Social-emotional education, educational reforms, the pedagogy of interiority

## **Introduction**

Mexico have faced severe problems in its attempt to provide quality public education to its citizens. In the 2016-2017 school year, almost 26 million students attained the primary and secondary levels, reaching 96.3% coverage (NSIS, 2017). Although school drop-out rate is not a problem at these levels, the results obtained in regards to learning are abysmal. According to 2015 PISA results, Mexico's performance is below average in

science with 416 points while across the OECD with the standard of 496; in reading with 423 points, which is below the OECD average of 493; and in mathematics, Mexico ranked the lowest score of all 34 OECD countries with 408 points, while the average is 490. In these three areas, less than 1% of students in Mexico achieved levels of proficiency (levels 5 and 6) (OECD, 2015).

Additionally, as Canedo (2016, 1) points out: “Government spending on schooling has not translated into gains in the quality of education. While Mexico spends 22 percent of public non-capital spending on education, the highest share in the OECD, spending per student is only one-third of the OECD average and the second lowest percentage among OECD and partner countries. Mexico devotes nearly 94 percent of its education budget towards teachers’ salaries and staff compensation.”

Although there are many problems due to poverty and poor distribution of wealth in the country, most of the responsibility for the low performance of the students is attributed to the poor quality of teachers. The government has little control in hiring or dismissing them because they receive protection from the National Union of Education Workers (SNTE), probably the most powerful union in Latin America.

During Enrique Peña Nieto’s government, and after a change in the leadership of the SNTE, long-term educational reform was established as of December 2012. However, the first part of this reform was focused on the evaluation of teachers’ performance. This is with the aim of training, promoting, and eventually removing them from their posts if they were not able to accredit their competence. To this end, the government created the National Institute for Educational Evaluation (INEE). Teacher riots and protests were common, and there were much criticism and unconformity of how the educational reform had been implemented. This also alleges that it was not an educational reform, but a labor one since there was no proposal for pedagogical transformation of the curriculum.

However, the document of the reform itself established that a new educational model should be created as part of it. After several revisions and consultations, this model was promulgated in the Official Gazette of the Federation on June 28, 2017. Thus, it will start operating in all schools in August 2018.

The New Educational Model declares itself humanist and advocates the integral formation of people. Among the most relevant developments are the introduction of a socio-emotional development area in the primary and secondary curriculum. It also entails an area of curricular autonomy that will allow schools to decide on specific curricular contents according to their needs and contexts.

The objective of this paper is to analyze the challenges posed by the implementation of socio-emotional education in the basic education curriculum in Mexico, specifically the one that implies the adoption of an adequate pedagogical approach. This is because the model has specific deficiencies in this sense. For this purpose, a comparative analysis was undertaken between the educational proposal of the model and the proposal of the Pedagogy of Interiority. This was carried out through the revision of the main categories of both of them to detect their compatibility and complementarity. The analysis concludes that the Pedagogy of Interiority can be an approach that contributes to a better appropriation and implementation of the proposal of Socio-Emotional Education in the Mexican model.

### **The Importance of Educating Emotions**

Emotions play a significant role in learning. Also, self-regulation is vital for a person to perform productively and successfully in daily coexistence with their peers in the workplace, family, and the society in general. It is essential to learn how to manage their emotions to self-produce states of tranquility, peace, and inner security. Therefore, it will allow them to better face the challenges and difficulties that life presents.

In this sense, socio-emotional education seeks to establish preventive measures to solve emotional problems that affect society in general, among which we can mention the following (INEGI: 2015):

- **Depression:** According to INEGI data in Mexico, in 2013, 5,909 suicides were recorded. This, however, represents 1% of registered deaths; placing itself as the fourteenth cause of death and presenting a rate of about five per 100 thousand. 40.8% of suicides occur in young people between 15 and 29 years old. Among them, the rate reaches 7.5 suicides per 100 thousand young people. Of the total deaths that occurred in 2013, 81.7% were completed by men and 18.2% by women.

- **Violence in the School:** Mexico is the first place of bullying in countries that make up the Organization for Economic Cooperation and Development (OECD). Out of more than 26 million students at the basic level, between 60 and 70% has suffered violence. Also, it has affected 18,781,875 primary and secondary students, both public and private, according to an OECD study. Even when accurate records are lacking, the absence of policies to prevent violence and bullying has resulted in low academic performance, desertion, as well as an increase in suicide among young people of secondary and upper secondary school age (SPSE, 2015).

International evidence shows that it is fundamental to support and invest in socio-emotional learning and the integral development of adolescents, considering that they are at a critical age when they begin to make crucial decisions in their lives. In the case of Mexico, the National

Survey of Exclusion, Intolerance and Violence 2013 (ENEIVEMS) applied at the high school level showed that 56% of students feel sad, 44% feel alone, and 26% feel that their life has been a failure. In the case of the PLANEA test, applied in 2015 to junior high school students, it was observed that only 15% of the students surveyed said they had a high level of perseverance, less than 2 out of 10 (18.4%) indicated that With decision-making skills, only 1 in 7 knew how to handle stress adequately, and only 2 out of 100 (1.6%) said they had a high level of empathy.

Other figures that are relevant for Mexico are those referring to teenage pregnancy, which is associated with a loss of 1 to 1.2 years of schooling in the long term for women. This can also be seen for the case of the high dropout rate at the level of upper medium. At this level, only 45.6% of the students who initially entered this level were able to conclude it.

The data presented here gives an account of a context in which risk behavior, violence, and school desertion can truncate the educational trajectory of students, and thereby limit their life choices. In this line, OECD (2015) has recently stated that an adequate acquisition of cognitive and socio-emotional skills were fundamental to individual well-being.

### **Socio-Emotional Education (SEE) in the New Educational Model in Mexico**

Etymologically, the term “emotion” comes from the Latin word “*emotio*,” meaning “movement or impulse” and “that which moves towards.” Psychologists defined “emotions” as psychophysiological reactions that occurs in a neutral organism as adaptive responses to the environment. Hence, they are a kind of “trigger” of behaviors before specific stimuli.

Emotions can be experienced in a pleasurable way, causing states of tranquility and joy, and unpleasantly, causing states of uneasiness or pain. We call the former “positive emotions” or non-afflictive emotions, and the latter, “negative emotions” or afflictive emotions (Bisquerra, 2015).

Neuroscientific studies generally speak of five basic emotions, which are those that are connected to the limbic system, the oldest and inner part of our brain: joy, sadness, anger, fear, and disgust. These emotions arise spontaneously and are associated with survival mechanisms. They have little relation to the neocortical processes so that the subject suffers them and cannot do much to control their appearance. This is despite the fact that he can learn to manage the way through which he externalizes them behaviorally.

In addition to the primary emotions, there are much more complex emotions, called secondary emotions or feelings, which are formed by a combination of the basic ones and by the influence of the sociocultural environment in which a person develops. They are more lasting moods than

the pure emotional experience and a trace of the characteristics of the personality. Examples of this type of secondary emotions are jealousy, envy, the desire for revenge, the feeling of persecution, resentment, and other precedents, which we might call negative. On the positive side, examples include solidarity, surrender, care, respect, aesthetic experience, altruism, love, and all those that lead to fuller and happier states of life.

Since people learn to respond emotionally within their specific social context and culture, the term "social-emotional education" has been preferred to indicate that emotions and their manifestation always involve a social component. Thus, this also means that the handling of emotions can be taught and learned, and in fact, various pedagogical proposals have been developed with this aim. The SEE provides internal resources to address the challenges that may arise throughout life (Reimers & Chung, 2016). In addition, it contributes to the development of personal talents and active participation in building a more inclusive and supportive world.

The SEE Program of the New Educational Model seeks to establish preventive measures to help solve problems such as violence and destruction of the social fabric, bullying (SIPSE, 2015), depression, lack of motivation, eating disorders or early pregnancies, among others. SEE is defined as: "a learning process through which children and adolescents develop and integrate into their lives the concepts, attitudes, and skills that allow them to understand and manage their own emotions, build their identity, show empathy for others, collaborate, establish positive relationships and make responsible decisions." (SEP, 2017, 7)

The Socio-Emotional Education contributes to the formation of responsible, free, inclusive and supportive citizens. Therefore, these citizens are capable of overcoming individualism and building a community environment by promoting one's well-being, that of others, and the situation. It seeks, through a process of lifelong learning, the acquisition and construction of personal skills for socialization. This uses integrated and enhanced cognitive development to generate a comprehensive education. Its objective states that students should put into practice actions and attitudes aimed at creating a sense of well-being, with themselves and for others, through activities and routines associated with school activities. In doing so, they will learn to deal satisfactorily with their impulsive or afflictive emotional states. Also, they would learn to manage to make emotional life and interpersonal relationships a trigger for motivation, learning, and the completion of substantive and constructive goals in life. In this sense, the school should be the ideal space for the construction of relationships, the solution of conflicts, and the development of tolerance and respect, which are essential aspects for a healthy coexistence and the creation of a peaceful and democratic society.

