

# RESEARCH HIGHLIGHTS IN EDUCATION AND SCIENCE 2016

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SELAHATTIN ALAN  
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## **Research Highlights in Education and Science 2016**

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*Section 1: Teaching and Learning*

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## FLIPPED CLASSROOM MODEL IN EDUCATION

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**ABSTRACT:** Today, the traditional classroom model teaching approaches in which learners are not active and teacher control everything is found insufficient by the educators. The effect of change in information and technology is seen in education field, too. In our world in which the only unchanging thing is change, the meaning of concepts such as education, teachers, learner, learning process are changing and as a result the expectation of learners from learning process varies. Consequently, different teaching models which respond the expectations of learners whose expectations differ are needed. One of these models is “Flipped Classroom Model” which started to spread recently. In this model, the effective use of out-of-class time is seen. In such a way that, the teaching in the classroom is presented to learners out of class, it is defined as carrying out the homework and activities, which are expected to be taught out of class because learners need teachers, in the classroom. For this purpose, this study aims to give information about emergence, development process, basis and procedures of Flipped Classroom Model and also reveal unknown aspects of model through discussing effects, advantages and disadvantages in company with literature.

### INTRODUCTION

There have been important changes in education system up to now and these changes are still going on. Many different methods and models are used during the transition process of learning approaches from the approaches that centralize teacher to the ones that centralize students. A model enabling students reach the contents individually, have an active role and follow according to individual interest areas is initially preferred with contribution of rapid changes in technology today (Bishop & Verleger, 2013).

Changing living conditions, increasing economic pressures, globalization and business life impacts, technological developments and accordingly facilitating the access to information have shown that traditional teaching models are insufficient and led to a situation in which the expectations from education differ. The generation, today, is called “millennial generation” (Wilson, Gerber, 2008) or “digital natives” (Prensky, 2001). When compared to previous generations, millennium generation has more access to technology, information and digital media. For that reason, on the contrary to previous generations, the millennium generation show less tolerance towards learning processes based on lecturing (Roehl, Reddy, Shannon, 2013). This situation has uncovered obligations to create learning environment for individuals towards making them question, use technology effectively and have high level thinking skills (Tezci and Perkmén, 2013).

In recent years, the learning concept which is expressed in various ways such as “Flipped Classroom” and “Inverted Classroom” (Baker, 2000; Lage, Platt & Treglia, 2000) in international studies and “Ters-Yüz Sınıf Modeli” (Gençer, Gürbulak and Adıgüzel, 2014; Sırakaya and Özdemir, 2014), “Çevrilmiş Öğrenme Modeli” (Sever, 2014) or “Evde Ders Okulda Ödev” (Demiralay, 2014) in Turkish, partly surpass the borders which are built by learning environments.

### What is FLIPPED CLASSROOM?

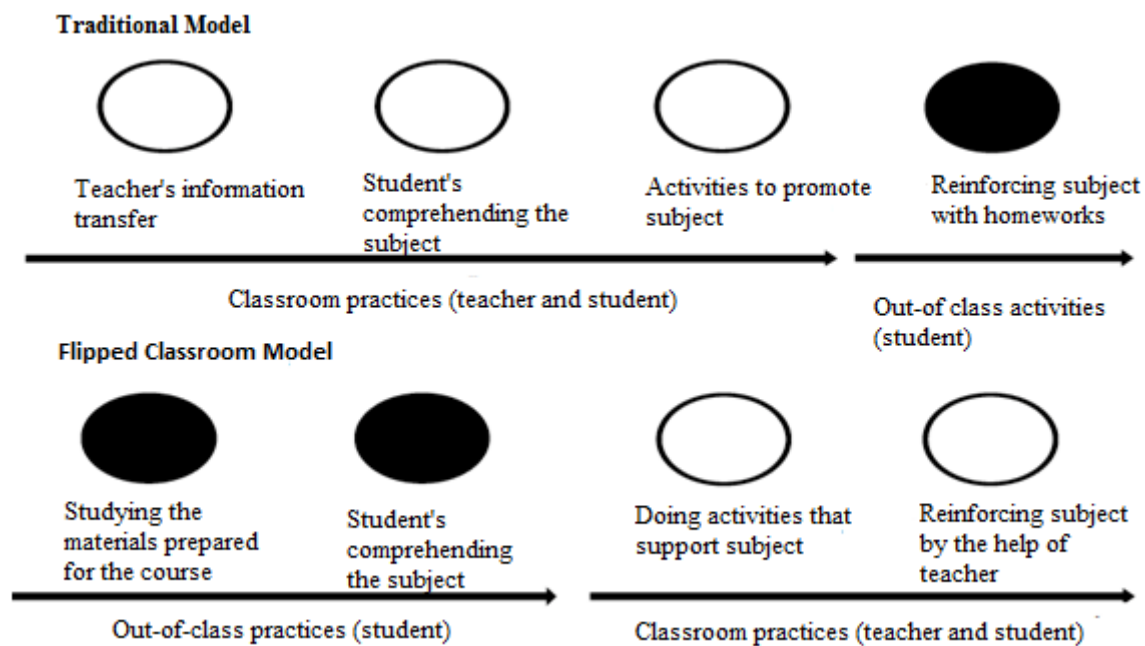
A learning model which is called Flipped Classroom and translated into Turkish as “Ters yüz Öğrenme” has emerged recently. The term flipping in Flipped Classroom is used to define the interchange of homework and classroom activities (Ash, 2012). The term “Flipped Classroom” was first emerged at an international conference on learning and teaching by J. Wesley Baker that he used it in his article “*The classroom flip, using web course management tools to become the guide by the side*” in 2000. In pursuit of this study, Lage and his friends did a study using a similar term called “*The Inverted Classroom*”

Flipped classroom model is a part of a broad educational movement which covers the blended learning, inquiry-based learning and other educational approaches and the tools that integrate flexible, efficient learners (Johnson, Becker, Estrada and Freeman, 2014). Besides, it is also a model which contributes to make learners take their own learning responsibilities (Fulton, 2012). Flipped classroom model provide an environment which include Project based or real world practices for learners in order to learn the subject better at class time. The learner realizes

learning watching course videos, listening podcasts, reaching e-books and meeting with peers online instead of getting information presentation from teacher at class time. Learners can reach to these broad sources any time they needed. So that, the teacher can spend more time to interact with each individual. The main goal is to provide learners a more authentic learning (Johnson, Becker, Estrada and Freeman, 2014).

The flipped classroom model approach was first seen under the name of inverted classroom in the study of a group of professors at Miami University (Lage et al., 2000; 30-43). In literature, this approach was used as inverted classroom then it was used as flipped classroom. The flipped classroom concept was first used and practiced by Jonathan Bergmann and Aaron Sams working at University of Northern Colorado (Talbert, 2012; 1). These two chemistry educators realized that students need teachers more while they are doing their homework not while they are taught and they recorded course videos for the students who could not Show up in the class in order to make them watch these videos and use the classroom to discuss the subjects and do other activities. After that, this method started to be noticed (Bergman and Sams,2012).

Flipped classroom model is a part of a broad learning activity which covers blended learning, inquiry-based learning and other educational approaches and the tools that integrate flexible, efficient learners (Johnson, Becker, Estrada and Freeman, 2014). Besides, it is also a model which contributes to make learners take their own learning responsibilities (Fulton, 2012). Flipped classroom approach emerged from the idea to provide education at home watching videos instead of traditional classroom education. In the classroom the time spend to internalize the previously given information by educator with different methods. This is achieved through video records given previously. Educators have the chance to get involved with students personally. In this way, the time spent in classroom is used effectively (Zownorenga, 2013; 2). In the following the differences of practices in traditional education approach and flipped classroom model are compared.



**Figure 1.** Comparison of Traditional Education Model and Flipped Classroom Model (Moravec et al, 2010)

As it is shown in the figure, we see that the places of classroom practices are changed out-of-class practices in flipped classroom model. In flipped classroom model, educator is no longer a direct person to educate, use different Technologies and provide flexible learning to students one by one or as a group. Teacher discusses the subjects that are not understood well by the students and reinforce the subject with different activities (Hamdan et al., 2013; 4).

In flipped classrooms students watch lesson videos at any computer, from their tablets, smart phones or from different media players at any time as they want. They bring their homework to the classroom and participate actively to learning process (Knewton.com, 2011). Flipped classroom approach does not eliminate the education in the class directly. On the contrary, this approach maximizes the time spend for each student instead of spending time for all students at once (Hamdan et al., 2013; 15).



Flipped (inverted) classroom which is defined as changing the place of classroom practices and out of class practices (Lage, Platt, & Treglia, 2000) is described as a popular pedagogical approach in science, math and other lessons. Flipped classroom model provide an environment which include Project based or real world practices for learners in order to learn the subject better at class time. The learner realizes learning watching course videos, listening podcasts, reaching e-books and meeting with peers online instead of getting information presentation from teacher at class time. Learners can reach to these broad sources any time they needed. So that, the teacher can spend more time to interact with each individual. The main goal is to provide learners a more authentic learning (Johnson, Becker, Estrada and Freeman, 2014).

The reason why flipped classroom is preferred is that teacher has the chance to spend more time on classroom activities and to correct the problems with classroom activities. In this way, even in crowded classes success can be achieved. Thus, the result of researches literature also supports this. The superior sides of flipped classroom model to traditional classroom practices are given in table which was created by Bergmann and Sams (2012).

**Table 1.** Comparison of Traditional Education Model and Flipped Classroom Model  
(Bergmann and Sams, 2012)

<i>Traditional Classroom</i>		<i>Flipped Classroom</i>	
<i>Activity</i>	<i>Time</i>	<i>Activity</i>	<i>Time</i>
<i>Warm-up activity</i>	<i>5 min</i>	<i>Warm-up activity</i>	<i>5 min</i>
<i>Going over homework</i>	<i>20 min</i>	<i>Question and answer activity</i>	<i>10 min</i>
<i>Presentation of new content</i>	<i>30-45 min</i>	<i>Guided and independent practice activities</i>	<i>75 dk</i>
<i>Guided and independent practice activities</i>	<i>20-35 min</i>		

The superior sides of flipped classroom to traditional classroom are especially about realizing more effective activities. In the light of information given in Table 1, it is seen they the activities in flipped classrooms are 40-55 minutes more than traditional classroom. This proves that it provides permanent learning. However, before applying this model, a good planning is important. Miller (2012) states that there are five basic factors that should be considered while planning flipped classroom model (Karadeniz, 2015).

**1-Meaningful Content:** The teacher should determine and take into consideration the content that will be saved. The reasons that the related content is necessary for the exam or will be used after graduation may not take attention of student. In this context, content should be creative and meaningful that increase the awareness feeling of student and also can be used in real life.

**2- Attention Grabbing Models:** while preparing a meaningful content, how the student will use this content is also important. Student should turn the acquired content into experience in classroom environment. Accordingly, while designing the classroom activities, some models such as problem-based learning, game-based learning, group interactive learning and project-based learning should be benefited.

**3- Technology:** Fort he flipped classroom model the technology used is also important. Teacher should have analyzed well which technology will be more effective during learning process and which ones will prevent this. During this process, teacher should consider many factors such as which media could be used to play the video, whether it supports mobile technology or not, the size and quality of video.

**4- Reflection:** teacher should have an expectation for each video prepared for students. Teacher should expect students be aware of the things they learned, transfer and adapt their knowledge in the scope of the video they watched. If reflection is not a planned fact within the scope of general structure, it will be a wrong attitude to expect flipped classroom be successful. It is important to improve the high-level skills of students and make them deal with contents and activities that can be reflected towards goal of courses.

**5- Time and Place:** Expecting students to watch videos as homework and not supporting them through this period may not be adequate. Thinking that not all the students may have same opportunities may lead to a way to design a structure which can support students at out of class activities. Another important point is that, students should be provided an appropriate time and place to watch videos. Thus, students will be able to watch videos in an appropriate environment under their control at a time span they want.

Shortly, the schools are given the mission to reach modern societies with modern philosophical approaches. The schools which have this mission are expected to turn into life centers which support cooperative learning and focus on problem solving and learning on learning skill in order to have an active role during learning process of students.

Apart from this, it is stressed that some models should be used while actualizing this duty. The first one is flipped classroom that started to be used at schools. The basic hypothesis is that students learn the subject that will be taught in the class before lesson through videos so that teacher have more time for supportive activities and practices (Tucker, 2012). The real reasons of using flipped classroom are its being student-centered, creating a learning environment which use activities towards research, creativity and problem solving, turning classroom into a laboratory or a studio changing the role of teacher from giving information also the student from just learning, converting them into individuals, in brief, bringing a “constructivist” understanding (Aybat, 2013). Flipped Classroom Model consists of also some concepts such as Constructivist Approach, Research-Based Methods, Active Learning and Student-Centered Learning (Amber, 2013).

### **Principles and Practices of the Model**

Many different approaches and practice styles of this model are being used. While the content of classes are recorded for students to make them watch the videos as homework out of class, in some practices these videos are watched in classrooms. In a different practice, different sources are advised to students according to their individual learning needs instead of making them watch videos and they are expected to benefit from these sources preferably (Ash, 2012).

Bergmann and Sams who wrote the book “Flip Your Classroom: Reach Every Student in Every Class Every Day” published in 2012 and practiced one of these learning methods for the first time had made some changes in their model after their study in 2006. According to this change, they developed “Current Approach in Education and Teaching: Technology Assisted Flexible Learning” “Flipped Mastery Model” over traditional Flipped Learning model. In this developed new model, students are not forced to watch video. Instead of this, students are given directions which include reading texts, videos and different sources related to course subjects and course goals. Student benefit from the sources given in accordance with his learning style and needs, also join the tests and exams according to his learning ability independent form class.

According to Chen and his friends (2014) even if many “Flipped” learning models are developed, the focus of each are different. As a result, while traditional “Flipped” Learning model by Khan Academy and “Flipped Mastery Model” by Bergmann and Sams (2012) focus on transferring content to students, Gerstein (2011) work on learning cycle of “Flipped Classroom Model”, Staker and Horn (2012) concentrate on physical and virtual dimensions (Chen et al., 2014). Chen et al. (2014) who think that these approaches are inadequate in determining the numbers of sub dimensions purposed a more comprehensive model for higher education. In this model called FLIPPED, each letter symbolizes subscales. According to this;

**F-** Flexible Environments

**L-** Learner-Centered Approach

**I-** Intentional Content

**P-** Professional Educators

**P-** Progressive Networking Learning Activities

**E-** Engaging and Effective Learning Experiences

**D-** Diversified and Seamless Learning Platforms

This new model had been applied in some fields such as nursing, engineering, mathematics, physics, biology, chemistry education and its effectiveness was proved with different study findings. It was proved with the practice by Bergmann and Sams (2008) and Baepler, Walker, Driessen (2014) that this new model had a positive effect on student success in the field of chemistry education. Gaughan (2014) used this method in history classes and stressed that model is more successful, students follow up course materials regularly and they got ready for class. Turan (2015) who used this method for students of preschool education and stated that the when compared to traditional model, the ones who got education using this method were more successful and had a more motivation level also their cognitive load was lower. In another study, Kara (2016) used this method for medical students during their internship period and stated that students defined the internship period more efficient after this method and this method can be used at clinical education.

### **The Advantages of Flipped Classroom Model Approach**

The Flipped Classrooms which are called radical changes by Bergmann and Sams have many advantages for both teachers and students. The advantages can be ordered as in the following (Fulton, 2012).

- Each student can follow their courses according to their own understanding speed, there is opportunity to watch again and again if necessary
- Homework is done in class; students can ask questions about the subjects they did not understand comfortably, educators may also provide suitable solutions according to the talent of the students.
- Students have a chance access course 7/24.
- Time spent in classroom is used more effectively in terms of both students and educators.
- Educators who have taught using this method indicated that they got higher results from the tests when compared to traditional method results.

In a study by national case analysis study center which has more than 15.000 members in the fields of science, technology, engineering and math, the views of almost 200 educators who use flipped classroom model are evaluated and according to the results the advantages are given as below (Herreid and Schiller, 2013; 62):

- More time can be spent with students about the original research
- Students are able to spend more time with scientific equipment that can only be used in the classroom
- Students' being able to easily follow the classes which they couldn't because of sport, conference activities
- Method pushes up student to think and study inside and outside the classroom
- Students' being more active in the learning process
- Students will participate to the learning environment more actively, and this will cause students to love the work they do.

### **The Disadvantages of Flipped Classroom Model Approach**

There are some disadvantages of flipped classrooms. The first one that comes to mind is creating the video content which takes most of teachers' time. If the teacher does not contact with students actively out of class, this can make students feel like doomed and may affect their motivation negatively. The students who are used to traditional model may face some problems in getting used to this new model and adapting themselves. If the videos prepared by teachers to make students watch can make students have difficulty in understanding the subjects (Talbert, 2012; 2).

In a study by national case analysis study center which has more than 15.000 members in the fields of science, technology, engineering and math, the views of almost 200 educators who use flipped classroom model are evaluated and according to the results the disadvantages are given as below (Herreid and Schiller, 2013; 62):

- Students may oppose this new method as they will face the course subject out of class for the first time. They may come to the class without preparing themselves for active learning. This problem can be solved out with the subjects learned from videos or reading sources out of class or with the exams online or in class.
- The tools such as video and reading sources should be created in accordance with class activities. Most of the educators use videos as part of out of class education. However, the educators in the study stated that students had difficulty in finding quality videos. The number of quality videos prepared by educators is quite less and time is needed to create them.

Jenkins (2012), Duerden (2013) and Miller (2012) state that flipped classroom model has some disadvantages as well as advantages these disadvantages can be summarized as;

- Following whether the students watch the video or not is difficult for teachers.
- Students who do not have learning capacity face difficulty in learning environment.
- Needing computer and internet for the application of model complicate the applicability of model.
- Need for technology increase cost.
- Students who learn through videos do not ask questions, have difficulty in establishing relationship between topics and as a result have difficulty in learning if there is no internet connection or computer.
- Not being able to create an environment where students can speak while learning the subject and their reaction can be measured.

### **CONCLUSION**

Because the Flipped Classroom Model which is spreading around the world and whose effect is revealed with many studies is so new, there are many issues that are not agreed. There are many different practice styles of this method. However, main components such as direct teaching in classroom, using effective learning strategies,

benefiting from teaching Technologies are common points of almost all practices. In addition to this, the number of participations to network called “Flipped Learning Network” is increasing day by day and the standards of this practice are still being mapped up. When the necessities of today and the profile of “learners” considered, it is obvious that different teaching methods than traditional ones are needed. As Prensky (2001) stated this time is the time of digital natives and if the digital immigrants, in other words, teachers would like to teach the new generation, they should redesign their methods and materials according to learners’ learning styles. Almost all the students follow up technology, smart phones or tablets are in the center of their life and also they use internet to follow up social media sites (Facebook, Twitter, Instagram, etc.). For that reason, the teachers present educational outputs of lesson contents that will attract students’ attention through educational social network tools such as Edmodo, Wiziq, edcanvas etc. In this way, it is aimed to carry teaching outside the class and increase readiness of students and also there will be more time for interaction and activities with students in classroom.

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# **INSTRUCTIONAL SKILLS WORKSHOPS: A MODEL FOR TRAINING PROFESSORS HOW TO TEACH**

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**ABSTRACT:** This paper describes a practical and experiential workshop designed for training professors and secondary school teachers how to teach. Training professors is a particular problem throughout the world as professors typically hired for their content expertise rather than their teaching skills. The workshop provides a model that enables professors and teachers to develop and deliver successful lessons. The model has six components called the bridge-in, outcome or objective, pre-assessment, participatory/active learning, post-assessment, and summary. The workshop takes four days with the first day covering the theoretical foundations for teaching effectively. The following three days start with an educational topic and then each participant presents a mini-lesson. The mini-lesson cycle lasts forty minutes consisting of up to ten minutes for setting up, ten minutes for lesson delivery, five to seven minutes for self-reflection and written feedback, and thirteen to fifteen minutes for oral constructive feedback. This paper will also discuss how this workshop could be implemented.

**Key words:** Instructional skills workshop, training, professional development

## **INTRODUCTION**

The Instructional Skills Workshop (ISW) is designed for training professors and secondary school teachers how to teach. Training professors is specifically a major problem in both developed and developing countries as professors are typically hired for their subject matter expertise rather than their teaching skills. Similarly, the ISW can be used to train secondary school teachers in countries where the teachers do not require training or have minimal teaching skills. Although this paper mainly refers to professors, secondary school teachers can equally and distinctly benefit from ISWs.

The ISW supports a model that, if followed, will enable professors to design and deliver successful participatory lessons. The model includes six components called the bridge-in, outcome, pre-assessment, participatory learning, post-assessment, and summary.

The workshop takes four days with the first day covering the theoretical base, which includes the model, characteristics of effective instructors, the learning process, writing learning outcomes, the mini-lesson cycle, and giving constructive feedback. The following three days start with an educational topic and then each participant presents a ten-minute mini-lesson. The mini-lesson cycle includes set up time, delivery of a mini-lesson, self-reflection, and constructive feedback. Each mini-lesson is video-recorded to give the participant an additional opportunity to reflect.

This paper presents a brief history of the ISW and then describes the ISW, its goals, its schedule, the six-phase lesson model, the mini-lesson cycle that has a focus on experiential learning, how the Facilitator's Development Workshop (FDW) is used to train facilitators, and the FDW cycle. This paper also discusses how the workshop can be implemented.

## **A BRIEF HISTORY**

In 1979, Douglas Kerr, a consultant hired by the British Columbia Ministry of Advanced Education, and numerous colleagues completed the creation of the ISW, which was intended to provide the basic instructional skills needed by post-secondary teachers. The program was updated in 1982, 1989, 1993, 2003, and 2006. It is currently undergoing a revision. Since its inception, ISWs have taken place in over 34 countries. Its popularity is due to its accommodation of a wide range of disciplines, its adaptability to both novice and highly-experienced professors, and the process profoundly impacting participants.

## **ISW DESCRIPTION**

The ISW is an intensive four-day, 24-hour workshop designed to provide professors with the skills needed to teach effectively. It is facilitated by trained individuals who are also professors or are professionals in the educational field. Each ISW is conducted with one facilitator (although it can be done with two facilitators) and four to six participants. Participants can be professors in any field with any level of teaching experience.

The ISW is a peer-based model where feedback is provided to professors by peers, who are the other participants. The ISW is based on experiential learning and principles of learner-centered instruction. Participants leave the workshop with an improved level of instructional competence and confidence in their ability to design and deliver instruction.

## **ISW GOALS**

The goal of an ISW is to provide professors with practice in:

- Writing learning outcomes
- Addressing the varying learning preferences of students
- Writing lesson plans based on the six-phase model
- Conducting participatory lessons using a variety of instructional strategies and techniques
- Using questioning techniques
- Using common instructional media (if available)
- Assessing learning
- Giving and receiving constructive feedback

To accomplish this, participants are expected to:

- Actively participate
- Ask questions
- Share experiences
- Take time to reflect and learn
- Be open minded

## **ISW SCHEDULE**

ISWs are typically conducted over four days. Day one provides the theoretical foundation for instructional skills development. Day two consists of learning more instructional skills (typically a 60 to 90-minute discussion) and forty-minute cycles where each participant presents a mini-lesson while the other participants take on the role of a learner. Each participant reflects on his or her mini-lessons, receives written and verbal feedback, and considers how to apply what was learned to his or her next mini-lesson and future lessons. The process of giving feedback also focuses each participant on the lesson model, and develops the professors' ability to analyze his or her own lessons. Days three and four are parallel to day two. Each participant delivers three mini-lessons and receives feedback three times. Three mini-lessons allow for enough practice, reflection, and feedback for professors to improve as well as for opportunities to challenge themselves or to experiment, such as trying one lesson in each of the cognitive, psychomotor, and affective learning domains.

Day one typically consists of introductory and group-development activities, discussions on the characteristics of effective and ineffective instructors, the basic learning process, how to write learning outcomes, the six-phase lesson model, and how to provide constructive feedback, and seeing the forty-minute cycle modelled.

The introductory activities on day one help the group formation process that is necessary for participants to effectively support each other throughout the workshop. The characteristics of effective and ineffective instructors' topic helps participants to reflect on both the good and bad instructional practices that they have experienced and become aware of what they should and should not do. The presentation of the basic learning process helps professors understand ways to help learners understand and retain what is taught. The writing learning outcomes presentation teaches professors how to write measurable learning outcomes that are at the highest level needed while stating appropriate conditions and criteria. Professors are then taught the six-phase model. This model provides a foundation for delivering successful lessons. The discussion on constructive feedback enables participants to provide effective feedback for the professor who delivered the mini-lesson as well as to teach how feedback should be given in their own classrooms. Modelling the cycle clarifies the mini-lesson cycle for the following days. Participants set individual goals and articulate them to focus their learning.

### BOPPPS LESSON MODEL

The BOPPPS (acronym) lesson model is a blend from several educational theories. It has the following parts:

Beginning:

1. **B**ridge-in: Connects the student to the lesson and answers the question “Why should I learn this?” It is meant to gain attention and establish relevance.
2. **O**utcome: A clear measurable statement(s) of what the learner will be able to do after completing the lesson. Outcomes (also called objectives) provide the foundation that the learning activities and assessment are based upon.
3. **P**re-assessment: Determines what the learner already knows related to the topic. This helps the instructor determine where to start, which activities are necessary, and how to involve learners who already have some degree of the knowledge or skill that will be taught.

Middle:

4. **P**articipatory (active) learning: The heart of the lessons where the learner receives instruction and practices with feedback. The learners interact with the material, the instructor, and each other.

End

5. **P**ost-assessment: Allows the professor and learners to confirm that they have achieved the specified learning outcome.
6. **S**ummary: Closes the lesson, connects the learner back to the outcome, and may prepare the learner for the next lesson.

The BOPPPS model allows considerable flexibility in delivery, while including the major functions that support learning.

### LESSON PLANS

Lesson plans are a tool professors can use to develop lessons and improve their teaching. Lesson plans follow the BOPPPS model and include items such as estimated time, materials and equipment needed, and activities the students will experience.

### CONSTRUCTIVE FEEDBACK

Constructive feedback is information provided to the professors to help improve their performance. It is critical that they identify what works so that they continue to do those things and what could be changed to improve performance. Effective feedback is specific, descriptive, behavioral, balanced, manageable, changeable, related to the needs of the receiver, timely, and checked for understanding. The receivers accept feedback, check for understanding, focus on what is important to him/her, and keep emotions separate. With three mini-lessons, each participant has the opportunity to experiment and check for effectiveness.

### ISW 40-MINUTE CYCLE

As shown in figure 1, the mini-lesson cycle takes forty minutes. There is up to ten minutes for setting up the learning environment, ten minutes for lesson delivery, five to seven minutes for professor self-reflection with the facilitator, and thirteen to fifteen minutes for constructive feedback from the learners (the other participants) to the professor.

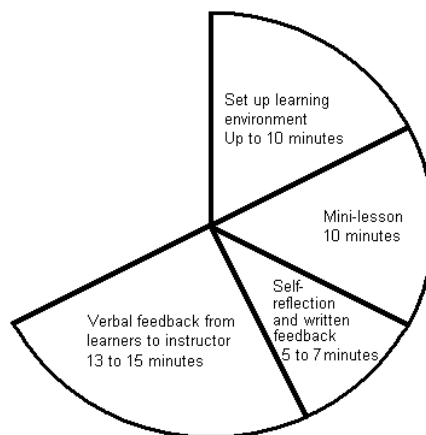


Figure 1. Professor Development 40-Minute Mini-Lesson Cycle



As illustrated in figure 2, the focus of an ISW is experiential learning. The learner has a real teaching experience and then learns from that experience through self-reflection, making conclusions based on the received feedback, and then planning for the next teaching experience based on what was learned. This process should be followed throughout one's teaching career.

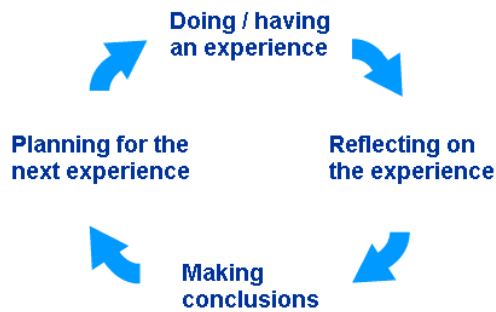


Figure 2. Experiential Learning Cycle

### FACILITATOR DEVELOPMENT WORKSHOP (FDW) DESCRIPTION

The FDW develops the skill to lead an ISW. It uses the ISW (one day of theory and three days of practice with feedback) as a nucleus with an emphasis on learning how to establish the group environment for a successful ISW, how to assist ISW participants to learn the six-phase model, and develop strategies to elicit useful feedback for the participants. A final day allows the participants to address issues in planning and delivering an ISW.

A highly experienced facilitator takes the role of trainer to teach the facilitation process. In the FDW cycle, one of the participants takes the role of facilitator, one the role of professor, and the others the role of learners/students. The professor delivers a mini-lesson as in the ISW. Then there are two levels of feedback. First, the facilitator practices eliciting feedback for the professor from the learners. Then the trainer elicits feedback for the facilitator.

### FDW 60-MINUTE CYCLE

As shown in figure 3, each facilitator development mini-lesson cycle takes sixty minutes. The initial forty minutes is the same as the professor mini-lesson cycle, as shown in figure 1. After that, there is five minutes for facilitator self-reflection, and fifteen minutes for constructive feedback from the learners to the facilitator.

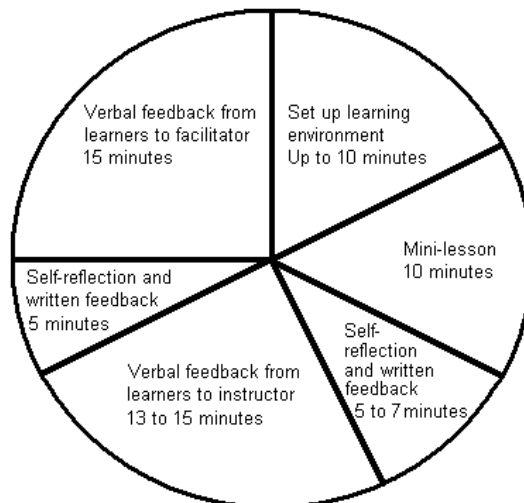


Figure 3. Facilitator Development 60-Minute Mini-Lesson Cycle

### IMPLEMENTATION IN DEVELOPED OR DEVELOPING COUNTRIES

In post-secondary education, professors are hired primarily for their subject matter expertise, specifically their academic, professional, and research background. In some countries, secondary school teachers have little or no

training. The Instructional Skills Workshop (ISW) provides a solid model for planning lessons and gives the participants direct experience teaching and analyzing a lesson to determine which parts are effective and which could be changed to improve the learning experience. The ISW is respectful of professors and teachers with teaching experience, building on their existing skills and guiding them to develop and improve needed abilities. Often workshops are most successful when the participants are of mixed specialties as they focus on the teaching itself as opposed to their specific content area. Workshops can be less successful when administrators, who have power or influence over the professors, and professors are in the same workshop if the professors are not comfortable in speaking freely or teaching in front of the administrator. It could be argued that there is little value in having an administrator attend a workshop. However, administrative support is essential and participation may convince an administrator that the workshop is effective.

The educational philosophy of the ISW is a mix of cognitive and constructivist theories and allows flexibility for professors to respond to individual classroom situations. The foundation of learning theory in the ISW is engagement with both the facilitator and other participants and active learning. This means that the professors, and consequently their students, learn best when they are connected to the content to be learned and actively practice the skills while receiving feedback on their progress. Content is more easily learned and retained when it has meaning in a student's life. Learning is supported by careful alignment between clearly expressed objectives, learning activities, and evaluation that are as authentic as possible.

When professors specifically address the cognitive, psychomotor, and affective learning domains (as is applicable), students gain a well-rounded set of abilities relevant to their future success. The cognitive domain relates to facts, theories, concepts, and their application to real-world issues. Psychomotor skills relate to physical abilities gained by practice and experience. The affective domain are attitudes, values, and beliefs that are important in relation to the content. These might be concepts like safety, professionalism, and ethics.

To implement a post-secondary teacher program, the long-term goal must be to acquire the independent capacity of the receiving organization to develop teaching skills in its faculty. The ISW has an existing structure that supports this goal. At the base is the ISW itself. It is where practiced facilitators lead a group (4-6 per facilitator) of professors through the process to learn and practice teaching skills. The next level is the Facilitator Development Workshop (FDW) where experienced ISW trainers help professors experienced in the ISW model to learn and practice the skills needed to facilitate an ISW. A future part of a subsequent FDW is where experienced facilitators work with experienced trainers to become trainers of facilitators themselves. Experienced trainers also take on the role of director or co-director to plan and coordinate the overall FDW. The directors also have the responsibility to monitor the whole process to ensure that the facilitators-to-be and the trainers are getting the experience they need and are achieving the skills at an acceptable level. The directors are connected to the ISW International Advisory Committee, which supports ISW activities to maintain continuity and ongoing improvement in materials like the ISW Handbook, the FDW Handbook, and other supporting materials. It also provides a level of quality control and reassurance to the receiving institution.

To implement the ISW in a new area, the following steps can be effective:

1. Prepare a plan for the development of instructional skills within a specific institution or region in cooperation with the institution(s) and relevant government agency/agencies. The plan must include ongoing support for the ISW.
2. Recruit a cadre of experienced professionals who are respected by their colleagues. This may be started in a department willing to invest the resources needed, and later extended to the whole institution as resources and time permit.
3. Schedule the ISW in groups of 4 to 6 professors with 1 facilitator, with the workshop to be delivered in the participants' home area. It would be helpful to deliver at least 2 of these workshops, to create a large group of teaching practitioners who share the same understanding and terminology.
4. Develop an ongoing exercise such as the professors developing lesson plans for a program, keeping a journal of their teaching experience, and/or visiting each other's classrooms regularly to encourage each to practice the instructional skills and mutually support each other in developing their skills further.
5. After some time practicing the teaching skills, schedule an FDW with the more successful professors becoming ISW facilitators. Four or five facilitators should be trained.
6. After a body of facilitators has been trained, schedule an FDW where some of the experienced facilitators become trainers of facilitators.
7. Once the process has been established, there should be ongoing development of facilitators and trainers to maintain an effective group and to enable the rest of the faculty of the institution/region to be trained.
8. All facilitators and trainers are linked to the ISW network for information and support and can call on the ISW International Advisory Committee for advice and connection to resources.

9. It can be useful to have cooperative ISW activities with other institutions, regions, and even countries.

The above program would take at least 2 years to get the numbers for the process to be self-supporting. It requires a commitment from the institution to provide ongoing support to be effective with the recognition that it takes time for professors to master the model of teaching. Participants need to continue to support each other after the workshop and this process should be built into the plan. Professors who successfully complete the ISW and practice the skills gained, can receive advanced credit towards the British Columbia Provincial Instructors Diploma (PIDP) delivered by Vancouver Community College, which provides additional skills such as course design, course evaluation, developing instructional media, and concepts like the characteristics of learners. The courses in the PIDP are available at a distance.

### **SUMMARY**

Post-secondary professors are mainly hired for their content expertise and often do not have any training regarding teaching skills. To support these professors, the Instructional Skills Workshop (ISW) provides a six-phase model (consisting of a bridge-in, objective, pre-assessment, participatory learning, post-assessment, and summary) for planning lessons, gives participants real teaching experiences, and helps them analyze lessons to determine the effective parts and which could be modified to improve learning. The ISW respects professors with teaching experience, builds on their existing skills, and guides them to develop and improve needed skills. The FDW attains the next level of training facilitators and trainers of facilitators.

Through careful planning and support, ISWs and FDWs can be successfully established in both developed and developing countries at both the post-secondary and secondary school levels.

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## **USING PEER ASSESSMENT IN EDUCATION**

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**ABSTRACT:** Peer assessment is an arrangement for work of each peers in similiar status to consider and specify the level, value, queality of work oramount of product or learning incomes or performance of the other learners. The goal of the assessment is to determine differences between expected performance and actual performance, give opportunities to students to take corrective action, and support their learning by providing affluent feedback. In addition, the assessment method has been utilised, including monitoring the performans of group assignments by instructors, or as a tool of reflection by students through to increase the pragmatic efficiency to reduce workloads of educators. Peer assessment emerges as a new form of assessment although it has actually been utilised for centuries. The advantages of the assessment of writing and the method was described. In recent years, there has been much renewed interest in the assessment because of a formative assessment method. Thus, peer assessment can be widely used vary in number of ways, including writing, teaching, business, science, engineering to medicine as well as using a teaching strategy in education.

**Key words:** Education, Peer assessment, Teaching

### **INTRODUCTION**

#### **Definition and Typology**

Peer assessment may sound like a new method; however, it has been used widely for hundreds of years now. Professor George Jardine from the University of Glasgow has identified the peer assessment methods adopted between 1884 and 1826, as well as its advantages. Today, peer assessment is identified differently.

“It is a process of a group of individuals evaluating their peers.” (Lee, 2008: 32). In this process, peer assessment uses the knowledge and skills of students to explain, review and improve the works of peers (Ballantyne, Hughes and Mylonas, 2002). In other words, peer assessment is a setting in which students of similar status evaluate individually the works, learning outcomes, outputs, levels, value, quality, and success of their peers (Topping, 1998) The main purpose of this setting is to identify the difference between the expected performance and actual performance, thus giving the students the opportunity to improve, supporting their learning by providing them with enhanced feedbacks (Gielen, Peeters, Dochy, Onghena and Struyven, 2010).

Peer assessment, used as a tool of performance monitoring by educators, or a tool of reflection by students, is a method adopted differently by instructors to increase the pragmatic efficiency while reducing their work load (Weaver and Esposto, 2012). Particularly popular among teachers as an alternative way of evaluation, Peer assessment has received much attention in recent years for its effectiveness in the learning processes of students. This novel strategy of evaluation and learning is broadly used in a large variety of areas (Tseng and Tsai, 2007). Nature of these evaluation activities vary with the different areas of use, or the curriculum. Even production of widely diversified products or outcomes, portfolios, private presentations, and performance tasks, as well as other acts that require skills may be evaluated through peer assessment.

The participants of the peer assessment application may be assessors or assessee, in parties varying from pairs to larger groups. Moreover, peer assessment may be applied one-sidedly, or reciprocally. The purpose of peer assessment application may vary from cognitive or metacognitive attainments of teaching, to time saving, etc. Further, attainment of positive results incentivize the in-silico application of peer assessment. Ultimately, peer assessment may take place within or outside the class; it is experienced not only in school, but throughout our lives. We all expect to be the assessor or assessee among our peers in different times and contexts. In conclusion, application of peer assessment in schools may improve the transferable skills used in the daily life (Topping, 2009).