The socio-emotional education is the axis of the integral formation because it allows the students to consolidate a healthy sense of identity and direction that helps them to make decisions to act freely. However, it takes into account the repercussion of their actions and decisions on their peers, next or far. For this reason, it pays to the formation of the sense of agency and the citizenship that can work in solidarity for the causes of the common good.

SEE is based on a model that articulates five dimensions: 1) self-knowledge, 2) self-regulation, 3) autonomy, 4) empathy, and 5) collaboration.

These five dimensions are briefly described below:

1) **Self-knowledge:** This ability is essential to a person's emotional life because it is based on other skills such as self-esteem, self-regulation, self-efficacy, and moral autonomy. It involves developing attention to one's own cognitive and emotional processes, the identification of emotions, and their proper expression. The purpose of self-knowledge is to be able to accept oneself, and to strengthen the sense of identity through taking and valuing oneself.

2) **Self-regulation** is the ability to modulate one's thoughts, emotions, feelings, and behaviors; it involves controlling impulses, tolerating frustration, persevering in the achievement of objectives, postponing the need for immediate rewards, managing the intensity and duration of emotional states, and even voluntarily arising constructive emotions. Proper self-regulation of one's own emotions helps people to be more reflective and tolerant, and it also increase their capacity for listening and dialogue. This, thus, contributes to creating an emotionally healthy climate in the environments in which they operate, favoring inclusion, collaboration, and the constructive solution of conflicts. Therefore, working with capacities to deal with our emotional states is essential to strengthen self-regulation.

3) **Autonomy** has various manifestations in the intellectual, emotional, and moral spheres. In the mental aspect, it means the ability to think for oneself: in terms of emotions, to regulate moods adequately; and in terms of morals, to make decisions about what is right or just considering the consequences that these decisions have on those around us. To achieve autonomy, the person needs to develop skills for self-knowledge and to possess a sense of self-efficacy and agency, that is, confidence in one's abilities to achieve the proposed objectives as well as to overcome obstacles that arise.

4) **Empathy** is fundamental in human communication because it involves the ability to perceive, identify, and understand behavioral and attitudinal elements that the other communicates, whether through verbal, corporal, and gestural language. Thanks to our empathic capacity as we can give fair

treatment to others, provide support, take care of nature, and generate well-being around us. Hence, empathy is an essential element to create healthy interpersonal relationships and constitutes the basis of solidarity, compassion, and human reciprocity (Zahavi, 2001).

5) Collaboration is defined as the set of skills that a person develops to establish harmonious relationships with others that lead to the achievement of group goals. It implies the construction of the sense of "we," which goes beyond the perception of merely individual needs so that the individual becomes aware of being a member of a community and seeks in their actions the good of it. Appropriating this skill requires being aware that in the group in which you interact, you can build positive relationships and build the habit of mutual help and set common goals.

For each of these five dimensions, the model establishes five vital social-emotional skills that can be seen in the following scheme:

Dimension	Associated Skills
1. Self-knowledge	<p><i>1.1. Attention</i>  <i>1.2. Awareness of one's emotions</i>  <i>1.3. Self-esteem</i>  <i>1.4. Appreciation and gratitude</i>  <i>1.5. Wellness</i></p>
2. Self-regulation	<p><i>2.1. Metacognition</i>  <i>2.2. Expression of one's feelings</i>  <i>2.3. Regulation of emotions</i>  <i>2.4. Self-generation of emotions for the well-being</i>  <i>2.5. Perseverance</i></p>
3. Autonomy	<p><i>3.1. Personal Initiative</i>  <i>3.2. Identification of personal and social needs and search for solutions</i>  <i>3.4. Leadership and openness</i>  <i>3.5. Decision making and commitments</i>  <i>3.6. Self-efficacy</i></p>
4. Empathy	<p><i>4.1. Well-being and decent treatment of other people</i>  <i>4.2. Taking perspective in situations of disagreement or conflict</i>  <i>4.3. Recognition of prejudices associated with diversity</i>  <i>4.4. Sensitivity to individuals and groups suffering from exclusion or discrimination</i>  <i>4.5. Care of other living things and nature</i></p>
5. Collaboration	<p><i>5.1. Assertive communication</i>  <i>5.2. Responsibility</i>  <i>5.3. Inclusion</i>  <i>5.4. Conflict management</i>  <i>5.5. Interdependence</i></p>

Emotional education has two strong pedagogical components: teacher modeling and learning experiences designed to develop students' emotional world which allows reflection. However, this is to enable them identify their own emotions and its proper management, gives more harmonious coexistence, and makes personal life more fulfilled and happy. Based on this purpose, a progressive order of achievement levels has been established for each social-emotional skill, which goes from the first year of primary to the third year of secondary education, and the experts designed diverse classroom, activities for each skill according to this progression. The teachers will use these activities during the time they will dedicate to this program: 30 minutes a week in primary, and 50 minutes in Secondary. Also, the idea is to ensure that SEE is a cross-curriculum element so that in all subjects as well as in all extracurricular activities, one can foster these social-emotional skills.

### **The Implementation of Socio-emotional Education: Challenges and Opportunities**

There are at least three key factors that imply serious challenges in the ESE implementation process: 1) parental support, 2) teacher training, and 3) the development of an adequate pedagogy that includes the assessment of the socio-emotional education. The present work focuses on this last challenge, but before tackling it, we will briefly review the first two challenges.

Regarding parental support, it is an element that is crucial to avoid conflicting messages that may be counterproductive. Socio-emotional education needs to propose strategies for parents to know, assume, and join the efforts of emotional education that will not be only for the good of the children but for the whole family. In the new educational model, there is a much closer link between teachers and parents through the strengthening of schools for parents and the presence of parents in school councils (Councils of Social Participation). Millions of children in Mexico live in conditions of poverty and marginalization, in insecure contexts, and they face problems of violence both outside and inside families. Social-emotional education can help heal emotional wounds through programs specially directed to parents and guardians. The school directors are a key element to promote the approach of the parents to the school, but there remains much to define about this problem.

Regarding teacher training, this is an aspect of which the school has greater control, but it requires the support that the government can provide to fund training workshops aimed not only at the knowledge of the program but the emotional development of teachers. There are several important reasons to train teachers in this regard. The following are the most important ones:

- First, since a curricular space for Social-Emotional Education was not previously conceived in the plans and programs of study, it is imperative that teachers should know and take ownership of the proposal through their training programs.
- Secondly, the most important way of socio-emotional education is modeling. In this area, as in no other, what works best for learning is the example of the teacher's actions, and not so many theoretical conceptualizations about emotions, their classifications, and ways of controlling them. Although conceptual knowledge is undoubtedly useful, what is genuinely crucial is the deployment of attitudes, behaviors, and habits that induce favorable emotional states that can be emulated by students. In the field of social-emotional education, the teacher must be fully aware that he/she is a model of attitudes and behaviors.

To become models, teachers must also develop their ability to be in contact with their own emotions, identifying, expressing and modulating them. They need to be aware of the way in which their interpretations of the facts and the circumstances influence their mood. As a result, they can learn to respond with attitudes and behaviors that enhance constructive interpersonal relationships and a sense of well-being.

Teacher training is perhaps the most significant challenge that socio-emotional education has. Hence, it requires designing strategies that include training programs in various modalities: online, blended, face-to-face, as well as a variety of materials. The Mexican Ministry of Education has to establish essential alliances with universities throughout the country, where specialists in socio-emotional education are located. Also, they should implement projects that allow socio-emotional education to be brought to nearly 1,400,000 basic education teachers, which seems an almost impossible task to achieve. On the other hand, from an optimistic perspective, it can be affirmed that in reality, socio-emotional education is something that most teachers already practice in the classroom, although not explicitly or with clear pedagogical rationality.

### **Pedagogy of Interiority as a Tool for Socio-emotional Education in the New Educational Model of Public Education in Mexico**

As stated in the introduction, this paper focuses on analyzing the challenges posed by the implementation of socio-emotional education in the basic education curriculum in Mexico. This is specifically for the one that implies adopting an adequate pedagogical approach, since the model presents specific deficiencies in this regard. For this purpose, a comparative analysis was undertaken between the educational proposal of the model and the proposal of the pedagogy of interiority. This is done through the revision of

the main categories of both them to detect their compatibility and complementarity.