#### **The Importance of Peer Assessment**

The recent years witnessed a never before seen growth in the numbers of students attending higher education institutions world-wide. Nevertheless, the rates of employment in many organizations are disproportionate to this growth (Oldfield, Mark, and Macalpine, 1995). As a consequence, classroom sizes and the workloads of teachers increased dramatically. The increase in the then current workload redounded palpably to the already grueling and tediously effort and time demanding field of assessment (Bilington, 1997). Homework, which needs to be overly

assigned if required comments and feedbacks are detailed, is rendered almost impossible to pursue due to the incompetency of the grading system corresponding to the resources (Davies, 2000; Gibs, Lucas, and Spouse, 1997). In this vein, this situation does not result with the equation of “larger classrooms, less resources, more competition”; on the contrary, in cases of large classrooms, it reduces the time that the instructor spares for each student, as well as meaning that students will receive the feedback they need for their homework less frequently (Gibs, Lucas, and Spouse, 1997). The situation is not projected to change in case of further proceeding of cost-cutting measures.

One of the most encountered problems in academic sense is the question of how to provide high quality evaluation and feedback in crowded classrooms, for the number of students per teacher does not seem likely to change. A possible solution to this problem is to involve students in the learning processes and nontraditional evaluation approaches such as peer assessment. This approach creates the opportunity to use time more efficiently for both the teachers and students who attend crowded classrooms, as well as improving learning efficiency, saving time in grading and feedback processes, and increasing the frequency of quantitative-qualitative feedbacks. Moreover, peer assessment is found to be effective in improvement of interpersonal relationships within classrooms (Sluijsmans, Brand-Gruwel, and van Merriënber, 2002). Many other studies too, emphasize that peer assessment has a positive impact on cognitive, metacognitive and social impact areas of students (Smith, Cooper, and Lancaste, 2002; Topping, 2003; Tsai, Lin, and Yuan, 2002), and its necessity for students during their education. For the aforementioned reasons and more, peer assessment is method needed to be employed (Ballantyne, Hughes, and Mylonas, 2002).

### **Benefits of Peer Assessment**

Peer assessment has been successfully applied in preschools, elementary, middle, and high schools, including with special educational needs (Scruggs & Mastropieri, 1998). The literature has indicated that peer assessment can result in improvements in the effectiveness and quality of learning at least as good as gains from teacher assessment. The benefits of peer assessment can be listed as follows:

- It gives students the opportunity to participate in the planning of their own learning schedule, as well as helping them identify their own strengths and weaknesses;
- It enables improving procedures at learning points, the target areas, as we call them;
- It helps in development of metacognitive and transferable skills, production of an enhancing impact on reflective thinking and problem-solving skills throughout a student’s education life (Sluijsmans, Docy, and Moerkerke, 1999; Smith, Cooper, and Lancaster, 2002; Topping, 1998);
- It is effective in the development of verbal communication and reconciliation skills, as well as of giving and taking criticism (Topping, Smith, Swanson ve Elliot, 2000);
- It incentivizes students to have a sound grasp of the goals and purposes of the lesson, as well as the evaluation homework (Topping, et al., 2000);
- It pushes the assessor to focus on the question of what the constituents of a work, good or bad, should be (Searby and Ewers, 1997);
- It enables going beyond the customary process of assessment, thus helps students comprehend why and how they will be rewarded with grades (Brindley and Scoffield, 1998);
- It helps students have a better understanding of the requirements for attainment of a certain standard, and enables them to be cognizant of the assessment process’ details (Falchikov, 1995; Hanrahan and Isaacs, 2001; Race, 1998);
- When used effectively, it improves the quality of the work subject to assessment, as well as augmenting the understanding ability and self-confidence of students (Dochy, Segers, and Sluijsmans, 1999; Topping, et al., 2000);
- It enables students to learn from each other’s mistakes, criticize and review the performance samples of their peers by letting them study various writing styles, techniques, ideas and skills (Race, 1998);
- It provides the opportunity to spotlight the contradictory applications employed by teachers in grading processes, and emphasize the importance of a work prepared in a clear, understandable, and reasonable format (Brindley and Scoffield, 1998; Race, 1998);
- It incentivizes students to reflect their own evaluation approaches on their evaluation homework (Dochy, et al., 1999);
- It constructs the cooperation of peer assessment in the development process of interdependent learning, mostly enabling the development of those skills effective at the interpersonal level, rather than inciting competition (Heron, 1981; Cited by: Resta and Lee, 2010).

### **Concerns about Implementation of Peer Assessment**

Several problems and limitations have repeatedly been associated with the process of assessing although the adoption of peer assessment is advocated in the literature. Most of these arise from the fact that the application of peer assessment method in higher education as a stylistic assessment tool is still a novel idea. Academic personnel, teachers and students' lacking of proper experience concerning this method of assessment can be given as an example. With this regard, students expressed dislike in assessing their peers and preferred the responsibility to be taken by their teachers instead (Ballantyne, et al., 2002).

Another remarkable negative aspect of the method is, that many teachers, who manage to involve their students successfully in the learning process through on cooperation, somewhat leave the internal control and management of their classes to their students. Nevertheless, some teachers are concerned about peer assessment's integration into the assessment process. The reason why is that students become a part of the assessment and grade their friends. What needs to be done, instead, is to involve them in the assessment process but leaving the final process of grading to teachers (Topping, 2009). Among the reasons are the example situations in which, close friends give better grades to each other and these being make-up grades, grading is prearranged, dominant students being given the highest grades, ultimately, even those who didn't even participate in the work benefit from the group grading (Ond, Ul-Haq, and Meyer, 1995). Avoidance of this negative situation can only be achieved through the employment of peer assessment along with self-assessment (Dochy, et al., 1999).

### **Pedagogical Merits of Peer Assessment**

The educational merits in application of the method of peer assessment, which is adopted in various stages of education, are approached in broad strokes for a remarkably large number of students benefit from the method within the process (Cestone, Levine, and Lane, 2008).

### **Feedback**

The primary purpose of peer assessment is providing students with feedbacks; therefore, these feedbacks should be confirmatory, suggestive and ameliorative. Polite and positive feedbacks help reduce mistakes, improve knowledge, construct theoretical knowledge more profoundly, and create a positive impact on learning (Butler and Winne, 1995; Topping, 2009). The most prominent feature of peer assessment is that it is efficient since the students always outnumber the teachers in a class. Moreover, students tend to take the feedbacks given by their friends as transitory and individual, whereas those they receive from their teachers are construed as a feedback of the authority. Therefore, feedbacks taken from peers are more substantial and beneficiary for students (Cole, 1991).

### **Cognitive Gains**

Peer assessment's gains are associated with both the assessor and assessee (Topping and Ehly, 1998). For this method of assessment can improve reflection on new situations, generalization, and metacognitive awareness, as well as incentivizing self-criticism. Therefore, the cognitive and metacognitive gains occur before, during and after peer assessment application.

### **Improvements in Works**

Peer assessment, like cooperative learning, is an evaluation method which can complement other approaches. In a group where students evaluate each other, for instance, criticism received from peers is considered to be more motivating by individuals in terms of improving the quality of the product. Further, students who participate in the peer assessment as an assessor are expected to be more inventive (Searby & Ewers, 1997). Thereby the personal performance and the quality of the product are improved.

### **Saving Teachers' Time**

It is stated that the method saves time for teachers since all students are assessed at once when students are involved in the assessment process. When the literature is considered, it is also seen that the method does not place a time-wise burden on teachers. However, some authors warn that it takes time to set up a quality peer assessment environment in senses of its organization, training and monitoring processes (Falchikov, 2001). In order to avoid time loss, peer assessment should be used as an evaluation method when needed, rather than as a complementary comment to the feedbacks teachers provide. Otherwise, this method of assessment turns more into a time-consuming application than a time-saver.

## **Guidelines for the Implementation of Peer Assessment and Evaluation**

It is essential that the assessment to be carried out during the teaching process is well-set and planned. For a well-set setting leads to lasting and productive results. Secondly, it eases the implementation process when the peer assessment to be held in the education process is planned well, is in harmony with classroom activities and teacher's feedbacks. Therefore, considering these steps will make it easier to apply the method. When the literature is scanned (Toppng, 2003; Webb and Farivar, 1994), it is seen that the guidelines concerning the implementation of peer assessment are as follows:

### **Setting Expectations**

It is essential to collaborate with colleagues, rather than establishing an individual setting. Once the setting is ready, the students to be involved in the process should be informed on the importance and the scope of the assessment. In the next stage, setting goals, taking student expectations into account, informing students on the procedure of assessment, organizing activities to explain expectations and their roles in the process render the process easier (Topping, 2009).

### **Involving Participants in Designing and Procedures**

Involving students in the first place, helps teachers determine the nature of the events to be held, matters concerning the purposes of the lesson, as well as the assessment criteria. Involving the participants in the process of determination and development of these criteria, even if their suggestions do not differ much from the already proposed style, yields positive impacts on students, such as helping them with possible feelings of anxiety, giving them the sense of belonging, preparing them, as well as making it easier for them to decide while making self-assessment (Cestone, Levine, and Lane, 2008).

### **Using Periodic Assessment**

Employing peer assessment as a regular assessment tool brings along many advantages. When this tool of assessment is used at the end of the learning process, it is seen to help students to avert their concerns of not being able to just (Gueldenzoph and May, 2002; Haberyan, 2007). Employment of this formative assessment method gives students the opportunity to acquire the skills they need to make assessments. On top of it, students have the chance to make an objective and reliable assessment, thanks to this standardized tool of assessment (Michaelsen, Knight, and Fink, 2004).

### **Matching Participants and Setting Contract**

Pairing the participants, and organizing the communication. Mainly, the purpose should be pairing peers with similar abilities. If the peers attend the same classroom, they can be classified roughly according to their abilities. In this way, those student groups or pairs from the lowest levels of the classroom can participate in works corresponding to their levels; nevertheless, with the support of their teacher, these students too, may gain more than expected, as they will be involved in a similar process although at a lower level (Topping, 2009).

### **Monitoring and Coaching**

Quality education makes remarkable difference. The students should be informed on the expectations from them, including the roles and actions to be taken by the assessors and assesses. In the next stage, the assessment process should be explained through a simulation of, for instance, two students assessing each other. For this, the assessor and assessee participating in the simulation should be monitored, given feedbacks if need be, and trained (Topping, 2009).

### **Evaluation and Giving Feedback**

Convey your own observations as the evaluator to the students on their performances, and examine the reliability of their assessments (Topping, 2009). For this, teachers should keep their expectations low while applying peer assessment in the beginning and guide their students by giving feedbacks. Those students at lower levels in particular should be encouraged. In this stage, teachers should compare their own assessments with their students', and discuss with them if there are major differences. This way, the differences will be observed to reduce in time, and the assessments peers made among themselves will yield better results in sense of reliability.

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## **THE EFFECTS OF MENTORING ON CHEMISTRY TEACHERS' PROFESSIONAL DEVELOPMENT**

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**ABSTRACT:** Studies so far have emphasized that mentoring has positive effects on teachers' academic success, personal and professional development, teaching philosophy, and motivation levels. It has also been reported that mentoring helps teachers perform their roles successfully in their classes and be satisfied with their job. Similarly, many studies indicated that teachers' self-assessment plays an important role in ensuring the continuity of their professional development. The present study, in turn, builds on the basis of an analysis to identify chemistry teachers' problems regarding the implementation of the curriculum, and proceeds with mentoring designed to help with these problems. The effects of mentoring on teachers' capabilities and their teaching behaviors were determined by means of their self-assessments. Four chemistry teachers, teaching in Anatolian high schools in the metropolitan area of a mid-size city located on the north-eastern part of Turkey participated in this study. A self-assessment form (SAF) compatible with the requirements of the chemistry curriculum was developed by the researchers; the final version of the form was revised with reference to the opinions of three science educators. SAF was filled out by the teachers, who participated in weekly mentoring activities, both before and after each mentoring session for eight weeks. The data obtained from SAF was analyzed for each participant as a particular case. It was found that although the teachers assessed themselves as "insufficient" in terms of some items in SAF (regarding existing knowledge and giving examples from daily life etc.) before the mentoring sessions, they rated themselves "sufficient" for the same items after they completed each mentoring session. This change could be regarded as an indicator that teachers have given up some of the negative teaching behaviors and improved their deficiencies through the mentoring sessions. In addition, while some of the participant teachers held overly favorable views of their professional competences, rating themselves "sufficient" or "excellent" with respect to certain items (using performance based assessment and evaluation, employing student-centric teaching perspectives) at the beginning, it was found that they reached to a more realistic assessment of their competence in these themes after the mentoring sessions. One can forcefully argue that mentoring contributes to the participant teachers' endeavors to get a better grasp of their capabilities. Based on these results, the incorporation of mentoring to teachers' pre-service and in-service trainings is expected to contribute to the enhancement of the teachers' competence levels. Considering that Ministry of National Education in Turkey has embarked on a new program in which a prospective teacher (mentee) is mentored by an experienced teacher (mentor) for six months before she/he starts teaching, training the experienced teachers in a such mentoring process wherein faculty members in science education supports them continuously, is expected to bring about a chain reaction to improve teacher competences at all levels.

**Key words:** Mentoring, chemistry education, teacher training, self-evaluation

### **INTRODUCTION**

Mentoring is one of the primary approaches to development; given its reference on how to use knowledge in addition to knowledge transfer from one generation to another (Rhodes, 2002). Mentoring not only contributes to the development of all involved, but also facilitates and enhances interaction between the stakeholders (Inelmen, 2004). Jacobi (1991) stated that mentoring does not have a clear definition because it has some similarities with the concepts of coaching, tutoring and psychological counseling.

In the mentoring process, sharing knowledge and experience is crucial. The ultimate aim of the mentoring process is to achieve personal and professional advancement of the mentee. A candid relationship covering every aspect of life exists between the mentor and the mentee. Through the mentoring process, the mentor provides guidance

and directions to help mentee achieve her true potential by building on her/his experiences (Kahraman, 2012). Expertise and skills in only a chosen issue is not a must. Through the mentoring process, the mentor not only reinforces the feeling of personal satisfaction, but also gets the chance to review her own growth, through a sharing of experience and insights (Crisp and Cruz, 2009; Kuzu and Kahraman, 2010; Perchiazzi, 2009).

One could say, in the light of these remarks and definitions, that mentoring is a multi-faceted concept. There are certain responsibilities and attributes to be exhibited by the mentor and the mentee through the mentoring process (Kahraman, 2012). Aynsley (2009) listed a mentor's responsibilities as maintaining confidentiality; remaining easily accessible; listening to the mentee carefully and without prejudice; supporting the mentee in decision-making processes; motivating the mentee to enable her/him to achieve her/his objectives; establishing a professional relationship with the mentee; acting as a role model; and setting the time frame to conclude the process. Lee et al. (2006) on the other hand, defined the obligations of a mentor who wishes to form an effective relationship as being prepared for the mentoring relationship; setting targets; establishing open and sincere communications; acting in a planned manner; operating with an open heart; willingness to learn; maintaining an open mind towards new knowledge; and effective problem solving. The roles and obligations of the mentor and the mentee form the infrastructure of the prospect of professional development in a given field.

The curricula, and hence, the roles and responsibilities of the teachers, change continuously in the light of the changes in technology, science, and the field of education. In this context, in-service teachers had better involve in constant professional development process. The changes and developments worldwide are reflected on education and teaching through the curricula. For this reason, curricula for different course subjects are revised continuously, in an endeavor to render them compatible with the requirements of the age. In a trend, comparable to those prevailing in other developed countries, Turkey has initiated comprehensive changes in its curricula since 2003, with a focus on contemporary learning approaches such as constructivism, active learning, student-centered learning environment, and inquiry based learning in both primary and secondary education (Gömlüksiz and Kan, 2007; Kurt and Yıldırım, 2010). Obviously, there are numerous factors shaping the process of raising individuals equipped with the requirements of the age, as well as the achievement of the objectives of curricula. The leading one among such factors is the teachers; the implementors of the curricula. That is why teachers in charge are expected to have some knowledge and skills regarding the contemporary learning approaches as well as the teaching methods and the techniques. The competence in these fields can be achieved only through continuous professional development of teachers. In Turkey, the impact of the professional development programs provided to support teachers remains quite limited and these programs do not often go beyond the training context (Günel and Tanrıverdi, 2014; Harris, 2002). Moreover, the group meetings of the same discipline teachers, which play a major role at schools, are also considered a means too limited to achieve the development of classes and schools (Küçük, Ayvaci and Altıntaş, 2004; Şahin, Maden and Gedik, 2011). At this junction, it is crucial that school administrators and teachers are influenced by their colleagues, have educational cooperation with each other, and play a part in the system through professional and personal mentoring.

Mentoring would be applied in numerous fields, from health to industry. Yet, the recent efforts in the US and Europe in particular have focused on the field of teacher training (Özdemir, 2012). Today the method of "presenting information to individuals" has been gradually abandoned. This method has been replaced by an emphasis on allowing individuals to construct their meaning through concrete and personal experiences. In this context, the system of mentoring presents an important domain of sharing knowledge and experience. Mentoring is also crucial in terms of enabling the teachers to assess their competence in teaching, and to improve their awareness of classroom practice. Celep (2002) listed the prerequisites of an effective learning/teaching process as follows: provision of a suitable physical environment; optimal planning; robust time management and effective use of time; regulation of social relationships; and learning experiences in the classroom in line with the objectives of curricula. In this context, it is evident that teachers assume major responsibilities for their profession. Effective class management depends mostly on the exhibition of effective teaching behaviors in the class. According to Doveston (1985), the effective teacher was the one who is capable of establishing good relations with the students; developing a teaching strategy regarding the topic presented; and making use of new techniques and resources for teaching (quoted by Dilekmen, 2008). Mentoring practices are deemed to be crucial in terms of developing and supporting all these responsibilities and capabilities. Numerous international studies have reported contributions of mentoring practices to the professional development of teachers (Holloway, 2001; Ingersoll and Strong, 2011; Lindgren, 2007; Pinkston, 2008; Waters, 2009).

The present study aims to assess the effects of mentoring provided to chemistry teachers on their competence and teaching philosophy in terms of in-class practices (course introduction activities, the didactic analysis of the course, student-teacher communications, student-centered approaches, assessment-evaluation perspectives, and classroom management).

## METHODOLOGY

In the present study, the "Holistic Multiple Case Study" was employed to address the research questions. A "case" may involve an individual or a program in such a study. In the holistic multicase study, there are more than one case which can be perceived on its own. Each case is initially reviewed completely yet in isolation, leading later on to comparisons between cases (Creswell, 2007; Karasar, 2005; Yıldırım and Şimşek, 2006). The present study mentees were reviewed and analyzed as individual cases.

### Participants

Four volunteering chemistry teachers working at Anatolian high schools in the metropolitan area of a mid-size city located on the north-eastern part of Turkey took part in the study (as mentees). The demographics of the participants are presented in Table 1. As seen in Table 1, all of the participants had at least 14 years of teaching experience and taught 10<sup>th</sup> grade chemistry at the time of the study. Of four teachers one was female.

**Table 1.** Demographics of the teachers

Participants	Professional experience	Graduation	Age	Gender	Class reviewed in the project	Previous participation in a similar project
KÖ1*	25 years	Faculty of Education	50	M	10	None
KÖ2	27 years	Faculty of Arts and Sciences	53	F	10	None
KÖ3	25 years	Faculty of Education	53	M	10	Yes
KÖ4	14 years	Faculty of Education	38	M	10	Yes

\*KÖ: Chemistry teacher

### Data collection

The researchers developed a Self-Assessment Form (SAF), with reference to the behaviors expected from the teachers within the framework of the chemistry curriculum. The form developed by the researchers on the basis of literature review and then it was put in the final form after the recommendations of three faculty members who specialized in the field of science education. The final version of the SAF contains 48 propositions (behaviors) associated with six main themes. The themes presented in the form are as follows:

- Course introduction activities (Theme A)
- Didactic structure of the course (Theme B)
- Teacher-student relationship (Theme C)
- Student-centered approaches (Theme D)
- Assessment-evaluation approaches (Theme E)
- Class management (Theme F)

SAF was applied with the participating teachers before and after the mentoring, in an attempt to find out to what extent the mentoring has been transferred to the participants' teaching.

### Data Analysis

The participants were asked to assess themselves to state their application levels of the propositions (behaviors) corresponding to the themes in SAF, before and after the mentoring practice. They were asked to employ the following criteria for self-assessment regarding the propositions (behaviors) provided in SAF:

- (0)-Never: The proposition (behavior) not observed,
- (1)-Low: The proposition (behavior) rarely observed,
- (2)-Medium: The proposition (behavior) observed at acceptable level,
- (3)-Good: The proposition (behavior) observed at required level,
- (4)-Excessive: The proposition (behavior) observed more than necessary.

The sum and average self-assessment scores assigned by participating teachers for each theme were specified separately. Moreover, comparisons were applied over the average of the scores teachers received for each theme in SAF before and after mentoring, in order to identify how the mentoring process affects the teachers teaching.

### FINDINGS

The findings are presented as a comparison of average scores each teacher (KÖ1, KÖ2, KÖ3, KÖ4) received with respect to each theme, before and after mentoring. The scores that the teacher coded KÖ1 received from each theme on the SAF, before and after mentoring, are presented in Table 2.

**Table 2.** Comparison of Pre-Test and Post-Test SAF Scores of the Teacher Coded KÖ1

Themes	KÖ1's Pre-Test Average	KÖ1's Post-Test Average	Change (-/+)
Theme A	2.4	2.2	0.2
Theme B	1.8	2.27	0.47
Theme C	2.71	2.43	0.28
Theme D	2	2.1	0.1
Theme E	2.33	2.17	0.16
Theme F	2	1.67	0.33

Table 2 reveals differences between mean scores of pre-test and post-test assessments of KÖ1 with reference to major themes and the subtitles. In particular, Theme B (Didactic structure of the course) was observed to present the largest margin. The lowest margin, on the other hand, was observed with Theme D (Student-centered approaches).

The scores that teacher coded KÖ2 received from each theme on the SAF, before and after mentoring, are presented in Table 3.

**Table 3.** Comparison of Pre-Test and Post-Test SAF Scores of the Teacher Coded KÖ2

Themes	KÖ2's Pre-Test Average	KÖ2's Post-Test Average	Change (+/-)
Theme A	2.8	3	0.2
Theme B	2.47	2.40	0.07
Theme C	2.57	2.71	0.14
Theme D	2	2.6	0.6
Theme E	2.17	2.67	0.5
Theme F	2.67	1.33	1.34

Table 3 reveals differences between mean scores of pre-test and post-test assessments of KÖ2 with reference to major themes and the subtitles. The margin was particularly evident with Theme F, standing for class management. The lowest margin, on the other hand, was observed with Theme B (Didactic structure of the course).

The scores that teacher coded KÖ3 received from each theme on the SAF, before and after mentoring, are presented in Table 4.

**Table 4.** Comparison of Pre-Test and Post-Test Self-Assessment Form Scores of the Teacher Coded KÖ3

Themes	KÖ3's Pre-Test Average	KÖ3's Post-Test Average	Change (+/-)
Theme A	2.4	1.8	0.6
Theme B	2	2.2	0.2
Theme C	2.71	2.57	0.14
Theme D	2.4	2.4	-
Theme E	2.33	2.33	-
Theme F	2.67	2	0.67

Table 4 reveals differences between mean scores of pre-test and post-test assessments of KÖ3 with reference to major themes and the subtitles. In particular, Theme F (Class management) was observed to present the largest margin. The lowest margin, on the other hand, was observed with Theme C (Teacher-student communications). A comparison of the results of the self-assessment by KÖ3 before and after the mentoring led to the conclusion that he had not perceived any changes regarding his behavior under the themes D (Student-centered approaches) and E (Assessment-evaluation approaches).

The scores that teacher coded KÖ4 received from each theme on the SAF, before and after mentoring, are presented in Table 5.

**Table 5.** Comparison of Pre-Test and Post-Test Self-Assessment Form Scores of the Teacher Coded KÖ4

Themes	KÖ4's Pre-Test Average	KÖ4's Post-Test Average	Change (+/-)
Theme A	2.6	2.6	-
Theme B	2.47	2.47	-
Theme C	2.14	2.43	0.29
Theme D	2.2	2.6	0.4
Theme E	2.17	2.83	0.66
Theme F	2	2.33	0.33

As seen in Table 5, differences between mean scores of pre-test and post-test assessments of KÖ4 with reference to major themes and the subtitles. In particular, Theme E (Assessment-evaluation approaches) was observed to present the largest margin. The lowest margin, on the other hand, was observed with Theme C (Teacher-student communications). A comparison of the results of the self-assessment by KÖ4 before and after the mentoring led to the conclusion that he had not perceived any changes regarding his behavior under the themes A (Course introduction activities) and B (Didactic structure of the course).

## DISCUSSION

The present study aims to assess the effects of mentoring provided to chemistry teachers on their competence and teaching philosophy. A brief glance at the findings may lead to a misperception that there is not any distinct pattern, because no changes were observed with four themes while score decreases were evident in the self-assessment results for 9 themes, and increases with 11 themes. Analysis closer look based on individual themes, on the other hand, reveals that three out of four teachers experienced improvements with their skills regarding assessment and evaluation, coded under "Theme D". The fourth teacher, in turn, reported no change. A similar yet contrasting pattern appears with the class management theme. Under the class management theme, three teachers' self-assessments worsened after the mentoring practice when compared to pre-mentoring data.

The reason of decrease on the scores of certain themes would be a real decrease in these skills. However, more realistic self-assessment for the themes as a result of mentoring process would be a better explanation. Combination of two different data sets actually supports this claim. The first one stems from in-class observations made by the researchers before mentoring showed that the teachers had actually performed lower than their self-assessment scores that we discussed somewhere else (Sağlam Arslan, Ünal, Karataş and Aslan, 2016). The second data sets came from demographics of the teachers. KÖ4 graduated from a faculty of education after the year 2000 as noted in Table 1. KÖ4's pre-service training included more pedagogical credit hours than the other participants with a five-year-program rather than four years. His training also focused on pedagogical content knowledge (PCK) in addition to general pedagogical knowledge as pre-service chemistry teacher education was changed in 1998 (Ayas, 2009). In other words, he is considered to have more extensive and in-depth knowledge regarding the six themes discussed here. Hence, his pre-mentoring self-assessment scores are more accurate than the other mentees. Dunning-Kruger effect may help explain this issue (Kruger & Dunning, 1999). One can put the case as follows: since other teachers lacked the foundations regarding the themes discussed in the mentoring practice, they had initially assessed themselves to be better in terms of such themes, followed by a more insightful and accurate assessment after the mentoring. In this context, the findings of the study revealed that mentoring had an impact on the teachers' self-assessment of their professional performance.

## CONCLUSIONS AND RECOMMENDATIONS

The developments in science and technology lead to continuous changes in curricula which cause changes in the roles and responsibilities of teachers who would continuously need help and support in order to keep up with the changes in professional development form. Numerous studies in the field of education present the need for and recommend inclusion of mentoring to support the personal and professional development of teachers, lead their careers, and ensure their coping with contemporary learning environments (Allen, et al., 2004; Kahraman, 2012). The findings of the present study revealed that, mentoring practices contribute not only to the professional development of teachers, but also in terms of enabling them become aware of their shortcomings/behaviors regarding in-class practices. One of the conclusions of the study was that chemistry teachers involved in the study had been able to achieve a more objective assessment of their capabilities after the mentoring process. Each teacher gained an awareness of his or her true potential and came to know which of his/her teaching practices require further improvement or which of them is at an acceptable level.

On the basis of these findings, the following recommendations were developed with respect to the teaching/learning environments, as well as any future studies:

- The present study attempted to establish a bridge between the faculty members working in teacher training, and teachers who are the practitioners –the designated beneficiaries of developments regarding the profession. Establishing the permanence of such practices, contributing to life-long learning on part of the teachers and helping them get more comfortable with constantly changing curricula, and hence improving their classroom practices are expected to produce innumerable benefits.
- The implementation of large-scale projects with funds to cover associated costs, with a view to motivating the mentors and mentees involved, is considered to be beneficial in terms of encouraging and supporting them.
- The factors and parameters involved in enhancing interaction through and ensuring efficiency of the mentoring process should be examined.
- The mentoring model utilized in this study can be integrated into pre-service teacher training programs. The crucial point in this context is to provide the mentoring not only pre-service teachers, but also the experienced teachers who supervise them at practicum. Unfortunately, the majority of experienced teachers do not keep up with current developments in the field of pedagogy.
- The study was based on group mentoring model. Further comparative investigations regarding the effectiveness of the mentoring models (one-on-one, gradual, peer mentoring etc.) are suggested to better suit the needs of in-service training.

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## **THE IMPORTANCE OF USING ARCHIVE IN SOCIAL STUDIES EDUCATION**

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**ABSTRACT:** To establish strong relationships between past and the future of people, to carry their experiences in almost all areas of society such as political, economic and cultural areas into future have a very important place in the history of societies and nations. Archives constitute an important issue for all countries in the world. The purpose of this study is to allow social studies teachers, specialists, educators and students who try to learn this lesson to understand how to use archive in the area of social studies. Archive is defined as services provided for institutions, natural and legal persons, communication made by them and documentation prepared as a result of operations, institution dealing with related documentation, the place where these are kept. This study was conducted by document analysis technique which is one of the qualitative research methods. Document management, librarianship, museology, history, management science, computer and communication technology issues were examined under major topics in order to collect data related to record keeping. Record keeping finds itself a place in almost all areas where documents exist. Because information and documents in here in it. According to the results of the data emerging from this research; it was understood that quality can't be provided and progress can't be made without going to sources and without returning to the essence.

**Keywords:** Social Studies Education Archive, Librarianship, Historical Resources

### **INTRODUCTION**

Archive originally comes from the word “ἄρχειον” in Greek, and the word “Archivum” in Latin. In addition, there are various definitions regarding archive. Some of them are as follows: According to Horcog Josef, archive is a formation arising as the result of the activities of any government agency, any official or semi-official community, family and individuals, and consisting of scripts being under their authority in order to be organized. According to Fekete Lajos, archive is all the written or drawn documents which arise as the result of official operations of a real person or legal entity, and which are required to be kept around (e.g. Ersoy, 1957, p. 101-102). According to Leonhardt, archives are institutions having an older origin compared to libraries. However, in the early periods, the concept of archive had meant belonging to government or formality. And today, this formality comprehension has been surpassing (trns. Keskin, 2000, p.79). Hilarj Jenkinson, Deputy Keeper of the British Records, specifies the definitions provided in Belgium, France, Netherlands, Italy and USA as follows: Archive is the documents which have naturally accumulated at any time during the operations of any special and general issue, and which are then prepared in order to refer later on by the individuals being responsible for the issues in subject or by the individuals fulfilling the responsibilities (e.g. Ersoy, 1957, p. 102). Based on some referred definitions of archive, the use of archive sources in social sciences course is extremely important in respect of benefiting from the experience and knowledge for enlightening today and the future.

#### **History of Using the Archive**

Establishing firm relations between the past and the future of people, and communicating the experiences in nearly all the fields of the society such as politic, economy and culture to the future in a healthy manner have an important place in the history of individuals, societies and nations. The archives constitute a subject that all the countries in the world overemphasize.

The archives document, organize and preserve the rights held by individuals being the basis of states, societies and formations. When we make any research etc., they try to enlighten, sort out and solve any issue. They determine the incidents of the current time, relations among people, values, traditions, customs and social relations. As it will be understood from the aforementioned points, the phenomenon called archive is nearly a part of our life, and ultimately it has to be. Today, nearly all the relations in the world are being based on some documents. And at this point, the archives step in. They have an importance in respect of building the relations of people on solid grounds. Today, all the nations are attaching great importance to archives, and they are deeming the archivists –who have a large share in the realization of this formation- as “protectors of the past and founders of the future” (Binark, 1980).

The commercial documents constitute the initial documents in the arise of archives. It can be said that the history of archive dates back to around B.C. 2000. It is being known that state archives were available in Mesopotamia in those years. In the archeological digs made on this subject, a large state archive had been found out where the

people of Hattusa had kept around 1900s the agreements, correspondences and laws of Hittite Civilization dating back to B.C.2000 (Bradsher, 1989). In the following years, temples had been constructed for keeping the archive documents. It is being observed that state archive buildings had been constructed especially in Athens and Rome. The civilizations were keeping the documents at special places they had built. For instance, the documents were being kept in temples in Egypt. The reason of it was that the people were deeming the temples as holy, and they had considered keeping them at such places with the thought that they wouldn't be damaged there (Posner, 1984). It shows the importance attached on archive documents by these civilizations. And in European countries, it is being observed that the importance of archives has increased as from the beginning of the 16th Century. After establishment of the British State Archive by the British State Archive Law -that was enacted in 1838 in England-, all official documents have started to be gathered together (O'Toole, 1993). And in Ottoman Empire, the notion of archive was dating back to very early periods. During Ottoman Empire period, all kinds of documents, materials etc. either significant or not were being kept. Today there are many archives in our current archives relevant to Ottoman archives and other civilizations. The official correspondences and laws of Ottoman Empire, edicts with other states are today being kept at Prime Ministry General Directorate of Archive in Istanbul. In our country, the first archive initiative in modern sense has started by the establishment of Treasury of Documents by Grand Vizier Mustafa Resid Pasha in 1845. And in the period of republic government, a chamber with the name of Document Storehouse Discernment affiliated to Prime Ministry Private Secretary Directorate had been established for the storage of the documents of Prime Ministry. And this chamber had gained the level of Head Documentation Directorate within the body of prime ministry in 1929, and it had gained the level of Document and Document Treasury Directorate with the law of May 20, 1993 with no 2187. And in 1976, Department of Republic Archive had been established within the body of Prime Ministry (Republic of Turkey, General Directorate of Government Archives, 2016).

### **Use of Archive Sources in Social Sciences Courses**

The discovery that the archives may function as an effective tool regarding educational and cultural activities in the society is a significant development in respect of the history of record keeping. By this means, the schools had obtained new opportunities in the subjects of social science such as history. This development, that had put the archives to an assisting position regarding education, had emerged in the form of using genuine sources during education of history and social sciences (Keskin, 2013a, p. 159).

Social sciences, history and geography courses -that are within the programs of primary and secondary education-enable communicating to students the elements that will hold a light on history of humanity. In these courses, it is important to communicate the information, skills and values relevant to humanity to new generations in accordance with the teaching methods. In the classic teaching method, it had been intended to make the students adopt the elements relevant to history of humanity through textbooks and the teacher (Keskin, 2013b, p. 2). However, the archives have the characteristic of being an environment preserving the basic sources for teaching of social sciences and history that are based on out of class practices. Today, a larger meaning has been attached to this characteristic as well as student centered constructivist education instead of teacher centered education, improving the independent research capacity of the student rather than having some information memorized, cultural history based education instead of political history based education, and starting to enrich the teacher, lecture note, textbook centered teaching methods by tours, out of class events, games, role sharing, critical readings, discussions and brainstorming (Keskin, 2013a, p. 159-160).

Today, the constructivist approach model -which is new learning method- is gradually becoming widespread. According to Jonassen, learning in constructivist approach model is the form of structuring the information depending on the experiences, mental structure and beliefs of the individuals (e.g Karaman, 2007, p. 6). In other words, it is an active process in which the information is being structured in the cognitive structure of the individual as the result of her/his interaction with the external environment. This condition is being assessed as learning of characteristics such as learning based on documents, self-development, development of empathy, development of cause and effect relation, development of chronological understanding, putting herself/himself in time in social sciences which also cover history and geography (Silier, 2000, p. 80). Thus, the archives are being deemed as a field of application in constructivist teaching. This condition, which means that the referred teaching style is being applied on archives, reveals that the archives are being used as effective tool in giving the students high level of thinking skills (Keskin, 2013b, p 4).

In this context, the documents which may be used in history courses may enable the increase of the success of students in the course as well as increasing the interest of the students in the course. And the first thing being remembered from among historical documents is first hand and second hand written sources. The written texts in

subject are able to affect the levels of the students to understand the history by developing strategies of establishing a meaning, and their historical thinking skills (Isik, 2008, p. 390).

There are various classifications regarding the skills that are required to be developed in the student regarding social sciences in general and the discipline of history in private. Stearns is examining these skills under three categories (e.g. Ata, 2002, p. 4).

These are;

1. 1. Ability to assess the document/evidence,
2. 2. Ability to assess the controversial comments,
3. 3. Experience of assessing the examples of change of the past.

The teaching being supported by educational tools such as the historical buildings, antique cities and museums outside the school is being called out of school history teaching. Subjecting the student to first hand unwritten evidences provided by historical environmental and source individuals requires out of school history teaching (Safran and Ata, 1998, p. 87). And archives are also being assessed as a part of out of school history teaching. Social sciences are closely related with usage of documents in history courses, the adopted comprehension of history and view of education. The usage of documents in history courses is based on the view that pedagogic history and scientific history are not basically different, and that the skills of historians should be developed in the students (Ata, 2002, p. 2).

One of the best means of establishing a connection in between the past and today and developing a comprehension of history in this manner in the students is the use of historical places. These places are concrete and real at the extent that the students will be able to touch and see, inhale and hear. Thus, along with being more effective than the words in education and teaching, it is one of the most significant tools in developing consciousness of history in the students (Gokkaya and Yesilbursa, 2009, p. 484).

For the students of today, the subject may not be interesting, but the historical places support the incidents and themes that the students read in the books. Thus, the real places enable the students to establish a stronger connection with the past, and they may increase their interest in history. And this assists them to surpass themselves in learning something regarding other times, places and cultures (Gokkaya and Yesilbursa, 2009, p. 486). The subjects required to be taught in social sciences, history and revolution history are being addressed under four dimensions:

1. Determination of the subjects, periods and places that are required to be taught,
2. Teaching the subjects by using dates, names and incidents,
3. How and by which concepts the subjects and information will be interpreted,
4. How the subjects will be distributed in the educational process.

These draw the highest frame of the information and comments that are required to be obtained by the student by the end of teaching (Keskin, 2013b, p. 4). Teaching based on documents and evidences is being performed in a planned manner within the frame of a purposeful and pre-prepared program which is the basic characteristic of formal education. By this method, the documents are able to be used for teaching a specific period, incident, place and concepts as well as being used for starting a discussion, raising interest in the subject and developing some skills in order to establish a relation with the experiences of the student (Keskin, 2013b, p. 5).

According to Nichol, in teaching of history based on evidence, there are three approaches relevant to teaching events being implemented within the class. These approaches may be listed as follows:

1. Teaching the students to understand what the historians are making,
2. Having the students partially or completely make what the historian does,
3. Behaving the students as the historians of the future who will carry out their own history studies.

These three interwoven approaches provide a specific learning hierarchy for the students of history. This hierarchy is based on the notion that teaching is not just obtaining the reached part of the information, but also the provision of the habits of research (e.g. Dogan, 2007, p.49).

In this context, the documents improve the students' thoughts of observation, data collection, simile and comparison, analysis and synthesis, assessing the evidence sources, establishing hypothesis and concluding. As these places teach skills as well as knowledge, they assist to realize the curriculum programs in the courses of history, geography and social sciences (Gokkaya and Yesilbursa, 2009, p. 484). Each course associates one or more historical places with the extensive subjects, publications and incidents connected to curriculum of history and social sciences. One of the purposes of teaching program with historical places is to enable the teachers to use the historical places as source as they easily use the written sources. Each course reveals the story of relevant place,

and provide the students high thinking skills. The courses arranged for the primary education students may be adapted to all the students until the high school students (Yesilbursa, 2008, s. 219-220). And for this, the students should have the opportunity to use sources such as written sources, pictures, photographs, music and computer based materials. They should be actively be together with history by asking questions, by eliminating and sorting out their own sources, by presenting the solutions with pictures and drama through verbal, written or model means, and briefly as being based on their own interest (Akbaba, 2005, p. 187). At this point, geography is stepping in as the assistant of history.

The places of history are assisting to teach history by a meaningful way from a wide perspective by enabling the students to understand the reality of historical facts and to see that history doesn't just consist of abstractions obtained from textbooks and documents of archive and that it is not independent from their own experiences (Avci Akcali and Aslan, 2013, p. 145). Moreover, geography courses are providing the students the learning environment at real space through tours, observations and field works. The teachers are able to relate the subjects with real life through the course applications to be performed at school garden or in close vicinity (Ministry of National Education, 2015, p. 6), but regarding the environment and implementations of learning-teaching geography, the teacher should select events as per the environment of the school or s/he should prepare the events. Instead of communicating the facts and incidents or instead of having the students memorize the textbooks, s/he should apply events based on active learning (Akinoglu, 2014, p. 87).

As the photographs being among the archive sources being in the first place, the tables, pictures and various drawings are consisting the visual documentary sources. The most important method developed in order to analyze such sources is content analysis: The application of content analysis method to visual data is being realized in six phases (Acun, 2004, p. 107).

1. Selection of the subject and determination of the research question,
2. Selection of visual data,
3. Formation of categories for analysis,
4. Determination of rules for the use of determined categories in order to code the data,
5. Formation of rules in order to sample the documents,
6. Counting the frequency of involvement of generated categories in the data.

Even if the results obtained by Turkey in international tests are in the direction of lack of use of visual tools, the visual tools being used in the whole world as a type of communication of information are frequently being used in educational activities and in daily life (Yazici, 2006, p. 660).

In most of the developed countries of today, the archive institutions are being accepted as one of the effective teaching environments and tools in carrying out the teaching of history. Many archive institutions of these countries are organizing tours -relevant to the history education and teaching program of schools, exhibitions -by which the students will be able to perform independent research- and document based educational events for the students, and they are preparing materials for these. All these practices are for making the school age children of a country more conscious within the society, and for preparing a more informative environment instead of rote learning. Again, these practices enable to gain consciousness in early ages regarding the basic and future functions of the archives. By this way, the young individuals will be able to have the consciousness of preserving the documents generated and acquired by them in their future lives, and they will be able to obtain a basic idea regarding the research values and opportunities of the archives (Keskin, 2013a, p. 175). The biggest advantage of Turkey in the context of course plans of constructivist teaching is allowing to relate with the curriculum various archive institutions having historical memory and the documents being preserved there. It is required for the authorities, academicians and teachers -who are directly carrying out the job of teaching- to assess the archive institutions under a cooperation and program, and it is required for these institutions to be used as out of class course environments.

Finally, Keskin (2013b) is making the following suggestions regarding the subject:

Teaching programs relevant to archives and archive sources should be prepared by the Ministry of National Education. This program may encourage the operations relevant to the use of archives in our country in the curriculum of social sciences of primary education and history course of secondary education. In this context, the archive sources which may be used in the courses and their examples may be listed. A teaching method in which the archive sources are related with curriculum may be actualized in this manner.

Archive institution which may be visited as relevant to document centered teaching method should be determined. The information on these institutions should be communicated to educational institutions through publications having the quality of announcement.

By making cooperation with the managers of archive institutions, the communication in between the teachers and them should be ensured.

A course should be formed under a name such as “teaching with the archives” in the social sciences and history teaching departments of the universities. Information should be provided to the students studying at these departments regarding the use of archive institutions in teaching. It should be taught to the students studying at these departments how the visits to archive institutions should be planned and implemented in accordance with the teaching method, and the curriculum should include model practices as much as possible.

The teaching method with archive documents is in conformity with the constructivist approach also being anticipated in the social sciences curriculum for the year 2005. Provision of in service training through archive institutions should be ensured for the social sciences and history teachers who had graduated from relevant teaching departments before the year 2005 and who had been assigned. Within this scope, information regarding how the archives and archive documents may be used in education and teaching and how tours conforming to the document based teaching method will be organized may be provided, and how the practices will be realized may be taught.

## CONCLUSION

The man, who is a social being in historical process, has involved in some activities either with other individuals of the community or with other communities through the community he is included as from starting to live together and forming a community by passing on to settled life. The man and the communities he forms had sometimes gained some rights within the historical process, and they had sometimes entered into obligations as the result of his activities that increase in respect of variety and amount in parallel to the developments arising in social, economic and political fields. The mankind, as an individual and community, had needed to keep the documents in order to keep in written form the activities that provide them rights or that impose obligations on them as from the finding of writing, to preserve their rights and liabilities, and to prove by documenting when required. In this context, while the documents are meeting the students’ requirements such as data collection, simile and comparison, it is also being known that they develop the students’ thoughts of analysis, synthesis, assessing evidence sources, hypothesizing and concluding that we call high level of learning skills included in the taxonomy of Bloom. As the archive places teach skills as well as information, it is being considered that they will assist in realizing the curriculum programs in the courses of history, geography and social sciences. It should be known that the success of our education system is directly proportional with the success of archive activities. As it will not be able to be reached to requested information and searched documents in a timely manner at units and institutions which don’t assign the required importance to record keeping activities and which carry out these activities as slapdash without any system, it will be inevitable to have delays and failures in the services of such units and institutions.

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## GEOGRAPHY STUDENTS' PERCEPTION ON IMPLEMENTATION OF MULTIPLE INTELLIGENCES IN A CLIL COURSE

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**ABSTRACT:** The paper focuses on Geography students' perception on the implementation of multiple intelligences in a CLIL course designed at the Faculty of Geography, University of Belgrade. It starts with an overview of Howard Gardner's theory of multiple intelligences and examines its implications for classroom activities, materials design and cross-curriculum teaching. Being cognitively demanding, CLIL tasks require implementation of several types of intelligence. In addition to verbal intelligence, which is prevalent in foreign language teaching, other intelligences that assist in processing of non-linguistic content are also activated. For example, logical-mathematical intelligence is used in problem solving, hypothesizing, collecting and classifying data, whereas spatial-visual intelligence prevails in interpreting and comparing charts and tables. The paper presents survey results of students' perception on the MI application in a language course. We examined 150 first-year Geography students who attended seven CLIL classes in which multiple intelligences were applied. The survey instrument was the explorative questionnaire designed to examine perceptions of Geography students on the MI application in a CLIL setting. The data obtained from the survey demonstrate that the use of specifically designed teaching materials and tasks, which involve problem-solving, creative and critical thinking, fosters effective learning of both foreign languages and content and enhances students' motivation.

**Key words:** multiple intelligences, CLIL, English language, geography

### INTRODUCTION

Intelligences shape the ways in which individuals take in, memorize and use information. Foreign language teachers as well as teachers of other subjects have noticed that their students react in different ways to activities done in the class and that each student has his/her own learning style. When teaching, focus is on the linguistic intelligence exclusively, some students may show excellent results – those who are strong in linguistic intelligence. However, students who are strong in other intelligences can be more encouraged to take part in classroom activities when these are carefully balanced to include other intelligences as well. Therefore, activities should include different exercises and tasks that allow students to approach language learning from their strength areas. Class materials and activities should be customized so that all students have the opportunity to learn and to demonstrate what they have learned – not just those who are gifted with words i.e. those who are strong in the traditionally favoured linguistic intelligence (Prnjat & Marković, 2014, p. 115). In particular, teachers who work with large mixed ability classes should adopt appropriate teaching techniques in order to help their learners study at their own pace and provide the opportunity for students of all linguistic abilities to demonstrate their different talents and creativity. In CLIL classrooms, linguistic and interpersonal intelligences, which are prevalent in language teaching, can be supported by other intelligences such as logical / mathematical (e.g. problem solving, predicting, collecting data, classifying, etc.) and visual / spatial (e.g. use of symbols, charts and graphs) (Ibid.).

### MULTIPLE INTELLIGENCES THEORY

Howard Gardner developed Multiple Intelligences (MI) theory and in his book *Frames of Mind: Theory of Multiple Intelligences* implied that "...human beings have particular intelligences because of informational contents that exist in the world..." (1993, p. xxi) and that "...some individuals will develop certain intelligences far more than others; but every normal individual should develop each intelligence to some extent..." (Ibid. p.278). All intelligences operate simultaneously since they complement each other. Gardner proposed the following seven types:

1. Intrapersonal intelligence
2. Interpersonal intelligence
3. Linguistic intelligence

4. Logical-mathematical intelligence
5. Spatial-visual intelligence
6. Musical intelligence
7. Bodily-kinesthetic intelligence

Intrapersonal intelligence is the ability to understand oneself, to distinguish complex inner feelings and to use them to control one's own behaviour. Students who are strong in this type of intelligence prefer to work alone, at their own pace and to pursue their own interests. The best type of learning activity is individual work (e.g. personalized project).

Interpersonal intelligence is the ability to identify and respond appropriately to the emotions and moods of others, to understand their intentions and desires. Students with a well-developed interpersonal intelligence are able to work effectively in groups and to establish good rapport with other members. They often prefer to lead teams and to mediate. The best activities for this type of learner are tasks performed in groups or pairs, interviews, debates and discussions (Prnjat & Marković, 2014, p. 114).

Sensitivity to spoken and written language (sound, rhythm and meaning of words) forms the basis of linguistic intelligence. Students with a well-developed linguistic intelligence are particularly good at reading, writing and retelling stories and learn best when they hear, say or read words and phrases.

Logical-mathematical intelligence is the capacity to detect and understand logical and numerical patterns. It is associated with scientific thinking and logical reasoning (Ibid.). Students strong in this type of intelligence are good at performing mathematical operations, discovering patterns, analyzing, systematizing, classifying and prioritizing data. The best activities for these students are: puzzles, problem solving activities, games such as treasure hunts, etc. (Puchta & Rinvoluceri 2005).

Spatial-visual intelligence is the capacity to perceive the spatial (visual) world accurately. Students whose spatial-visual intelligence is well-developed are good at arts and crafts. The most suitable activities for these students are the ones that involve working with symbols, graphs, diagrams, maps and geometrical forms (Ibid.).

Musical intelligence is the ability to appreciate various musical patterns: melody, beat, rhythm and tone. Students with well-developed musical intelligence easily understand various forms of musical patterns and prefer listening to music, singing and playing instruments.

The ability to use one's body or parts of the body skillfully and in highly differentiated ways forms the basis of bodily-kinesthetic intelligence. Students strong in this type of intelligence prefer to move around the classroom, to do things and they usually excel in class activities such as miming and performing with realia (Ibid.). Every human being possesses all these types of intelligences. However, because of genetic variations and experience gained in early childhood, no two people have the same intelligences equally developed.

### **Multiple Intelligences in the CLIL Classroom**

Gardner's Theory of Multiple Intelligences is particularly significant for CLIL educational settings (in which a foreign language is taught simultaneously with content of a curricular subject. CLIL materials and activities are often rather cognitively demanding and require implementation of several types of intelligence (e.g. logical-mathematical intelligence for hypothesizing, collecting and classifying data; spatial-visual for interpreting and comparing charts and tables, etc.).

Besides developing students' linguistic and general academic skills, CLIL contributes to development of cognitive abilities as well. Also, studies have shown (ICF Report 2014, Marsh 2002) that integrated learning improves the ability to learn and study, it promotes students' responsibility, confidence and learner autonomy and provides "a holistic educational experience" (Coyle, Hood & Marsh, 2010, p. 1).

### **TEACHING UNIT**

In this section, we present a teaching unit in which logical-mathematical and spatial-visual intelligences are used alongside linguistic intelligence. The unit was designed for the students at Geography Department at the Faculty of Geography, University of Belgrade. It consists of a text on the history of urbanization in Europe and exercises designed to test reading comprehension. Also, students do exercises that involve drawing city plans and performing calculations.



### Teaching Aims

- creation of interactive teaching and learning environment that involves the use of logical-mathematical and spatial-visual intelligences so that students who are strong in these intelligences can demonstrate their talents and creativity (Prnjat & Marković, 2014, p. 115);
- promotion of cooperative learning (pair and group work) and peer assessment;
- acquisition of new vocabulary (human geography, demography, cartography).

### Materials and Activities

For purposes of brevity, only some materials and tasks are presented in the paper.

#### *Activity 1 (individual activity)*

Students read five excerpts from the text on the history of urban development in Europe. The excerpts and subsequent comprehension exercises are based on the material taken from *English in Social Studies*.

1. The first true cities **appeared** about 5000 years ago, in the food-producing communities of the Middle East. They **were** much larger and more densely populated than any previous settlement. A complex hierarchy of social classes and specialization of labor **developed**. Moreover, the need to keep records **led** to the development of writing and arithmetic. Arts **flourished** as well.
2. Three main phases in the growth of the West European city **can be distinguished**. The first **is** the medieval phase, which **extends** from the beginning of the eleventh century A.D. to about 1500. The second **includes** the Renaissance and Baroque periods and **can be traced** from about 1500 to the beginning of the nineteenth century. The third **marks** the beginning of the modern era, extending from the early nineteenth century to the present day.
3. Every medieval city **began** as a small settlement that **grew** round a geographical or cultural focal point: a stronghold, a cathedral or a monastery. In districts where travel and trade **were established**, the focal point **was** a market, a river crossing, or a place where two or more trade routes **converged**. In studies of urban geography, the oldest part of a town **is referred to** as the nuclear settlement. There **are** many small towns in Europe where it **is** still possible to trace the outline of the original nuclear settlement.
4. The decision to establish a settlement in a particular place **depended** basically on two factors: politico-cultural and economic. The builders **sought** a prominent hill site or a promontory surrounded on three sides by sea, river or marsh. Such a site **dominated** the surrounding countryside and **had** the benefit of natural defenses. On the other hand, economic activities **required** easy access, room to expand, and contact with the main trade routes. For this reason, most settlements **were built** by navigable waterways.
5. All urban settlements **must meet** a number of basic requirements. They **must be** reasonably compact in form, so that all parts of the town are easily accessible. There **ought to be** adequate space between the buildings for pedestrian or vehicular traffic. Perhaps most important of all, citizens **must have** security so the earliest settlements **were often attached** to an existing castle. At a later stage, towns **founded** in the later Middle Ages **were surrounded** with walls of their own.

#### *Activity 2 (pair / group work)*

Students read the statements and decide which paragraph each statement refers to.

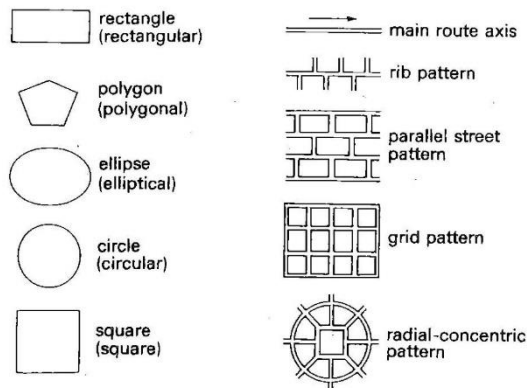
1. Medieval cities began as settlements built around geographical, economic or cultural focal points, such as churches, markets, river crossings or trade route junctions.
2. Politico-cultural and economic factors were both important in selecting a site for a medieval town.
3. Easy access and security have always been a vital consideration in the development of urban communities.
4. The growth of cities made possible the development of a hierarchy of professional classes.
5. The Renaissance and Baroque phase of the European urban development lasted for about three centuries.

#### *Activity 3 (pair / group work)*

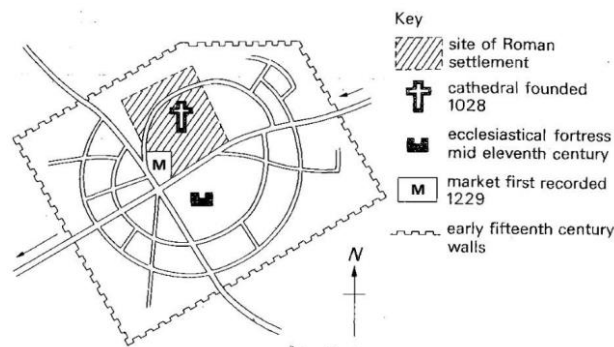
Students draw the timeline of the urban development in Europe.

#### *Activity 4 (pair work)*

Students study the symbols representing the shapes of city fortifications and street patterns. Then they read a description based on the diagram and fill in the blanks.



**Image 1.** Symbolic Representation of the Shapes of City Fortifications and Street Patterns



**Image 2.** A Historical Diagram of a Medieval Town in Europe (Town A)

Town A developed on the site of a (1) \_\_\_\_\_ on a main route axis running from the north-east to the north-west. The nucleus was a (2) \_\_\_\_\_ founded in 1028 and a (3) \_\_\_\_\_ built in the mid eleventh century. A (4) \_\_\_\_\_, south-west of the cathedral, was first recorded in 1229. The (5) \_\_\_\_\_ were built in the early fifteenth century in the form of an irregular (6) \_\_\_\_\_. Further growth tended to radiate outwards from the cathedral and market place, thus forming an example of the (7) \_\_\_\_\_ pattern of urban development.

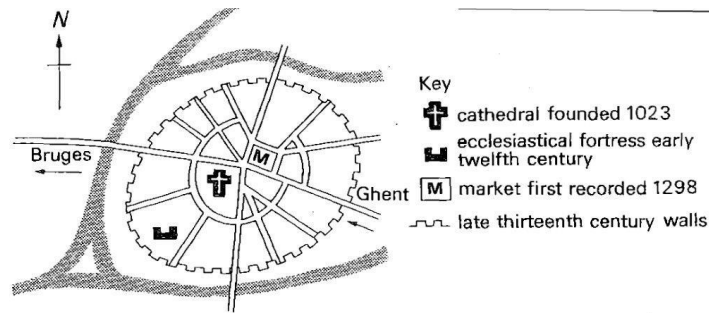
**Activity 5 (pair / group work)**

Students read three descriptions and draw diagrams. They present the diagrams to the class and engage in peer assessment. For purposes of brevity, only one description is presented in the paper.

Town B developed on the main east-west axis running from Town A to Town C. The settlement was located on a promontory surrounded by marshes on two sides, and the nucleus of settlement was a twelfth century fortress and a church founded in 1062. A market, to the north-east of the church, was established by 1136. The fourteenth century walls form an almost perfect rectangle. The streets are based on a rectangular plan and are spaced at more or less equal intervals. The town is a good example of the 'grid pattern' type of urban development.

**Activity 6 (pair / group work)**

Students study three diagrams and write descriptions based on them. They present the diagrams to the class and engage in peer assessment. For purposes of brevity, only one diagram is presented in the paper.



**Image 3.** A Historical Diagram of a Medieval Town in Europe (Town C)

## RESULTS AND DISCUSSION

The main objective of the study was to determine perceptions of Geography students on implementation of multiple intelligences in a CLIL course. The study tasks were to identify: 1) satisfaction with this type of activities; 2) perceived difficulty of this type of activities; 3) perceived benefits of this type of activities. The sample consisted of 150 first-year Geography students who attended seven CLIL classes in which multiple intelligences were applied. The survey instrument was the explorative questionnaire (Likert-type scale questions).

The study results show that a vast majority of students (68%) expressed a high level of satisfaction with the teaching and learning activities. Only three students considered this type of activities, drawing city plans in particular, a waste of time (they did not complete the tasks). Also, low level of satisfaction expressed by other nine students can be attributed to their lack of interest in drawing.

**Table 1.** Students' Overall Satisfaction

Not at all satisfied	2 %
Slightly satisfied	6%
Moderately satisfied	24%
Very satisfied	56%
Extremely satisfied	12%

Regarding the perceived difficulty of the activities, almost all students answered that they were very demanding (86%). The task that required transformation of graphical data into textual was taught to be the most difficult.

**Table 2.** Perceived Difficulty of the Activities

Very difficult	82%
Difficult	4%
Neutral	2%
Easy	8%
Very easy	4%

Regarding the perceived benefits of the activities, more than three-quarters of students stated that they found implementation of MI in a CLIL course beneficial (78%). Majority of them answered they would like to have more classes with similar activities.

**Table 3.** Perceived Benefits of the Activities

Not at all beneficial	2%
Not beneficial	8%
Neutral	12%
Beneficial	66%
Very beneficial	12%

## CONCLUSION

Students learn more efficiently and are more motivated if individual differences in preferred learning styles are taken into account. Hence, many foreign language teachers have realized the importance of encouraging learners to explore and employ all of their intelligences. Creation of stimulating and varied activities and tasks based on

multiple intelligence strategies can enhance students' motivation and foster class interaction. Also, such activities may help teachers to better appreciate the hidden strengths of their students, whereas students themselves may feel more respected by their classmates and feel better about their progress and achievements.

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## **CREATING REAL LEARNING EXPERIENCES RATHER THAN TEACHING BASED ON THE TRADITIONAL TRANSFER OF MATHEMATICAL INFORMATION, AT COLLEGE LEVEL**

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**ABSTRACT:** Innovation in Education is a must in the 21st century education around the world. The TEC de Monterrey system in Mexico is working hard in preparing and encouraging their teachers to innovate and use new educational models. Teachers are constantly implementing new teaching and learning techniques, not only to have better teaching practices in all fields, but also to build important life skills in their students. Competences such as collaborative work, problem solving, leadership and critical thinking are some of the skills that are cultivated by using these techniques. A group of Mathematics' teachers in the Tec de Monterrey Campus León in Guanajuato México, have been using challenges in class as a way to create real learning experiences by using technology, flipped learning, and mystery stories to improve reading comprehension skills as well as mathematical knowledge. Mathematics lessons have evolved from the simple transfer of extensive amounts of information to creating the conditions necessary for students to develop life long experiences. In a preliminary survey about math lessons in our campus, more than 54 % of the total students in this project, mentioned that they find math courses in general very difficult, tedious, mechanical and without challenges. This study suggested that students learned math faster and deeply in a dynamic and fun way, 91 % of students in the final survey answered that learning math through the new method was more meaningful and enjoyable, improving the enthusiasm about learning math amongst students. Math scores were higher in the groups that followed this new educational technique.

**Key words:** learning experience, dynamic, innovation, challenge.

### **INTRODUCTION**

We are living in times of significant change; our societies, institutions, businesses, occupations and the way in which we communicate and interact with others continue to evolve. Therefore, it is the responsibility of the educational community to generate new learning platforms, models and strategies that when implemented to the students, will help them coalesce to the XXI century professional life. In the Tec, de Monterrey, we strive to provide relevant learning experiences that include hands on practice in the community; this ensures the development of an important level of maturity in the students to deal with different cases, situations, problems and projects. As Karl Fisch so perspicaciously stated in 2007 (Fisch, 2015) "We are currently preparing students for jobs that don't yet exist, using technologies that haven't been invented in order to solve problems we don't even know are problems yet", and our challenge as educators consists in taking advantage of the years in which our students will be with us to help form the future leaders of these changes.

We live and learn with every aspect of our personality. When we combine our emotional knowledge with our physical knowledge, we achieve true human learning, which, according to Claxton (Claxton, 2008) occurs when we no longer know what to do, and therefore any learning experience will pose a certain risk, a gamble, in which we must accept uncertainty free from any anxiety or anguish, living each new challenge as an element of a complex society in which a culture for learning will emerge that will stimulate the individual's confidence in his or her learning ability in any situation. Let us embrace this idea and allow every student to actively experience their responsibility for their own learning and that of their teammates, (Gomez, 2016) following a determined set of instructions, training and actions that based on technology and several communication strategies will develop personal and social skills which will transform into a habit of collaborative learning.

After working with college freshmen for many years, we have noticed that the newer generations have developed additional curricular competencies during their middle school and high school education. While these students display an increased ability to communicate in a language other than their native tongue, follow social roles and effectively work in teams, their logical thinking skills and creativity in problem solving have diminished. This newer generation, commonly referred to as the Millennials, is less devoted to formal reading. Although they claim to spend much time reading, their perusing is mostly confined to social media and brief articles they find on the web to superficially become acquainted with subjects that have temporarily gained their interest. When specifically questioned about their interest in reading books, regardless of the topic matter, we have found a repeating pattern in new college students, only 20 percent have a consolidated interest in reading, while 80 percent state total disinterest.

Although we will not generalize, it is common to find in students entering higher education in Mexico, that a large percentage of them deem certain subjects as too difficult, rejecting fields such as mathematics, arguing that it is a boring and useless branch of education. According to a survey conducted by the National Survey of Habits, Practices and Cultural Consumption by CONACULTA (Cultura, 2010), 77% of the population of Guanajuato reported not reading any books, 49% reported not reading newspapers and 58% never reads magazines. When considering this data it came as no surprise that in 2012 of the 108 countries that make up the UNESCO, Mexico has the next to last place in the reading index, estimating that a mere 2% of the Mexican population has a permanent habit of reading.

## METHODS

The pedagogical proposal presented in this innovation project was to promote the passion for reading while simultaneously uncovering the charm behind the world of mathematics. Therefore, the book *The Mathematical Novel* was included in the classroom and homework sessions, thus allowing the students to experience a more individual and collaborative approach to the numerical challenges presented in this book, along with weekly activities associated with the Schoology educational platform.

The idea for this Project arose from the need to promote new technological platforms, different from those that the students are accustomed to use in the system of the Technological of Monterrey. Currently the Blackboard platform is used, which generates a significant expense for the university and indirectly for the students, therefore a project that would validate the use of new, technological innovative projects on platforms such as Moodle, Schoology free version and Design2 was proposed. We must consider that although our students are constantly using technology, being on campus there are very few students that enroll and complete online courses and take advantage of the resources of online education.

To implement the proposal the first task was to create an instructional design of the course to include course sessions that would feel natural to the students. Classwork and homework were also designed that would outline each student's individual responsibility as well as their collaborative responsibility in the group activities. The dates for the work to be turned in either in paper and/or on the platform were also defined. Last but not least was the importance of transmitting the responsibility to the corresponding teacher's in his or her involvement in the project to ensure good monitoring and review of the work of the students as well as motivation for the students to finish their readings along with the mathematical challenges.

### Text Selection and Generation

One of the motivators behind this project was to increase each student's annual reading tally by at least one book by the end of this mathematics course. For this reason, choosing a book that would be of an attractive genre and writing style for students between the ages of 18 and 21 was of paramount importance. Although we initially considered using a book in the classic literature genre that would transversally promote Spanish areas, after conversing with several upperclassmen we learned that mystery and fiction sagas are not only more appealing to young adults, but also foster a continuing reading habit. Therefore, a murder novel was chosen; in which the challenge was to discover the killer.

To generate empathy, the novel revolves around four young university students, (which correspond to the number of students in each team) who witness the last minutes of life of the city's ruler, whom explains to them the importance and the negative impact on the community if they do not catch his murderer. Therefore, with his dying breath of air, he urges them to catch his murderer and he gives them the first clue that they must follow. Coincidentally, the beginning of this novel also elaborates on the traits and hobbies of the students, who also share a dislike for mathematics.

In the initial section of the reading, while the plot and the characters' traits were being introduced, the personality of the Millennials was subtly included. The aim of this was not to criticize the Millennials, but to highlight the advantages of this personality in each of the friends' and how they will aid in solving real life problems, regardless of whether or not they were good in a certain area of education such as math, physics, chemistry or sciences in general. This section was also written with enough emphasized information so as to measure in the first exercise of online evaluation, the students' reading retention. This was important, since one of the hypotheses of the faculty involved in the project was that when the young students read only social media excerpts, which are characterized by a very reduced length, they consequently have a diminished retention of details described in a longer or more intellectually challenging reading.

In the later chapters of the novel, two innovative elements were included that would allow the reader, in this case the students, to generate a very real connection between the concepts of a pre-university level mathematical course and reading comprehension skills.

- One challenge (from a total of 9) that they must solve and send online to the city's ruler to demonstrate that their investigation is on the right track. To solve this challenge, it is necessary to use the mathematical knowledge and skills that were presented in class each week. The solution to each of these challenges is accomplished after each student has finished reading each chapter individually and has agreed to assign each responsibility necessary to turn in the results in the correct time and fashion. This activity was designed to be completed outside of the classroom.
- One clue (from a total of 9) that can be solved by using mathematical logic, deduction and common sense that has been acquired in previous stages of the students' life. This clue will allow the characters to continue their search and come closer to finding the murderer's hideout. In order to solve this clue, 25 minutes in the last session of each week were allotted for the students to argue, solve and fundament why they reached that particular solution and to submit it onto the platform, so as to gain access to the following chapter in the novel.

During the development of the novel, a point of concern that influenced the content of the writing was: What will happen if the teams did not reach the correct result for the clue? To address this question and to encourage mathematical analysis, as well as an interest for reading, the decision to start each chapter with the solution that the characters must generate during their trek through the city to find the new challenge, was taken. The possibility of changing geographical locations in further novels, in which clues are found in historical sites, and the inclusion of local legends that would relate to each city or state in which the crime occurred are important discussion points that remain on the table, particularly considering Mexico's rich history and demographical diversity.

### **Activity Distribution for the students**

This activity was designed to be implemented in 12 weeks. Although a normal semester in the Tec de Monterrey is 18 weeks long, it was determined that one of the key elements in this Project was to generate a passion for reading and for solving mathematical challenges, as opposed to a feeling of burden and hindrance to complete their other school activities. For this reason, the decision to eliminate the evaluation and activities of the Tec System was reached.

The project began with a survey of reading habits, and the students' opinion about the relationship between learning about math and reading comprehension. After this we continued with a three-week long presentation of the place, its history, its costumes and social conventions, as well as the role that each of the five main characters had in the community. During this stage, initial information about the students' reading comprehension was gathered by means of online evaluations. This not only served to verify reading comprehension elements but also to familiarize the students with the Schoology (free version) platform. It is important to note that Schoology is a platform that has specialized in the application of gamification as an educational strategy, therefore, since the beginning it was very well accepted by the students. Another great advantage of this platform was the benefit that teachers could include alerts and reminders in the system's calendar that would keep the students aware of their deadlines. Although the project was defined as one predominantly centered around teamwork, it was of vital importance to remind the students by means of their calendar of the activities that were to be solved through group collaboration and those that were to be submitted individually.

During the first class, when the project was presented, the students were divided into groups of four and roles were assigned stressing the importance of individual work, which in this case consisted of reading the chapter pertaining to each week. The teamwork consisted in the following role assignment:

- One student who would be responsible for organizing the time allotted in the classroom. The student in charge of this role would be responsible of reminding the team that the agreements that were made regarding submitting the work that was assigned to be completed outside of the classroom must also be respected. The person in this role could take an agenda with reminders for the team concerning their activities and the dates they agreed upon completing the activities by.
  - One student responsible for formalizing a proposed solution. The role of this team member is very important; since he or she shall be responsible for collecting the information, proposals and methods that each of the teammate will develop and summarize them into the final version, which will be handed in.
  - One student in charge of questioning and validating the results. This member is of vital importance to the group since there may be differences in the propositions of the solution, therefore he or she must be able to mediate the dialog and discussion with the team members to identify the correct proposal and formalize the one they decide to turn in. Even though the group may reach a consensus regarding the correct answer, the student in this role must always question the others to make sure that their proposed solution is, in fact, correct.
  - Last but not least, another student that would be in charge of uploading the work onto the platform. This student must be well familiarized with the correct use of the Schoology platform so as to deliver the work in a timely fashion, adhering to the specifications that were laid out on the rubric.
- During the first two weeks the students had to read chapter 1 and 2 respectively and during class on Fridays they would take a reading comprehension quiz. This phase helped determine each student's initial reading comprehension level as well as introducing the story to the students.
  - From week 3 to 11, the individual reading was divided into two parts:
    - The first part of the corresponding chapter was made available every Monday, in which the characters are confronted by two elements: a challenge and a clue. To have time to read the chapter and propose solutions individually the students were granted of half a week. During class on Thursdays, the students were given time out of class destined to work collaboratively on solving both the collection of evidence and coming to a proposed solution, which must then be uploaded to the Schoology platform. It is important to mention that at the beginning, there were several teams that arrived to class with the solution already completed and were encouraged by the teacher to use the class time to further discuss their solutions to make sure each team member agreed with the result they generated.
    - The second part of the chapter becomes available for the students to read from Friday to Sunday. During this section of the chapter the characters describe the correct solutions they reached and they continue their search. This way the students can effectively compare their proposal to that of the characters' and witness the correct interpretation of the challenges and clues. Part of the reading comprehension evaluation and reflection of the given solutions was encouraged by asking the students, during their classes on Thursdays, to share about the differences in their solutions to those that were presented by the main characters of the novel and to explain why there were differences in their results.
  - From weeks 6-12, during class on Fridays, students were evaluated individually and online regarding the elements that were described in the chapters, so as to measure the variation in reading comprehension.
  - During week 12, and after each team handed in their proposed solution to the ninth and final challenge and clue, the final solution and conclusion to the mystery of the novel became available on the platform.
  - During week 13 the students were again surveyed on their reading habits and their opinion of the relationship between learning mathematics and reading comprehension.



## Implementation

This project can be found on the Schoology platform and was implemented on the students of the August-December 2015 semester of the class MA1001 Introduction to University Level Mathematics, which is integrated by students who are lacking in some of the required areas to begin mathematics in their corresponding careers.

To begin the semester, the platform was organized and each student was given clearance to access it. The two surveys were uploaded, along with three reading evaluations, the 9 blocks of the novel, including the readings with the problems that must be solved and the clues that must be deciphered, as well as the solutions that were reached by the characters from the novel and the 9 spaces in which each team must turn in the result of their work. Each of these elements was programmed so that it would only become visible to the students after a specific date. Therefore, the instructional design and the scheduling of the activities on the Schoology platform was vital. A great advantage of this platform was that it would send notifications and alarms to each student's personal email to remind them of upcoming evaluations, readings and deadlines to upload their work; as well as notifying the teachers when an assignment was uploaded that would need to be graded. This platform would not only allow teachers to give feedback to each student or group evaluated, but it would also notify the teacher when the student or group read the evaluation, therefore ensuring that the feedback was understood by the team.

The screenshot displays the Schoology interface for the course 'Introducción a las Matemáticas: MA1001'. The main content area lists several materials and assignments. The materials include 'Capítulo 1.pdf', 'Módulo2.pdf', and 'Solución 1.pdf'. The assignments include '¿1 y 1 son 11 o 27, ¿De qué se trata la historia?', '26 + 7 + 1947 = 8 + 7 + 21 = 36 = 3 + 6 = 9', '10 - 8 + 6 - 4 + 2 - 4 + 6 - 8 + 10', '26 de julio de 1947.pdf', and 'Problema 1 y Pista 1'. The page also features a sidebar with navigation options like 'Inicio', 'Cursos', 'Grupos', and 'Recursos'.

## Responsibility of the Teachers

The development and implementation of this project required the collaboration of several teachers that were in charge of different responsibilities:

- A language teacher was responsible for writing the novella. This was a great responsibility considering that the success of this project depended on the teacher's ingenuity and ability to create suspense.
- A mathematics teacher was in charge of the problems and mathematical challenges that were related to the subjects covered each week as well as programming the math classes into the semester. Including mathematical challenges into the novella was relatively easy, since the author of the novella would leave a space in the story where the students would come across an envelope that would contain a mathematical challenge. Therefore, the math teacher would simply write the content of the envelope and in the following chapter would uncover the solution to the mathematical challenge of the previous chapter.

- An instructional designer was in charge of validating the pedagogic proposal and uploading the program onto the Schoology platform.
- The teacher in charge of accompanying and evaluating the students' work was also responsible for encouraging individual reading and emphasizing each team's responsibility of uploading their work onto the platform. Each week the teacher evaluated each of the solutions and assigned the appropriate sticker to each development, it is important to note that even though the solution might not have been accurate, creativity, enthusiasm, team work and strategy were evaluated, so as to encourage the passion for math and reading.

One of the key factors that greatly influenced the success of the project was that the story was designed ahead of time. This was very important because in each chapter the clue to find the murder must be carefully incorporated into the storyline as well as the mathematical solution to the challenge in the previous chapter of the novel. The author also had to creatively develop the way in which the novella's characters reached the corresponding solutions and how these continued defining the plotline of the story. Needless to say, this was one of the most challenging stages of the project's preliminary design as well as when the faculty team truly experienced the project's transversality.

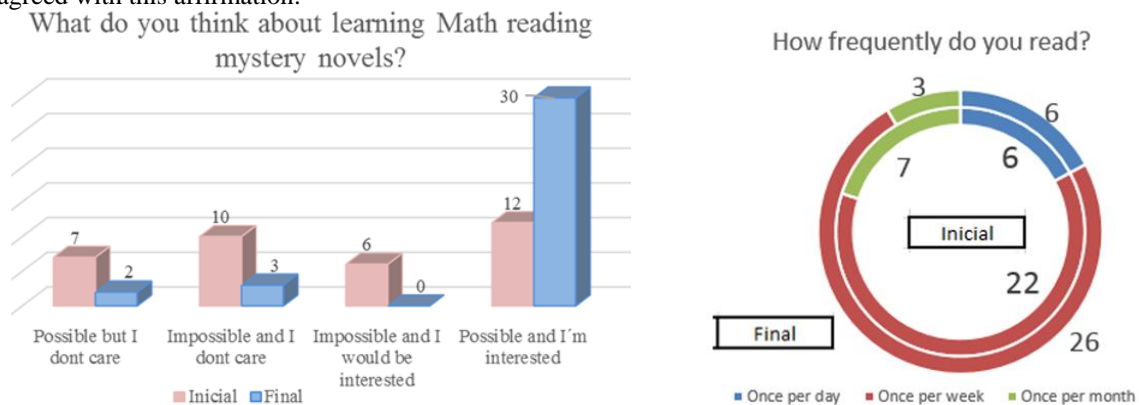
In order to measure the effectiveness of this proposal for Educational Innovation linking the passion for mathematics with reading through the technological platform Schoology, the team of professors that collaborated in this project would record weekly incidences to measure the project's effectiveness and implement improvements, in which the following variables would be reported:

- The planned activity could be carried out, virtual activities were completed each session by means of the platform,
- All products or evidence were handed in/received in time for their evaluation,
- Instruments were employed -such as rubrics and checklists- from the platform to evaluate the activities,
- Descriptions of the reasons that lead to registering an incidence or lack of incidences were reported.