The challenge of implementing the SEE in which we want to emphasize in this text refers especially to developing an appropriate pedagogy and teaching materials based on that pedagogy. In the market, many self-help materials are not always supported by a scientific approach and, besides being lacking in seriousness, they can be used to manipulate people. The Secretariat of Public Education, with the help of specialists, has developed both a didactic approach and materials in the form of "record cards," which contain activities for promoting socio-emotional development. The educational approach adopted is based on experience, through dynamics and games, to encourage reflexive processes of introspection. In general, it does not deepen this approach.

For this reason, this paper proposes to analyze in greater depth the pedagogy that should support social-emotional education. In this sense, we consider that the most promising approach comes from the so-called "Pedagogy of Interiority," which has been developed by a group of academics from the University of Barcelona. Thus, this university is one of the first institutions of higher education in the Hispanic world who offers social-emotional education. The objective of this pedagogical proposal is to get the person to connect with their interiority to favor their inner growth but not to stay in an intimate setting, but to be able to interact with others constructively and proactively. To develop interiority would be in this sense "to be more oneself, to know how to recognize what one is and how and where it is, to widen the inner world and ultimately to inhabit more and better in oneself" (Galve & Lullá, 2013, 43).

This pedagogical proposal holds that the knowledge and development of interiority can be the object of learning: it is a pedagogy that helps us to look inwards and from there look outwards. Deepening our inner dimension implies deliberate pedagogical efforts to promote awareness, experience and the elaboration of the experience. Promote the processes of sustained and focused attention, silence, meditation and other forms of introspective work, dialogue through open questions, attitudes of listening, acceptance and inclusion, all those that favor the broadening of consciousness, that stimulate interest and creativity and metacognitive processes, to name a few are the elements of this pedagogical style.

The individual's interior is a dynamic. It has a fluctuating reality in which wishes, emotions, feelings, memories, beliefs, and convictions are mixed. Pedagogy of Interiority assumes the need to make a journey within ourselves, and like any trip, implies an exploration of our limits: "We discovered how far we could endure. The limit tells us who we are, regulates our identity, but it is also the frontier that indicates the meaning of our march"

(Otón Catalán, 2013, 62). Hence, the great poet “Rilke” has affirmed that the actual journey is towards the interior. As one can guess, the categories of travel and exploration are essential for this pedagogical approach that focuses on socio-emotional education from a personal growth perspective. Become more owners of ourselves, live more fully, know how to create emotional states of peace and joy, achieve inner well-being and engage in similar constructive relationships are the great purposes from which socio-emotional education makes sense, and the pedagogy of interiority becomes an indispensable ally of the social-emotional education.

### **Methodology of Comparative Analysis between Pedagogy of Interiority and the Model of Socio-emotional Education**

The present work proposes to analyze the possible contribution of Pedagogy of Interiority in the implementation of socio-emotional education in the Mexican model. As a result, it is necessary to contrast the objectives of socio-emotional education against the pedagogy of interiority. The following table presents the result of this analysis through the categories of analysis that helped to contrast the objectives of socio-emotional education against Pedagogy of interiority. It was carried out through the review of the sources consulted.

	Socio-emotional Education (ESE) of the New Educational Model	Pedagogy of the Interiority (PI)	Similarities and Differences
Objectives	Students will put into practice actions and attitudes aimed at generating a sense of well-being, with themselves and for others, through activities and routines associated with school activities, so that they can: - understand and learn to cope satisfactorily with impulsive or afflictive emotional states, and - manage to make emotional life and interpersonal relationships a trigger for motivation, learning and the completion of substantive and constructive goals in life	Encourage internal growth of people, to interact with others productively and proactively.  To develop the interiority would be in this sense "to be more oneself, to know how to recognize what one is and how and where it is, to widen the inner world and ultimately to inhabit more and better in oneself"	Both approaches coincide with the main objective of achieving the inner well-being of people to achieve a better coexistence
Contents	The five socio-emotional dimensions and their	It emphasizes the following:	PI can be an important aid in the

	<p>associated abilities:</p> <ul style="list-style-type: none"> <li>• Self-knowledge</li> <li>• Self-regulation</li> <li>• Autonomy</li> <li>• Empathy</li> <li>• Collaboration</li> </ul> <p>We must work better for the dimensions of autonomy and empathy, which are unclear in the model</p>	<ul style="list-style-type: none"> <li>• Self-knowledge</li> <li>• Self-regulation</li> <li>• Autonomy</li> </ul> <p>These dimensions have the objective that the person becomes "more owner of herself."</p>	<p>development of the first three emotional dimensions</p>
Pedagogical methodology	<p>Active learning methods through dynamics and games</p> <p>Experience- Reflection- Interiorization</p> <p>Playful approaches: learning based on the game</p>	<p>Introspective methods:</p> <p>Discernment</p> <p>A trip, exploration inside</p> <p>Notion of limit</p>	<p>The methods are compatible and can enrich each other.</p> <p>ESE emphasizes play and experience.</p> <p>PI emphasizes experience and introspection. PI has worked in greater depth on these methodologies</p>
Assessment	<p>Formative assessment that allows the progressive improvement of the socio-emotional skills</p> <p>Emphasis on metacognition</p>	<p>The assessment process is personal and is carried out according to the criterion of inner well-being</p> <p>Focus on self-evaluation</p>	<p>There is a fundamental coincidence in the approaches, beyond the language differences</p>

As can be seen, both proposals coincide with the general objective of achieving the subjective well-being of people that have an impact on a better interpersonal coexistence. In terms of content, the Mexican model emphasizes five dimensions: three intrapersonal (self-knowledge, self-regulation, and autonomy) and two interpersonal (empathy and collaboration). In this sense, it offers a more complete proposal than the Pedagogy of Interiority, which focuses on the development of intrapersonal dimensions. Therefore, this was done so as to play a significant role in their development. Besides, the Pedagogy of Interiority can contribute to strengthening the idea of autonomy through the process of discernment that takes into account the analysis of the emotions experienced by the person.

There is a possibility of an essential contribution of Pedagogy of Interiority for the Mexican model which is in the pedagogical methodology. The Mexican model speaks of strategies based on experience and the game to encourage the reflection of the person, but does not deepen in this proposal nor offers more elaborate sustenance. The Pedagogy of Interiority,

meanwhile, has devoted itself to increasing methodologies that favor introspection and reasoned decision making through discernment exercises that comes from philosophical traditions, such as the Socratic-Platonic and the Aristotelian, or the Jesuit educational tradition. The Mexican model can benefit a lot from the knowledge of these methodologies.

Regarding the last category, it is necessary to point out that evaluating emotional development is quite complicated due to the critical burden of subjectivity that it implies (in fact, most of the instruments of evaluation of socio-emotional education are self-perception surveys) as well as the ethical dilemmas that may lead to the use of this type of assessments. From the educational point of view, the best approach is that of formative evaluation, which does not imply establishing qualifications and whose only intention is to offer the person possibilities of self-improvement. In this sense, what the Secretariat of Public Education proposes is very similar to what the Pedagogy of Interiority approach suggests. This is because both coincide in the idea that, in the education of emotions, the vital thing is not to acquire a note at the end of the course, but to promote reflexive processes that allows the improvement of social-emotional skills.

Pedagogy of Interiority focuses on inner well-being and emphasizes an evaluation that promotes greater self-knowledge, better emotional self-regulation, greater autonomy and more responsible decision-making. The Mexican model, for its part, coincides with the preceding but also emphasizes the capabilities of social interaction, empathy, and collaboration. In the emotional itinerary, there are always ups and downs, afflictive circumstances that put to the test what an individual has achieved, and lead him to setbacks that can make him feel that the road traveled was useless. However, from the formative evaluation approach, these setbacks are nothing more than new opportunities to explore the internal landscapes and learn more and grow more. It is from this positive inner growth that the foundations of an intensely lived ethic can be laid.

## **Conclusion**

The analysis made indicates that the main advantages offered by Pedagogy of Interiority for the Mexican model of social-emotional education refers to the theoretical and methodological support that this pedagogy provides since it reflects the humanist traditions that promote the processes of introspection. These are particularly important for developing intrapersonal dimensions, among which autonomy stands out, which is the dimension that can be strengthened with the PI approach.

It is important to consider that working the emotions requires a pedagogical proposal based on humanistic philosophical anthropology that recognizes the person as a relational being, endowed with intelligence, will,

the capacity of free will, and with an inalienable dignity. Working with emotions involves entering the human universe of interiority, what makes an individual unique and different in the world. In this sense, emotions arise from external stimuli and internal resources. For instance, memory and imagination can evocate emotional states with no anchorage to the outside world.