## RESULTS

To evaluate the project, two variables were considered. One of the variables considered was the students' interest and perception of reading and the possibility of improving their math skills through reading. The other variable considered was the students' competence in solving mathematical reasoning problems as well as their reading comprehension. Both mathematical reasoning and good reading comprehension are basic skills for the 2020 Plan of the Tecnológico de Monterrey. This plan was not only designed to improve the mathematical reasoning skills in young college students but also as yet another strategy to be implemented in private and public educational institutions to encourage the habit of formal reading in the population of Guanajuato.

Considering that the project stretched from the months of August to November, 12% of the participating students reported a change in their reading habits from 1 time per month to one time per week. There was also a significant increase of those of the sample who believed they could learn mathematics reading a mystery novel, at the beginning of the semester 34% believed this affirmation was possible, whereas by the end of the semester 86% agreed with this affirmation.



Figures 1 & 2. Results at the initial and final of the project.

Regarding the reading comprehension competency measurement of the project, the group had an average of 46/100, 85/100 and 78/100, which was related to the increasing number of visits to the course on Schoology and

the time each student was connected to the platform. As the semester continued, these indicators also increased, demonstrating a 69% rate of improvement of their reading scores as measured by their level of retention, comprehension and memorization.

As far as the work turned in regarding the mathematical clues and challenges, these evaluations also demonstrated an evolution in the group average since they were of 76/100, 87/100 and 93/100 at the midterm cut. This demonstrates an improvement in their competence for logical reasoning and mathematics. It is important to mention that even by the second evaluation, the students continued to question the validity of the evaluations since not all of the elements in the book had yet been covered by their math sessions; however by the last delivery dates, this was no longer an influential factor and the academic achievement rose by 22%.

These numbers allowed us to consider the project successful. The following are some of the comments we received from the students that inspire us to keep innovating, creating more stories and new ways to make their learning experience more meaningful.

- It was easy to read and solve the problems as a team because we helped each other out.
- I liked that the lectures were programmed and distributed from the start. We got better at how we solved the problems and we also helped each other with the reading.
- Schoology's calendar would let us know via email about the deadlines on the reading, which was helpful, especially since there was a lot of reading for some of the weeks.
- During exam week, I lost the thread of the story.
- The Schoology sessions felt like a break from math class. There were some weeks where I had so much homework from other classes, and this activity distracted me from the stress and relaxed me.
- As always I found teamwork real challenging. Initially two classmates did not fulfill their obligations, so the burden on the rest of us felt really heavy. However when the people that weren't working noticed their grades were significantly lower than ours they decided to integrate into the work. It was very evident to the teacher that they weren't cooperating when they wouldn't do anything on Thursdays.
- I am not sure if I have learned math as such, nor if I would consider what we read a book, because our homework wasn't that long. But I definitely liked working like that, the teacher was very motivated, and talking about the novel really got my interest, I was very excited to discover if our solution to the challenge had been correct... and well the end of the story was a bit predictable.
- I don't like reading, and I didn't like that I had to read to do math, however this semester I read this book.

## **CONCLUSION**

The objective of this project consisted in implementing some of the tools proposed by the Model Tec21 to improve the students' abilities by joining two elements, mathematics and Reading. One of the most important findings of this project was that the students were able to learn in a completely different way, without so obviously following a lesson plan, the learning experience became something innovative, stimulating and challenging. In the students' mind, it seemed impossible to imagine that a mystery novel would hold all the elements of a math program. It was also equally gratifying for the students to discover that their preconception that "I was born bad for math and for problem solving" was nothing but a myth. The students were able to propose creative and insightful strategies to find the solutions to the clues and challenges from the novel. Although they sometimes doubted their proposed solutions because they recognized it did not fully adhere to the methodology proposed in the classroom, they discovered that there are several different ways to apply their knowledge to solve a problem. This project would have been demonstrated less effective results if we had not integrated several of the elements that these new generations learn and work with, including: the importance of knowing their role in a team, so as to guarantee their participation in teamwork, the use of a technological platform not only made the reading easier, it also enhanced the follow-up, turning in the assignment and the feedback from each student. These elements made the project more familiar and pleasant for the students.

## **RECOMMENDATIONS**

The next step consists in inviting more teachers from different areas to join us in linking their corresponding subjects to a good story. This project will not only apply to mystery and mathematics; it can be applied to any subject in which the student can take their knowledge and the information they learn in class and convert it to a fun, imaginative context in which they can practice.

A new tendency in education at the university level is to ensure learning by solving real cases that have occurred in businesses. By doing this it is expected that the student will develop the knowledge and abilities necessary to

solve the problems that were presented. We consider that this didactic technique can be easily translated into a novel since the real information regarding the solution to the problem is available, thanks to the case reports by businessmen or administrative employees. The framework of these elements would be essential to highlight and analyze in the story and would be the skeleton of the novel. However, in order to implement the reading assignment and reach solutions during a semester, a large group of professors willing to work at least a semester prior to when the program will be implemented, would be necessary in order to finish all the requirements.

In the Tecnológico of Monterrey, we have teachers with the necessary innovative and creative profiles to implement this new didactic technique. However, choosing to implement a project like this would unfortunately disrupt the faculty's current teaching sessions since much instructional design is necessary. Therefore, we suggest that this project be elaborated in conjunction with other academic bodies so as to lighten the workload and experience the benefit of working with more collaborators.

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*Section 2: e Learning*

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## **THE IMPACT OF THE EDULAB MODEL ON THE LEARNING PROCESS: STUDENTS AND TEACHERS' PERCEPTIONS**

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**ABSTRACT:** Currently, it has been implemented and tested, in ten Portuguese schools grouping, a new model of technologies' integration in education: the EduLab model. This model seeks to promote the development of digital literacy, knowledge and competencies of teachers and students involved in it by creating classrooms equipped by educational and technological resources. In addition, the EduLab model predicts teachers' training and pedagogical accompaniment, seeking to encourage the adoption of innovative teaching practices, using the technologies that will lead to an improvement of the educational process. This study intends to assess the impact of the EduLab model on improving students' learning ability in the School Grouping of Gafanha da Nazaré (Aveiro, Portugal), one of the groups of schools that integrate this pilot project. To this goal, it was used the survey technique and were applied two questionnaires: one for students of the second, fifth and eighth grades and another for teachers involved in the project. The majority of students in the second and fifth grades refers that they enjoy using these technologies having a positive impact on their learning. The students of the eighth grade are not so confident and, mostly, do not recognize that technologies provide them a better learning. Teachers involved believe that technology has a positive impact on students' interest, motivation and participation. They also note that technologies support the development of disciplinary skills, promote the development of specific skills and an autonomous and student-centered learning.

**Key words:** EduLab model, technologies, learning, students and teachers' perceptions.

### **INTRODUCTION**

The research underlying in this article is part of the first author's doctoral project in Multimedia in Education (University of Aveiro, Portugal), and the second author is her supervisor. This PhD project aims to evaluate the impact of the EduLab model on basic education. In addition, this study is integrated into AGIRE project (Apoio à Gestão Integrada da Rede Escolar - Support for School Network Integrated Management), a collaboration between the Consortium E-Xample (which gathers 26 companies in the areas of education and/or technology), the Department of Education and Psychology at the University of Aveiro (Portugal) and the Gafanha da Nazaré School Grouping (Aveiro, Portugal) (AEGN). The EduLabs project is a pilot project, which involved ten groupings of Portuguese schools in 2014/2015 academic year, including the AEGN, with the goal of creating educational experimental ecosystems where, through provision and the use of educational technology resources, seeks to promote innovation in education.

This paper aims to evaluate the impact of the EduLab model, and therefore the integration of technology in the educational process, in student's learning, considering their own perceptions and those of the teachers involved in the EduLabs project. In order to achieve this aim, surveys were applied to teachers and students involved in the AEGN EduLab. This chapter begins by presenting the principles of the EduLab model and the theoretical foundation with emphasis on this research in particular, namely, on technology integration in the educational process and the perceptions of students and teachers resulting from studies that were implemented in this area. The following chapter presents some methodological considerations, including the techniques and tools for collecting and processing data. Subsequently, we present the results of this study that focus in the first part on the students' perceptions and then on the perceptions of teachers. Finally, we formulate the main conclusions and recommendations for future work.

### **EduLab Model**

In recent years, Portuguese schools are implementing several programs to encourage technologies' integration in education, a reflection of the technological advancement on today's society. The EduLab model aims to be assumed as a new model for technologies' integration in an educational context. By equipping the schools with

educational resources, the technological oriented EduLabs, or educational Labs, seek to develop skills and digital literacy of those involved and responds to future generations' interests and needs.

Classrooms involved in EduLabs are equipped with computer, projector and interactive whiteboard and both pupils and teachers integrated in the project, have a tablet with digital books, Open Educational Resources (OER), e-learning software/classroom management (Mythware) and Internet access (Figure 1). Students of the first cycle of basic education (6-10 years), instead of a tablet, have a laptop, "Magalhães", designed specifically for children: robust, resistant and with reduced dimensions (8.9-inch screen).



**Figure 1.** EduLab Model (adapted from E-Xample, 2014)

More than equipping schools with technology, as it happened with many projects that were implemented in Portugal; the EduLab model provides teachers' training and accompaniment as a way of encouraging the adoption of educational formats seeking appropriate and innovative performance. In this way, it is intended to provide a dynamic and more efficient teaching and learning process, with students, teachers and parents' involvement.

The EduLab model puts the focus not only in the technology implementation and integration in the classroom but also in the evaluation of its impact, advocating that evaluation can promote innovation in education. In this sense, this model intends to reach the following dimensions: *i*) digital literacy of the people involved; *ii*) teachers' training aiming technologies' integration in the educational process; *iii*) innovation in pedagogical practices; *iv*) community involvement, particularly the parents; and *v*) digital content and platforms to support management and dynamization of classes and other educational tasks (Pombo, Carlos, & Loureiro, 2015).

The evaluation recommended by the EduLab model has an essentially formative character and aims to provide relevant information on the impact of technologies on the above dimensions. It intends, above all, understand deeply the relationship between innovative educational practices, learning ecosystems enriched by technology and the improvement of students' learning as well as digital literacy of the ones involved.

### Technologies in Education

The current society has a strong scientific and technological component and, in this sense, the technologies assume a vital role in different areas, looking to improve the quality of life of all individuals. In order to keep up with the technological revolution clear in recent years, the school has been suffering important transformations regarding pedagogical strategies adopted, the working arrangements proposed and how the information is conveyed.

The European Commission, in a communication "Opening up Education: Innovative teaching and learning for all through new Technologies and Open Educational Resources" (2013), argues that the potential benefits of the information technology revolution in education are several and that technology is an opportunity to increase education' efficiency and quality. According to this report, technology enables people to customize and individualize learning methods and makes knowledge no longer confined to classrooms and to specific class time, since students can easily acquire knowledge from other sources in addition to their teachers.

Valente and Osório (2006) state that children are attracted to technologies in an almost impulsive way and alert to the fact that the school doesn't always take advantage of that motivation for the development of other learning skills. Schrum and Levin (2009) consider that school must seek to develop in students the 21<sup>st</sup> century skills, including critical thinking, problem solving, creativity, innovation, communication and collaboration.

Balanskat, Blamire and Kefala (2006) synthesize a series of studies that claim that technology has a positive impact on students' motivation, concentration and behaviour, promoting communication, collaboration and learning, which becomes more active and autonomous. Jonassen (2007) states that students should learn with technology and that, if it is used as cognitive tools, may promote construction of knowledge and the students' development of creative and complex critical thinking, some of the 21<sup>st</sup> century skills referred by Schrum and Levin (2009).

The Organization for Economic Co-operation and Development (OECD, 2015) argues that technologies have the potential to improve the education and teaching in a number of ways, including through the involvement of students, giving them control of their learning. The report "Students, Computers and Learning – Making The Connection", the OECD (2015) draws attention to the fact that, generally, technology may increase the efficiency of already efficient processes but it can also cause inefficient processes to become even more inefficient. According to the OECD (2015, p. 6), "*technology can amplify great teaching, but great technology cannot replace poor teaching*".

Despite the vast benefits of Information and Communication Technologies (ICT) use in educational context, Ruivo and Mesquita (2013, p. 22) emphasize that, in order to promote changes in the educational process, digital technologies should not be used as "*simple machines to teach or learn, but as pedagogical tools that create an interactive environment that will provide the apprentice, facing multiple problem situations, to investigate, raise hypotheses, test them and reset initial ideas, building their own knowledge*".

The EduLab model assigns special importance to 1:1 relationship since each student has access to a device, tablet or laptop, which can be used either in school, in formal learning activities, whether at home, to study or to other informal activities.

Balanskat (2013) suggests that the use of tablets should not be limited to the classroom, so students should use them in informal or non-formal learning environments and that should be further exploited by teachers. According to the author, the use of tablets in the informal or non-formal learning contexts, where tablets are used to extend learning beyond the formal classroom context, may lead to radical changes in the practices of teaching and learning. Rodrigues (2013) states that the 1:1 relationship only improves learning if learning opportunities with the technology are promoted and not only the access to technology.

Howard and Rennie (2013) distinguish two models of implementation of projects that are based on 1:1 relationship: the model of saturation and the adoption-diffusion model. In the model of saturation, all students take advantage of the devices, regardless of the use that is made by the teachers and the integration in their practice. This model predicts that students have the responsibility of guarding the device, which ensures continuous access to technologies. Adoption-diffusion model recommends that the implementation of 1:1 programs should start from teachers' involvement so that they can integrate the devices into their practice and encourage its use in learning. In this model, students might have, or not, the guard of the device and the possibility of the use beyond the classroom.

Additionally, Lanzi, Ferneda and Vidotti (2011) synthesize some benefits of using tablets: mobility (light and reduced dimensions); practicality (several functions); ease of use; fun (of recreational activities); and diversity of applications. Clarke (2012) highlights some educational benefits of programs that encourage the 1:1 relationship: motivation, improving the classroom environment and communication (with teachers and between students) and autonomy. However, Howard and Rennie (2013) stress that the potential benefits of individual use of technological devices have not yet resulted in measurable gains in student learning. However, Bannister, Balanskat and Engelhardt (2013) define a set of practical lines of guidance for 1:1 initiatives implementation. In the field "Maintenance and Support", the authors point out the importance of wireless network quality, device characteristics (weight, autonomy and possibility of connection to other devices which might be used in school) and the existence of a technical support at school, to which the teachers can appeal if necessary.

### ***Perceptions of Students and Teachers***

In a study conducted in three schools in the United Kingdom, involving 18 focus group of students, parents and



teachers, Clarke (2012) sought to evaluate the process of integration of the tablet in the teaching and learning process. According to the author, the students involved consider to be more motivated to learn and highlight the fact that the tablet allow their learning in a more fun and diverse way given the variety of resources and opportunities it offers. In the context of this study, the teachers consider that the tablet has caused changes in education, as teachers started to "facilitate" learning, rather than to instruct. In addition, teachers report that students have become more autonomous and more involved in the schoolwork. However, these teachers report differences between the groups, noting that younger students report more benefits of using the tablet in learning, although they need further support.

The report that presents the results of a pilot study of introducing tablets in education, held in 63 schools from eight European countries, with 263 teachers, Balanskat (2013) states that more than half of the teachers involved claims that the most rewarding result was the students' motivation increase. These teachers also highlight the fact that they have had more opportunities to implement new methods of teaching. In this study, 41% of teachers' state that the use of technology has a very positive impact on students' learning, while 45% considers that technologies have an impact on students' learning and the remaining claim not to recognize any positive impact. In a more specific context, such as the tablet, 46% of the teachers agree and 13% disagree that the use of the tablet has a positive impact on students' learning (the remaining claim not to agree or disagree).

Moreover, Lewin and McNicol (2014) present the results of a pilot study, the iTEC project, carried out in 17 countries, where they intended to assess the impact of the integration of technology in teaching and learning process. The results of the questionnaire applied to 1399 teachers and 1488 students reveal that both teachers and students consider that learning mediated by technologies contributes to the development of 21<sup>st</sup> century skills, such as, independent learning, critical thinking, solving real-world problems, communication, collaboration and creativity, as well as digital literacy in students. Both teachers and students recognize the positive impact of the iTEC project on students. Teachers highlight the attitudes and the involvement of students in the school work. According to teachers, increased motivation and autonomy are two of the most important benefits of technology integration into the curriculum. Students reported that the project had a positive impact on their involvement in activities and learning. 85% of the students agree that became more confident in the use of technologies and 86% stated that, after the project, are able to use a wider range of new technologies.

## METHODS

The research presented here is a case study of a mixed nature, which aims to assess the impact of the EduLab model on the teaching and learning process. This paper, in particular, focuses on the impact of this model in the learning process, considering the perceptions of the pupils and teachers involved.

In the 2014/2015 academic year, twelve teachers and five courses were involved in the AEGN project EduLabs, distributed by three cycles of basic education. In order to evaluate the impact of the EduLab model in the learning process it was used the survey technique and then proceeded the application of two questionnaires: one for students,

([https://docs.google.com/forms/d/1Sduy9CAg\\_UF8257aF2yZXQXTWtTwwcma48v0TNS2vGc/viewform](https://docs.google.com/forms/d/1Sduy9CAg_UF8257aF2yZXQXTWtTwwcma48v0TNS2vGc/viewform)) and other for teachers (<http://goo.gl/forms/9Sdjs5Duvs>).

The questionnaire applied to students was conducted online and filled in by 19 students of the second year (7/8 years), 20 of the fifth year (10/11 years) and 22 of the eighth grade (13/14 years). Its implementation occurred in February 2015, roughly in the middle of the first year of implementation of the project in EduLabs AEGN. The students' questionnaire, essentially, aimed to know: *i*) the taste for the use of different resources provided by EduLabs project; *ii*) the existence of difficulties in the use of these resources; *iii*) their opinion on the resources' contribution for learning; *iv*) students' preference between using the digital or the paper student book and their justification; *v*) their perspective on the changes in class raised by technological resources, as well as other suggestions for its use; and *vi*) their interest in joining the project in the following school year. In addition to these issues, common to the questionnaires applied to all students, the questionnaire applied to students in the fifth and eighth grades also intended to determine the opinion on the contribution of the tablet for home study.

In addition, to seek the perspective on the impact of technologies in the teaching and learning process, the questionnaire applied to teachers meant to identify the frequency that teachers use technology in the classroom and some factors that contribute to a less frequent use of this resource type. Concerning the level of impact of the EduLab model on the learning process, with particular emphasis in this paper, the questionnaire allowed to know what teachers think about: *i*) the effect of technology on students' attitudes (interest, motivation, participation, attention/concentration and autonomy); and *ii*) the contribution of technology for the development of students'

skills. This questionnaire was online filled in a year after the beginning of the EduLabs project implementation by 11 teachers.

The data collected using the teachers' questionnaire, given its quantitative nature, were the subject of statistical treatment. The data collected through the questionnaire applied by students were also subject to statistical treatment, although, some items, by their nature, were treated through qualitative content analysis. The results are presented in the next chapter.

## RESULTS AND FINDINGS

In this chapter, the results from surveys application are presented, that allow evaluating the impact of the EduLab model on the learning process. Initially, it focuses on the perception of students from second (7/8 years), fifth (10/11 years) and eighth (13/14 years) grades, then, it is considered the perspective of the teachers involved in the AEGN EduLab.

It should be noted that, due to the rounding of the percentages of students, in tables 1, 3, 6 and 9 the sum of the relative frequencies do not make up to 100%, with a maximum deviation of 1%.

### The impact of the EduLab Model on the Learning Process: the perception of students

The results presented focus on the students' perception in relation to the interest and use of the resources available in the context of the EduLabs project, as well as their contribution to the students' learning.

In general, the students of the second grade referred they like to use the interactive whiteboard, the computer, the Mythware software, OER and the digital book. It is highlighted the existence of only 11% of students (value that corresponds to 2 students) who likes a little to use Mythware software and 5% (1 student) who likes a little to use the OER (Table 1).

**Table 1.** Interest of Students (2nd grade) by the Use of Technological Resources

	Nothing	Little	Very much	Totally	I don't know
<b>Interactive Whiteboard</b>	0%	0%	11%	89%	0%
<b>Magalhães</b>	0%	0%	21%	79%	0%
<b>Mythware</b>	0%	11%	16%	74%	0%
<b>OER</b>	0%	5%	11%	84%	0%
<b>Digital Book</b>	0%	0%	21%	79%	0%

Regarding the fifth-grade level, it can be said that, in general, students like to use the different features. However, while students of the second grade are mainly in the "totally" level, the fifth-grade students' preference appears clearly distributed by levels "very" and "totally". Compared with the second grade, there are also a higher number of students who like a little to use the interactive whiteboard (15%; 3 students), the tablet (5%; 1 student), the Mythware software (15%; 3 students) and the digital book (15%; 3 students). It turns out that, at the level of the fifth grade, 5% of the students (1 student) like a little to use OER and 5% (1 student) expresses dislike on using it (Table 2).

**Table 2.** Interest of Students (5th grade) for the Use of Technological Resources

	Nothing	Little	Very much	Totally	I don't know
<b>Interactive Whiteboard</b>	0%	15%	40%	45%	0%
<b>Tablet</b>	0%	5%	35%	60%	0%
<b>Mythware</b>	0%	15%	25%	60%	0%
<b>OER</b>	5%	5%	40%	50%	0%
<b>Digital Book</b>	0%	15%	45%	40%	0%

About pupils' interest for the use of technological resources in the classroom, eighth-grade students take an opinion clearly opposite to that of second and fifth year students. Except for the interactive whiteboard, there is a higher percentage of students who do not like or like a little to use the mentioned resources than the one that likes to use them effectively: tablet, 68% (15 students); Mythware software, 81% (18 students); OER, 63% (14 students); digital book, 73% (16 students) (Table 3).

**Table 3.** Interest of Students (8th grade) for the Use of Technological Resources

	Nothing	Little	Very much	Totally	I don't know
<b>Interactive Whiteboard</b>	9%	32%	45%	9%	5%
<b>Tablet</b>	23%	45%	23%	9%	0%
<b>Mythware</b>	36%	45%	14%	5%	0%
<b>OER</b>	36%	27%	36%	0%	0%
<b>Digital Book</b>	23%	50%	23%	5%	0%

In addition, in what concerns their like using technological resources (Table 1), the second grade students claim not to have difficulties in handling and operation. There is only 5% of the students (1 student) that claims to have a lot of difficulties in using the software Mythware (Table 4).

**Table 4.** Difficulties of Use of Technological Resources by Students (2nd grade)

	Nothing	Little	Very much	Totally	I don't know
<b>Interactive Whiteboard</b>	95%	5%	0%	0%	0%
<b>Magalhães</b>	95%	5%	0%	0%	0%
<b>Mythware</b>	74%	21%	5%	0%	0%
<b>OER</b>	100%	0%	0%	0%	0%
<b>Digital Book</b>	84%	16%	0%	0%	0%

At the fifth grade level, it can be said that the majority of students does not present significant difficulties in the use of those resources. It turns out that it is in tablet (15%) and in the digital book (20%) that students refer to have more difficulties, values that correspond to three and four students, respectively (Table 5).

**Table 5.** Difficulties of Use of Technological Resources by Students (5th grade)

	Nothing	Little	Very much	Totally	I don't know
<b>Interactive Whiteboard</b>	65%	25%	5%	5%	0%
<b>Tablet</b>	65%	20%	10%	5%	0%
<b>Mythware</b>	70%	20%	5%	5%	0%
<b>OER</b>	55%	35%	5%	5%	0%
<b>Digital Book</b>	55%	25%	10%	10%	0%

The comparative analysis between tables 1 and 4, concerning the second grade, and tables 2 and 5, for the fifth year, could allow inferring that there is a relationship between the difficulties in the use of resources and the interest/pleasure that students demonstrate for their use in an educational context. Relating these tables, the smaller the students' difficulties in the exploitation of resources, the greater the interest is. However, no correlation tests have been made that prove a direct relationship.

With regard to the eighth grade, although most students refer not to feel difficulties in the use of different resources, there are a significant number of students who manifest an opposite opinion. We highlight, for example, the interactive whiteboard and the digital book, where 27% of students (6 students) refer to feel difficulties (Table 6).

**Table 6.** Difficulties of Use of Technological Resources by Students (8th grade)

	Nothing	Little	Very much	Totally	I don't know
<b>Interactive Whiteboard</b>	32%	32%	27%	0%	9%
<b>Tablet</b>	41%	36%	18%	5%	0%
<b>Mythware</b>	45%	36%	18%	0%	0%
<b>OER</b>	41%	32%	23%	0%	5%
<b>Digital Book</b>	41%	32%	23%	5%	0%

With regard to the contribution of technologies for learning, the second-grade students refer that they learn better

when they use different resources in the classroom. There are only 5% of the students (1 student) who claims that the software Mythware has a little contribution to improve his/her learning experience (Table 7).

**Table 7.** Contribution of Resources to Improve Students' Learning (2nd grade)

	Nothing	Little	Very much	Totally	I don't know
<b>Interactive Whiteboard</b>	0%	0%	21%	79%	0%
<b>Magalhães</b>	0%	0%	16%	84%	0%
<b>Mythware</b>	0%	5%	42%	53%	0%
<b>OER</b>	0%	0%	11%	89%	0%
<b>Digital Book</b>	0%	0%	5%	95%	0%

In this context, at the fifth-grade level, it is observed that the majority of students believe that technology has a positive impact on their learning, since they contribute to learn better. However, the results are not as positive as in the second grade, since a higher percentage of students refers that these resources contribute little or nothing to improve learning. It is noted that 30% of students (6 students) considered that the interactive whiteboard contributes little to the improvement of their learning, as well as 5% (1 student) has the same opinion regarding the tablet, 10% (2 students) in relation to the Mythware software and 25% (5 students) to the digital book and the OER. We should also stress the fact that 5% of the students (1 student) consider that the OER didn't contribute to a "better learning" (Table 8).

**Table 8.** Contribution of Resources to Improve Students' Learning (5th grade)

	Nothing	Little	Very much	Totally	I don't know
<b>Interactive Whiteboard</b>	0%	30%	45%	25%	0%
<b>Tablet</b>	0%	5%	45%	50%	0%
<b>Mythware</b>	0%	10%	45%	45%	0%
<b>OER</b>	5%	25%	40%	30%	0%
<b>Digital Book</b>	0%	25%	40%	35%	0%

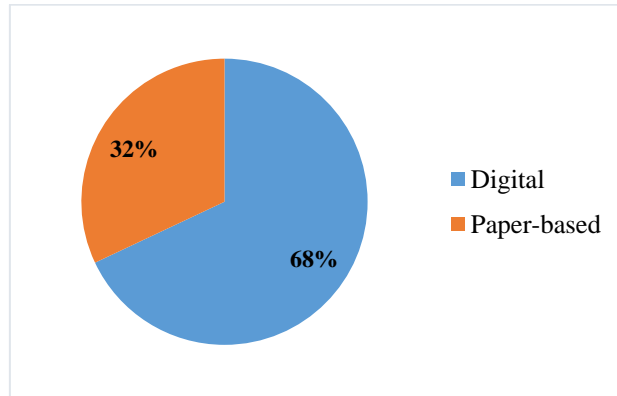
Eighth-grade students don't consider the impact of learning technologies to be so positive. For all the resources analyzed, most students stated that they contribute little or nothing to improve their learning. In this sense, it is found that only 27% of students (6 students) considered that the interactive whiteboard and the tablet contribute a lot on improving the learning, 18% (4 students) have the same opinion regarding the Mythware software and 23% (5 students) regarding the OER and the digital book (Table 9).

**Table 9.** Contribution of Resources to Improve Students' Learning (8th grade)

	Nothing	Little	Very much	Totally	I don't know
<b>Interactive Whiteboard</b>	18%	50%	27%	0%	5%
<b>Tablet</b>	27%	45%	27%	0%	0%
<b>Mythware</b>	27%	50%	18%	5%	0%
<b>OER</b>	41%	36%	23%	0%	0%
<b>Digital Book</b>	32%	41%	23%	5%	0%

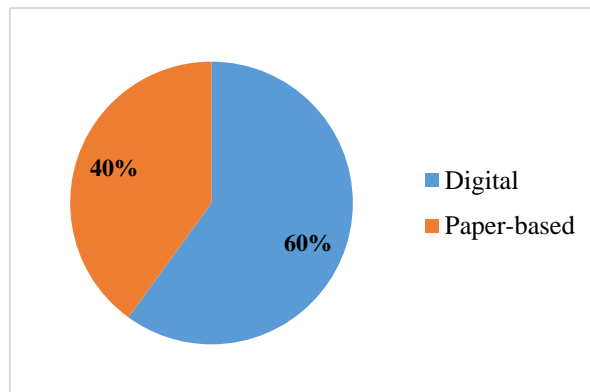
Tables 1, 2 and 3 show that, as they advance in their schooling, students demonstrate less willing and interest for the use of technological resources in the classroom. Also in tables 7, 8 and 9 it is noted that the more advanced the grade, the lower the percentage of students who believes that technologies contribute positively to the improvement of their learning. Therefore, it can be thought that there is a cause-and-effect relationship between them: no pleasure/interest in using a particular resource because this does not contribute to learning improvement. However, no one can safely say that this cause-effect relationship really happens because it was not possible to assess whether students who are less interested in the use of technology are those who consider that they contribute less to their learning.

When faced up to about their preference between the use of books in digital version or paper, 68% of students (13 students) of second grade state that they prefer the digital book (Figure 2). The reasons that lead to this preference are related to the fact that the digital book is, accordingly to students, more pleasant and funny and allow teaching and learning through games and other tools. On the other hand, 32% of students (6 students) (Figure 2) states that they prefer the book on paper because you can add notes manually.



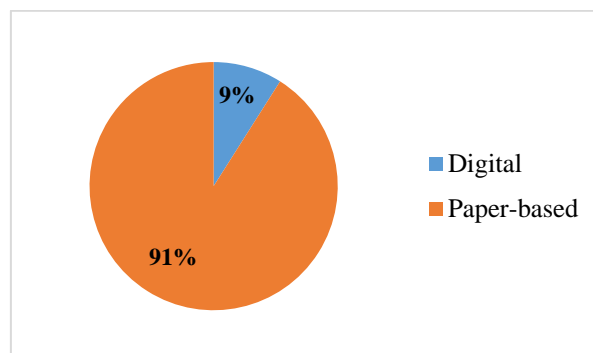
**Figure 2.** Digital Book *versus* Paper-based Book (2nd grade)

Similarly, 60% of students (12 students) of the fifth-grade state they prefer the digital book, against 40% (8 students) who prefer the book on paper (Figure 3). Among the reasons mentioned by students to prefer the digital book, it is highlighted the fact that it allows to access to a wide range of resources, is more fun and make students carry less weight, since a tablet has digital books for different subjects. On the other hand, students stress that the book on paper "works every time" and does not present technical problems, lets them add handwritten notes and does not prevent accessing multiple resources simultaneously, for example, book and schedule of activities.



**Figure 3.** Digital Book *versus* Paper-based Book (5th grade)

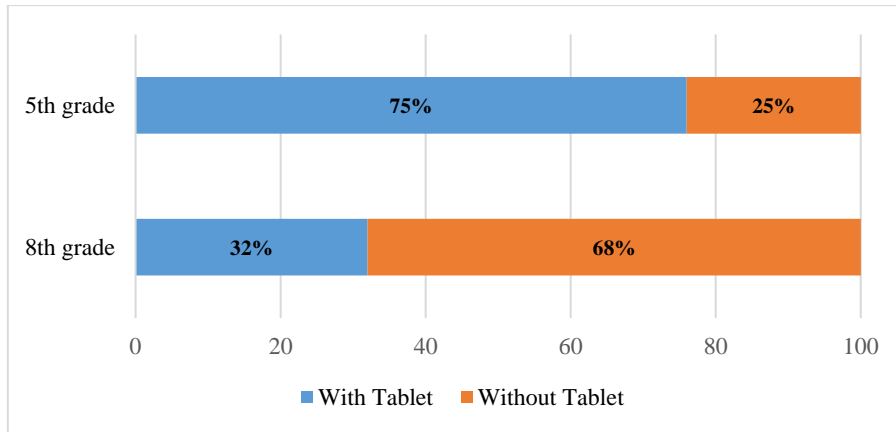
The views of eighth grade students are not as favorable to the use of the digital book: 9% (2 students) prefer the digital book while 91% (20 students) like to use the book on paper (Figure 4). More than half of the students points to the absence of technical problems associated with tablet exploitation of the digital book as a reason to prefer the paper-based book.



**Figure 4.** Digital Book *versus* Paper-based Book (8th grade)

The placement of students in the fifth and eighth grade stated on figures 3 and 4, also reflected their opinion on the relevance of the tablet for the home study. While 75% of students (15 students) of the fifth grade believe that they study better with the tablet at home than without it, just 32% (7 students) of the eighth grade expresses the same opinion (Figure 5). The reasons pointed out by fifth grade students meet those that had already been

mentioned when asked whether they prefer digital or paper book. Some students point out that the use of the tablet at home allows them to study using more applications and using files sent by teachers through the Mythware software, for example. On the other hand, without the tablet, which implies the existence of paper books, students consider, again, that it's easier to access multiple resources simultaneously, such as books and workbooks. Access to more features, for example, through Internet is one of the most cited reasons for eighth grade students and that value that they can take advantage of the tablet at home. However, the students return to express the opinion that without the tablet there are less technical failures and a book on paper is easier to use and allows adding handwritten notes. There is also a student who states that without tablet there is less distraction when studying.

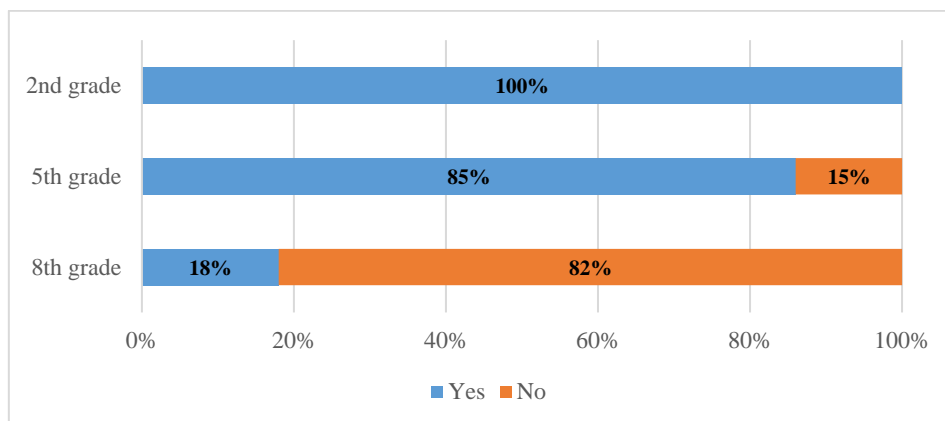


**Figure 5.** Preference of Students (5th and 8<sup>th</sup> grades) to Study at Home

The EduLab model assumes the adoption of innovative performance formats, leading benefits for the teaching and the learning process, through an integrated educational and motivating use of technologies. When asked about the changes that have taken place in the development of the class with the integration of technologies, some second-year students state that they started accessing a greater diversity of resources, which made the lessons more fun. They suggest using more games and other digital resources and all of them have shown interest in continuing to integrate the project in the next school year (Figure 6).

Fifth grade level students also value the fact of having access to a greater diversity of digital resources, which, in the opinion of some, facilitates learning and creates more funny lessons. If, on the one hand, there are students who mention that the integration of these technologies has led to more attention in class, some people also consider that it contributes to more distraction. Students of the fifth grade suggest that further research needs to be carried out using these resources and 85% (17 students) means that they would like to continue to integrate the project in the next school year (Figure 6).

Related to what has been presented concerning the lack of eighth-grade students in other parameters, in this field it is also highlighted the fact that most students of this year of education consider that the integration of these technologies, due to frequent technical problems led to a large number of "lost" classes. On the other hand, there is a small number of students who believes that these technologies promote the implementation of more interesting and fun classes and stimulate the students' attention. In this sense, only 18% of students (4 students) reveals that they would like to join the EduLabs project in the next school year (Figure 6).

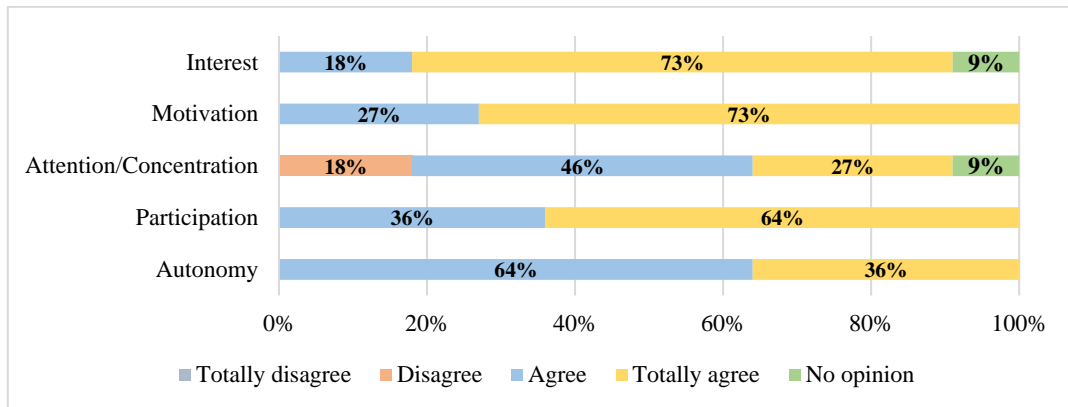


**Figure 6.** Students' Interest in Integrating the EduLabs Project Next Year

**The impact of the EduLab model on the learning process: the perception of teachers**

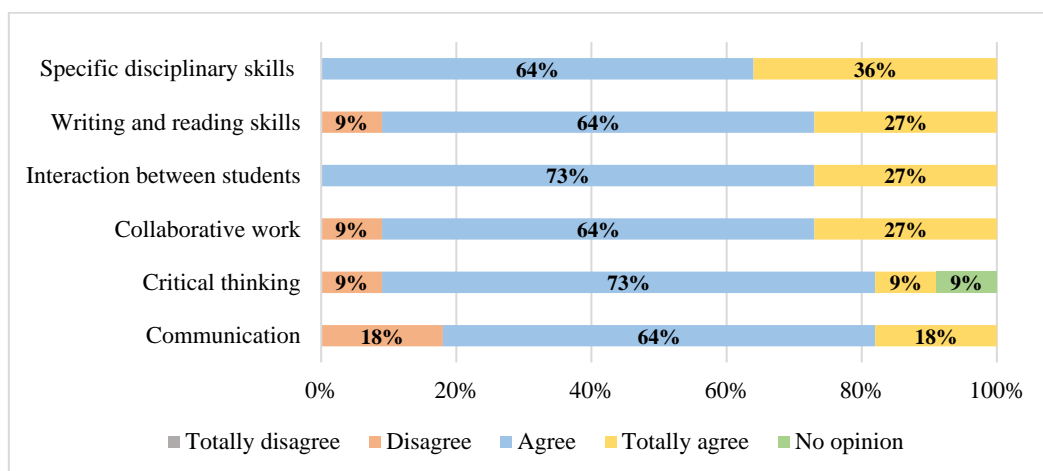
The results presented here focus on the perception of teachers on the impact of the EduLab model on students' learning, especially in their attitudes and skills development.

The answers submitted by 11 teachers in the survey allow affirming that they consider that the technology has a positive impact on students' attitudes. All teachers involved agree that technologies motivate students, encourage class participation and promote a more autonomous learning (Figure 7). There is still a large proportion of respondents (91%, which corresponds to 10 teachers) who claims that technologies are of great interest to students, and the teacher who has not expressed an opinion in this regard, indicated not having an opinion (Figure 7). Regarding attention and concentration, 73% of the teachers (8 teachers) agree that technologies contribute to stimulate these cognitive processes, while 18% (2 teachers) disagrees and 9% (1 teacher) claims not to have an opinion in this regard (Figure 7).



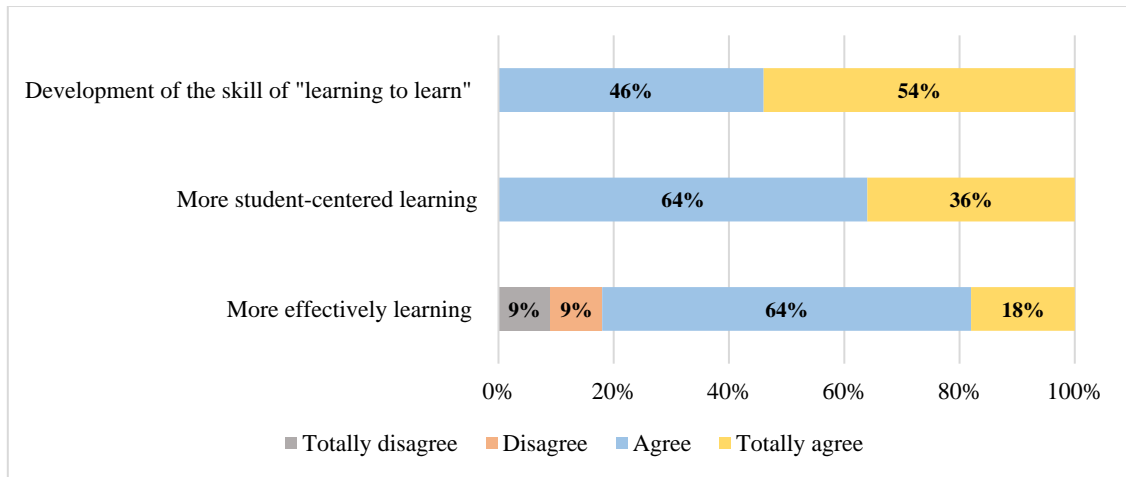
**Figure 7.** Impact of Technologies on the Attitudes of Students

Regarding students' skills development, teachers are unanimous in saying that the technologies support the development of specific disciplinary skills and 91% (10 teachers) considers that also the writing and reading skills can be developed by using the technologies (Figure 8). To the level of social skills, it turns out that all the teachers argue that technologies promote the interaction between students and 91% (10 teachers) states that these tools encourage students to collaborate among themselves (Figure 8). It is also stressed that 82% of the teaching staff (9 teachers) believes that technologies foster the development of students' critical thinking and communication skills (Figure 8).



**Figure 8.** Skills Developed with Technologies

All the teachers consider that technologies allow to develop the "learning to learn" skill and promote a student-centered learning (Figure 9). However, 18% of the teachers (2 teachers) disagree with the fact that technologies help students to learn more effectively (Figure 9).



**Figure 9.** Contribution of Technologies for Learning

Moreover, as shown in figure 9, all teachers disagree the fact that technologies make students more passive in their learning process. However, when asked if the technologies can mitigate the difficulties of the students, the teachers are not unanimous: 36% (4 teachers) disagree; 55% (6 teachers) agree; and 9% (1 teacher) has no opinion on whether the technology effectively mitigates students' difficulties.

### CONCLUSION

Through the integration of technologies in the educational process and teachers' training and monitoring, the EduLab model aims to make the educational process more dynamic and motivating and to promote the development of skills of all students and teachers involved in. In this paper, it was intended, by means of surveys, to evaluate the impact of the EduLab model in the learning process, collecting the opinions of students and teachers.

At the level of students' perceptions on the contribution of the integration of technologies in their learning process, it is observed that the considerations of younger students (second and fifth grades) differ from those of the older students (eighth grade level). While second and fifth grades students express interest in the use of technologies and consider that these contribute to learn better, eighth-grade students are not so interested and consider that technologies have a little contribution to their learning process.

The evident difference at the level of different grades students' perceptions, reflected also in students' preference for the use of books in digital form or paper. On the one hand, second and fifth grade students refer they prefer the digital books because they consider them to be more fun and allow a greater diversity of resources, accordingly to the results obtained by Clarke in his study of 2012. On the other hand, eighth-grade students claim to prefer using the paper book and point technical problems as the main reason for the manifestation of this preference.

It is important to ensure that students' perceptions and, consequently, the success of the project, does not depend on technical issues and, to this end, it is essential that will be taken into account the guidelines laid down by Bannister, Balanskat and Engelhardt (2013). Despite the differences, both groups consider not having difficulties in using these resources. Also, the study of Lewin and McNicol (2014) refers to a very significant number of students considered to be confident in the use of technologies.

It should be noted that in several items of the questionnaire, students highlight the low weight, the playful and practical character and diversity of applications such as a plus in the use of the tablets, which corroborates the benefits singled out by Lanzi, Ferneda and Vidotti (2011).

The way the EduLabs project was designed for AEGN includes ownership of the tablet and that is based on the adoption-diffusion model, proposed by Howard and Rennie (2013). The fact that students can take advantage of the tablet outside school, in informal learning environments or non-formal, is in accordance of Balanskat (2013). In this sense, a considerable number of fifth grade students (75%) believes that they study better with the tablet at home than without it. However, only 32% of eighth grades recognize the importance of the tablet for home study. This consideration meets the study implemented by Clarke (2012), where teachers reported that younger students recognize more benefits in using the tablet in the learning process. This result may be related to the fact that older students have already developed other methods and study skills without using the tablet. Moreover, it can be



observed that these students have their own mobile phones more powerful than the provided tablets, which might cause them some discouragement in using them for learning.

In general, the perceptions of the teachers involved reflect the recognition of the positive impact of the integration of learning technologies, especially at the level of motivation, class participation and autonomy, which meets the potential referred to by Balanskat, Blamire and Kefala (2006), presented in the introduction to this article. Most of the teachers (91%) believe that the technologies are of great interest to students, perception that goes against that revealed by eighth-grade students.

Most teachers from AEGN agree that technologies foster the development of 21<sup>st</sup> century skills (Schrum, & Levin, 2009) as critical thinking (82%), collaboration (91%) and the students' communication skills (82%), as did the study of Lewin and McNicol (2014). All the teachers consider that technologies allow to develop the competence of "learning to learn" and promote a more students focused learning. However, not everyone agrees that the technologies make the students learn more effectively. Also in the study of Balanskat (2013), the teachers were unanimous in recognizing a very positive impact on students' learning.

### RECOMMENDATIONS

In terms of future work, it would be interesting to know the students' perceptions in more detail, looking to find out what is their perspective on the impact of technologies integration in their learning process, in terms of their attitudes (e.g., motivation, interest, participation and autonomy) as well as the skills that may be developed (such as critical thinking, creativity, communication, collaboration, among others). On the other hand, it is suggested that it should be understood the existing inequality in terms of different grades students' perceptions.

It is further considered that it constituted an advantage to know parents' perceptions about integration technology contribution to the learning of their children.

It would also be interesting to implement EduLab model with other classes and other schools and take the project off the Portuguese context, testing it in other countries.

### ACKNOWLEDGEMENT

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## **NEW RECOMMENDER SYSTEM USING NAIVE BAYES FOR E-LEARNING**

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**ABSTRACT:** Coming into prominence at the present time, e-learning is a great opportunity for learners. It provides tremendous assets most valuable of which is distance free learning. Besides, there is a great deal of e-learning resources on the web that causes information overload. Accordingly, it turns into a requisite that you ask for recommendation so as to find the resource you surely need. There are readily available recommendation services arranged for that purpose. Such systems have various rating systems; furthermore, users tend to rate the materials in different manners. Our goal with this paper is to generate confidential referrals thanks to Naive Bayesian algorithm for e-learning materials rated multifariously by learners. We also researched the effects of several data preprocessing techniques on achieving this goal.

**Key words:** Naïve Bayesian Classifier, Data Preprocessing, E-learning, Recommendation Systems

### **INTRODUCTION**

Rapid advances in technology have led to be used the new methods in education as in other areas. One improvement is that people learn something using mobile phone or web based systems. It was named as e-learning which supports traditional education yet began to replace it because in this way they feel comfortable and so prefer e-learning platforms because of independent time or place. In other words, people, both learn something whatever they want without going to school in a specific time easily and take a certificate or diploma in this way so demand has increased to e-learning day by day.

On the other hand, people, can present any educational documents or videos effortlessly. If you have a camera and internet connection, you can publish any educational materials without control mechanism. Whereas some of them are useful for learning, others cannot be beneficial for a learner. The problem is that given the increasing number of e-learning platforms and materials, learners are frequently overwhelmed with the large amount of learning resources available online (Souali, El Afia, Faizi, & Chiheb, 2011). Therefore, having a right material in right time is also difficult. People have tried to find most suitable resources themselves by asking someone who used this to solve the problem but not enough. It is almost impossible to select appropriate materials because of reaching limited users. In order to overcome this issue, there is need for a system that recommends the correct materials extracted automatically from preferences of similar users.

Computer-based recommender systems are the most appropriate methods in order to recommend materials for people. The main purpose of a recommender system is to generate meaningful recommendations to users which expect suggestion for items or products that might interest those (Melville & Sindhvani, 2011). Recommender systems have a wide usage area in our daily life such as movies, music, books, food and healthcare.

Our goal in this paper is to implement Recommender System with Naïve Bayes algorithm for e-learning materials rating from learners with different ways. Several data preprocessing operations are applied before applying Naïve Bayes Classifier. The vestigial of this paper is regulated as follows. Section 2 presents related works. Section 3 exhibits proposed architecture. Section 4 includes experimental results. Section 5 gives a short conclusion and future works.

### **RELATED WORKS**

In this section, we present some of the research literature related with e-learning recommender systems. Bayesian Network is utilized in order to detect learner's learning style and discover their preferences (Carmona, Castillo & Millán, 2007; García, Amandi, Schiaffino & Campo, 2007). Ueno and Toshio (2007) created learner model via

Bayesian Network. Using the learner model, learner’s final status (Failed, Abandon, Successful, Excellent) is predicted. Next, active learner’s learning processes are compared with excellent learners’ learning processes, and appropriate messages to the learner are generated. Colace and De Santo (2010) studied on the role of ontologies in the context of e-learning. A novel algorithm for ontology building with Bayesian Networks is presented in their work. Analyzing students’ learning performances, their proposed method can analyze the courses’ ontology and propose corrective actions. Thus, teachers better understand the requirements of their students and can redesign their courses appropriately. Moreover, an ontological basis is provided to determine learning paths to personalize learning. Chang, Kao, Chu and Chiu (2009) proposed a learning style classification mechanism to classify and identify students’ learning styles. The proposed method improves k-nearest neighbor classification and combines it with genetic algorithms. The proposed method is implemented on an open-learning management system. García Amandi and Schiaffino (2008) detected a student’s learning style automatically from the student’s actions in an e-learning system using Bayesian Networks. E-teacher uses the information contained in the student profile to proactively assist the student by suggesting him/her personalized courses of action that will help him/her during the learning process. Özpolat and Akar (2009) addressed the problem of extracting the learner model based on Felder–Silverman. Using Naïve Bayesian Tree in conjunction with Binary Relevance classifier, the learners are classified according to their interests. Learners’ learning styles are defined using these classification results.

### PROPOSED ARCHITECTURE

In a conventional e-learning system, instructors procure some teaching documents or materials to the e-learning system for learners. Learners using the system can utilize these materials comfortably via the web in their education. These learners also leave ratings for the materials they use according to their interest. These collected ratings are stored by the e-learning system. In the case that a new learner enters into the system he can search and use any material he wants. He can also ask for a material recommendation from the system but, he must have rated a certain number of materials before. By means of the user ratings, preference of that user is extracted first. The system tries to recommend the most appropriate material by combining that preference with the previous learners’ rating feedbacks.

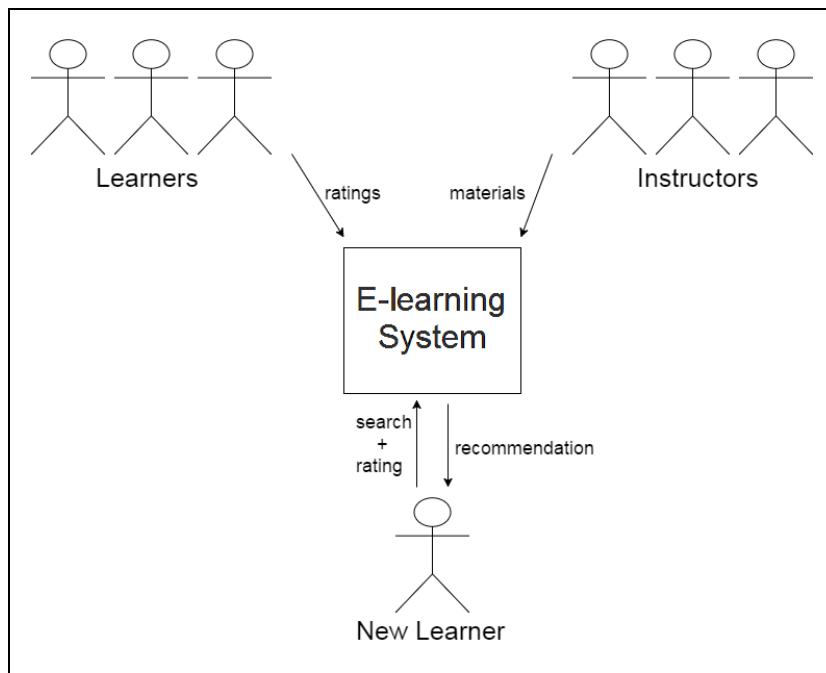
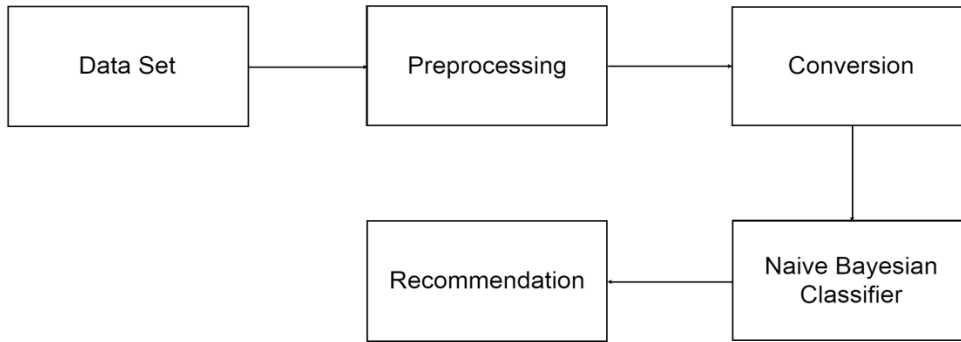


Figure 1. E-learning system scenario

Our proposed architecture basically aims to produce effective predictions with Naïve Bayesian Classifier for e-learning systems. Figure 1 shows the framework model for e-learning recommendation. It is necessary to have a quality dataset in order to get efficient predictions. Thus, we take the advantage of some data preprocessing operation (missing values problem). We also slog on maintaining their studies at generating predictions from binary data because of not having a binary dataset with great amount of data. After preprocessing, conversion step is dataset into binary dataset which is includes all values 0 and 1. This data is trained with leave-one out method and eventually the system recommends to user with Naïve Bayesian Classifier.



**Figure 2.** The framework of the recommendation model for e-learning

## EXPERIMENTAL WORK

### Dataset

In our approach, we need e-learning dense data set and we wait particularly learner information, educational material and ratings of learners to materials. When used this dense data set, system can suggest most suitable material to learners with a high probability. A small sample of e-learning data set which is expected is below for this study:

**Table 1.** A small sample of e-learning data set

<b>Learner</b>	<b>Education Material</b>	<b>Rating</b>
User 1	Material 2	5
User 2	Material 1	4
User 2	Material 3	2
User 3	Material 2	4

Firstly, we need to select suitable data set because we do not have a real e-learning data set with continuous values. After researches a lot of recommender data sets have been used in academic works due to efficiency such as MovieLens, Jester, Amazon and Book Crossing.

In this study, Jester Data Set are selected. This data set includes 4.1 million continuous ratings of 100 jokes from 73,496 users which are -10 to +10. Ratings are real values and null values are 99 (Goldberg, 2016). Compared to number of jokes and users this data set is dense so it is suitable to our e-learning recommendation study.

### Experimental Design

We select a subset containing 200, 1000 and 2000 users each rated 100 items. We get rid of the missing values by filling them with the mean of overall ratings. Then we selected five items randomly for each user and produced predictions for them with leave-one-out technique.

We are constrained to convert continuous or discrete dataset into binary dataset. In these conversions, researchers make some assumptions to decide the rating scales to be converted into ‘true’ and ‘false’. If we denote the possible minimum and maximum ratings as  $R_{min}$  and  $R_{max}$  respectively, common technique is selecting a threshold value  $t$  as  $(R_{min}+R_{max})/2$  then converting the ratings greater than  $t$  as 1 and less than  $t$  as 0. In a 1~5 rating scenario, converting 1, 2, 3 into 0 and 4, 5 into 1; is another frequently used technique. We proposed some new approaches to convert continuous data into binary data in the hope of creating more accurate predictions.

After the conversion process, predictions for the selected items are generated via Naïve Bayesian Classifier algorithm. This is a probabilistic classification method based on Bayes Theorem on the work of Thomas Bayes. According to this theorem probability of  $P(a|b)$  can be expressed as:

$$P(a|b) = \frac{P(b|a)P(a)}{P(b)} \tag{1}$$

In our converted dataset, binary values 1 and 0 are referred to as particular classes. In Naïve Bayesian Classifier attributes have independent distributions.

$$P(a/b_j) = P(a_1/b_j) * P(a_2/b_j) * P(a_3/b_j) * \dots * P(a_n/b_j) \quad (2)$$

Applying equation (2), class of the target item is determined which can be expressed as the prediction result.

### 4.3 Evaluation

We present our solution with accuracy, specificity, precision, recall, f-score and g-mean metrics using confusion matrix.

**Table 2.** Confusion Matrix for Evaluation

	Recommended by System	Not Recommended by System
Expected	True Positive (TP)	False Negative (FN)
Not Expected	False Positive (FP)	True Negative (TN)

Formulas are as below:

$$Accuracy = \frac{TP + TN}{TN + TP + FN + FP} \quad (3)$$

$$Specificity = \frac{TN}{FP + TN} \quad (4)$$

$$Precision (P) = \frac{TP}{TP + FP} \quad (5)$$

$$Recall (R) = \frac{TP}{TP + FN} \quad (6)$$

$$F\ Score = \frac{2 * P * R}{P + R} \quad (7)$$

$$G\ Mean = \sqrt{P * R} \quad (8)$$

### Performance Analysis

We conducted 3 groups of experiments which have different concepts to convert discrete ratings into binary.

In the first group; we make the conversion with respect to quartiles of the rating domain. The quartiles are selected as thresholds and higher and lower values are converted to 1 and 0 respectively. For the Jester dataset, values of Quartile 1 (Q1), Quartile 2 (Q2) and Quartile 3 (Q3) are -5, 0 and 5 respectively because values of this data set are -10 to 10. According to threshold of Quartile 1, ratings smaller than -5 is taken 0, bigger than -5 is taken 1. This implementation is similarly applied to Quartile 2 for threshold 0 and Quartile 3 for threshold 5. Threshold of Quartile 2 is the most widespread approach in applications.

In the second group; conversion is made considering the ratings in the dataset. Consecutively, thresholds are defined for each user and each item separately so the conversions are made separately as well. Besides, threshold value is assigned to overall mean of the ratings and conversion is made with that threshold for all ratings. For User Mean Method (UM), ratings of each user are collected and mean value of each user is calculated. This mean value is a threshold and each user has a different threshold value in this method. For Item Mean Method (IM), ratings of each item are collected and mean value of each item is also calculated. Each item has a different threshold value in IM. For Overall Mean Method (OM), mean value is calculated by using all ratings.

Third group methods are similar to second group techniques for conversion. If mean of ratings is negative, this value is multiplied by -1. If positive, methods are same as second group. Respectively Absolute User Mean (AUM), Absolute Item Mean and Absolute Overall Mean are similar to UM, IM and AOM.

Test results for 200 users and 100 items are shown in Table 3.

**Table 3.** 200 users - Performance of Quartiles and Means

	<b>Accuracy</b>	<b>Specificity</b>	<b>Precision</b>	<b>Recall</b>	<b>F-Score</b>	<b>G-Mean</b>
<b>Q1</b>	0.8460	0.6019	0.9503	0.8740	0.9106	0.7253
<b>Q2</b>	0.7850	0.8168	0.6519	0.7182	0.6833	0.7659
<b>Q3</b>	0.8500	0.8681	0.4471	0.7265	0.5535	0.7942
<b>UM</b>	0.7490	0.7723	0.7032	0.7179	0.7104	0.7446
<b>IM</b>	0.7700	0.8049	0.6701	0.7075	0.6883	0.7547
<b>OM</b>	0.7890	0.8214	0.6639	0.7226	0.6919	0.7704
<b>AUM</b>	0.8100	0.8393	0.5019	0.6859	0.5796	0.7587
<b>AIM</b>	0.8130	0.8319	0.4963	0.7297	0.5908	0.7791
<b>AOM</b>	0.8120	0.8351	0.5092	0.71502	0.5948	0.7727

Test results for 1000 users and 100 items are shown in Table 4.

**Table 4.** 1000 users - Performance of Quartiles and Means

	<b>Accuracy</b>	<b>Specificity</b>	<b>Precision</b>	<b>Recall</b>	<b>F-Score</b>	<b>G-Mean</b>
<b>Q1</b>	0.8412	0.5132	0.9382	0.8803	0.9083	0.6721
<b>Q2</b>	0.7642	0.8071	0.6375	0.6785	0.6574	0.7400
<b>Q3</b>	0.8210	0.8532	0.3869	0.6091	0.4732	0.7209
<b>UM</b>	0.7552	0.7897	0.6648	0.6975	0.6808	0.7422
<b>IM</b>	0.7650	0.8092	0.6946	0.6942	0.6944	0.7495
<b>OM</b>	0.7732	0.8177	0.6469	0.6823	0.6641	0.7469
<b>AUM</b>	0.8030	0.8356	0.4567	0.6499	0.5365	0.7369
<b>AIM</b>	0.7954	0.8312	0.4894	0.6513	0.5589	0.7358
<b>AOM</b>	0.8014	0.8387	0.4938	0.6479	0.5604	0.7371

Test results for 2000 users and 100 items are shown in Table 5.

**Table 5.** 2000 users - Performance of Quartiles and Means

	<b>Accuracy</b>	<b>Specificity</b>	<b>Precision</b>	<b>Recall</b>	<b>F-Score</b>	<b>G-Mean</b>
<b>Q1</b>	0.8477	0.6086	0.9502	0.8758	0.9114	0.7300
<b>Q2</b>	0.7784	0.8154	0.6558	0.7042	0.6791	0.7577
<b>Q3</b>	0.8306	0.8683	0.4432	0.6109	0.5138	0.7283
<b>UM</b>	0.7564	0.7642	0.7090	0.7461	0.7270	0.7552
<b>IM</b>	0.7708	0.8096	0.6889	0.7058	0.6972	0.7560
<b>OM</b>	0.7807	0.8169	0.6683	0.7108	0.6889	0.7620
<b>AUM</b>	0.7872	0.8246	0.4880	0.6432	0.5550	0.7283
<b>AIM</b>	0.7972	0.8364	0.4883	0.6372	0.5530	0.7300
<b>AOM</b>	0.7930	0.8347	0.5071	0.6366	0.5646	0.7290

According to the experimental results, F-score of the Q1 results the best among all techniques. Here Q1 can be thought as an outlier because of the characteristics of the dataset. As we can see from the tables, techniques used in the second group of experiments are all resulted in better f-scores than Q2 while techniques in third group of remain deficient according to f-scores. In the view of g-means, techniques in second group can be selected as the bests. Specificity remains stable in the third group of techniques which may be used for different purposes. Q3 has the best accuracy except Q1 but, there is a critical fall in f-score. Hence we may select the techniques used in the third group for accuracy concerns. Thereupon changes in the user counts do not cause a remarkable change in the specified measures, all of the applied conversion techniques can be approved as scalable.

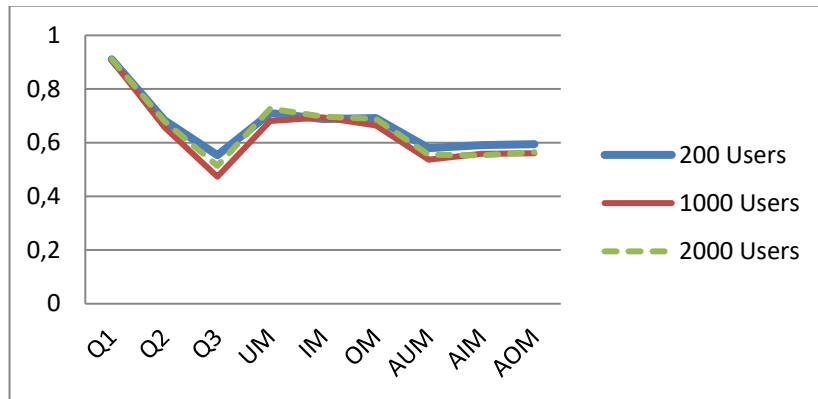


Figure 3: F-Score Metric

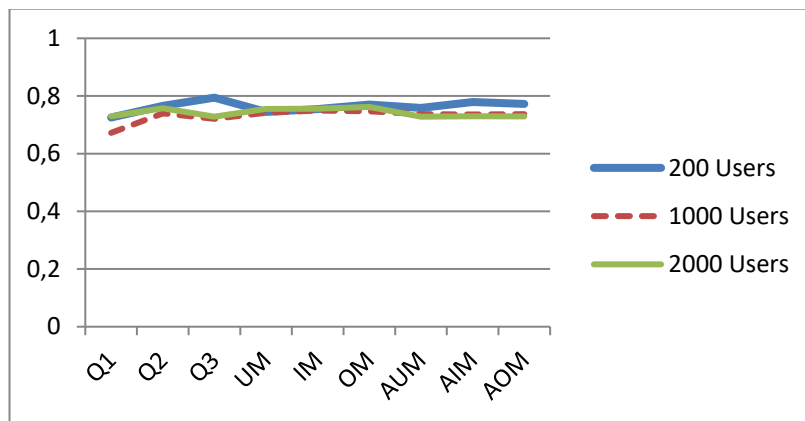


Figure 4: G-Score Metric

### CONCLUSION

E-learning is a leading practice for every kind of learners with its tremendous opportunities. On account of the fact that there is a huge amount of e-learning resource on the web, it is inevitable to benefit from a recommender system in order that one can determine the right material to study. We proposed to take advantage of Naïve Bayesian algorithm to achieve this goal. Our study includes the evaluations of several data preprocessing operations applied in continuous to binary conversion step. It is inferred from the results that preprocessing techniques considering the rating means are the best regarding f-measure. The other preprocessing techniques can be preferred to apply through different aspects.

Experiments in this study are held on a different kind of dataset instead of a real e-learning one. In future work, we desire to use real e-learning data set with continuous and discrete values, and improve our approach in this way.

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## **BUSINESS EDUCATION IN PALESTINE INFORMATION TECHNOLOGY AND BUSINESS EDUCATION**

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**ABSTRACT:** This chapter aim at exploring the role of five-selected learning models in enhancing business education; as well as testing the key role of information technology in supporting the application of these learning models in the business education field. The effectiveness of an information technology is analyzed through the appropriateness of the technology in supporting a particular learning model. The mapping of information technologies to learning models identifies technologies in which business schools should invest in order to improve their educational environment and quality. The chapter concludes at exploring the learning models used in business education, and the opportunities for implementing information technology to enhance business education. It demonstrates that information technologies can enable the effective application of objective, collaborative, constructive, Cognitive and Socio-culturist learning in business education. Therefore, this paper states that computer-based learning modules enhance the delivery of learning materials by embedding a structure into learning process. Hence, computer-based learning modules are rooted in the objective rather collaborative or constructive model.

**Key words:** business education, information technology

### **INTRODUCTION**

Many countries worldwide reinforce their education and training systems capacity to respond to the pressures of globalization and challenges of the knowledge society. Closer cooperation between business and education is one of tools for providing learners with new skills and competences for work. However available on the current forms and modes of cooperation between the education and economic sectors, and the roles and responsibilities of the different stakeholders is limited and fragmented.

In this modern day and age, information technology plays a vital role in all aspects of life. However, if you are not in the field of information technology yourself, you might not know just how information technology touches your life. Information technology is the study and use of systems for storing, retrieving, and sending information. This can include software, hardware, applications, and so much more. Much of what people use in the 21st century was created with the help of information technology.

In many business schools, the blackboard chalk and overheads still remain as the primary teaching tools, even while the merits of information technology to improve efficiency and quality of communication are widely recognized by business professions and researchers. As business schools experience increased competitive pressures in maintaining student numbers and teaching quality, information technology becomes an area that schools should explore in order to improve educational environments and qualities.

However, although computer software has already permeated into business classrooms in many universities, information technology is still largely used as a functional tool to support practical topics of business subjects. It appears that there is clearly a lack of understanding and guidelines of how information technology can be applied to achieve teaching and learning improvement. In order to address these issues, this research paper examines models of learning that are commonly advocated, and discusses how information technology can be interwoven with the learning models to improve business education.

### **CONCEPTUAL FRAMEWORK**

The educational field has recently witnessed great developments by means of the growing modern technology. Hence, the development in technology originates modern educational tools that meet the students' requirements in education in today's modern life. As a result, students must be well prepared to cope with the modern technology so as to have better future. Therefore, the modern technology reflexes the future of our students who will become the future leaders, teachers, entrepreneurs, and businessmen and businesswomen. In addition to what has been said, the students' lack of the needed skills and competencies in dealing with the modern technology will lead to insufficiency and then having weak abilities in this competitive world.

Hence, the relationship between education and information technology is considered as the foundation stone for creating creative students who are able to have better opportunities; and then maintaining the ability to have a good job opportunity by offering the needed training in schools and pre-graduation. Fortunately, many schools provide access to online courses connected with different means of modern technology like computers and mobile phones. Thus, the computerized courses help students to quickly upload their assignments and other works simply and at any time.

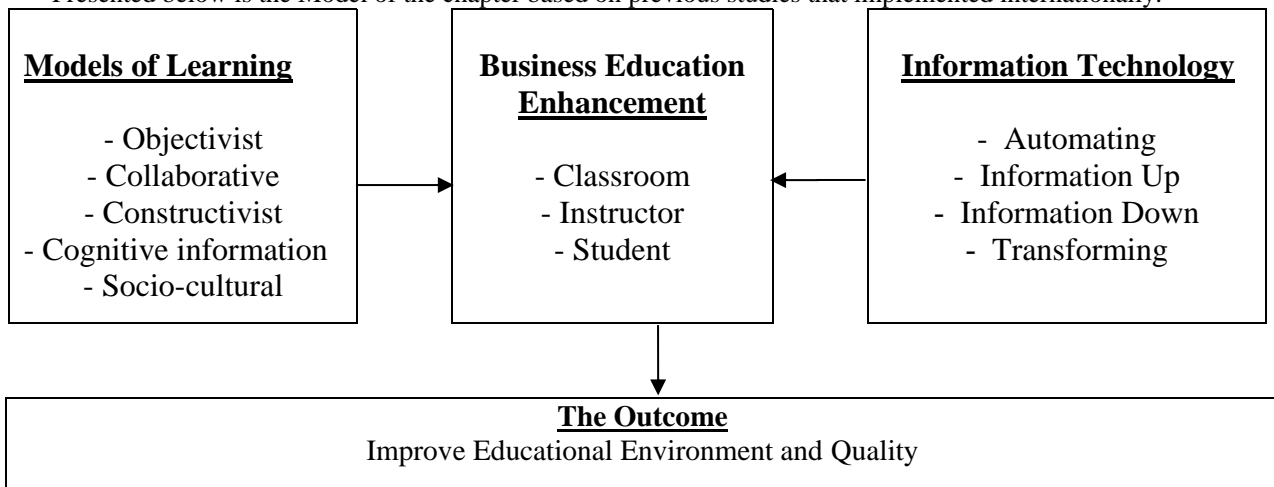
In respect to the aforementioned criteria, there is another important and central issue, which is the role of teachers and their readiness in dealing with the different aspects of modern technology. In fact, there is a heavy duty on the people in responsibility and senior officials to qualify the teachers by offering them training courses and keeping them up-to-date with the latest developments in technology. Consequently, teachers will be qualified to deal with and operate all of the modern technological devices such tablets, mobile phones and other new means of communications.

Having mentioned all of this, there is another important role for modern technology in decreasing the number of dropouts among the high school and college students. This achievement is obtained by offering online courses, where students can continue their education easily. Technology in fact helps to prevent students from being dropouts.

The information technology takes away many previous obstacles that deterred the advancement of this vital field. It helps to simplify the process of learning and teaching conditions. Hence, it appears the "one million dollar question." Can the modern technological means lead to real progress in education? What are the obstacles of using the modern technology effectively? What are the expected benefits of the modern technology tools? However, these questions are answered by thirteen previous studies.

**The Model of the chapter**

Presented below is the Model of the chapter based on previous studies that implemented internationally.



**Figure 1:** The Model of the Chapter

**Related Literature and Studies**

Some of these studies are explained as in the following

**The Study of Ministry of Telecommunications and Information Technology** (2011), titled "Telecommunications and Information Technology: National Strategy for Information and Communication Technologies (ICT) and Post, 2011-2013". The strategy plan has been prepared based on a methodology that addresses all of the concerned parties including the governmental sector, the private sector, the civil society organizations, and universities. As a result, extensive discussions took place through a series of workshops that dealt with planning the strategy by investigating the following points: Firstly, analyzing the challenges of the status quo. Secondly, identifying strengths, weaknesses, opportunities, and threats of various sectors; and then setting goals and strategic priorities and policies in the sectors of (telecommunications - information technology – and post). As well, determining the strategy of evaluation and controlling. However, in the field of information technology, the plan stressed on applying the following recommendations: (Providing the requirements and the

needed support for implementing the plan, improving and enhancing the sector, creating an enabling environment and legislative procedures to encourage the investment in this sector, and then offering training courses to qualify iconic creative generation. As well, it stressed on developing all fields of scientific research in the sector of information technology, and promoting information literacy.)

**The study of the Economic and Social Commission for Western Asia (ESCWA) (2009)**, titled " The National Profiles of the Information Society in Palestine", which aims at re-flexing a clear and comprehensive image of the development of the telecommunications and information technology sector between 2007 and 2009. This period, in effect, has witnessed a set of positive factors and other negative ones, which affect directly or indirectly the telecommunications and information technology sectors in Palestine.

**The study of Badie Sartawi, titled "Information Society in Palestine"** that comes to identify the information society; indeed, the telecommunications and information technology in Palestine. It comes at a time where it was difficult to identify accurately the characteristics of any sector or activity because of the difficult situations that Palestine suffers from, for instance, the current political and security situations. As well, the study displays the reality of the telecommunications and information technology infrastructure and services in Palestine, information technology and developing plans, education and skills development, work environment, information technology sector, the determinants of work structure and the possibility of its growth. Then the conclusions, and ended with introducing the study recommendations.

**The study of Al'a bin Mohammad Al Musawi (2008)**, titled "E-learning and Activation Requirements ", which aims at determining the readiness and the requirements of the E-learning technologies in the public education system environment in Saudi Arabia. The paper includes the following issues: the requirements associated with the application of E-learning (concepts, requirements, and the proposed developing strategy), the aspects and the requirements of the E-learning (tools and direct requirements, tools and indirect requirements), strategy of implementation E-learning, and the proposed model for applying the E-learning technologies in the public education schools, E-learning technologies portfolio (systems and programs portfolio, training and development portfolio).

There is no doubt that there are national profiles for that distinguished the information society in Palestine from (2007-2009), wherein the most eminent one is the report that done by (ESCWA, 6, 2009). However, the most important aspects of this report are explained in the following:

- Freeing the telecommunications market and information technology from monopoly after a period of domination, licensing new operators, and starting the work of new operators.
- This period has witnessed new growth and increasing in investment in this sector.
- The effective governmental activities during this period have led to issue a number of decisions; as well as legislating laws and regulations to legalize the process of freeing the market from monopoly. This also led to increase competition among investors and offering more investment opportunities, which are considered as basic requirements for developing this vital sector.
- Implementing several vital projects by the government to improve this sector within the government's medium-term plan of 2008-2010.
- Wataniya Mobile launched as the second mobile operator in Palestine (Wataniya Mobile); as well as the entry of the strategic partner (Zain) into the market.

#### **Obstacles of Applying E-Learning in Palestine:**

A set of obstacles prevents achieving the objectives of E-learning. These obstacles are summarized in the following points: 1- The majority of the developing countries suffer from weak infrastructure because of the difficulty in offering the required funding to establish strong infrastructure. 2- The learners suffer from a lack of competency and professionalism in using the modern technology, computer, and browsing the international telecommunications networks. 3- The academic staff and lecturers at universities are not convinced with using the modern electronic multimedia in teaching and training. This refers to their fears from minimizing their role in the educational process; in addition to the replacement and transition of their role to the educational software designers and the specialist of educational technology; as well as the difficulty of applying the assessment process. 4- The community members distrust the distance-education as they believe that the E-learning' position is less than the regular education. In addition, the official authorities in some countries don't grant official accreditation to the certificates awarded by distance-learning universities. 5- The high fees of connecting to the internet, and the high cost of designing educational software products is another prominent obstacle.