Now, the fundamental postulate of these authors is that it is possible to learn to know and develop interiority and that education can contribute to the development of interiority. If the social-emotional education proposed by the New Educational Model in Mexico wants to be successful, it is going to be necessary to focus the school towards the work of interiority seriously. Concentration, the development of concentrated attention, silence, the exploration of one's moods, the identification of the reasons that lead us to make a decision, are only examples that imply the dimension of interiority in pedagogical work of emotions. Therefore, promoting this look will be the challenge for the school in the years to come.

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## **Crimequest, A CLIL Approach of "Learning on Gaming" to Improve Science Education and Language Learning**

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### **Abstract**

This work focuses on Science teaching in high school using the Content and Language Integrated Learning (CLIL) approach. Students need to be educated as science active citizens so that to be able to close the skills gap between science literacy and societal requirements. In fact it is important to combat misconceptions in order to face challenges that daily involve society and request skills and knowledge in science. Teachers need new insights to foster youngsters learning and to enhance digital literacy and competences and need to update them continuously. The authors have realized a role playing computer game called CrimeQuest with a specific Role Playing Engine, which involves all students into the adventure through their personal mobiles or tablets, with a complete interaction of the whole class with the game. The students interact with the system using their own smartphones and tablets with a new technology, which collects the individual answers. At the same time the system calculates the overall response according to the criterion of majority voting. The game works without Internet and is realized with a specific software engine that interprets a text file as the adventure plot, with text-to speech multi-language voices. Learning on gaming through our Computer Class Role Playing Game is a way to realize "authentic learning": it lets students feel themselves on a Crime Scene, involving them in their own learning. In this way foreign language becomes a vehicular tool to discover new topics and their specific

glossary: it is a CLIL approach, in which the not language subject is taught through a foreign language.

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**Keywords:** Learning on Gaming, CLIL, Science Education, Forensic Science, CALL

### **Introduction:define CLIL**

Foreign languages are essential to ensuring that European citizens can move, work, and learn freely throughout Europe. This will help boost jobs and growth, reducing unemployment and increasing living standard (European Commission 2014). Education is central to developing the capabilities required to expand the opportunities people need to lead meaningful lives in equal dignity. A renewed vision of education should include developing critical thinking, independent judgment and debate (UNESCO 2015). Education is a sort of equalizer, never as important as today. European countries have developed strategies and plans that focus on different ways to increase the efficiency and effectiveness of foreign language education in schools. Content and Language Integrated Learning (CLIL) is a competence-based teaching approach that has been growing over the last ten years and is expanding quickly across the European education systems and beyond. It is an approach to teach the content of curricular subjects through the medium of a non – native language. In a CLIL course, learners gain knowledge and understand the curricular subjects while simultaneously learning and using a target language. We can define CLIL as “an educational approach in which a foreign language is used as the medium of instruction to teach content subjects for mainstream students” (Nikula T., et al, 2013). CLIL is an integrated approach to content and language (Lasagabaster D., 2008). It integrates content and language by learning a content subject through the medium of a foreign language and by learning a foreign language through studying a content-based subject (Ruiz de Zarobe, Y.R.,, 2008). CLIL methodology, as CBI (Content Based Instruction), helps students to learn better: CBI-CLIL offers models, curricular variations and a continuum which highlights the fact that institutions may opt for content-driven as well as language-driven implementations. Science and technology education in schools has traditionally served an elite group of students (Driver, R., Leach, J., Millar, R., & Scott, P, 2005; Fensham, P.J., 1992). “*Traditional school science teaching attempts to socialize students into a scientific way of thinking and believing* “ (Aikenhead G.S., 2005). Very often traditional science lessons result decontextualized not connected to real life and then boring. Moreover, the opportunity to find new engaging learning environments is very intriguing for learners, while classroom teaching propose often the same traditional educational setting. “*This social*

*need gave rise to the science-technology-society (STS) movement in science education*”(Aikenhead, G.S., 1994). Nowadays students need to understand the interactions between science & technology and their society. Teachers know that motivation is one of the most important factors to enhance student learning. Teachers are key players in the renewal of science education..

According to 21<sup>st</sup> Century Directions: The main recommended approach to teaching key competences is through the provision of interactive learning environments in which learners can engage in practical, inquiry-based tasks. These environments present open-ended problem and challenges to be solved through debate, experimentation, exploration and creativity.

*“Among other methods, being part of a network allows teachers to improve the quality of their teaching and supports their motivation”* (Rocard M., et al., 2007).

CLIL works with meaningful, challenging and authentic context that can motivate learners much more than traditional approach. Real world contexts engage students because they provide suitable learning environments for problem-based learning. CLIL scaffolding reinforces students’ learning. They need scaffolding (Böttger, H., Meyer O., 2008) in order to improve language. Scaffolding is a powerful teaching tool; in fact facilitates students in understanding the content and the language in the task and enables learners to complete exercises by providing correct supportive structures. Scaffolding, besides, supports the enrichment of specific vocabulary and entire phrase construction by providing motivation, enthusiasm and language proficiency enhancing skills. It promotes the interaction between learners that begins to communicate with each other in an authentic way, stimulating thinking skills together with a specific topic glossary. The resulting outputs consist in enhancing fluency in communication and in increasing self esteem.



Figure1: Screenshot of one CrimeQuest page regarding a hands on activities ( fingerprint detection).

## **CALL (Computer Assisted Language Learning)**

*“We live in an increasingly connected world”*(Brito Vieira, M. & Runciman, D., Representation, 2013) with new technologies and social networks. Strengthening education systems, joining innovation and creativity with technologies aimed at young students can enhance European students’ full potential. *“Digital technologies are an inseparable part of today's learning process. The European Commission works on several policy initiatives in order to modernise education and training, provides funding for research and innovation in order to promote digital technologies used for learning and measures the progress on digitization of schools”*( *Digital Learning & ICT in Education, European Commission 2018*) According with the Digital Agenda, many European countries have realized significant investments in order to ensure universal access to ICT, particularly to help tailoring the use of technology in the education process to improve digital skills. A large majority of headmasters and teachers agree with the positive impact of Information and Communication Technology (ICT) use in learning environments and students’ motivation. An overwhelming majority of students is also positive about the impact of ICT on the classroom atmosphere and on different learning processes.

Computer assisted language learning (CALL) refers to any process in which the learner uses a computer to improve foreign language competence. The involved technology includes not only computers but also smartphones, tablets, MP3 players, and consoles. A large number of studies confirm that learners enjoy using technology in foreign language learning and that they prefer using technology over more traditional methods and materials (European Commission 2014).

## **Methodology**

We created an innovative methodology based on the game, that enhances the interdisciplinarity, the information retrieving and decoding, for all school levels. The Computer Class Role Playing Game (Fig.1) is a new technology designed for deeper learning of Biology, Earth Sciences, Chemistry, Environmental Sciences, by improving the innovation and creative capacities of learners and by supporting the new role of teacher as a learner’s coach. Our game uses EVO-RPGE (Role Playing Game Engine), a new engine (Sacerdoti F.M. & Maraffi. S., 2015) developed to easily build interactive role-playing games, which involve all students who participate in the game through their own mobile or tablet (Fig.2), giving a global interaction of the class within the game. The game can be followed by the whole class with a IWB (Interactive White Board) or a projector (Fig.3).

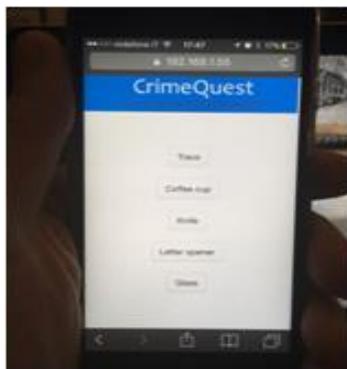


Figure 2: Screenshot of CrimeQuest on a smartphone



Figure 3 A whole class following the game with an IWB

The game can be played in a laboratory to accomplish one or more hands-on activities or in a classroom simulating a workshop activity.

Texts are spoken by a high quality synthesized computer voice in several different languages, so it is perfect for CLIL compliance.

Teachers can create their own "adventure" writing a text file enriched with texts, image names, questions, jumps, fostering students' curiosity in their learning etc. The system is multi-language allowing different text files one for each idiom.

### **CrimeQuest**

In CrimeQuest we take advantage of storytelling (see an example of story setting in Fig.4), which is a powerful tool to foster students' curiosity and to improve learning. Our game is interactive: we bring all the participants (or our students in a class) on a virtual crime scene in a lab. In the story, a researcher is found dead in a research lab: was it an accident or a suicide or a murder? "Who killed Prof. Maya Foster?". The students must solve forensic logic problems and they are involved in many hands-on activities with "poor materials": DNA profiling, digital fingerprints, hair comparison, analysis of sticky soil on killer's shoes (players will compare different kinds of soil with an Earth Science hands-on Lab) and Luminol test on the crime scene. Students collect all the clues and the bodies of evidence on the Crime Scene and can have free access to materials that they found

along the way, including original texts created on purpose, as a note-book about Biotechnology. Materials consultation is easy and immediate, since they are realized as synthetic PowerPoint presentations or PDF files rich of icons and pictures (Ercolino I., Maraffi S., Sacerdoti F.M., 20016). Students can check their personal score, related to their role in the game, on their devices. In fact, players can choose a different “role” in the game: scientist or journalist. The system gives distinct scores to each group based on the "weight" each question has for the different roles played by participants. The progression of the game can be followed by students with different levels of knowledge and skills using the note-book as compensatory measure. The iconographic contributions, the use of different communication codes (visual and auditory) and the structuring of the questions are ideal for a personalized teaching, even in the case of Special Education Needs.