## **Telecommunications and Information Technology in Education and Training in Palestine**

There is no doubt that the release of the E-learning initiative in June 2007 is considered as a new era in the use of (ICT) tools in education and training. Also, the government policies and strategies stressed on activating the use of these technologies in education and training. This initiative aims at using the E-learning in the Palestinian educational system, where it is considered as one of the most important priorities of the ministry's development plan. Hence, the developments in the digital content for universities and higher educational institutions through adding lectures and teaching materials on these sites may shape a quantum leap in developing the educational content of the taught subjects. Hence, it becomes necessary to indulge lecturers and students in adopting this content, which will enhance the use of these applications after developing specialized educational programs. Similarly, the well planned and the serious efforts by the educational institutions and their insistence on achieving the desired goals in developing the quality of this field with promising programs will enhance the use of the telecommunications tools. Consequently, the information technology use in education and training programs in the higher education will be enhanced too.

However, there are several initiatives and projects implemented by the Ministry of Education and Higher Education regarding enhancing the educational system at schools. These initiatives aim at employing the telecommunications and information technology in developing the educational system and making it more efficient. Achieving this goal, on the first hand, was made after adding the information technology courses into the Palestinian curriculum. On the second hand, Intel project comes to improve the quality of education and to implement teacher-training strategy. The project targets training about (1,000) teachers of the primary stage. This program will be implemented during 3 years starting from 2009 (ESCWA, 2009.8-7).

### **MAPPING INFORMATION TECHNOLOGIES FACILITATING TO LEARNING MODELS**

#### **IT Enhanced Objectivist Model of Learning**

Recently, it becomes easier to add different contents like videos, pictures, audio tracks, and illustrations into any learning module. Hence, students can use and review the lecture and the educational material at any time. Another advantage appears in the ability of including enhanced models of assessment where the students are provided with instant feedback on their own performance. This goal is achieved by using the computerized learning module that known as the computer-based learning (CBL).

Hence, (CBL) technology comes to simplify the use of modern technology in education. The application of technology in education has some requirements. For instance, the study of (Clark, 1973) states that "The technology imposes a structure into the learning process that may not otherwise have existed. However, despite the common brief that structured and vivid presentation of knowledge enhances learning efficiency". In his study, Clark doesn't find remarkable difference in the students' performance towards the computerized content. In other words, he plays down the role of (CBL) in enhancing the education. In contrast, he appreciates the traditional methods of education. He added, the CBL module increases the instructor controlling which collides with the traditional objective of learning.

#### **IT-Enhanced Collaborative Model of Learning**

It's worth to be mentioned that collaborative learning model stressed on the importance of both information sharing and participation via communication and technology. Hence, the technology is employed to improve and ease the communication between the students and their instructors; in addition to ease the communication between the students with their peers. In respect to this issue, many studies explore the problems that face communication in education. For example, (Briggs and Ramos, 1992) state that the large number of students in classes makes students hesitate and fear making presentations publicly. Also, the study of (Harris and Mc Caffer, 1992) shows that "students prefer to raise questions to their instructions electronically than through face-to-face conversation". Moreover, the study of (Leidner and Jarrenpaa, 1995), explains that "akin to the finding that employees in business organizations feel more comfortable sending messages than talking to their peers."

One of the most important tools of communication among students is the E-mail; where it allows them to investigate any issue while reading off-class. In contrast, little disadvantages appears in respect to using E-mail, for instance, it's difficult to response to students inquiries directly from their instructors. However, other negative aspects of using E-mail in communication among students and business higher education require implementing more studies to reveal its pros and cons.

### **IT-Enhanced Constructive Model of Learning**

There is another important model known as the construction model that concentrates on giving learners the chance to explore and realize issues depending on their own efforts. This model encourages students to get access to information through providing suitable learning environment by using the information technologies. In respect to this, some aspects of these technologies like software packages, shared database, World Wide Web (WWW), and virtual reality are discussed as in the following: Firstly, World Wide Web is considered as one of the most important elements that is widely employed to get access to information. However, there is a similarity between database and WWW, wherein WWW is used to seek information and suiting this information in a way that can meet the need of learners. In respect to business education, there is a great possibility to employ WWW in business education field to get access to information. However, to prove the role of WWW in business education, there is an urgent need to do several studies in this regard. Long ago, simulation technology was used as a mean of knowledge construction; where it offered intensive learning experience and indirect specific theme to students. Indeed, several simulation software employed in serving in business education. Virtual reality technology has a great role in students' assistance to acquire knowledge through virtual experience. It may be possible to illustrate the role of this technology in education through the following example. A class was divided into a number of groups and teams in which each team represents a contractor, and the available jobs. The bids organized into a set of elements that included the costs of construction. This data was entered into a program. A week later, the win, loss, cash flow report, and profits were produced by the program. Hence, this example shows how students can acquire knowledge in a competitive game within the participation of large number of students and within a week. Also, this shows how students can create a virtual reality.

### **IT-Enhanced Cognitive Information Processing Model of Learning**

There is another learning model that is considered as an extension for the constructivist model. This model is the cognitive information-processing model. For instance, (schuell.1986) states that "Learning involves processing instructional input to develop, test and refine mental models in long-term memory until they are effective and reliable enough in problem-solving situations." Similarly, (Bovy, 1981; Bruning, 1983), explain that " The frequency and intensity with which a student cognitively processes instructional input controls the pace of learning. Instructional inputs that are unnoticed, or unprocessed, by learners cannot have any impact on mental models." (Bovy, 1981) states that " A major assumption of the model is that learners differ in terms of their preferred learning style. Instructional methods that match an individual's learning style will

be the most effective."; where Bovy stressed on the importance of individualized instructions in providing effective learning style. However, he adds that "The cognitive processing model also assumes that the individual's prior knowledge is represented by a mental model in memory and that the mental model is an important determinant of how effectively the learner will process new information. The implication is that the instructional support required is inversely related to the depth of existing knowledge as well as to the effectiveness of the learner's information processing style." Similarly, (Bruning, 1983) explains that "Selective attention is an interrelated function of the display, the cognitive structure of the learner, and the prior experience of the learner. Pre-instructional methods such as topic outline and learning goals might improve learning because they direct attention.

### **IT-Enhanced Socio-cultural Model of Learning**

Information-processing model of both collaborative and the cognitive models are considered as an extension of constructivism. This illustrates that the socio-cultural model is also considered as an extension that faces and opposes some assumptions of constructivism. Particularly, the socio-culturalists refuse Piaget's interpretation that says the main aim of learning is to create abstract concepts so as to represent reality. For instance, (O'Loughlin 1992) states that it impossible to separate knowledge from the historical and cultural elements of the learner. Similarly, Iran Nejad, et al, 1990) illustrates that "The more meaningful, the more deeply or elaborative processed, the more rooted in cultural background, meta cognition, and personal knowledge an event is, the more readily it is learned (While socio-culturalists embrace the concept that there is no one external reality, they argue that constructivism and collaborativism force the minority culture into adopting the understanding derived by the majority. Even a collaborative work group does not foster participation for minorities: "shared understanding" is biased by cultural and social factors".

**Table 1. Summary of Learning Model**

Model	Major Assumptions	Goals	Basic Premise	Implications for Instruction
<b>Objectivism</b>	Learning is the uncritical absorption of objective knowledge.	Transfer for knowledge from instructor to student. Recall of knowledge	Instructor houses all necessary knowledge. Students learn best in isolated and intensive subject matter.	Instructor is in control of material and pace Instructor provides stimulus
<b>Constructivism</b>	Learning is a process of constructing knowledge by an individual.	Formation of abstract concepts to represent reality. Assigning meaning to event and information.	Individuals learn better, when they discover things themselves and when they control the pace of learnings.	Learner-centered active learning Instructor for support rather than direction
<b>Collaborativism</b>	Learning emerges through shared understanding of more than one learner.	Promote group skills-communication, listening, participation. Promote socialization.	Involvement is critical to learning. Learners have some prior knowledge.	Communication oriented Instructor as questioner and discussion leader
<b>Cognitive information processing</b>	Learning is the processing and transfer of new knowledge into long-term memory.	Improve cognitive processing abilities of learners. Improve recall and retention.	Limited selective attention. Prior knowledge affects level of instructional support needed.	Aspect of stimulus can effect attention Instructor needs feedback on student learning
<b>Socio-Culturism</b>	Learning is subjective and individualistic.	Empowerment. Emancipatory learning. Action-oriented socially conscious learners with a view to change rather than accept or understand society.	Anglos have distorted knowledge and farmed information in their own terms. Learning occurs best in environments where personally well known.	Instructor is always culturally value laden Instruction is embedded in a person's everyday cultural/social context

**THE ENHANCEMENT OF BUSINESS EDUCATION IN PALESTINE**

**Educational Situations in Palestine**

Based on UNICEF (2010) statistics, there are 1,141,828 students in 2,611 schools from the first grade till the twelfth grade; 1,955 governmental schools, 325 UNRWA schools and 308 private sectors. Compared to the details demonstrated before, there is a clear change in the number of students. According to the MOEHE, in governmental schools, there are 70% attendance, 22% in UNRWA and 8% in private sectors. Since the last elections in 2006, Gaza has been under siege and the needed construction material has been prevented to enter Gaza, which caused a problem from the increasing number of students, leading to increase the need for the double shifts in schools. Double shifts reached 82% in governmental schools, 90% in UNRWA schools, which lead schools to cut off the educational hours in order to cope with the large numbers of students. In addition, the Ministry adds that there is an urgent need to build new schools in the next coming five years in order to absorb the increasing number of students. Thus, its recommendation was to build at least 100 UNRWA schools and 105 governmental schools. Nonetheless, obstacles hindering the movements of students to their schools have not got easier; they still suffer from long distances and are obliged to walk as far as 25 km to reach their schools. In addition to paying a lot of money on a monthly basis (UNICEF, 2010, pp. 1-2)

**The Higher Education in Palestine**

Educational Institutions; Palestinian Higher Education for the Academic Year 2014/2015

**Educational Institutions:**

**Table 2. Summary of Educational Institutions**

	West Bank	Gaza Strip	Total
Traditional Universities	9	5	14
Open University	-	-	1
University Colleges	13	6	19
Community Colleges	11	7	18
<b>Total</b>	<b>33</b>	<b>18</b>	<b>52</b>

The distance-learning, there is 1 university with (22), 17 educational centers at West Bank and 5 educational centers at Gaza Strip.

**New Student: 62,454 = Female 36,141+Male 26,313**

**Table 3.** Summary of New Students

	PhD	Master	Higher Diploma	Bachelor	Diploma2 years	Others	Total
Traditional Universities	28	2,776	103	31,422	1,265	621	36,215
Open University	-	-	-	11,302	-	2,495	13,797
University Colleges	-	-	-	1,870	4,718	84	6,672
Community Colleges	-	-	-	-	5,770	-	5,770
<b>Total</b>	<b>28</b>	<b>2,776</b>	<b>103</b>	<b>44,594</b>	<b>11,753</b>	<b>3,200</b>	<b>62,454</b>

**Enrolled Student: 221,395 = Female 133,362 + Male 88,033**

**Table 4.** Summary of Enrolled Student

	PhD	Master	Higher Diploma	Bachelor	Diploma 2 years	Others	Total
Traditional Universities	40	7,751	194	121,008	2,624	832	132,449
Open University	-	-	-	57,405	-	2,825	60,230
University Colleges	-	-	-	5,903	10,431	112	16,446
Community Colleges	-	-	-	-	12,206	64	12,270
<b>Total</b>	<b>40</b>	<b>7,751</b>	<b>194</b>	<b>184,316</b>	<b>25,261</b>	<b>3,833</b>	<b>221,395</b>

**Graduated Students: 40,043 = Female 24,111 + Male 15,932**

**Table 5.** Summary of Graduated Student

	PhD	Master	Higher Diploma	Bachelor	Diploma2 years	Others	Total
Traditional Universities	-	2,302	54	21,163	887	761	25,166
Open University	-	-	-	7,702	-	370	8,072
University Colleges	-	-	-	1,040	2,472	53	3,592
Community Colleges	-	-	-	-	3,142	71	3,213
<b>Total</b>	<b>-</b>	<b>2,302</b>	<b>54</b>	<b>29,905</b>	<b>6,501</b>	<b>1,255</b>	<b>40,043</b>

**Employees: 15,584**

**Table 6.** Summary of Employees

	PhD	Master	Higher Diploma	Bachelor	Diploma 2 years	Other	Total
Traditional Universities	2,546	2,550	55	2,783	757	1,552	10,273
Open University	470	1,093	-	455	200	362	2,580
University Colleges	178	502	25	649	238	290	1,882
Community Colleges	45	274	5	346	95	85	849
<b>Total</b>	<b>3,239</b>	<b>4,419</b>	<b>85</b>	<b>4,233</b>	<b>1,290</b>	<b>2,289</b>	<b>15,584</b>

**Academicians**

**Table 7.** Summary of Academicians

	Prof	Associate Prof	Assistant Prof	Lecturer	Instructor	Other	Total
Traditional Universities	215	367	1,416	566	1,273	-	4,303
Open University	19	52	327	80	807	-	1,431
University Colleges	5	8	81	184	17	357	949
Community Colleges	2	-	13	123	279	30	447
<b>Total</b>	<b>241</b>	<b>427</b>	<b>1,837</b>	<b>953</b>	<b>2,376</b>	<b>387</b>	<b>7,130</b>



## **INFORMATION TECHNOLOGY**

### **Surfacing Educational Assumptions**

#### **The Automating**

##### **A future look towards introducing resourceful automated classrooms**

Automated classroom is the awareness that IT replaces all of the traditional expensive and unreliable means including the human factor with cheaper, more reliable and more trusted one, it is the revolutionary technology. In respect to the organizations, the IT is widely employed to improve quality and providing operational savings through implementing the operational tasks and other related functions more efficiently and in a reliable and structured way. However, teaching and learning are considered as semi-structured activities in which these activities are not included within the automation process. In contrast, it should be mentioned that some aspects of teaching and learning activities have the possibility of automation, mainly the characteristics of the objectivist model of learning through information delivery is considered prone to automation. Therefore, the information technology aims at providing tools for presenting and manipulating educational material in classrooms which is considered in this paper as classroom automation technology. Hence, the basic role of technology in respect to classroom automation is summarized in the following points: (1) providing software and display tools to help limit instructors' interference and aid them in controlling. (2) Helping students to operate independently with their computers and instructor consoles. (3) Learning via computers by providing exercise and practice programs. (4) Providing the constituents of enhancing distance learning.

#### **Informing Up**

Providing the instructor with effective access for the information (Schein, 1992) explains that the employment of IT as a management tool for controlling aims at keeping managers well informed with their organizations performance. In education, this idea will help the instructor to estimate the level of the students understanding of the educational material. Hence, the instructor will be able to deal with the difficulties that the students face. In contrast, there are negative aspects in respect to this that include the students' tendency to be reticent; the instructor will be unable to assess his students understanding efficiently and the absence of the instructor in case the students need to explain questions and inquiries. In other word, the sole way to connect the instructor with students is via the key response pads and email.

#### **The Informing Down**

The use of technology to provide further access to information technology plays a great role in providing information to organizations in different specific levels. One of these levels is providing information to lower level employees of an organization. This means that the control of the senior and middle level management will be increased. This process is known as informing down. However, in education, the term informing down aims at providing data to students which allow them to analyze information and discuss different issues within peers set. Informing down technology is tested by providing information to students; and then by providing communication tools. Hence, the designed technologies to provide the information to students are known as the classroom technologies. In contrast, the designed technologies to provide communication tools to students are identified as classroom technology. These technologies, in term of use, are implemented in regular classrooms.

#### **The Transforming**

With the appearance of the supposed continuous learning in education, it becomes necessary to employ information technology to get and share information and ideas with others beyond traditional classrooms. Technology also must be employed to enable effective teamwork among learners. Similarly, IT enables learners to have continuous education with no time limits. Therefore, it enables learners of different levels to get multi-levels and multi-speed creativity. In other words, technology links dispersed students geographically at any time. Hence, the distance education let the learners to participate and co-operate world widely across distances. In other words, the e-learning allows a group of students of similar courses to connect each other's thoughts and share ideas with their peers.

**Table 8.** Technology Fit with the Theories of Learning

	Objectivist	Constructivist	Collaborative	Cognitive IP	Socio-cultural
<b>The Vision to Automate</b>					
Instructor console	√√				
Instructor console and stand-Alone student computers	√√	√			
Computer assisted learning	√√			√	
Distance Learning	√√				√
<b>The vision to Informate Up</b>					
Key Response Pads	√√			√	
Instructor student E-mail				√	
<b>The Vision to Informate Down</b>					
Learning Networks		√√			
Hypermedia /Internet		√√			
Simulation/ Virtual Reality		√√			
Synchronous Communication Classrooms			√√		√
Groupware-Supported Synchronous Communication Classrooms			√√	√√	√
<b>The Vision to Transform</b>					
Asynchronous Communication Across Distances			√√		√
Groupware-Supported Asynchronous Communication Across Distances			√√	√√	√

√√ represent the primary match, √ represent a secondary match

The above table shows the linkages between the technologies and the models of learning. No vision of technology is more desirable than others. Rather, the most appropriate technology depends on the underlying model of learning that the instructor wishes to employ.

### IT Usage in Palestine

Currently, IT usage is increasing rapidly especially after the signing the peace process which allows more freedom for Palestinians to build their infrastructure. The Palestinians through mainly the academic institutions especially universities are very active in wanting to join the global developments in information technology. The institutions as well as the government have realized the importance of IT to Palestinians at this point in history in building a nation. With the universities being the major customer of IT, there has been a demand for access to accurate information and resources. They are also playing a major role in the development of the Palestinian information highway.

### Legal Environments in Palestine

There are many challenges that face the Palestinian legal system. Due to the lack of an existing autonomous and unified Palestinian law, there has been inconsistency regarding what is legal and what is not. The existing laws are a combination of several powers that occupied Palestine through the years; as well as the present PA's laws. At the same time, most of the law schools in the Palestinian territories as well as the other Arab countries do not teach the use of information technology to search for legal information. Therefore, there is no law that protects the intellectual property, especially software copyrights. The situation in the territories is not ready for such laws because it is not of importance now. At the same time, most Palestinians cannot afford to buy computers. Only the academic institutions own modern computers, and can purchase software, and other products. Even if there is a law against piracy, it will be difficult to enforce it presently.

Another problem that may arise regarding implementing the law is that laws in the West Bank vary from the laws in Gaza Strip. Developing laws that will integrate the different laws will be the next step. Neighboring Israel

recognizes the copyright conventions, also experiences piracy. This spills into the Palestinian territories despite regulations that exist, but are not fully enforced. Despite this problem, it is not of utmost importance and statistics of piracy in the Palestinian territories is difficult to control. In spite of the current situation of piracy in the Palestinian territories, the short run will not incur any huge problems. However, once IT is well developed in the State of Palestine, then the long run needs a respecting of rules to build a state that can develop its own intellectual power. By doing this, Palestine will be able to lure foreign investment for further development. For the time being, intellectual property is not recognized not only in the territories, but also in the entire region.

**Table 9.** Impact of Information Technology on Business Learning

	<b>Automating</b>	<b>Information Up</b>	<b>Information Down</b>	<b>Transforming</b>
<b>Technology</b>	Instructor Console	Keypad Response	Learning Networks	Virtual Learning Spaces
	CAI/CBT	Instructor-student email	Virtual Reality	
	Distance Learning	Simulations		
	Instructor Console & Student Workstations		Communications Classrooms	
<b>Classroom Structure</b>	Hierarchy/Tree	Star	Ring	Dynamic
<b>Model</b>	Objective	Objective, Cognitive IP	Constructive, Cognitive IP, Collaborative	Collaborative, Cognitive IP, Socio-cultural, Constructive

**PROCESS DIMENSIONS**

Instructor	← Control of Pace, Content	→ Student
Knowledge Dissemination	← Purpose of Instruction	→ Knowledge Creation

**OUTCOME DIMENSIONS**

Ephemera	← Impact on Self-Variables (motivation, interest, self-efficiency)	→ Long-term
Factual./procedural	← Impact on Levels of Learning	→ Conceptual
Lower-order Thinking	← Impact on Cognition	→ Higher-order Thinking
Low	← Impact on Behavior- participation and attention	→ High
Improvements on Factual./procedural	← Impact on Behavior -performance	→ Improvements on Conceptual Asses

**THE OUTCOMES OF EDUCATIONAL QUALITY**

**Standards for Academic Programs Quality in Higher Education Include**

**Intended learning outcomes (ILO):** Intended learning outcomes are distributed to students; where ILOs are related to the students major. It's also constructed to be achievable.

**The academic plan content:** The courses content specification appears to be current, flexible, and within the international standards. It is also clear, comprehensive, and enhances developing a critical and resourceful thinking.

**Assessment:** (Bsharatand Rmahi, 2016) states that the assessment of student learning is implemented through using a set of valuation techniques. For instance, the process of informing the students in writing of the followed evaluation criteria, and providing immediate feedback, written and oral, regarding all of the students learning activities with the intended learning outcomes. All evaluation tools are designed in a reliable and transparent way.

**Standards for the Quality Learning Opportunities Include**

**Specifications of teaching and learning:** There many different teaching methods like teaching through organizing mall and large groups; as well as individual and self-learning method. However, in today's recent times, more attention is paid toward considering the active learning as one of the most active models. Hence, students

have the responsibility for their learning. It represents the optimal student attendance, and offers active training opportunities.

**Student advancement:** the students' advancement is enhanced through corresponding coursework to their specializations. Thus, the student percentage of dropout is increased.

**Resources of teaching and learning:** There are a set of teaching and learning resources. For instance, there are science labs, computer labs, and libraries. However, the efficiency of these resources in enhancing ILO's, competencies and expertise of teaching faculty meet the aims of the ILO's program.

The quality of the academic administration includes the following standards:(Bsharat, and Rmahi, 2016).

**Objectives:** Both administrators and faculty create transparent descriptions and clear goals for the academic programs.

**Controlling:** Administrators and faculty must control and monitor the quality of all majors and specializations.

**Data-driven decision-making:** Administrators must gather data from students and faculty on regular and systematic basis so as to enhance the decision-making regarding program quality improvement.

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### Interview:

[1] Interview with Palestinian individuals living in the Palestinian territories.

[2] Interview with Palestinian businesspersons who did minor business with Palestine: Dr. Noor abualrub.

Links:

<http://www.birzeit.edu/web/history.html>



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*Section 3: K-12 Education*

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# **INVESTIGATION OF VIEWS OF MIDDLE SCHOOL STUDENTS, PRESERVICE SCIENCE TEACHERS AND SCIENCE TEACHERS TOWARDS ROBOTIC APPLICATIONS**

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**ABSTRACT:** In this study, it was aimed to determine views of middle school students, preservice science teachers and science teachers about robotic applications. This study aims to present views and knowledge levels of middle school students, preservice science teachers and science teachers about robotic applications. In the study one group pretest-posttest experimental design was used. The study group of study consists of a total of 60 people including 20 middle school students, 20 preservice science teachers and 20 science teachers. In the study, the “Robotics Pre-Test”, which was developed by Riberio (2006) and translated into Turkish by Koç Şenol (2012), as well as "Robotics Satisfaction Test", which was developed by Silva (2008) and Gibbon (2007) and translated into Turkish by Koç Şenol (2012), and “Personal Information form" and a semi-structured interview form developed by the researcher after reviewing the relevant literature were used to collect the data. The study lasted for 60 hours in 3 stages. Middle school students were trained about robotics in the first stage, preservice science teachers were trained in the second stage and science teachers were trained in the third stage, respectively. In the first stage of the study, the Robotics and Lego Mindstorms Education EV3 Training Kits that will be used in the activities were introduced along with presentations and videos to the participants; in the second stage, they were informed about the use of Robotics program interface; and in the last stage, they designed a sample robot by using lego parts and performed some activities with programming. Descriptive statistics (frequency and percentage distribution) were used in the analysis of the data obtained from the study and inductive content analysis was applied in the analysis of the interview data. In the light of this study, views and knowledge levels of middle school students, preservice science teachers and science teachers about robotic applications as well as how they see the use of robotics as a method were determined.

**Keywords:** middle school student, preservice teacher, teacher, robotics

## **INTRODUCTION**

Although needs and life perspectives of communities have been changed with changing living conditions, the idea that this change and development can be achieved by education has not been changed and the necessity for education has become compulsory (Açışlı, 2010). This situation caused by rapid changes in information and technology, requires people to adapt to innovation (Yamak, Bulut and Dündar, 2014). There is a close relationship between technology, society and education (Fidan, 2008). Education system has to be constantly innovating to keep pace with changing and emerging technologies (Balci, 2007). Countries require students to use technology effectively, have skills such as problem solving, critical thinking, willing to take responsibility and being part of a team as well as being science and technology-literate as education gains importance every passing day (Özdoğru, 2013).

The use of new methods and teaching materials has become obligatory in order to improve the quality of science education, make students more interested in the course and establish the relationship between everyday life and scientific subjects (Sungur, 2013). In this context, it should be noted that robots are actively used in the science and technology courses in many educational programs (Özdoğru, 2013). According to Wood (2003), the purpose of studies conducted about the use of robotics in education should be providing a robotics education program integrated with science and technology to instructors and more meaningful and lasting learning by performing robotics and advanced technology applications in the education (Cited by Koç Şenol, 2012).

Many countries began to use robot kits in science and technology education in addition to robotics education (Fidan and Yalçın, 2012). According to Costa & Fernandes (2004), robotics is a significant area in the science and technology education. Because, as a result of robot design, robot contents and robot project applications held in science and technology education, students gain many skills such as problem solving, finding practical solutions, critical thinking, being aware of their own abilities, gaining first-hand experience, improved technology use and being more disposed to use technology (Cited by Koç Şenol and Büyük, 2013).

Considering the studies conducted on robotics in the literature; Cavas and Çavaş (2005) states that Legos play an important role in the development of abstract learning skills of middle school students such as computer-assisted

robot programming; Çayır (2010) suggests that a learning environment supported by legos has positive impacts on scientific process skills of students; Tse (2009) states that Lego training sets have positive effects on the success of students; Koç Şenol (2012) states that students have positive thoughts about robotics and robotic applications improve scientific process skills of students; McWhorter (2008) states that robotic activities increase student interest in computer programming; Riberio (2006) says that robotics provide discipline and high level of motivation in students; Barker and Ansoorge (2007) state that students have more fun and active learning process with the use of Lego Mindstorms robotics sets; Wei, Hung, Lee and Chen (2011) state that students using robotics have more fun and their motivation for learning is increased.

In science education, pre-service teachers and teachers should be trained with new methods in order to apply them effectively (Marulcu and Sungur, 2012). Considering that robotics is a very promising technology, studies to be conducted in this field become more important (Koç Şenol and Büyük, 2013). In this context, in this study, it was aimed to determine thoughts and knowledge level of middle school students, pre-service science teachers and science teachers about robotics.

## **METHOD**

In this study, it was aimed to determine thoughts and knowledge level of middle school students, pre-service science teachers and science teachers about robotics. In the study, single group pretest-posttest experimental design was used.

The study lasted for 60 hours in 3 stages. Middle school students received robotics training in the first stage, while pre-service teachers received in the second stage and finally science teachers received robotics training in the third stage, respectively. In the first phase of training sessions, Mindstorms Education EV3 Robotics Education Sets, which will be used in activities along with presentations and videos, were introduced to the participants. In the second phase, they were informed about the use of robotic programming interface. In the last stage, participants of the study were asked to design a robot by using Lego parts and perform various activities.

### **Sample**

The study group consists of 20 science teachers including 11 women and 9 men; 20 7<sup>th</sup> grade middle school students including 10 girls and 10 boys and 20 pre-service science teachers including 12 men and 8 women, respectively.

### **Instrument**

In the present study, the "Robotics Pre-Test", which was developed by Riberio (2006) and translated into Turkish by Koç Şenol (2012), as well as "Robotics Satisfaction Test", which was developed by Silva (2008) and Gibbon (2007) and translated into Turkish by Koç Şenol (2012) were used to collect the data. In addition a "Personal Information form" and a semi-structured interview form developed by the researcher after reviewing the relevant literature were used. "Robotics Pre-Test" was administrated on students, pre-service science teachers and science teachers prior to the study in order to receive their opinions about robotics. "Robotics Satisfaction Test" was administrated after the application.

### **Data Analysis**

In the study, descriptive statistics (frequency and percentage distribution) were used to analyze the data obtained from Robotics Pre-Test and Robotics Satisfaction Test and inductive content analysis was used for the analysis of the interview data.

## **FINDINGS**

The answers of middle school students, pre-service science teachers and science teachers in response to both "Robotics Pre-test" and "Robotics Satisfaction Test" are presented in the tables below.

**Table 1.** Frequency and percentage distributions of 1<sup>st</sup> and 2<sup>nd</sup> questions of robotics pre-test

		Yes		No	
		f	%	f	%
<b>Question 1:</b> Have you ever used Lego parts before?	Student	17	85	3	15
	Pre-Service Teacher	10	50	10	50
	Teacher	7	35	13	65
<b>Question 2:</b> Do you have any information about Lego Mindstorms Robotic System?	Student	3	15	17	85
	Pre-Service Teacher	2	10	18	90
	Teacher	4	20	16	80

As it can be seen in Table 1, 85% of the middle school students said yes and 15% them said no, while 50% of pre-service teachers said yes and 50% of them said no and 35% of the teachers said yes and 65% of them said no in response to the question “Have you ever used Lego parts before?”

On the other hand, 15% of the students, 10% of pre-service teachers and 20% of teachers said that they have information about Lego Mindstorms Robotic System and 85% of middle students, 90% of pre-service teachers and 80% of the teachers said that they have no information about the System.

**Table 2.** Frequency and percentage distributions of 4<sup>th</sup> and 5<sup>th</sup> questions of robotics pre-test and robotics satisfaction test

		Yes		I Haven't Decided Yet				No					
		Pre-test		Post-test		Pre-test		Post-test					
		f	%	f	%	f	%	f	%				
<b>Question 4:</b> Do you think that you can teach/learn science and technology and other courses by using computers and robots?	Student	15	75	18	90	4	20	0	0	1	5	2	10
	Pre-Service Teacher	18	90	20	100	2	10	0	0	0	0	0	0
	Teacher	18	90	20	100	2	10	0	0	0	0	0	0
<b>Question 5:</b> Do you think that you can design appropriate robots for future activities?	Student	17	85	19	95	3	15	0	0	0	0	1	5
	Pre-Service Teacher	14	70	18	90	6	30	2	10	0	0	0	0
	Teacher	12	60	19	95	8	40	1	5	0	0	0	0

As it can be seen in Table 2, 75% of the middle students participated in the pre-test said yes, 20% said I haven't decided yet and the remaining 5% said no in response to the question “Do you think that you can teach/learn science and technology and other courses by using computers and robots?” and 90% of them said yes and 10% said I haven't decided yet in response to this question in the post-test. On the other hand, 90% of the teachers and pre-service teachers participated in the pre-test said yes and the remaining 10% teachers said I haven't decided yet in response to the same question and 100% of them participated in the post-test said yes in response to this question.

85% of the students participated in the pre-test said yes and the remaining 15% said that they haven't decided yet in response to the question “Do you think that you can design appropriate robots for future activities?” and 95% of the students participated in the post-test stated that they can design the appropriate robots and the remaining 5% said no to the question. On the other hand, 70 of pre-service teachers said yes, and the remaining 30% said they haven't decided yet in response to the question in the pre-test and 90% of them said yes and 10% said I haven't decided yet in the post test. 60% of the teachers participated in the pre-test said yes and the remaining 40% of the teachers said that they haven't decided yet in response to the question “Do you think that you can design appropriate robots for future activities?” and 95% of the teachers participated in the post-test stated that they can design the appropriate robots and the remaining 5% said they haven't decided yet.



**Table 3.** Frequency and percentage distributions of 6th, 7<sup>th</sup> and 8<sup>th</sup> questions of robotics pre-test and robotics satisfaction test

		Partly Difficult				I haven't decided yet				Easy			
		Pre-test		Post-test		Pre-test		Post-test		Pre-test		Post-test	
		f	%	f	%	f	%	f	%	f	%	f	%
<b>Question 6:</b> What do you think about the use of computers in the activities that you perform/will perform?	Student	1	5	0	0	4	20	2	10	15	75	18	90
	Pre-Service Teacher	3	15	0	0	2	10	0	0	15	75	20	100
	Teacher	1	5	3	15	3	15	0	0	16	80	17	85
<b>Question 7:</b> What do you think about the use of robots in the activities that you perform/will perform?	Student	5	25	2	10	3	15	0	0	12	60	18	90
	Pre-Service Teacher	2	10	0	0	10	50	0	0	8	40	20	100
	Teacher	0	0	0	0	14	70	2	10	6	30	18	90
<b>Question 8:</b> What do you think about programming robots in the activities that you perform/will perform?	Student	4	20	1	5	4	20	2	10	12	60	17	85
	Pre-Service Teacher	9	45	4	20	4	20	0	0	7	35	16	80
	Teacher	4	20	4	20	8	40	1	5	8	40	15	75

As shown in Table 3, 5% of the students participated in the pre-test said it would be partly difficult for them, while 20% of them said that they haven't decided yet and the remaining 75% said that it would be easy in response to the question "What do you think about the use of computers in the activities that you will perform?" and 10% of the students participated in the post-test said that they haven't decided yet, while 90% of them said that it was easy, respectively. In the pre-test, 15% of the pre-service teachers said it would be partly difficult for them, while 10% of them said that they haven't decided yet and the remaining 75% said that it would be easy in response to the same question and 15% of the pre-service teachers participated in the post-test said that it was partly difficult for them while 85% of them said that it was easy. 5% of the teachers participated in the pre-test said it would be partly difficult for them, while 15% of them said that they haven't decided yet and the remaining 80% said that it would be easy in response to the question "What do you think about the use of computers in the activities that you will perform?" and 15% of the teachers participated in the post-test said that it was partly difficult for them, while 85% of them said that it was easy, respectively.

25% of the students participated in the pre-test said that they it would be partly difficult for them, while 15% said that they haven't decided yet and the remaining 60% said that would be easy for them in response to the question "What do you think about the use of robots in the activities that you perform/will perform?" and 10% of the students participated in the post-test said that they haven't decided yet and the remaining 90% said that it was easy, respectively. On the other hand, 10% of the pre-service teachers participated in the pre-test said that it would be partly difficult for them, 50% said that they haven't decided yet and the remaining 40% said it would be easy. 100% of pre-service teachers participated in the post-test said that it was easy for them. 70% of the teachers participated in the pre-test said that they haven't decided yet and 40% of them said that it would be easy in response to the same question and 35% of the teachers participated in the post-test said that it was partly difficult, 10% said that they haven't decided yet and the remaining 55% said that said that it was easy, respectively.

20 of the students participated in the pre-test said that it would be partly difficult, 20% of them said that they haven't decided yet and the remaining 60% said that it would be easy in response to the question "What do you think about programming robots in the activities that you perform/will perform?", while 5% of the students participated in the post-test said that it was partly difficult, 10% of them said that they haven't decided yet and 85% of the students said that it was easy, respectively. On the other hand, 45% of the pre-service teachers participated in the pre-test said that it would be partly difficult for them, 20% said that they haven't decided yet and the remaining 35% said it would be easy. 20% of pre-service teachers participated in the post-test said that they had difficulties while the remaining 80% said it was easy. 20% of the teachers participated in the pre-test said that it would be partly difficult, 40% of them said that they haven't decided yet and the remaining 40% said that it

would be easy in response to the same question, while 20% of the teachers participated in the post-test said that it was partly difficult, 5% of them said that they haven't decided yet and 75% of the teachers said that it was easy, respectively.

**Table 4.** Frequency and percentage distributions of 1<sup>st</sup> question of robotics satisfaction test

	Not Satisfied		Satisfied		Very Satisfied		
	f	%	f	%	f	%	
<b>Question 1:</b> Are you interested in robotic applications?	Student	0	0	1	5	19	95
	Pre-Service Teacher	0	0	1	5	19	95
	Teacher	0	0	2	10	18	90

As seen in Table 4, 5% of the students and pre-service teachers said that they are satisfied and the remaining 95% said that they are very satisfied in response to the question "Are you interested in robotic applications?" On the other hand, 10% of the teachers said they are satisfied and the remaining 90% said that they are very satisfied in response to the same question.

In the Robotics Satisfaction Test, 100% of the students, pre-service teachers and teachers said that they are more interested in response to the question "How you are interested in robotics currently when compared to your previous thoughts before the project?".

100% of the students, pre-service teachers and teachers said yes in response to the questions "Would you recommend your colleagues to use robotic?", "Once you start using robotics, would you follow innovations about it?", and "Do you think you would use robotics in your future courses?".

The answers of some students, pre-service teachers and teachers in response to the questions during interviews are given without any revisions in order to present the current situation. Students were coded as S-1, S-2, S-3,.... while pre-service teachers were coded as P.T-1, P.T-2, P.T-3,.... and teachers were coded as T-1, T-2, T-3,....

Some of the answers of teachers and pre-service teachers in response to the questions "Does the use of robotics affect professional development of the teacher? How?" are as follows:

**T-1:** "Learning new technologies and broadening their horizon contributes to the professional development of teachers."

**T-2:** "It would have positive impacts. It encourages them to use different teaching methods. Furthermore, the classroom management becomes easier since it will attract attention of students."

**T-3:** "Yes, it affects. Students don't like and pay attention to the lectures without using any materials in my class. Using robotics in the class develops a positive attitude towards both the course and technology."

**T-4:** "It allows teachers to be informed about today's technologies robots. Professional development becomes necessary."

**T-5:** "Yes, it affects. Students respect their teachers and pay attention to the course as long as teachers are well-equipped and improved in their subjects."

**P.T-1:** "Yes it affects, it brings participation level of students in the course to the maximum level and the use of robotics keeps you one step ahead of your colleagues. In addition, the use of robots while doing some experiments minimizes the margin of error."

**P.T-2:** "Yes it affects, using robots requires a specific knowledge. This gives extra points to teachers to improve themselves."

**P.T-3:** "Yes it affects, because it is an enjoyable learning material for both teachers and students. In addition, teachers become happy and think multidimensionally when they develop projects frothier students and work with them."

**P.T-4:** "Technology is progressing every passing day and traditional methods don't draw attention of students. Therefore, using a technological tool increases interest of students in the course and students learn better. In this way, teacher's academic standing also increases."

**P.T-5:** "Yes it affects, because technology is advancing and there are robots everywhere and in every area. Using robots positively affects professional development of teachers."

Some of the answers of middle school students, pre-service teachers and teachers given in response to the questions "What kind of advantages are provided with the use of robotics in the class?" are as follows:

**T-1:** "I think it will increase the attention of the students and facilitate the learning process."

**T-2:** "It will provide a student-centered classroom environment with applications."

**T-3:** "It may pave the way for efficient, effective and lasting learning."

**T-4:** "I think it will increase the attention of students for the course."

**T-5:** "Students' responses will make me happy. My class will be more fun."

**P.T-1:** "Using robotics in the classroom provides permanent learning for students."

**P.T-2:** "Courses become more interesting and fun. In addition, students don't get bored in the classroom."

**P.T-3:** "I think my class becomes more fun if I use robotics and students learn in an easier way."

**P.T-4:** "The course becomes more fun and the information taught becomes more permanent and students become more interested in the course."