## Conclusion

We presented CrimeQuest at Science on Stage festival 2017 and tested it with some high school classes: at present we are analyzing the experimentation results. The observation in the classrooms during the game gave very good results: students were interested and participated for the entire duration of the activity (Fig.5). In fact, the game is an activity aimed at promoting the development of everybody’s personality, especially in the perspective of learning to learn (Key Skills) (Maraffi, S. & Sacerdoti., 2017). We observed that CrimeQuest Game really engaged students in their learning. Our future goal is to experiment again the combination of CLIL and CALL with new method logical and pedagogical tools for implementing CLIL in bilingual education and for assisting teachers as well, in their own storytelling design, by supporting teachers to express their creativity and provide them with an adequate setting for CALL integration. Therefore we strongly advice the development of this type of CLIL tools combining a technological component.

*“Life is increasingly non-routine, problem-based and technology rich. That’s why education systems are moving away from solely content-led approaches, and focusing more on helping learners develop a range of competences to cope in our complex world. Education today, just as in previous centuries, is intended to promote learners’ personal growth, citizenship and preparation for the world of work.”* (Smith, M.K., 2005).

CrimeQuest is an innovative teaching tool developed according to this vision and, through testing, has proved effective in facilitating learning with a competence-based approach.

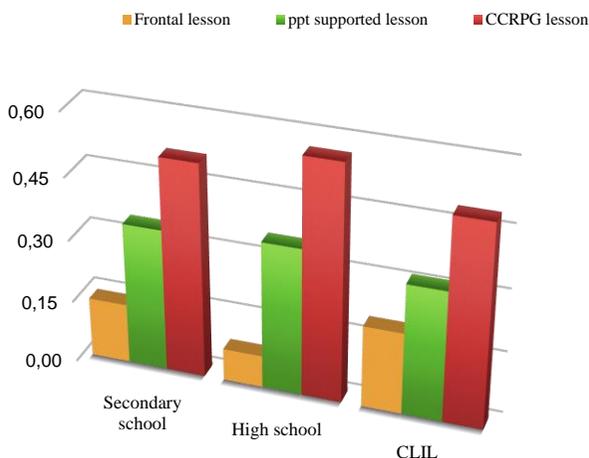


Fig. 5. Efficacy of interactive methodologies, also in case of CLIL methodologies (Content and Learning Integrated Learning), compared with Traditional and PPT lessons.

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## **Combinatorial Mathematical Tasks in the Education in Mathematics for Grades 1.- 4.**

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### **Abstract**

The choice of strategies and their correct combination over the course of training of the students to solve tasks from the area of combinatorics for composing combinatorial compounds from permutation type is one of the important factors for performance of efficient education in mathematics during the classes for extended and additional training in the Primary school. Object of the study is the influence of the applied strategies on the process of acquiring of knowledge, development of skills and competencies in the students for solving tasks from the area of combinatorics in the education in mathematics during the classes for optional education in Grades 1. – 4. The research work was performed in qualitative and quantitative aspects. The following methods were applied: experiment, observation, test, analysis of the content, mathematical-statistical method for data processing. As a result of the study it was found out that due to the applied methodology system of work where different strategies were combined, the competences and competencies for solving tasks from the area of combinatorics were developed in the students from Grades 1.- 4.

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**Keywords:** Strategies, combinatorics, permutations, education in mathematics

### **Introduction**

Nowadays, at the present level of the education in mathematics in the Primary school the development of skills, knowledge and competencies in the students for solving tasks from the area of combinatorics is of significant importance for the purposes of achieving high level of general knowledge in mathematics.

#### **I.**

**Goal** of the present study is through application of suitable strategies of work to facilitate the development of knowledge, skills and competencies

in the students for solving tasks from the area of combinatorics in and through the education in mathematics during the classes for Optional education in Grades 1.-4.

**Object** of the study is the process of education in mathematics during the classes for Optional education in Grades 1.-4.

**Subject** of the study is the influence of the applied strategies of work on the level of acquiring of knowledge and development in the students of skills, strategies and competencies for solving tasks from the area of combinatorics during the classes for Optional education in Grades 1.-4.

To achieve the goal of the study the researchers completed the following **tasks**:

1. Research and theoretical analysis of: Research works of foreign and Bulgarian authors regarding concepts related to: strategies, pedagogy technologies, approaches, methods and combinatorial compounds from permutation type.

2. Study of the main characteristics of some strategies and their application for development of a technology, a methodology system of work. Their use in the education in mathematics during the Optional mathematics classes in Grades 1.-4. with the idea to facilitate development of mathematical competencies in the students for solving tasks from the area of combinatorics directed to composing of combinatorial compounds from permutation type.

3. Study the efficiency of the applied strategies and methodology system of work during the Optional mathematical classes in Grades 1.-4. Comparative analysis and assessment of the results from the empiric study, summary. Presentation of conclusions.

For the purposes of the empiric study following criteria were offered: knowledge and skills to compose combinatorial compounds from permutation type with two elements – numbers; knowledge and skills to compose combinatorial compounds with three and more elements – numbers; knowledge and skills to compose combinatorial compounds with two elements of other type (different from numbers); knowledge and skills to compose combinatorial compounds with three and more elements of other type (different from numbers).

The following methods were used for the purposes of the research work: didactical experiment, analysis of content (content – analysis), observation, written work, mathematical-statistical methods for data processing.

In the process of analyzing Bulgarian and foreign literature on the topic it was found out that there are multiple studies on the problems related to the strategies for education. Some of the authors whose works were analyzed are Alexander (1991), Andreev (2001), Bruner (1995), Kostova –

Chavdarova and others, (2012), Merdzhanova (2005), Radev (2007), Woolfolk (1992) and etc.

In didactics the concept of strategy is used to describe procedures and activities related to teaching and studying, with organization of the educational process. Historically, this terminology is used as a synonym of “method” or “procedure” and contains the meaning for “system of knowledge”, “skills, ability to manage”, different means, tools and methods for achieving a goal. (The International Encyclopedia of education, 1987)

After summarizing the results from the performed theoretical analysis it was found out that there are different classifications depending on the basis on which different strategies have been formed. The following strategies were used for the purposes of the study: direct strategy (reproductive), indirect strategy (problem-productive, situational strategy) and a strategy for joint studying and cooperation (strategy for work on a project, topic).

The direct strategy puts an accent on teaching and its main characteristic is the clear purposefulness, the exact quantification of the performed activities and their structuring.

The problem-productive (indirect) strategy of education is based and organized on the familiarization and inclusion of the student in an active transforming activity. Studying through research, studying through solving problems and making decisions, studying through discovery– these are the solutions that normally are related to this strategy.

Typically, the strategy for joint studying and cooperation, provides that the goals and the interests of the group have got the priority. The following features are included: interdependence between members of the group; cooperation of “face-to-face” type, individual responsibility towards the common goal; development of skills for work in a small group; reflexive discussion of the work done. (Chavdarova – Kostova and others, 2012)

For the purposes of the empiric study and based on the performed analysis and the proposed theoretical concepts, a poli-didactical technology was developed and applied during the Optional mathematics classes for Grades 1.-4. The strategy by nature is purpose oriented – mathematical, developing, informational (acquiring of knowledge, skills and competencies) and heuristic (the creative skills of the students are getting developed), educational, makes the young students more active and finally, according to the prevailing method of education is problem oriented, creative.

In the course of the research work the author developed a methodology system of work that was systematically applied during the Optional mathematics classes in Grades 1.-4. The new system combined the strategy for joint studying and cooperation (strategy for work on a project, topic), problem – productive strategy (indirect, situational strategy) and a reproductive (direct) strategy.

Mathematical tasks assigned as combinatorial were known to people from ancient times. In XVII century the results from multiple works of Tartalia, Erigon, Pascal and Ferma on this topic were known, but the scientific foundation of the theory were laid in 1666 by the twenty years old Leibnitz in his work „Dissertatio de arte combinatoria“, where this area in mathematics received its name from.