**P.T-5:** "I think students will learn the concepts better and they will have fun at school."

**S-1:** "What we learn remains in our mind. It provides an easy and effective learning."

**S-2:** "It is effective in choosing the future profession and allows students to be more knowledgeable compared to their peers."

**S-3:** "I think the use of robotics in schools creates curiosity in children and the number of future engineers increases."

**S-4:** "Students like schools more with the help of robotic applications and they become more excited about school. Thus, we have a fun learning process and I think we better understand the lesson."

**S-5:** "I think it allows us to use our mind better and we can go from part to whole in the events that we cannot resolve."

Some of the answers of middle school students, pre-service teachers and teachers in response to the questions "What are the positive effects of using robotics on students when they are used in the classroom?" are as follows:

**T-1:** "I think it will improve efforts of students because it will attract their interest to the course. It will also improve their intellectual development and self-confidence because they will conduct their own studies by themselves after learning the program."

**T-2:** "It may be very useful because one of the best learning methods is trial-and-error method and it allows students to experience real experiments and it is fun like a game. In this way, students will want to learn new thing with the use of robotics."

**T-3:** "Producing new products is very important for self-confidence of students and they may gain new perspectives by trial-and-error methods. Creativity, finding solutions to different events and get rid of the shallow thinking."

**T-4:** "The use of robotics in the classroom make students participate in the class more willingly and happily. It may result in more permanent learning since it appeals to senses."

**T-5:** "It will be very useful for my students. They will have a robot made of legos and they will be able to give commands to the robot. They will experience the happiness of building a robot, and thus they will make use of their spare times by thinking about more possibilities."

**T-6:** "They will not forget this knowledge since they will learn by experiencing and practicing. They adapt to new technologies. Students work together by sharing the workload. It allows learning to be permanent."

**S-1:** "They come to school willingly."

**S-2:** "They like school more and they become more excited about the course."

**S-3:** "I think Legos are the best tools to build something in a way that we want."

**S-4:** "They learn through fun."

**S-5:** "They perform more efficient learning."

**P.T-1:** "It improves the intelligence, creates curiosity, draws attention and facilitates learning."

**P.T-2:** "Learning becomes more permanent. Makes it difficult to forget. Courses become more enjoyable and fun."

**P.T-3:** "It provides a more effective learning since it appeals to more senses."

**P.T-4:** "Students participate in the class more actively because they are encouraged to learn by experiencing. They become more interested in the course and eager to go to school."

**P.T-5:** "Their imagination can improve and they can produce alternative solutions to problems."

**P.T-6:** "I think they will like the course and will have fun in the class, and their dexterity skills will also develop."

Some of the answers of middle school students, pre-service teachers and teachers in response to the questions “What are the possible negative impacts of using robotics on students when they are used in the classroom?” are as follows:

**T-1 and T-2:** “There may be problems about the time. Time problems may be the biggest drawback.”

**T-3:** “It may be difficult to use in crowded classrooms. In addition, the cost of materials can be another problem and it may be expensive to apply on all students.”

**T-4:** “The only problem is that each student will want to have his/her own robot. I don’t see any other possible problem.”

**P.T-1:** “It cannot be used in every lesson. Students with poor dexterity skills may experience some difficulties.”

**P.T-2:** “Limited time can be a problem.”

**P.T-3:** “All contents of the course cannot be covered due to the limited time.”

**P.T-4:** “Every student should take advantage of these applications. However, it will be a problem to get a sufficient number of them since they are expensive. The course can be disrupted since it will take time to educate all students with a limited number of robots.”

100% of the middle school students participated in the study stated that they don’t think using robotics would have any negative effects on the course.

Finally, all participants said yes in response to the question “Would you like to use robotics in the classroom?”

## DISCUSSION AND CONCLUSION

In this study, views of middle school students, pre-service science teachers and science teachers in regard with robotics were investigated. Prior to the study, opinions of middle school students, pre-service science teachers and science teachers participated in the study about robotics were determined. According to the results of the study, 85% of the middle school students, 90% of the pre-service science teachers and 80% of the science teachers stated that they have no information about Lego Mindstorms Robotic System. However, 85% of the middle school students, 50% of the pre-service science teachers and 35% of the science teachers stated they have used lego parts before. In this context, since a large portion of the participants don’t have any prior information about Lego Mindstorms Robotic System, they would be more curious and willing about robotic applications and they wouldn’t have difficulties since they have used lego parts for different purposes. In addition, according to the results of post-test, 95% of the middle school students, 90% of the pre-service science teachers and 95% of the science teachers stated that they can design the appropriate robots for future activities.

The participants were asked “How often do you use a computer?” since the use of computers is required for the applications and 65% of all participants said that they use a computer on a daily basis. In this context, it is thought that they won’t have too much difficulty in robotic programming. Considering the results obtained in this context, 87% of all participants find it easy to use of computer programming in the applications.

According to the results of the study, 51% of the participants participated in the pre-test stated that it would be easy to use robots, whereas 93% of the participants participated in the post-test stated that the use of robots in the applications is easy, respectively. Similarly, in the pre-test, 45% of the participants said that programming robots would be easy, whereas this rate is increased up to 80% in the post-test. This result shows that the participants were afraid to fail in the use of robots and programming these robots since they have never tried such applications before.

According to the results obtained, 97% of the participants think that they can learn/teach science and technology courses by using computers and robots. In addition, 5% of the students and pre-service teachers said that they are satisfied and the remaining 95% said that they are very satisfied about the robotic applications. On the other hand, 10% of the teachers said that they are satisfied and 90% of them said they are very satisfied about robotic applications. In the Robotics Satisfaction Test, 100% of the students, pre-service teachers and teachers said that they are more interested in response to the question “How you are interested in robotics currently when compared to your previous thoughts before the project?”. In addition, 100% of the students, pre-service teachers and teachers said yes in response to the questions “Would you recommend your colleagues to use robotic?”, “Once you start using robotics, would you follow innovations about it?”, and “Do you think you would use robotics in your future courses?”.

According to the results of the study, in which views of middle school students, pre-service science teachers and science teachers in regard with robotics were investigated; it was determined that middle school students, pre-service science teachers and science teachers were very satisfied about robotic applications performed, they had fun while learning, their motivation for learning was increased. Considering all these positive impacts, various courses and activities should be organized about robotics, which is the technology of our age, for teachers and students.

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## **LEADERSHIP STYLES ADOPTED BY HEADTEACHERS AND THE INFLUENCE ON STAFF PERFORMANCE IN PRIMARY SCHOOLS OF CHIMOIO CLUSTER IN MOZAMBIQUE**

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**ABSTRACT:** The research study was designed to examine the leadership styles adopted by head teachers and the influence on staff performance in primary schools of Chimoio cluster in Mozambique. The research design used was a mixed method that incorporated both the quantitative and qualitative approaches. The target population consisted of head teachers, teachers and non-teaching staff from which a sample of five head teachers from five schools, thirty teachers and twenty non-teaching staff were involved in the study through purposive and random sampling. The research instruments used to collect data were open and close format questionnaire, in-depth interview and document analysis. The study findings showed that the overwhelming majority of head teachers employ democratic leadership style in Chimoio cluster primary schools which enhances positive school staff performance. Regarding to major factors that influence negatively the staff performance, the majority of the respondents highlighted lack of motivation, pupils' incompetence, low remuneration, coercive measures and lack of in-service training for professional development. It was evident from the findings that through democratic approach, staff participation and involvement in school matters and positive interpersonal relationship between school staff and head teachers influence the staff performance in various primary schools in Chimoio cluster. The study also established that there is a significant relationship between democratic leadership style and school climate. The main recommendations were addressed to the District Services of Education, youth and technology of Chimoio that should sensitise head teachers to apply democratic leadership style to enhance positive school staff performance, to run periodically in-service training to head teachers in collaboration with local universities which could adopt them with competence-based approach, towards management and leadership skills so that they improve the performance of their schools, to find ways of increasing school income for paying incentives and monetary reward so that it motivates the school staff.

**Key words:** Leadership styles, School performance

### **INTRODUCTION**

This paper focuses on leadership styles adopted by head teachers and the influence on staff performance in primary schools of Chimoio cluster in Mozambique.

Leadership is defined by Voon, Lo and Ayob (2011) as a process of interaction between leaders and followers where the leader attempts to influence followers to achieve a common goal. Leaders carry out this process by applying their leadership attributes, such as beliefs, values, ethics, character, knowledge, and skills. Leithwood, Louis, Anderson and Wahlstrom (2004) noted that leadership influences the interpretation of events for followers, the choice of objectives for the group or organization, the organization of work activities to accomplish objectives, the motivation of followers to achieve the objectives, the maintenance of cooperative relationships and teamwork and the enlistment of support and cooperation from people outside the group or organization.

According to Eduardo (2012) Mozambique has been embarked on a rapid expansion of access to primary schooling as a result of construction of many schools, enrolment of many children and teacher training institutions compared to the past whereby the colonial government had no real interest in educating the indigenous African peoples. The country's laws regarding education sector have also improved. For instance, the new National Education Law of 1992, which replaced the 1983 legislation, also states that education is a right and duty of all citizens, and, while reaffirming the government's central role, opens up the sector to non-state actors. However, the expansion of school network should be accompanied by appropriate school leadership (ibid).

Primary schools in Chimoio cluster have been facing serious problems such as low performance of school staff, demotivation of teachers and school workers due to shortage of wages, overloaded classrooms and higher teacher to pupil ratios. The quality of education is the overriding concern for a system, on which the multitude of reforms so far appear to have had no significant positive effects, and there is increasing evidence that the costs of education are excluding segments of the population (Eduardo: 2012).

School leaders are appointed to be the solution of the above problems through employing appropriate types of leadership styles. Transformational leaders employing democratic style differently from laissez-faire and

autocratic leadership styles, transform the value, needs, aspirations, followers' priorities and also motivate their followers to exceed expectations (Thamrin: 2012).

As a matter of fact, in last decades' scholars from worldwide show a great deal in educational leadership matters and several studies were made. For instance, a study made in Iran by Rizi, Azadi, Farsani and Aroufzad (2013) concerned with the relationship between leadership styles and job satisfaction among physical education organisations employees, showed that there is a positive correlation between the overall leadership styles and job satisfaction.

In Mozambique, Bazo (2011) also conducted a research entitled "Transformational Leadership in Mozambican Primary Schools". The main purpose was to examine the association between transformational leadership and organisational learning and the findings revealed that three school leader transformational practices, namely, vision and goals, structure and performance expectations were positively associated with individual teacher learning.

From the above studies, the researcher concludes that there is a clear gap in all researches which do not examine leadership styles adopted by head teachers and the influence on staff performance in primary schools of Chimoio cluster in Mozambique which is the main purpose of the current study.

### **Statement of the Problem**

The problem in this study is related to the low performance of teachers and non-teachers which influence the quality of education in primary schools of Chimoio cluster primary schools. Based on Eduardo (2012), primary schools in Chimoio cluster are facing serious problems such as low performance of school staff, demotivation of teachers and school workers due to shortage of wages, overloaded classrooms and higher teacher to pupil ratios. The quality of education is the overriding concern for a system, on which the multitude of reforms so far appear to have had no significant positive effects, and there is increasing evidence that the costs of education are excluding segments of the population (ibid).

The District services of education, youth and technology of Chimoio cluster has been registering an increasing number of schools and school staff. This development has to be followed by the existence of head teachers who adopt appropriate leadership style to his/her school staff, mainly teachers and non-teachers so that they perform adequately towards the fulfilment of the intended school goals.

The quality of education in public primary schools is generally considered by civil society, stakeholders, donors and parents as poor. Spaul (2011) points out that many problems faced today in education sector, such as pupils failing to read a text accurately in Portuguese and writing a composition after completing the primary level, teachers absenteeism, poor content teaching knowledge, dropouts estimated in 40% at primary level should be regarded as enemies for education development. In addition, we commonly see non-teaching staff not performing well their tasks such as cleaning conveniently classrooms, toilets, school offices and so forth, despite the various interventions of the community and head teachers. Such a situation is alarming, bearing in mind that public schools accommodate the majority of the pupils and workers (teachers and non-teaching staff).

The current study sought to examine leadership styles adopted by head teachers considered as a catalyst approach towards the school staff performance. Based on the background above, it is pivotal to ask the question: *To what extent do leadership styles adopted by head teachers have an influence on the school's staff performance in primary schools of Chimoio cluster in Mozambique?*

### **Research Objectives**

This study addresses the following research objectives:

- To identify the most predominant leadership style adopted by head teachers in Chimoio cluster primary schools;
- To assess the major factors that influence negatively the staff performance in Chimoio cluster primary schools;
- To examine to what extent do head teachers' leadership styles influence the staff performance in Chimoio cluster primary schools;
- To find out the most predominant school climate that exists in Chimoio cluster primary schools;
- To evaluate to what extent the leadership style influence school climate in Chimoio cluster primary schools.

## METHODOLOGY

The researcher used a mixed method which is inductive of qualitative and quantitative research design. The Qualitative research design was used due to personal involvement and in-depth responses of individuals who secure a sufficient level of truthfulness of the results. Through quantitative research design, data were represented numerically in tables in statistical analysis and pie charts. A total of fifty (50) primary schools with the corresponding number of head teachers, one hundred and forty-eight (148) teachers and one hundred and one (101) non-teaching staff were the target population involved in the study, with the sample of five (5) primary schools with five head teachers, 30 teachers and 20 non-teachers from public and missionary primary schools through purposive and random sampling. Open-ended and close-ended questionnaires, semi-structured interviews and documentary review concerned with statistical reports were used as research instruments in the process of data collection.

## RESULTS AND FINDINGS

### Findings Gathered through Questionnaire Instrument

In closed-ended and open-ended questionnaire format, the researcher involved head teachers, teachers and non-teaching staff in order to present full information needed in regard to leadership styles and the influence on staff performance in Chimoio Cluster primary schools.

#### a) In-service training of head teachers in Chimoio Cluster primary schools

The findings from table 8 indicate that 100% of head teachers participated actively in the present study. 40% of them assured that they are trained once per semester, similar percentage argued differently from others who assumed to be trained once per year while 20% of head teacher respondents once in two years.

**Table 1.** In-service training of head teacher respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Once per semester	2	40.0	40.0	40.0
	Once per year	2	40.0	40.0	80.0
	Once in two years	1	20.0	20.0	100.0
	Total	5	100.0	100.0	

In-service training through meetings, workshops, seminars being organised in schools provides the platform for sharpening and enriching the professional knowledge and skills of head teachers.

#### b) Description of school staff performance

Staff performance is a key issue for any school to achieve the intended goals. Data collected through questionnaire in regard to school staff performance presented below reveal that 60% of head teachers who participated in the study assumed that they have been facing high performance of their employees that is, teachers and non-teachers. However, 40% of respondents had different view characterised by facing low staff performance.

**Table 2.** Teachers and non-teachers' performance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High	3	60.0	60.0	60.0
	Low	2	40.0	40.0	100.0
	Total	5	100.0	100.0	

When commenting on staff performance, one had teacher respondent expressed that: *“In my school I feel that teachers and non-teachers are conscious of their roles. My subordinates are assiduous, punctual and obedient. They follow strictly the school rules and regulations. I feel that they are competent and confident when working. We run this school altogether democratically and in open climate because we understand that these key issues will help us to accomplish our school goals. We have been facing decreased rate of teachers’ absenteeism, students’ drop out, low pass rate, efficient participation in school matters of all subordinates. We are in a right position”*. Another head teacher had this to say: *“Generally, I feel that in my school we are not accomplishing adequately our school goals mainly due to teachers’ behaviour. Some of them come to school smelling alcohol in class. Others*



ask pupils for gift especially when they are celebrating their birthdays and teachers' day October 12<sup>th</sup>. Life is hard for every Mozambican, kids from primary schools or their parents should not be penalised for their personal interests. So, "The Ministry of Education should change its policy. Teachers should be hired at 30 years old. In this school, many teachers do not show commitment with their job".

Another head teacher had this to say: "We normally call for meetings periodically every two weeks. In such meetings, we analyse pedagogic issues (teaching contents) and administrative matters. Because I understand that through meetings teachers and non-teachers have the opportunity to voice out their own ideas, opinions, and comments for a better school success towards the achievement of better school goals. Everybody is involved in school decision-making".

**c) Types of School Climate faced by Teachers and Non-teachers**

In regard to school climate the school staff that participated in the study according to the tables below revealed that the overwhelming majority of teachers (93.4%) face open climate while (3.3%) characterized it as closed climate. Non-teachers, on the other hand, assumed to be facing open climate based on 85% of the respondents while (10%) closed climate.

**Table 3.** School climate faced by teachers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Open climate	28	93.4	93.4	93.4
	Closed climate	1	3.3	3.3	96.7
	Other	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

**Table 4.** School climate faced by non-teachers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Open climate	17	85	85	85
	Closed climate	2	10	10	95
	Other	1	5	5	100.0
	Total	20	100.0	100.0	

When the respondents were asked to comment on the school climate faced in Chimoio Cluster primary schools, one teacher had this to say: "...when the head teacher is an open person, friendly and talkative, like mine, the working environment and the school climate are good. The pedagogic planning occurs smoothly, we assess our pupils following strictly the planned schedule. Our pupils normally perform well. Our pass rate is about 90% to 95% annually. We hardly see girls leaving the schools for marriages or house working to increase the family income as we see in rural area". Another teacher respondent expressed his feelings in this way: "We can't penalise our pupils due to bad leadership approach used by a head teacher. This post is not trustful. Today you sleep as a school head and tomorrow wake up as an ordinary teacher. I am strongly committed with the school goals. This missionary school offers good conditions for us and for students. Our pass rate is always high almost 100% per year, because there is no complain. You find everything in the school. The school climate is really open." One veteran non-teacher respondent affected in administration sector commented that: "Sometimes our head teacher use coercive measures as a means to test people. But an old person like me I don't bother because it is a trap for getting demoralised and therefore affect my working performance. Even junior staff are able to separate this in our school. They know that the head teacher's behaviour should not affect their performance. I am punctual at work, I dress smartly and I hardly stay at home in working days. The school climate is good".

**d) Interpersonal Relationship between school staff and head teacher**

The interpersonal skills at working place are relevant in building healthy relation in school towards the achievement of better results. The findings gathered from teachers and non-teachers reveal that there is a satisfaction with regard to their head teachers. As table 12 illustrates, (53.8%) of teacher respondents encounter good relationship with their head teachers and 16.5% assumed to be very good. However, bad relationship was pointed out by (16.5%) of the respondents and normal for 13.2%.

**Table 5.** Relationship between teachers and head teacher

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	16	53.8	53.8	53.8
	Bad	5	16.5	16.5	70.3
	Normal	4	13.2	13.2	83.5
	Very good	5	16.5	16.5	100.0
Total		30	100.0	100.0	

**Table 6.** Relationship between non-teachers and head teacher

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	15	75	75	75
	Bad	3	15	15	90
	Normal	1	5	5	95
	Very good	1	5	5	100.0
Total		20	100.0	100.0	

The majority of non-teachers (75%) who participated in the study based on data from table 13, expressed satisfaction because they have been facing good relationship with their head teachers. On the other hand, (15%) expressed as facing bad relationship while (5%) normal and similar percentage very good.

**e) School Staff motivation**

Both participants in the study that is, teachers and non-teachers expressed their lack of motivation as admitted by the overwhelming majority (93.4%) of teacher respondents who feel low motivation also assumed by (90%) of non-teacher respondents. This crucial result is minimised by 3.3% of other teacher participants and 5% of non-teachers who assumed to be strongly motivated while similar percentage of 3.3% and 5% of teachers and non-teachers respectively, are strongly demotivated as table 14 and table 15 indicate below:

**Table 7.** Teachers' motivation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low motivated	28	93.4	93.4	93.4
	Strongly motivated	1	3.3	3.3	96.7
	Strongly demotivated	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

**Table 8.** Non-teachers motivation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low motivated	18	90	90	90
	Strongly motivated	1	5	5	96.7
	Strongly demotivated	1	5	5	100.0
	Total	20	100.0	100.0	

When the researcher asked the respondents to comment on the answer given, one participant had this to say: *“The main problem starts with the salary. In education sector teachers, do not earn a salary but peanuts. How can I get motivated with peanuts? Besides having the low salary, it also comes late due to excessive bureaucracy. We never know the exact days of payment”*. Another participant in the study had this to say: *“We are in general strongly demotivated. Apart from having low remunerations, we do not have incentives in schools differently from our neighbouring countries. The salary is not enough and it does not cover 30 days of the month”*.

**Relevant Findings Gathered through Interview Instrument**

The researcher addressed the interview entirely to teachers because he understands that the main focus when examining leadership styles commonly employed by head teachers at primary schools the pillars are teachers in

providing reliable and valid information concerned with their superiors and not the head teachers themselves. In this circumstances, 30 teachers participated actively as respondents after the approval of District Education authorities.

a) Which leadership style is commonly adopted by head teachers in Chimoio cluster primary schools?

Generally, most participants corroborated that head teachers were democratic, though at times they were autocratic and laissez-faire, depending on the situation encountered in the school.

For instance, during an interview a teacher from school A had this to say:

*“...I have been working in this school for five years now and I was received by the current head teacher. We normally attend several meetings because our school head is so democratic and when we face problems like lack of course-books, chalks, parents not attending school meetings, our boss uses to call for meeting so that we find the solution as a group. He is a nice person although sometimes he shows a bad temper when he gets angry...”*

Another teacher from School B when interviewed about the types of leadership style employed by head teacher commented that: *“...I normally do not see the presence of my head teacher here. Anyone does whatever he/she wants to do. In case of any difficulty he normally says ‘do what you think is good for you’...some of us teach without a dustcoat our head teacher does not care. Some pupils do not come to school on Saturdays for cleaning he does not take any measure. I do not feel the authority of our school leader. He fights to look nice for everybody without caring for the school and I cannot find any adjective to qualify him...”* Focusing on the same question teacher C easily said: *“My head teacher is an authoritarian person. She acts as the only person with ideas. Whenever we face school problems we hardly sit as a group for problem resolution. I remember when I missed five lessons because of malaria. She ordered the administration sector to discount my salary without allowing me to present any justification....she behaves like a soldier. She does not allow any worker to come late even in the rain season, pupils are forbidden to make noise in corridor during the break time. I have never seen a head teacher like mine...”*

As the pie chart illustrates below, an overwhelming majority of teacher respondents, (82%) defend that their head teachers employ democratic style in school management while (12%) use laissez – faire style and (6%) argue that their head teachers employ autocratic leadership style.

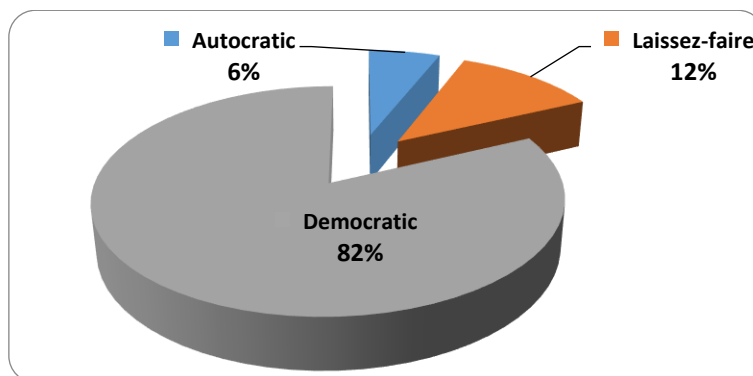


Figure 1. Types of leadership styles employed in Chimoio cluster primary schools

b) What are the main factors that influence negatively staff performance in Chimoio cluster primary schools?

The overwhelming majority of participants in the study indicated that the main factors hindering staff performance in Chimoio cluster primary schools are lack of motivation, pupils’ incompetence, low remuneration of teachers and non-teachers, coercive measures adopted by some head teachers and lack of in-service training for professional development.

One of the respondents had this to say: *“...I am teaching from grade 1 to grade 5. In grade 1 the class is composed of 89 students. The class is overloaded without enough chairs and course-books. When I set a test, it is difficult to invigilate properly. Consequently, pupils end up copying to each other. Which performance do you expect from me? I am not motivated at all”*. Another respondent expressed his feelings in this way: *“The autocratic style employed by head teacher is the major factor which contributes negatively to our bad performance. People in this school do not have the working uniform beside teachers with dustcoat. The school toilets are authentic mess. The head teacher does not value us as workers of this school. She is arrogant, no communication with subordinates and she hardly calls for meeting”*.

c) *To what extent the leadership style influence school climate in Chimoio cluster primary schools?*

The respondents through an interview corroborated that higher democratic style employed favourable open climate the head teacher cultivates on his /her school staff. The more authoritarian is the leader more closed is the climate. One of the respondents expressed his feelings in this way: *“If everything is under control there is no complain. Head teachers in missionary schools lead the schools democratically which enhances open school climate. The school offers good conditions for us and for students. Our pass rate is always high almost 100% per year. You find everything in the school. The school climate is really open.”* On the other hand, one veteran non-teacher respondent affected in administration sector commented that: *“Sometimes our head teacher use coercive measures as a means to test people. But it is very bad because it affects directly the staff performance. Consequently, we end up coming late to our working place without morale and motivation to perform well”.*

**Documentary Review**

The researcher sought permission to access statistical reports from District Services of Education, Youth and Technology from 2012 to 2013 related to pupils’ academic achievement and the findings are as follow:

**Table 9.** Average of pupils’ pass rate in five schools from 1 to 7 grades:

Year	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7
2012	86,85%	76,54%	86,80%	86,15%	66,31%	85,03%	67,93%
2013	90,2%	80,0%	89,6%	89,9%	69,9%	86,2%	70,8%

**Drop rate**

The annual average drop rate was 7.7% in 2013 against 9.4% in 2012, a decrease of 1.7% in comparison to the previous year. The highest rate was registered in school C a public institution with 24.2% and the lowest in School B a missionary with 5.02%.

**CONCLUSION**

This paper attempted to examine the leadership styles adopted by head teachers and the influence on staff performance in primary schools of Chimoio cluster in Mozambique. The findings revealed that most of the head teachers employ democratic leadership style in the school management affairs proved to be successful in attainment of school goals. However, few of them are reported at times employing laissez-faire and autocratic leadership styles, depending on the situation. The main factors hindering staff performance in Chimoio cluster primary schools are lack of motivation, pupils’ incompetence, low remuneration of teachers and non-teachers, coercive measures adopted by some head teachers and lack of in-service training for professional development. It also emerged from this study that the the best leadership style that influence positively school staff performance is democratic style associated with other practices such as staff participation and involvement in school affairs and positive interpersonal relationship existing between school staff and head teachers. In regard to school climate data revealed that the school staff faces mostly open climate and finally, the study established that there is a significant relationship between democratic leadership style and school climate. It was highlighted that higher democratic style more favourable open climate the head teachers cultivate in primary schools of Chimoio cluster in Mozambique.

**RECOMMENDATIONS**

This study deeply recommended that even though the majority of head teachers employ democratic leadership style, there are some of head teachers who adopt laissez-faire and autocratic leadership styles. It is recommended that the District services of education, youth and technology of Chimoio, should sensitise head teachers to apply democratic leadership style in Chimoio cluster primary schools because it enhances positive school staff performance. It emerged from the study that had teachers attend irregularly in-service training for professional development. The District services of education, youth and development in Chimoio in collaboration with the local universities should run periodically in-service training to head teachers which could adopt them with competence-based approach, towards management and leadership skills so that they improve the performance of their schools. From the study, it also came out that lack of staff motivation, pupils’ incompetence, low remuneration of teachers and non-teachers, coercive measures adopted by some head teachers were described as the hindrance factors which directly affect staff performance. In regard to these factors the District services of education, youth and technology

in collaboration with different school stakeholders should find ways of increasing school income for paying incentives and monetary reward so that it motivates the school staff. It is also recommended that the head teachers and different stakeholders, should find strategies to improve teachers' school accountability as civil servants so that they play their expected role with ethics, morality and able to safeguard students' health and well-being, avoiding absenteeism and asking for gift on birthdays. Conclusively, head teachers are recommended to keep improving the school climate and staff performance through the persistent use of good practices such as staff participation and involvement in school affairs and positive interpersonal relationship existing between school staff and head teachers for attainment of intended school goals.

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## **PLATE TECTONICS “INTEGRATIVE CONCEPT” IN THE MOROCCAN CURRICULUM OF SECONDARY SCHOOLS**

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**ABSTRACT:** Teaching earth sciences is particularly delicate and apparently problematic, however, it's a domain for which the expectations of all the actors of the Moroccan pedagogic community should be strong and immense, especially if we take into consideration the wide surface of the country called "The Paradise of the Geologist". Morocco has rich immense geologic zones and sites. This country is characterized by its great scientific and economic importance, and its diverse natural resources, which means that it's a rich site in terms of natural pedagogic materials. Yet, it's a scientific domain in which knowledge and paradigms change quickly, especially with the modern techniques used in the fields of study regarding the possible solutions of scientific problems that have a geological order. All these necessitate a permanent revision and reconstruction of the curriculum which influences the conceptions and values that these official pedagogical documents may convey in an explicit or implicit way. In this research, we analyse the evolution of programs, dealing with the themes linked to the tectonic plaques -integrating concept-, starting from 1967 till today. The objective of this analysis is to identify the approaches with which the programs treat the topics of geology in secondary school, and to know the conceptions and implicit and explicit values which structure the choices made by these official curricula.

**Key words:** Earth Sciences, plate tectonics, conceptions, curricula.

### **INTRODUCTION**

Geology is deemed a difficult discipline, rejected and abhorred by learners (G. Gohou 2001; J. & N. Dodick Orion 2003), and its teaching in Morocco seems to be problematic for both Moroccan learners and teachers. It seems that learners are not sufficiently interested in this discipline and rarely directed towards the jobs available in this field of study. Besides, didactic works concerned with the teaching and learning of geology are rare compared to the teaching of other experimental scientific disciplines such as physics and biology. Albeit our country is named "The Paradise of Geologists" and is characterized by a large area that is rich in huge outcrops and geological sites of great scientific importance and natural resources, teaching geology does not take an important place in the secondary curriculum.

The choice of our study focus has been well motivated by the fact that the course of geology and concepts of earth sciences are among the most difficult scientific aspects learners learn, given the relationship that discipline has with the time and space. In geology class, it is difficult or almost impossible to conduct experiments in their real dimensions, we can achieve that level of mini kits on very specific time scales, which requires more caution when interpreting the results of these experiments, while emphasizing the spatial and temporal conditions that are different from reality. Thus, simplification of experimental models requires strict criticism of the realized projections. The earth sciences are distinguished from the life sciences with all these features that can be incredibly an obstacle in teaching and learning, and make the best approaches for treating geological concepts, chosen by the program and curricula makers.

For all these reasons, we considered important to investigate for the underlying roots of the difficulties encountered in the teaching and the learning of earth science in Morocco. We'll investigate at one aspect of the problem related to program content. It deals with the evolution of teaching about concepts and geological phenomena that have a relation with plate tectonics "integrative concept", from 1967 until today. It aims to identify approaches with which the programs address the topics of geology in high school.

## OBJECTIVES AND RESEARCH QUESTIONS

The objective of this research is to analyze the contents of the programs of earth sciences, to assess development in the concept of plate tectonics, and identify approaches in dealing with concepts and geological phenomena from the program.

Our research questions were formulated as follows:

1. What is the emphasis on geology in the Live and Earth Sciences (L.E.S) programs especially that they respond appropriately to the aspirations and ambitions of the actors of the educational community, and they keep pace with increases experienced by science of the earth, particularly the concept of plate tectonics?
2. What are the pedagogical approaches used in teaching geology concepts, such as "plate tectonics»?
3. In terms of external didactic transposition, what are the obstacles we can identify in the teaching of concepts and geological phenomena associated with plate tectonics?

## METHODOLOGY

In this study, we conducted a diachronic analysis of the evolution of official programs for teaching integrative of the concept "tectonic plates" since 1967 to today. To trace the history of the construction and teaching of integrative concept of "the plate tectonics" in high school, we gathered various existing official programs for the teaching of earth sciences that have made our analysis corpus.

Our corpus of analysis consists of official documents (teaching guidelines that have been called official instructions) dating from 1967 to the present. We believe this is a date that corresponds to a sufficient period (30 years) before the introduction of plate tectonics. We will focus our analysis on the geological concepts and notions relating to the internal geology and that has a material relationship with the plate tectonics.

All official texts available to us are operated by a semantic analysis to determine the approaches of education of the plate tectonics "integrative concept" in a given program. The gap between scientific advances and their introduction into the teaching will also be evaluated. We will not limit ourselves only to the analysis of the evolution of scientific knowledge, but we will try to identify the different factors that promote or inhibit and block the introduction of certain themes in school curricula, and for this we measured the Time of the Didactic Transposition (DTD Quessada & Clement, 2005a).

## RESULTS AND ANALYSIS

The preliminary analysis of our documents indicates the existence of two periods: before and after introduction of the concept.

**Table 1.** Board of Teaching About Plate Tectonics in The Programs of Natural Science (Sciences of Life and Earth From 1967 To 2007)

Year of Program publication	Teaching level (Age)	Keywords of the school curriculum	Approaches used in the program
1967	Level 9 (15-16 years)	Igneous and metamorphic rocks Geological history of Morocco Petrographic and tectonic concepts	Descriptive
1971	Level 7 (13-14 years) Level 9 (15-16 years)	Volcanism, volcanic rocks Moroccan rocks: basalt, granite ... Petrographic and tectonic concepts	Descriptive analytic
1974 1976	Level 8 (14- 15 years) Level 10, experimental sciences (16- 17 years)	Volcanism, volcanic rocks Moroccan rocks: basalt, granite ... Petrographic and tectonic concepts Crystalline state, minerals, crystals	Descriptive analytic
1979	Level 8 (14- 15 years) Level 10, experimental sciences (16- 17 years)	Volcanism, granite, Magma Structure of the earth, study of Earthquakes. Notions of endogenous and metamorphic rocks Tectonic Concepts	Descriptive analytic
1984	Level 8 (14- 15 years) Level 10, experimental sciences (16- 17 years)	Crystalline state, minerals, crystals Volcanism, granite, Magma Structure of the earth, study of Earthquakes. Notions of endogenous and metamorphic rocks	Descriptive analytic



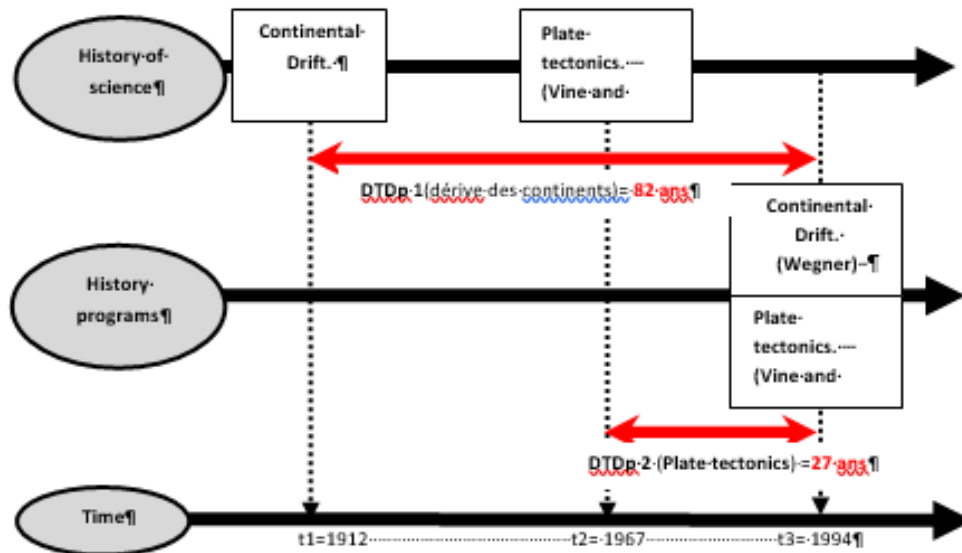
1995	Level 9 (15- 16 years) Level 10, experimental sciences (16- 17 years)	Tectonic Concepts Internal geological phenomena Magmatism, volcanic and plutonic rocks Tectonic deformations Metamorphism Intraplate volcanism Plate tectonics.	Explanatory deductive Synthetic
2007	Level 8 (14- 15 years) Level 12, experimental sciences (18- 19 years)	Internal geological phenomena Magmatism, volcanic and plutonic rocks Tectonic deformations Metamorphism Plate tectonics.	Explanatory deductive Synthetic systemic

**A- The analysis of the first part program: before the introduction of plate tectonics :( 1967 to 1995)**

The analysis of the Moroccan program of geological education in high school, before the introduction of integrative concept "tectonic plates" (the first part: from 1967 until 1994), showed that the taught content has remained generally stable, and has not suffered any major changes in broad outline (see Table 1). The approach often used, whose knowledge is divided into parts, is purely analytical and remains without significance for the learner, and it is very difficult to learn, and may not engage properly taught knowledge in given situations. We conclude that while the program and curricula makers neglect the relationships between the different elements of the taught geological phenomena, and this can be justified by the absence of an inclusive concept which can give a global vision and a deeper understanding of the taught concepts.

**B- The analysis of the second part program: after the introduction of plate tectonics: (1995 to 2007)**

The introduction of tectonic plates has helped programs and curricula makers offer a systemic approach; it helps bring the relationship between the different elements of geological phenomena that have internal identifying reactions. This approach gives importance to the overall vision in the study of phenomena, and allows the study of several variants at the same time, with simple models to use even when they are often inaccurate. The concept of plate tectonics is introduced for the first time in the 1994 program, integrating concept is discussed in detail in the programs of two successive levels of education, the 9th level and the 10 level in the high school.



**Figure 1.** The Period Of Didactic Transposition Of Curricula (Dtdp), The Dtdp1 For The Concept Of Continental Drift, And Dtdp2 For The Inclusive Concept Of Plate Tectonics.

The didactic transposition of scientific concepts in official texts of school curricula is an important step, we studied the use of the concept of DTDs historical curricula, measuring the DTPP (within didactic transposition programs) for two geological concepts that are "the drifting of continents" and "the plate tectonics" (fig 1). We notice when there is a wide variation of DTDP for the two examples studied, it reflects that there are other influences that the development of scientific knowledge on program renewal.