There are multiple publications related to the combinatorics and the Probability Theory (Balabanova, Dineva, 1995), (Sougarev, Kamenarov, 1974) and etc.

According to Balabanova and Dineva combinatorial compound means “group of objects, numbers, letters, etc. amongst the elements of a given multiplicity which are created in accordance with a certain rule and differentiate from each other by the elements themselves or by their location in the group.” Depending on the ways of their creation, the compounds can be different. There are two types of combinatorial compounds: compounds without repetition and compounds with repetition. “When the elements in a given compound are different from each other, then this compound is called compound without repetition. In the opposite case the compound is called compound with repetition.” (Balabanova, Dineva, 1995)

Sougarev and Kamenarov described the permutations without repetition: “It is easy to understand the pattern for creation of permutations – to each element of the compound add the permutations of the rest of the elements. The number of these permutations is equal to the number of all the elements minus one.”

The multiplication of the successive natural numbers from 1 to n, i.e.  $1 \cdot 2 \cdot 3 \cdot \dots \cdot n$  can be defined as  $n!$  and shall be read “n factoriel”.

Consequesntly, the number of the possible permutations from n elements will be:

$$P_n = 1 \cdot 2 \cdot 3 \cdot \dots \cdot (n - 1) \cdot n = n!$$

Other words, the number of possible permutations  $P_n$  from n elements is equal to the result from the multiplication of the natural numbers from 1 to n”.

There are four areas (Clusters) of competency specified in the educational programs in mathematics approved by the Ministry of Education and Science of republic of Bulgaria. for Grades 1.-4.: “Numbers”, “Measuring”, “Geometry figures and bodies” and “Modelling”. The knowledge, the skills, the relations and the competences developed in the students as a result of solving combinatorial tasks belong to the competency Cluster “Numbers”.

Over the course of analyzing the educational documentation – textbooks and notebooks related to the mandatory educational content, it was found out that they content certain tasks from the area of combinatorics

without. However, the textbooks and the notebooks in question do not offer systematic approach for work with them during the mandatory mathematics classes in Grades 1.-4.

The methodology system of work with tasks from the area of combinatorics during the Optional mathematics classes for Grades 1.-4. was created to facilitate the development of: student's thinking; the skill to find non-standard solutions of mathematical tasks.

The new system includes series of mathematical tasks whose creation was based on the understanding that they are the "main tool" for development of mathematical competences. There are tasks which form separate elements of mathematical competences related to solving combinatorial tasks from competency Cluster "Numbers" as well as tasks that form the overall mathematical competency of the students. These tasks complete each other and create "complex repeating situation". (Petrov, Temnikova, 2016). Some of the tasks included in the series as well as their specifics are presented below.

In the course of education during the Optional mathematics classes for Grade 1 the work with combinatorial tasks starts even during the so called pre-number period. The number of elements in the compound from permutation type without repetition is two and these are colors used by the students to color objects sketched in advance – small houses, boats, ships, cars, airplanes, balls, flags, umbrellas, flowers and geometry figures (square, circle, triangle, and rectangle). When studying the numbers up to 10 the number of elements in the combinatorial compound shall be increased to three. To facilitate the students during solving the first tasks for composing compounds from permutation type with three elements, the total number of these compounds is given in advance and also a colored example of two of the compounds is given. The first graders have to color the other 4 compounds making analogy in their minds.

After studying the numbers up to 20 during learning addition and subtraction the following type of mathematical tasks were included: The numbers 1 and 0 are given. Wright with them one-digit numbers and two-digit numbers. Find the difference between the biggest and the smallest of them.

The alphabet letters learned during the Bulgarian language and literature classes can be used as elements in the combinatorial compounds. The following task can be used as an example: The word LAK is given. Compose and wright down all possible combinations with these three letters. Underline those who make sense.

The tasks related to construction of geometry figures are interesting for the children. The work with such tasks starts with a task where a square is divided in 4 parts – triangles. A figure of a human is composed by these

triangle which need to be colored by the students. On the next stage of the works the children work with the Chinese game “Tangram”. This is a square which is divided into 7 parts. The students use them to compose new figures using given example – racket, cat, fish, ostrich, etc. The students work with individual didactic material.

In Grade II the work with combinatorial tasks continues with composing permutation compounds without repetition with three elements. These elements could be numbers or to be of other type. The students compose the compounds and perform additional activities like coloring fishes, three-color bands, toys, etc. The work related to construction of geometry figures continues with the game “Tangram” but the examples get more complicated in comparison with those used in Grade I.

In Grade III the students compose combinatorial compound of permutation type with three elements that might be numbers, geometry figures or other type. The methodology system of work includes tasks for composing three-digit numbers. Again, the additional requirements in the tasks after composing the combinatorial compounds are related to acquiring knowledge and development of skills and competencies from competency Cluster “Numbers” as the methodology system provides work with numbers within the range between 100 and 1000. The students do transfer of the competencies acquired during the activities performed in Grade II thus developing their thinking through convergent and divergent behavior over the process of applying the acquired knowledge as well as during performance of analysis, synthesis and analogy for solving combinatorial tasks. The conditions for transfer are created thanks to the combined higher class strategies used by the teacher – problem-productive (indirect) strategy and the strategy for joint studying and cooperation (strategy for work on a project or topic). The combinatorial compounds with three elements from other type which the students compose shall be colored by rows and columns (the rows and columns are formed by different objects) without repeating the colors. Also, there are tasks which require composition of combinatorial compounds (sentences) with three words (elements). For example: Compose all possible sentences with the following words: rain, outside, it.

The tasks related to modelling of different figures using example composed of sections of a square from the “Tangram” game get more complicated. The methodology system of work offers combinatorial tasks requiring modelling with the parts of the “Egg of Columbus”. There is increasing difficulty in the example figures which have to be used by the students for the purposes of the task solving. The series of tasks include such tasks which require the students to create their own figures without following an example figure.

In Grade IV the students compose combinatorial compound of permutation type with three elements (numbers). Additionally, the tasks require the students to: put the composed numbers in a row starting from the smallest number or with the biggest number, present the combinations as sum of ordinal units. The students start composing permutations with four, five and six elements and consequently start composing four-digit, five-digit and six-digit numbers. These tasks require the students not to compose all possible permutations differently from the combinatorial tasks for composing permutations with two and three elements where all possible permutations need to be composed. For example the task: "Without repeating the numbers 2, 0, 6, 7 and 4, write down at least 4 six-digit numbers. Put in a circle the biggest and the smallest number." As it can be seen, there is an additional requirement after composing the compounds and namely to determine the biggest and the smallest one. There are conditions offering the students different options for solving the task.

Some of the combinatorial tasks included in the methodology system of work offer a Table where the students write down the combinatorial compounds of permutation type which they composed. The purpose of the Table is to help the students to easier solve the task.

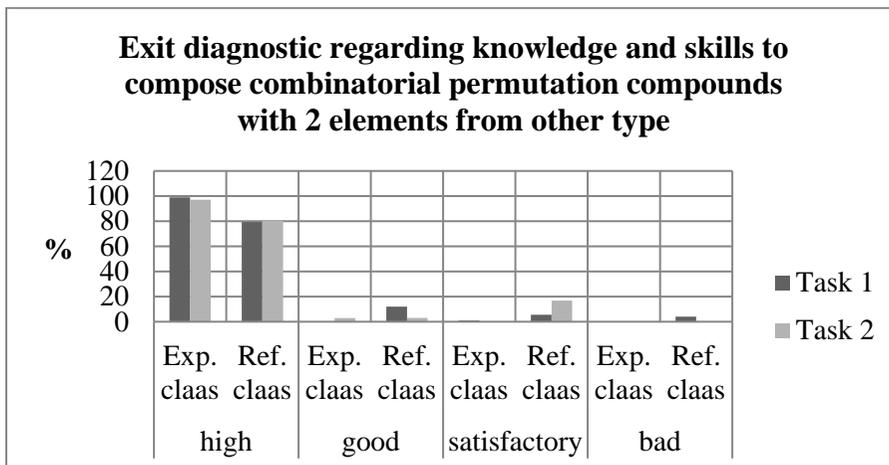
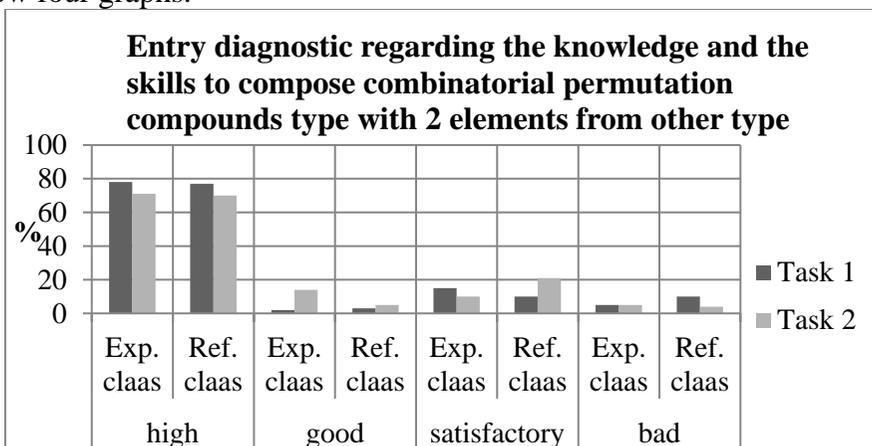
The teacher may allow team work and decide which task to be solved by separate teams or groups.

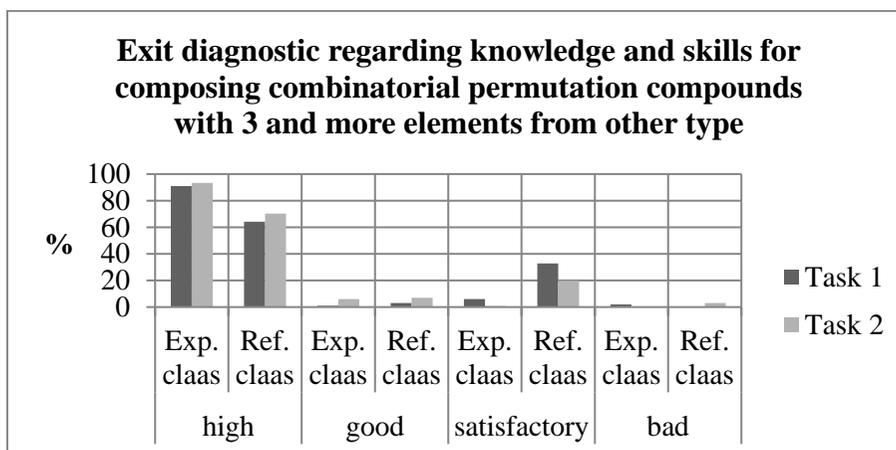
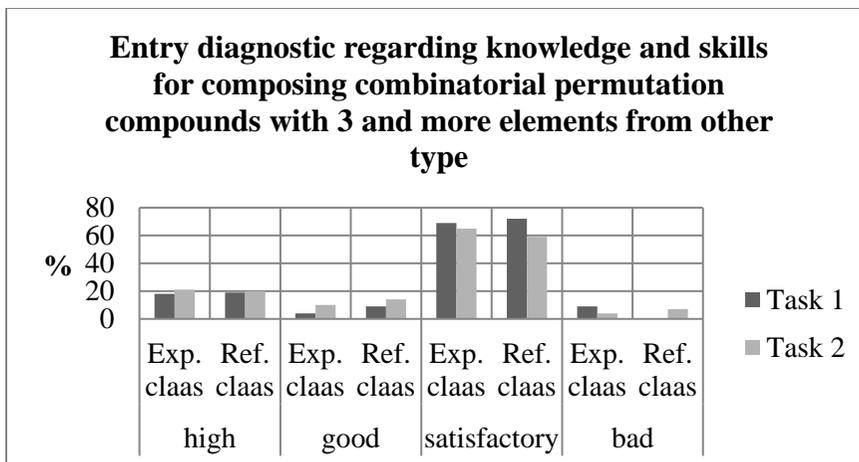
Over the period between 2012 and 2017 the researchers performed a study regarding the knowledge, the skills and the competencies of the students to compose combinatorial compounds without repetition from permutation type. The study concentrated on the education in mathematics for Grades 1.-4. during Optional mathematics classes. Two classes of students with statistically equal levels of educational achievements were subjected to the study. One of the classes was the experimental class where the newly developed system of work was applied and the second class was the referent class where the traditional system of work was applied.

Two tests were used in the empiric study: one for determining the entry diagnostic and the other one for determining the exit diagnostic of knowledge, skills and competencies of the students to solve combinatorial tasks for composing permutations. The objectivity, the validity and the reliability of the tests were studied as well as the separating power of the tasks included in them.

The results were analyzed including performance of comparative analysis. The data from the comparative analysis of the results from the entry and exit diagnostics regarding the knowledge and the skills of the students to compose combinatorial compounds from permutation type with two elements (numbers); regarding the knowledge and the skills to compose combinatorial compounds from permutation type with three and more

elements (numbers); knowledge and skills to compose combinatorial compounds with two elements from other type (different from numbers); knowledge and skills to compose combinatorial compounds with three and more elements from other type (different from numbers) are presented in the below four graphs.





The data from the entry diagnostic show that there is no statistically significant difference between the results from the respective lots of students subjected to the study from the experimental and the referent class in respect of knowledge, skills and competences. After the experimental work it was found out that in the exit diagnostic there is significant difference between the results achieved by the students from the experimental and the referent class. The percentage of students who correctly composed combinatorial compounds from permutation type with two elements (numbers) is within the limits of 97,1% and 99% for the experimental class and between 79,5% and 80,2% for the referent class. No students from the experimental class failed to compose combinatorial permutation compound with two elements from other type while 4% of the students from the referent class failed to do this. The level of knowledge, skills and mathematical competences of the students who correctly composed combinatorial compounds of permutation type with 3 and more elements (numbers) was increased from 15% to 90,1% for the

students from the experimental class and from 22,7% to 75,4% for the students from the referent class. 93,3% of the students from the experimental class correctly composed combinatorial permutation compounds with 3 and more elements of other type while only 70,3% of the students from the referent class managed to do this. The difference in the results was proved to be statistically significant.

### **Conclusion:**

Based on the received results the following conclusions can be made: due to the applied new methodology system of work the students from the experimental class developed higher level of knowledge, skills and competencies for composing combinatorial compound of permutation type in comparison with the students from the referent class.

The systematic application and combination of strategies for joint studying and cooperation (strategy for work on a project, topic), the problem-productive (direct, situational) and reproductive strategies in the education during Optional mathematics classes in Grades 1.-4. for solving combinatorial tasks facilitates for both acquiring of knowledge, development of skills and competencies from competency Cluster “Numbers” and for development general mathematical competency in the Primary school students.

The applied methodology system of work helps to develop students’ thinking and their ability to look for non-standard solutions of mathematical tasks. The combinatorial tasks from permutation type increase students’ interest to mathematics as a whole and stimulate the creativity, research ambition in every child, widen his mathematical horizon.

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## **Design Of A Minicomputer Separator Of Urban Solid Waste (RSU)**

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### **Abstract**

In Mexico, the society in general lacks the habit and ethics of properly disposing garbage or in taking care of the environment. This paper focuses on analyzing and disposing garbage in an automated way. The present study also seeks to create and promote care for the planet. The minicomputer (GreenScanProcess) is an automated system whose process is based on an algorithm that stands out for its functionality. GreenScanProcess has sensors that allow the analysis and scanning of garbage. It also measures the weight and humidity of the garbage. The minicomputer also examines the garbage to know its composition. Likewise, GreenScanProcess takes the garbage to the container according to the garbage. The benefits obtained when conducting the research were: environmental, economic, technological, and educational.

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**Keywords:** Minicomputer, automated process, algorithm, garbage separation

## **Introduction**

Currently, one of the most important concerns of today is garbage, its handling, and its classification in order to improve the natural environment of the world. Bernad (1999) pointed out that the amount of garbage originated is directly proportional to the number of inhabitants. However, in the United States, they generate approximately 750 kilos of garbage in a year per person, while Japan generates approximately 400 kilos of garbage in a year per person. OPS (1988) mentioned that in Latin America, the per capita production of garbage has doubled in the last 30 years, reaching half a kilo per day per person. Aguilar (2008) opined in his article that Mexico has a disgraceful pride of having the largest garbage dump in the world, the Bordo Poniente, located in Ciudad Nezahualcoyotl, Estado of Mexico. Therefore, despite not having space available, the useful life has been lengthened by the difficulty of finding another place to deposit the thousands of tons of garbage produced by the Distrito Federal and its metropolitan area.

Deffis (1994) defines garbage as suggesting dirt, lack of hygiene, bad smell, displeasure at sight, contamination, fecalism, turbidity and impurity. Mora (2004) stated that the word “garbage” means a lot of derogatory words to too many people. It is regarded as something that has no value and what needs to be undone as soon as possible. Silva (2013) pointed out in his work that garbage comprises of the waste of the citizen that he discards on a daily basis by sweeping the front and the inside of his home. Logically speaking, it refers to all types of waste such as those deposited in the bathroom, containers, papers and with all those wastes that leave the home, the office, the street, and the industry.

Flores (2012) indicated that waste is all material, which after having fulfilling its work or having served for a certain task, is discarded. This term is generally used as a synonym for garbage, as it is the broadest word in the language to name all waste discarded by people in their daily work. On the other hand, Alegria (2015) pointed out that the word “solid” is used to designate things and objects, which are presented in a defined form. Panarisi (2015) mentioned that all solid, liquid or gaseous elements that lack economic value for their producer or owner are called residues. However, it is considered that they should be eliminated.

In Mexico City, there is the Environmental Standard NADF-024-AMBT 2013 on Separation, Classification, Selective Collection, and Storage of Waste from the Distrito Federal. This norm came into force in July 2017 in order to reduce the amount of garbage that reaches the sanitary landfills and increase the recycling of solid waste (SEDEMA, 2017). Thus, the classification of this standard is as follows (see Figure 1):

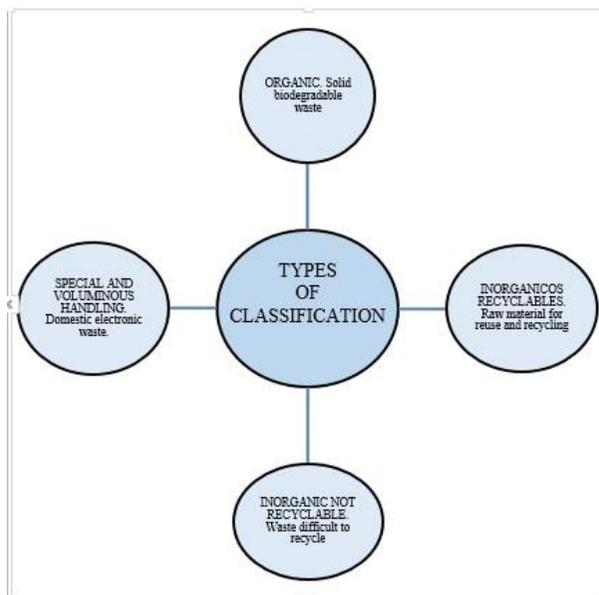


Figure 1. Example of classification of garbage.  
Source: Own elaboration.

Lopez (2017) states in his article that the inhabitants of Mexico City only separate 20 percent of the 13 thousand tons that are produced daily in the city. Valdez (2017) stated in his article that the delegations of Iztapalapa, Gustavo A. Madero, and Cuauhtemoc are the delegations that generate majority of the garbage in Mexico City. Notimex of Diario de Yucatan (2017) argued that large amounts of waste are produced every day and it is estimated that around 77 million tons are generated in Mexico each year. This means that during this period, each person generates an average of 300 kilos, of which only 11 percent is recycled. Therefore, this shows that there is still much to be done in that area.

Gongora (2014) cited in his article that one of the biggest obstacles to achieving a significant advancement is based on the fact that the collection and disposal of waste is done within the framework of municipal competencies. Sanchez (2015) argued in his article that the issue of recycling must be from childhood. The writing of Sol de Hidalgo (2017) stated that in Mexico, the issue of recycling and separation of waste is attributed the fact that Mexico lacks the necessary culture to take better advantage of the reuse and treatment of garbage. Romero (2017) pointed out in his article that citizens should be sensitive and aware to understand that the sum of all in these tasks of separation of solid waste will help our environment and the future generation to have a better environment.

With all of the above, this paper focuses on optimizing the processes of separation of solid waste through weight and humidity. It also aims to

reduce the ecological footprint in the environment based on the percentage of the improvement of the environment, recovery of some spaces, as well as the teaching of recycling, and the reduction of costs at the business level.

### **General Objective**

Design of a minicomputer separator of urban solid waste (RSU) with the aim of reducing waste and generating awareness in people about caring for the environment.

### **Justification**

The main objective of this research is to design a process for the separation of solid urban waste in Mexico and taking, as reference, the Environmental Standard NADF-024-AMBT 2013. This will, however, benefit the environment and would in turn have an impact on society. With this, there would be a proper awareness of every inhabitant in this country which will solve the problem at the national level. The importance of our research lies in the environmental, economic, technological, cultural, and social impact.

Altamirano (2016) mentioned in his article that the inhabitants of Mexico City live in an unhealthy environment, not only because of the air pollution, but also because of the poor management that their authorities give to the garbage. Lira (2016) stated that Mexico City is the second with the largest solid waste generation worldwide after New York. This analysis was made based on a study published in the scientific journal Proceedings of the National Academy of Sciences (PNAS).

For this reason, the study of Maldonado (2006), through a program of separation of byproducts, managed to reduce by 67% the volume of garbage sent to the landfill of the city of Merida. Industrias Leblan (s / f) developed a device that allows an effective separation of the solid waste that is deposited on it based on its physical characteristics: size, shape, and density. Before the waste is selected (manually or automatically), it must go through this separation called “gravimetric”. Subsequently, the present project provides an alternative to achieve a positive change in the environment. With this, there would be a reduction in pollution and people would be able to generate favorable habits towards the environment.

### **Methodology**

The methodology used for the project was that of Scrum. Bustos (2014) pointed out that it is a methodology that consists of applying a series of good practices, such as separation of roles, team meetings, and reviews. This takes place within a group iterative process, in which partial deliveries

are made. Also, it has been prioritized with the goal of delivering results quickly.

The stages that were developed were those proposed by Mariño and Alfonso (2014). Figure 2 represents an example of the aforementioned.

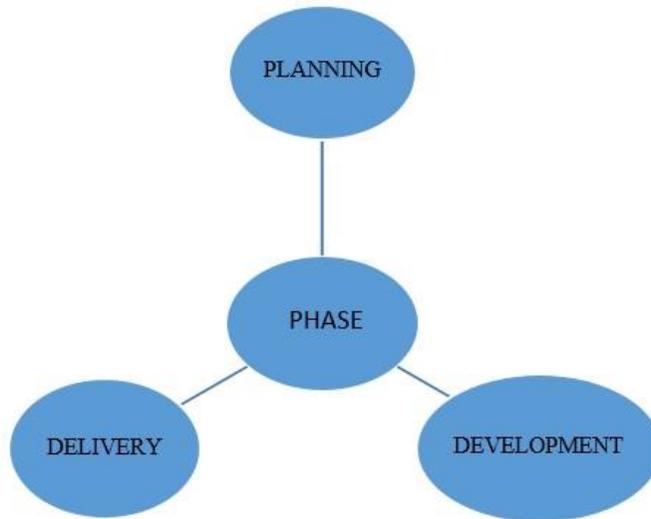


Figure 2. Example of methodology used.  
Source: Own elaboration.

**Planning:** In this stage, the work plan is defined (Navarro, Fernandez & Morales, 2013). This phase was divided into two:

- **Selection of the Area:** Through the work of team meetings, the area to work on the research and the sources of information to be consulted was informed. The work team names the project “GreenScannProcess”.
- **Selection of Viable Topics to be Developed:** This stage is characterized for the investigation of materials, competencies, name of the process, brands, author rights, sustainability, state of the art, needs of use, ease of use, target market (market segmentation). The project's image was developed (see Figure 3).



Figure 3. Example of project image  
Source: Own elaboration.

**Development:** It refers to the lifting of requirements and the system model (Madariaga, Rivero & Leyva, 2016). An investigation of the properties of the objects was carried out, which will be used for their identification and classification. Thus, it makes use of the different types of correct sensors that are capable of recognizing their individual properties. A diagram of the phases of the process (container states, detection of the sensors, location of the container on the boats, etc.) was also elaborated, optimizing the tasks that are redundant and thus obtaining a maximum performance, and obtaining results in a minimum time to pass for each cycle of this process (for each object classification). Figure 4 represents an example of the prototype of the project.



**Figure 4. Prototype example.**  
Source: Own elaboration.

To perform the performance tests, GreenScannProcess was applied in developing a software with a new technology called Raspberry pi 3. Basically, 3 types of sensors were used: The weight sensor will determine that there is an object in the container that we need to classify; the humidity sensor to identify organic waste; and another sensor to identify recyclable inorganic materials. A cart was developed that contains the system installed, and is able to move in the container in order to classify and deposit the waste in the corresponding boat. Figure 5 represents an example of the operation of the project.



**Figure 5. Example of project operation**  
Source: Own elaboration.

**Delivery:** This phase is characterized by the finished prototype. The duration of the project was 16 weeks. Figure 6 represents the finished prototype.



**Figure 6. Prototype finished.**  
**Source: Own elaboration.**

## **Conclusion**

The overall goal was achieved 100%. The proposal of automatic separator managed to classify the different objects in an expected time of 3 to 5 seconds. The project achieved separation of garbage. Hence, the size of the automatic separator is expected to be improved. This proposal can be the door for several Mexican companies that want to achieve ISO 14001 certification: Environmental management system.

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