The analysis of the history of science shows that the tectonic theory was developed between 1960 and 1967 to 1968. In 1970, the model of plate tectonics was developed, and the different actors of the scientific community were beginning to consider its significance and implications in all the earth sciences, which is why she is considered in the field of education, as integrator concept. Indeed, in sciences, nothing is constant, everything changes, and there are always confirmations and changes. At this level, we note that the new curricula of 2007 has not taken into consideration these confirmations and changes made during 37 years of its existence, which could enrich the content of curricula and textbooks, especially as these amendments are linked the development of modern techniques used in field studies and resolution of scientific geological problems. Unfortunately, the programs only sustained transfers of the taught content from one level of education to another.

## **DISCUSSION AND CONCLUSION**

The analysis program allowed us to distinguish two periods in the content of programs related to the integrative concept of plate tectonics.

- The first period from 1967 to 1994, where the taught content has remained broadly stable in outline until the introduction of the theory of plate tectonics, currently considered integrating concept. In this period the school institution was awaiting the stability of academic knowledge related to continental drift and plate tectonics, and building consensus among members of the scientific community, before its introduction into the school curriculum. We see then that the scientific community does not introduce knowledge that is still debated among scientists.

- The second period from 1994 until today where the concept of plate tectonics is introduced for the first time in the 1994 program, knowing that this concept has been constructed and accepted by the scientific community in 1968. The programs have undergone, significant changes, but are still insufficient. The model of the tectonic theory has not only provided some explanations for understanding the dynamics, function and history of the earth, but has also indirectly unified the way and built several areas of study of Earth sciences as petrology, volcanology, sedimentology, paleontology, stratigraphy, and tectonics and gave rise to new sciences such as geodesy, geostatistics, geophysics and geochemistry (Gohau 1990). And until now, the educational system has not yet decided to introduce these new especially applied sciences, and could make knowledge to be too meaningful to the learner and the teacher.

The decision to introduce new geological knowledge in education depends on many factors related to the actors of the educational institution and the balance of power between institutions: ministries, inspection, universities and research institutions, associations and group pressures.

We note that the results generated from this research, urges us as a researcher in science education, to ask questions about the inclusion of the results of such research in the revisions and changes in programs, and think about editing textbooks just for this subject like the case of disciplines: history and geography HG and PC physics and chemistry whose each discipline is taught by a single teacher, but has two independent books) to give the opportunity to those who specialize in geology and its teaching to offer programs and edit textbook that adequately meet the aspirations and ambitions of the actors of the educational community.

We note also that until now, there has been no introduction of a historical approach in teaching subjects related to tectonic plates, which will give a coherent view of science and technology and their joint development. An approach has to present scientific knowledge as a progressive human construction and not as a set of revealed truths, and clarify with examples the reciprocal nature of the interactions between science and technology (Savatton 2011).

On the other hand, the analysis programs do not have the applied economic interest and the model of tectonic plates. At this level, programs should provide examples that will show that the model of plate tectonics provides an understanding of the conditions of existence of exploitable resources (oil and gas fields located in a passive margin basin.)

This work has allowed us to demonstrate that the old programs studying the geology of local areas near schools, examples of the geological regions and Moroccan rocks, the economic interest of the rocks, which will motivate learners and their teachers, for the new programs have really neglected this aspect of great interest, especially that Morocco is a rich country in terms of geologic, scientific and economic views. The results of this research would merit serious reflections on the part of the ionosphere: program and curricula makers, scientists, didactic researchers and the main actors of the educational system. The marginalization of this science by the Moroccan curriculum must indeed be questioned!

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## CHALLENGES OF 4<sup>th</sup>-YEAR MIDDLE-SCHOOL STUDENTS IN THE PROCESS OF MATHEMATICAL MODELING: SUMMER JOB PROBLEM

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**ABSTRACT:** The purpose of this qualitative study is to examine mathematical modeling processes of 4<sup>th</sup> year middle school students while working on a model eliciting activity, *the Summer Job Problem*, and to determine the difficulties encountered in the processes. This research was conducted in a middle school in a small county of a large city along the Black Sea Region of Turkey. Participants were 4<sup>th</sup> year middle school students in a state school. After a six-week preliminary study implemented on 24 students who had not experienced modeling before, the criterion sampling method was used to select three students that would be recruited into the focus group. The focus group was asked to work on the model eliciting activity of the *Summer Job Problem* and the entire process was recorded on video. A written transcript was made of the video recording, after which the recording and the students' worksheets were analyzed using the modeling cycle. The results of the study revealed that students expressed their ideas through discussions with students in the process, developed different assumptions and they appropriately could do mathematical calculations. On the other hand, students had difficulties (a) to interpret the data tables, (b) to identifying the variable of intensity, (c) use the main factors at the data tables and develop assumptions which includes these main factors, (d) justify the developed model.

**Key words:** Model Eliciting Activity, Mathematical Modeling, Summer Job Problem, Middle School Students

### INTRODUCTION

The problems we face in the world become more complex considering the innovations and spread of technology. Especially educators in different disciplines emphasize that success only in school is not enough and it is important to train students who are able to overcome problem situations that include complex systems in order to achieve success beyond school (Lesh & Doerr, 2003). One of the things that can be used for this is mathematical modeling which includes model creation, analysis and correction (Lesh & Zawojewski, 2007; Romberg, Carpenter, & Kwako, 2005). NCTM's book "Principles and Standards for School Mathematics" (2000) emphasizes the need for the approach of modeling and that students should utilize mathematical models to show and understand numerical relationships from the pre-school period to the final year of high school. Mathematical modeling takes part in the school curricula starting from elementary school in various countries including Germany, the United States, Australia, the United Kingdom, Sweden and the Netherlands (Ng & Lee, 2015). Considering the updated middle school (5-8th grades) (MEB, 2013) mathematics curriculum, it may be seen that it encourages the improvement of the problem-solving capabilities of the students while promoting conceptual learning, being confident in operations and communicating with their mathematical knowledge. While focusing especially on problem-solving skills, it "approaches learning as an active process, emphasizes the need for students to take part in the learning process as active participants, and therefore projects that students will become subjects of their own learning process" (MEB, 2013). In this context, class environments where students can conduct investigations and questioning, establish communication, think critically, develop reasoning, share their opinions easily and present different solution methods should be established. In order to establish such learning environments, open-ended questions and activities that provide autonomy to students should be utilized and students should be provided with opportunities to study mathematics. The previous statement clearly describes how and in what kind of environment students are expected to solve problems. The curriculum emphasizes the need for the establishment of environments that make it possible for students to solve problems, develop different ways of representation of concepts and the relationships among these, discover mathematical relationships and improve their communication and reasoning skills. Therefore, in this study, modeling processes of 4<sup>th</sup> grade students were investigated with the help of model eliciting activities which include complex real-life situations, and the parts where the students experienced difficulties were determined.

When the national literature is reviewed, it is seen that the research on model eliciting activities is rare, but increasingly popular (Doruk and Umay, 2011; Delice and Kertil, 2015; Eraslan and Kant, 2015; Kal, 2011; Sandalcı, 2013; Şahin and Eraslan, 2016; Şahin and Eraslan, 2015; Şahin, 2014; Tekin-Dede and Bukova-Güzel,

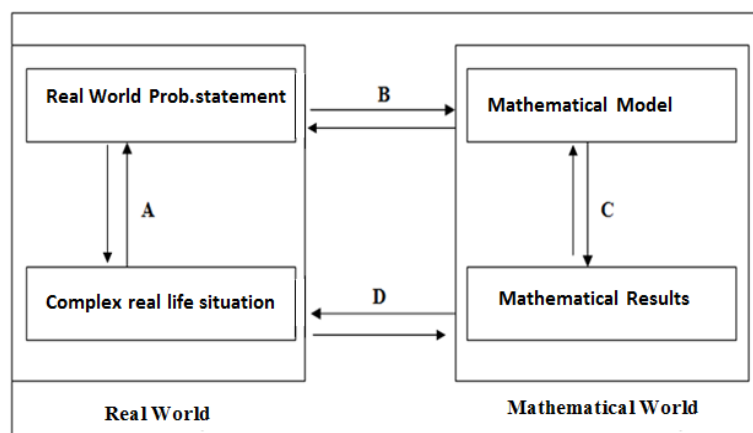
2013; Tekin-Dede and Yılmaz, 2015). Due to the limited amount of research on the stages where students experience difficulties in the solution processes of model eliciting activities, the most general research question was determined as “what are the difficulties 4th-year middle school students face in processes of mathematical model eliciting?” in the light of the information in the literature, and the secondary issues were determined as the following in the data collection and analysis process:

1. Which thought processes 4th-year middle school students use during the activity of mathematical model eliciting?
2. Which difficulties 4th-year middle school students face in processes of mathematical model eliciting?

**Theoretical Framework**

*Modeling*, according to Lesh and Doerr (2003), is the act of organizing, coordinating, systematizing and ordering problem situations in the mind and finding a pattern, and eliciting models by using different schemes in the mind, in the process of interpreting (defining, explaining or establishing) events and problems. *Models* are conceptual systems that take part in equations, diagrams, software or other materialized representative media held in mind or applied in practice by students or problem-solvers (Lesh & Doerr, 2003). *Mathematical modeling* in this framework is the process of expressing a mathematical or non-mathematical real life situation in terms of mathematics, and it is a systematic process which includes various metacognitive activities such as analysis, synthesis and interpretation (Swetz & Hartzler, 1991). Lesh and Doerr (2003) defined mathematical modeling as a stage of model eliciting or a process that takes place during activities of model eliciting. Therefore, in the most general sense, *Model Eliciting Activities* are not general problems that are solved with a number or word at the end, but are problem situations that contain possible different solutions, which represent non-routine/complex real life situations, require individuals to mathematically interpret this situation, and describe or formulate the process of method mathematically, in order to help individuals who will benefit from this issue make decisions (Mousoulides, 2007; Lesh & Zawojewsky, 2007; Eraslan, 2011).

English and Lesh (2003) emphasized that the most important thing in modeling problems, as opposed to traditional problems, is not only reaching a goal, but the information that allows expression of the purpose and the possible steps of the solution. Lesh and Doerr (2003) stated that modeling problems are activities where students improve their research and discovery skills which contain transformation of real life problems into mathematics problems, planning how these problems are solved and ideas are developed, and making decisions on whether the ideas need revision or scope expansion and whether the ideas satisfy the conditions and assumptions given in the problem. Students spend most of their times developing various ways to think about relevant relationships, structures, systems and information. In this case, they actually change or transform their own characteristic ways of thinking regarding the data during the activity (Lesh & Doerr, 2003). In this study, in order to successfully explain students’ ways of thinking during model eliciting activities, OECD (2013) mathematization process and the modeling cycle by Blum (1996) were used together.



**Figure 1.** Modeling Cycle

They explained the cognitive processes that take place while transitioning between the steps on the modeling process above as the following: *A: In transition from the complex real life situation to the Real-world problem statement:* it is aimed to understand, simplify and make simplified assumptions about the *problem* and interpret the context. *B: In transition from the Real-world problem statement to the mathematical model:* team members are expected to determine the variables to be contained in the algebraic model, create a symbolic formula and form

hypotheses that are related to the simplified assumptions they made in the process of understanding the problem. *C: In transition from the mathematical model to the mathematical results:* they are expected to apply the suitable symbolic formula and decide on the suitable mathematical operations, use mathematical tables for computation and obtain mathematical results that allow interpretation of the solutions. *D: In transition from the mathematical results to the complex real life situation:* it is aimed that the process comes back to the point it started, meaning, what is given and what is requested are compared, mathematical outputs are interpreted, the conclusion is approved and reported if the results are satisfactory, and the process is repeated if they are not.

## METHOD

This is a qualitative study which aims to analyze model eliciting processes of 4<sup>th</sup> year middle school students, and determine and explain the reasons for the problems that may arise, if there are any. The study was designed as a case study, which is described as thoroughly investigating and analyzing a group or an event. The case approached in this study is to determine the mathematical modeling processes of three 4<sup>th</sup> year middle school students regarding the *Summer Job Problem*.

### Study Group

This study was implemented at a state school with low socio-economic level in a small district of a metropolitan city in the Black Sea Region. The implementation was made at a 4<sup>th</sup> grade middle school class with twenty students. Firstly, before the main study, groups of three or four students were given a different model eliciting activity to work on every week for six weeks. While the researcher took an active role in this preliminary study as an implementer-teacher in the class who operated activities in person, the teacher of the class did not intervene. At the end of six weeks, the focus group of three students to be included in the main study was established using the *criterion sampling* technique, which is in scope of the method of *purposive sampling*. The following criteria were used to establish the group: the students were (a) able to work together in harmony during the six weeks, (b) talkative, self-confident and able to freely express thoughts, (c) academically successful.

### Data Collection Tools

Following the six-week preliminary study which featured different model eliciting activities in the literature, the *Summer Job Problem* model eliciting activity was implemented with the group chosen from the class by the method of *purposive sampling*. The *Summer Job Problem* was adapted to Turkish from Johnson and Lesh's (2003) study. The *Summer Job Problem* is a model eliciting activity that allows students to use their skills of interpreting mathematical and scientific information presented in the form of text and diagrams; reading data tables; analyzing and representing data; forming hypotheses on these, preparing a written report on the analyzed data; being able to work in groups and share the solutions reached at the end of the work (Johnson and Lesh, 2003). The focus group implementation which lasted a total of 90 minutes was video-taped; the data were sorted out, and analyzed qualitatively along the students' work-sheets.

### Data Analysis

The mathematical ideas developed and written responses presented by the 4<sup>th</sup> grade middle school students in the study during the solution of the *Summer Job Problem* were analyzed using the method of *descriptive analysis*. Descriptive analysis consists of the stages of: (a) establishing a framework for descriptive analysis, (b) processing the data based on the thematic framework, (c) describing the findings, and (d) interpreting the findings (Yıldırım and Şimşek, 2011). Therefore, the thought processes of the 4<sup>th</sup> grade middle school students in the focus group interview on model eliciting activities were analyzed using the modeling cycle adapted by the researchers (figure 1).

## FINDINGS

The three students in the focus group were given the pseudonyms Sila, Nur and Veli, while this section provides the discussion examples that reflect the difficulties they experienced in the processes.

### A: Complex Real Life Situation Real World Problem Statement

While students are transitioning from the complex real life situation to the real-world problem statement, they are expected to understand the problem, simplify it, come up with simplified assumptions and interpret contexts. The following discussion reflects the difficulty the students faced in this stage:

Sıla: *is it the amount of things she sold, I do not get it*

Nur: *look, I found it, let me explain the table. Gizem, for example, sold this much in a day or a month or whatever when she was busy or earned this much money*

Sıla: *but look, Merve sold 34 of the goods when not busy and earned 765 TL of money*

Nur: *Sıla, these are not goods (products)*

Sıla: *Oh. How? But it says busy time. Where did it say it?*

Nur: *look, it is based on hours and months*

Sıla: *it says hours and months here, says very low average. I do not get if the hours fell behind*

According to the discussion above, Sıla thought of the working duration as the “quantity of goods” while Nur stated that it was not the quantity of goods, but number of hours. This shows that the students found it difficult to understand the working times table they were given. It is seen that the students were not able to thoroughly interpret the real-life situation and they could not “understand” that the hours in the table were the totals of the amounts workers spent working in different times.

## **B: Real World Problem Statement** → **Mathematical Model**

While group members are transitioning from the real-world problem statement to the mathematical model, they are expected to determine the variables to be included in the algebraic model, create a symbolic formula and form hypotheses based on the simplified assumptions they made during the process of understanding the problems. The students formed the following hypotheses in this stage.

Veli: *now, for me, the time is not important. I think the ones earning the highest amount of money should be the best*

Nur: *but what is expected of us?*

Sıla: *but Veli, it is based on the time they work*

Veli: *we are going to find the best 3 employees*

Sıla: *Veli, they earn based on the time they work. So, one earns 300 million working for 1 hour, another earns 300 million working for half an hour. Which one?*

Veli: *okay, I think we will find both the one who brings and the one earns the highest amount of money*

Sıla: *we will also find the one who brings the highest amount of money in the shortest time.*

According to the text above, two different approaches were used in determining the main variable. The first hypothesis was Veli’s “time is not important, the one who brings the highest amount of money should be the best”, and the other one was Sıla’s “when it is low, the one who brings the highest amount of money in the shortest time should be the best.” In this case, it is seen that the students used variables of *being busy* and *working time* interchangeably. It is seen that Sıla’s proposal used the statements of *being less busy* and *short time* interchangeably. However, Sıla’s approach was still more comprehensive than the first one as it contained both variables. Upon Sıla’s proposal, they decided to calculate the *average monthly amount of money earned* as the following:

Sıla: *let us try to find it*

Nur: *we just had to understand the table*

Veli: *it seems the man did not want to do anything in August*

Nur: *now, I am saying it, what are you doing now?*

Sıla: *let us do this part first. 474*

Nur: *474 874 406 (Ali’s earnings in June)*

Sıla: *equals, divided by 3, equals 584. Let us not include the decimals, ‘kuruş’ (currency subunit) is not important. This is all June*

Nur: *there may be a problem later*

Sıla: *let us look at Ahmet. 1047 plus*

Sıla: *but we will find both the one who works full-time and the one who works part-time*

Nur: *and not everyone here has the same working hours*

Veli: *but, is it working hours?*

Nur: *yes, it is the hours worked*

The discussion above shows that while students did not “understand the question”, they tried to make sense of it through a set of mathematical operations. Sıla calculated the average money earned that she calculated for the worker *Gizem* in the month of June, for *Ali* this time. At this moment, they preferred to exclude the decimals of results and round them into integers. While the calculations made below contained the sub-variables of *June, July*

and August, the students acted in compliance with Sila's proposal to firstly find the averages of the data with *high*, *medium* and *low* density in steps, and then find the average of the three months.

### C: Mathematical Model → Mathematical Results

In the stage of transition from the mathematical model to the mathematical results, students are expected to implement the suitable symbolic formula and decide on the suitable mathematical operations, use mathematical tables for calculation and obtain mathematical results that will allow interpretation of the solutions. The decision on the number of people they needed to choose as part-time and full-time and the calculations regarding these were discussed by the group members like the following:

Veli: now, how many groups will this be?

Nur: three

Veli: seriously, three groups

Nur: not

Sila: we will divide it into three groups

Nur: but 6 people will work on the thing

Sila: 3 people part-time, 3 people full-time, and the rest will be excluded

Veli: no, three people part-time

Nur: look a little, three full-time, three part-time... oh, correct

Veli: did you get it, Nur?

Nur: we do not need three of them. No need for three

Sila: alright, we will divide them into three groups and dismiss the remaining three. They are the surplus. There is one left. I can make the histogram or you do it

The students stated that they need to divide the workers into three groups by focusing on the presumption that they should choose the one with the highest earnings in the shortest time. These three groups were part-time workers, full-time workers and workers who would not work. As a result of discussions, while they agreed on using a *scoring system* to determine the workers, they faced difficulties in the necessary calculations. As a result, they combined the three months by taking the averages of the averages they previously found for the months of June, July and August. The students, who preferred to simplify their data by reducing the number of variables, determined the group gaps among the average earnings of the workers and their magnitudes. The students noticed that they had a miscalculation after they divided the workers into three groups, but they were only able to confirm the calculation of the average working time in three months. Later on, they tried to develop a scoring scheme to analyze both types of data (average earnings and working time). Their discussion at that moment was the following:

Sila: look, now, one point each, one point. I will allocate the highest points to the ones in the first group

Veli: give highest points to these?

Sila: it will be three, two, one, and we will add these

Veli: why?

Nur: these are the ones who worked the least

Sila: there are 3 points, 2 points, 1 point. Let us add these. How many points does Ahmet have? 1 point from here, 2 points from here.

Veli: 4

Sila: addition of two and one makes four?

Veli: three, three

Sila: Gizem has 1 point from here and 1 point from there. Gizem equals 2. Gizem has 2 points. Selim has 1 point here and 1 point there. Selim also has 2 points. Zeynep has 2 points from here and 3 points from here. Zeynep equals 5

Veli: this scoring system has good mathematics. I am glad I found a scoring system

As seen from the discussion above, contrary to the presumption of "choosing the one with the highest earnings in the shortest time" that the students had agreed before, they gave three points to both the workers who worked the longest hours and the ones who earned the most, while reducing the points for others, resulting in a *scoring system* which also includes 2 points and 1 point.



**D: Mathematical Results** → **Complex Real Life Situation**

Among the three groups established in this stage, while assigning scores to the groups in the working times table, the students disagreed the most on the group to assign the highest score (3 points). Sila suggested assigning 3 points to the ones who worked the least, while Veli suggested assigning 3 points to the ones who worked the most; they discussed the issue as the following:

***Veli:** just a second, look at this, there should not be confusion*

***Nur:** the shortest time*

***Veli:** just a second, why so? I am telling you, let us give higher scores to ones who work the most. They will work full-time. They should be the ones who work the most*

***Nur:** but the one who makes the most in the shortest time makes more profit*

***Veli:** but how will they work full-time? They should earn the most by working the longest*

***Nur:** not the longest, but the shortest*

***Veli:** but look, one will be part-time and the other will be full-time, is it not about that?*

***Nur:** look, we are saying...*

***Veli:** okay, go on*

***Nur:** who would be more advantaged? Someone who writes the longest in the shortest time, or the longest time?*

***Sıla:** Veli, now there is Ayşe and Ahmet. One day, Ayşe...*

The quotes above show that the students discussed by presenting two different approaches while assigning scores to working times. While Sila and Nur suggest assigning 3 points to ones who work for the “shortest times”, Veli suggests assigning 3 points to the ones who work for the “longest times” as full-time workers should be the ones who work the most. However, later on, Veli is not insistent on his opinion and conforms to the decision of other group members. Then, the issue of creating different models for selecting part-time and full-time workers was discussed by the group members as the following:

***Veli:** okay, okay. I get what you are saying, but I was talking about a different thing. I was talking about full-time*

***Sıla:** Veli was talking about full-time, but we cannot find part-time if we do this thing for full-time*

***Nur:** but it becomes meaningless here, look, the method we found is different*

***Sıla:** so, if we do the full-time, part-time...*

***Veli:** I get what you are saying, I get it. What I was saying was...*

The discussion above shows that the students thought they should sue different methods to determine the workers who would work full-time and part-time. However, it is seen that they accepted the previous assumption instead of creating a new model or symbolic formula. In other words, it was observed that the students saw the limitations and insufficiencies of the model they created by questioning it, but they did not create a new model by going back to the process of model eliciting. Later, they created a table by giving 3 point to the group with the least amount of working time. According to this table, the students determined that 5-point workers were full-time workers and 3-point workers were ones that would not work. However, they found it difficult to determine the third worker to work full-time, as well as workers who would work part-time. Later on, Veli gave the paper to the others and asked them to decide. Nur took the paper and decided on the workers as a result of the discussion with her peers:

***Veli:** you find this last thing, I could not find it. I cannot comment*

***Nur:** stop, stop. Let me take these 5-point ones for at least a minute*

***Veli:** never mind it, find this other side*

***Nur:** the one you and I made will be different. Is Fatih not the last one? Fatih, the 4-point ones... Where is Selim? This will be the last one. Who is before Selim? Gizem. This one also gone*

***Veli:** go down starting with high scores*

***Nur:** keep quiet a little, Veli. You should have done it, then. Gizem, Ahmet. This will come before, and this one after. Then other 4-point ones...*

***Nur:** Selim. Why did you put down Ayhan? Ayhan does not have 4 points. Why did you write his name to the top? Look, it is the last one from the start. You got it right. Ayhan, Selim, Gizem. It is done*

The quotes above show that Nur determined the workers who would work only by looking at the tables, without developing any strategy. In other words, it is seen that the students were not able to interpret the situation they encountered by going back to the complex real life situation while deciding on workers with the same score, improve their models by forming new assumptions, or create alternative models. The group members approved

the result without any discussions after determining the workers as in the process above, and completed this activity by creating a written report.

## CONCLUSION

The results obtained from the groups during the model eliciting process show that 4<sup>th</sup> grade middle school students face some difficulties in the process of mathematical model eliciting. In the *transition stage from the complex real life situation to the real-world problem statement*, the students found it difficult to make sense of the variables in the problem and tried to understand the problem over one variable by simplifying the data. In this stage, the students experienced difficulties in the stage of understanding the problems as reported in the studies Blum and Leiß (2007) and Sol et al. (2011). The students especially had difficulties in making sense of the concept of being busy and the relationship between the money earned and the hours worked. In order to overcome this difficulty, the students tried to understand the problem by repeatedly re-reading the problem and the data table. A set of mathematical relationships were sought among the data and simplified assumptions were formed regarding the criteria to be analyzed collectively.

In the next stage of *transitioning from the real-world problem statement to the mathematical model*, the students had difficulty in developing a model by approaching all variables comprehensively and determine the main variable. As also reported in the studies of Blum and Leiß (2007) and Schapp et al. (2011), this situation shows that the students were not able to use or relate all variables. Hypotheses were related to real life and the ones that were not found relevant were not accepted as true. As in Kaiser's (2007) and Blum and Leiß's (2007) studies, the students experienced difficulties in establishing a suitable model and structuring that model.

In the stage of *transitioning from the mathematical model to the mathematical results*, the group members made various mathematical calculations on the models they created. They noticed the operation mistakes they made, related their results to real life, and dismissed their operations and hypotheses in cases where those were found unrealistic. The students found it difficult to use the given variables together, and they obtained mathematical solutions which represented the real-life situation by mathematical calculation towards discovering the relationships among the components of the given variables. Because they experienced difficulty in using the data collectively, they determined a scoring scheme as an analysis criterion by simplifying the data. The students, regarding the difficulty in grouping the workers based on this criterion, developed an unsystematic solution and completed the process. This may be caused by the students' desire to reach a solution quickly, without spending a sufficient amount of time to understand and analyze the problem (Blum and Ferri, 2009).

In the stage of *transition from the mathematical results to the complex real life situation*, the group members did not choose to check or question whether the established groups are correct or not. This situation is in parallel with Kaiser's (2007) and Galbraith and Stillman's (2006) results that students find it difficult to interpret the mathematical results they obtained for real life. The group members chose to accept the solution as it is, without reviewing the model. This approach shows that, in similarity to Maaß's (2007) study, the students were not aware that the model's validity needed to be established.

Consequently, during the modeling process, the group members experienced difficulties in understanding the problem to develop models suitable for the real-life situation, discovering the relationships among the components of the qualitative variable, relating all variables to each other, forming hypotheses suitable for the data, creating the suitable model based on these hypotheses, and establishing a connection between real life and mathematics by establishing the validity of the model. One reason for this may be the effects on the modeling process by personal characteristics of the group members such as habits based on previous experiences that shape their ways of mathematical thinking, attitudes towards mathematics, and creative thinking skills (Chamberlin, 2004; Ferri, 2011). Additionally, students' expectations from the activity and whether they find the activity interesting or not, are shown among the factors that affect this process (Schoenfeld, 1992). When the work of the students during modeling activities was analyzed, it was observed that mathematical modeling activities have a very strong aspect which contributes to students' communication skills and provides opportunities for them to improve these aspects of theirs. When modeling activities are implemented in the form of team work, students show behaviors in the form of asking critical questions, expressing, defending and proving opinions, and persuading their peers (Zawojewski, Lesh and English, 2003). Additionally, when students express their ideas during the solution of the problem, they actually take part in a different activity which gradually assesses their own ways of thinking.

## RECOMMENDATIONS

It is seen that a modeling approach is adapted for the *Mathematical Applications* course put in place in 2012, and similarly structured activities are covered to achieve the modeling activities of the course. However, it is seen in the results of the conducted research that these activities and the course itself fall short of the expectations. This situation shows the necessity of in-service training for teachers who are the implementers of this program towards the purposes, outcomes and necessity of model eliciting activities. Moreover, inclusion of mathematical modeling skills among basic skills in the primary school (1-4<sup>th</sup> grades) mathematics curriculum necessitates the expansion of mathematical modeling classes in teacher training programs to also include primary school teachers.

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*Section 4: Special Topics*

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## **IMPACT OF GLOBAL CAPITALISM ON NATIONAL EDUCATION “THE CASE OF TURKEY”**

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**ABSTRACT:** Globalization, which was called as colonist, capitalism, imperialism, fascism and then, developed countries in the past, may use many new methods from religious belief to economics, from using military force to psychological war, from environmental pollution to art in order to delay the building-up endeavors of developing countries by the other countries which are strong regarding economy and army and to use them in favor of their interests as much as possible during the 21<sup>st</sup> century. The firms, which are the striking power of global capitalism today, have more powerful financial structure than many countries. The target group of global companies in commerce mainly is the children and youngsters. The victims of civil wars, which are started with the plans of external powers, are also the same group. The most significant victims of chaos and starvation in the world are the children as well as the children who live well. More than 20.000 children are lost in European countries where they sought asylum escaping from civil war in our neighbor, Syria. There are significant concerns that they are escaped by the organ mafia. Despite of economic recession in the world and our neighbor, European Union (EU) countries and the security issues of region, it is seen that the long-term preparations about slowing Turkey that was developing fast and steadily resulted unsuccessfully by preventing the coup attempt. It is understood that it is tried to slow down and stop the economic and social development and progress systematically fraying and jamming the National Education System, demoralizing the teachers, guardians and students, creating the unhappy and pessimistic human societies in Turkey during the process started before 1980. In this scope, trends toward creating the conditions, which enrich the human life, are substituted with conformist trick (Küçükcan, 2002) and with the works which the global capitalism makes the national education a simple sub-sector economy (McLaren & Farahmandpur, 2001). In this article, the permanent objectives of global capitalism, and despite of them, Turkey’s economic and social development and human resources potential, and the education system will be told, and some methods, which are applied by the capitalist powers in order to use these resources against the country and so as serving their benefits, will be discussed. At the end of paper, the system’s normalization, and the measures that should be taken in order to strengthen the immunity system, which will protect the country and state from the similar attempts, will be discussed.

**Key words:** National education, global capitalism

### **LONG-TERM OBJECTIVES OF GLOBAL CAPITALISM**

Imperialism and fascism, which become the synonym of capitalism today, mean that economically less developed countries are subjected to the developed countries economically, politically and militarily. In other words, the imperialism is the system of asymmetric relations in the world economy (Brown, 1974). Imperialism shows itself by expanding the territory of a country using military and economic powers, imposing the tax by one nation or society to another nation or society, benefiting from their underground and ground resources, imposing their culture to them and using their people as slaves. Imperialism history is studied at three main phases. The first phase continued until 16<sup>th</sup> century and was related to the expansion of empires; the second phase started with the geographical discoveries and continued until 19<sup>th</sup> century; the new imperialism phase started in 1880s and led to increasing of interest in colonies again and to sharing of Asia and Africa (CE, 2016). In this scope, the human being was mostly considered as meta along with the industrial revolution. We may think the years of 2000 as the beginning of an era that the imperialism uses wilder methods and tools. This era is defined with weakening and narrowing of independent decision-making and implementing power of the less developed countries. Vladimir Lenin renewed the Marxian viewpoint and said that the capitalism turned necessarily to the monopolist capitalism in order to find the new resources and markets, namely to imperialism, and this represented the final and top phase of capitalism (Lenin, 1916). In the book, Protestant Ethic and Spirit of Capitalism, Max Weber discusses how capitalism changes the traditional economic movements. The spirit of rational activity removed the traditional limitations which prevented the capitalist change and allowed the development of modern capitalism. This spirit was gradually attributed to a legal system. It doesn’t assume the “freedom” of selling of their labor by wageworkers as a result of technology among them. Instead, the root of capitalism lies behind arising of new entrepreneurship spirit which occurs in the politic and cultural world. According to Weber, the capitalism is the most developed and complex economic system of the history of humanity. Advanced business partnerships, public credit and modern world bureaucracy are closely related to the capitalism. However, Weber explicitly says that rationalized trends of capitalism create the potential threats to the cultural values and organizations and may put the human’s freedom

to an iron cage (*stahlhartes Gehäuse*), and we may say that this prediction occurs in the education field (Weber, 1905).

As a nature of imperialism which has the global structure, it tends towards making the national education system of developing countries the sub-sector of international economic system (McLaren & Farahmandpur, 2001). According to the point of view developed by French Philosopher Michel Foucault, Leon Tikly states that the developed countries place importance on and give priority to creating the systems and resources which will serve to the management power necessary for increasing the economic power (Tikly, 2014). So, upon USA takes the position of UK that has the widest colonies of world in the world economy, other developing countries unavoidably go towards the position which will feed the USA's global power. Upon regional markets expand and the world becomes a single market, the global companies start to take place of capitalist countries in a crueler manner.

### **Economic and Social Development Targets of Turkey**

Let's briefly look at the economic and social structure and potential of Turkey that develops fast during this process based on the fundamental data and try to explain why global companies show deep interest in our country. The population in working age of Turkey that population reaches almost to 80 million is 58.134.000 according to the data of 2015. 26.856.000 out of 30.003.000 population in working age is employed. The number of unemployed person is 3.147.000 and proportionally, is 10.5%. The unemployment rate in young population is beyond the general average and is 19.3% (TUİK, 2016). Turkey, which is the 17<sup>th</sup> big economy of world with USD 718 billion GDP and 4% of GDP growing in 2015, targets to become one of first 10 countries in 2023 (World Bank, 2016)). Turkey stands at the threshold to high income today, with GNI per capita at 10,830 US dollars in 2014 (Nguyen, Taskin, & Yilmaz, 2016). World Bank defines high income economies as those with a GNI per capita of \$12,736 or more. In 2023, the 100<sup>th</sup> anniversary of establishing the Republic of Turkey, it is aimed that the population will be 82 million, national income will be USD 25.000 per capita, the export will increase from USD 155 billion to USD 500 billion and foreign trade volume will be USD 1 trillion, the employment rate will increase 10 points and working population will go beyond 30 million, and unemployment rate will decrease to 5%. As the education budget of governments is average 4.5% of GDP, it is 3% in Turkey (World Bank, 2016). Pre-school and adult educations will be provided to everybody and it will be ensured that 100% of schooling rate will be sustainable in 12-year compulsory education. In 2023, as all citizens will be covered by the National Health Insurance System, the number of physician per 100 thousand citizens will be minimum 210. It will be possible to travel with high speed trains to all big cities, and the travel between Ankara, the political capital city of Turkey and Istanbul, the economic capital city will take 1.5 hours by high speed train. More than half of 64 thousand kilometers of highway will have been dual carriageway, and one of 10 biggest ports of the world will be in Turkey. Turkey will develop its plane, satellite and defense industry, and will establish the aviation and ship building organized industry zones. Turkey will become the production and logistics center of 3 continents. Almost total 8.5 million hectares of all irrigable areas will be irrigable until 2023. As all citizens have broadband internet connection before 2023, minimum three nuclear energy plants will go into production. Today, 28.5 million persons of tourist number will reach to 50 million and tourism income to USD 50 billion annually. It will be Turkey where GAP, DAP, DOKAP and KOP regional development projects will have been completed and will have been turned to the granary, agriculture center of the world. The pluralistic and liberal constitutional order will gain strength by resolutely taking the democratizing steps, becoming the country having the most advanced democratic standards, and making the freedoms have advanced standards (KB, 2016).

### **Public, Private Sectors, Foreign Capital Investments in Turkey and Investments Abroad**

Economic magnitude of Turkey is proven with which the rate of fixed capital investments of the private sector in total GDP is 15.9%. Annual investment amount reaches to 464 billion TL. The rate of private sector in the investments is 78%. Total investment to the education sector is 70.3 billion TL and 69.3 billion TL out of it is made by the private sector.

As a result of 5<sup>th</sup> Region Incentives to the private school investments and bursary by government to the private school students, the significant increasing and acceleration begin in education investments by the private sector. 3.631 incentive certificates were issued during January-October 2015. Forecasted total fixed investment amount is 81.6 billion TL, and forecasted new employment is 110.517 people. During this period, total 31.6 billion TL of incentive certificate was issued to 185 investment projects of foreign capital (ME, 2016).

**Table 1:** Private and Public Sector Investments in Turkey (million TL), 2015

<b>Sector</b>	<b>Public Sector</b>	<b>Private Sector</b>	<b>Total</b>
<b>Mining</b>	9.575	6.288	15.863
<b>Production</b>	1.513	11.793	13.305
<b>Energy</b>	1.015	138.874	139.889
<b>Transport</b>	5.212	11.569	16.782
<b>Tourism</b>	35.343	53.764	89.107
<b>Housing</b>	787	27.241	28.028
<b>Education</b>	965	69.303	70.268
<b>Health</b>	13.807	12.563	26.370
<b>Other Services</b>	6.016	16.479	22.495
<b>Total</b>	100.954	363.039	463.993

Source: 10<sup>th</sup> Development Plan, 2014-2018

Capital inflow to the developing countries is USD 1.032 billion in 2014 (IIF, 2016). The capital inflow, which was USD 71.9 billion in 2013, was USD 42.8 billion to Turkey in 2014. Direct foreign capital inflow to the developing countries and emerging market economies was USD 534.8 billion in 2015. Net direct investment inflow to Turkey was USD 5.7 billion in 2014 and USD 9.2 billion during the first eleven months of 2015. About USD 2 billion of increasing in direct foreign capital investments by foreign residents to Turkey was effective in aforesaid growth. However, when we look at the qualities of these investments, we see that they are for consuming purpose and the profit is transferred abroad.

In 2014, the portfolio investment inflow to Turkey was USD 20.1 billion. As net USD 370 million of inflow occurred in investments of Government Securities in 2014, net USD 4.2 billion of plus occurred via securities exported by Treasury to abroad. Banks and other sectors provided USD 13.7 billion and USD 3.3 billion of capital inflows via exporting the securities to abroad in 2014. Net capital inflow was USD 16.9 billion in 2014 (KB, 2016).

### **Need for Qualified Labor Force Having Higher Global Competitiveness**

Turkey targets to train the personnel whom;

- Thinking, perceiving and problem solving capabilities are developed,
- Have the self-confidence and sense of responsibility and the entrepreneurship and innovativeness qualifications,
- Internalize the democratic values and national culture,
- Able to interpret the different cultures, and develop the personality and skills,
- Open to sharing and communication,
- Have the strong artistic and aesthetic senses, open to the scientific developments, and tend to use and production of technology,
- Meet the requirements of information society, and are productive and happy
- Convert the knowledge which they produce to the product, technology and service and share them,

with an education system, which provides the equal opportunity to each citizen that approaches to 80 million, and is quality and sensitive to the needs of society and economy (MEB, 2016). As seen from the number of student given in Table 2, the number of students in formal and informal education in Turkey is about 40 million. This capacity attracts the attention of global companies.

Human and physical infrastructure was improved in order to provide more qualified, extensive and easily accessible educational services for the purpose of creating strong society with the qualified manpower, the schooling rate increased, the number of student per classroom was minimized, and continuity of attending the education by girls and poor students was provided. The mobile teaching was strengthened, it was concentrated on in-service training of teachers, and accession to education was increased and the quality of education was improved. The schooling rate in pre-school education is 46.83% according to the data from 2014-2015 academic year. The number of student in pre-school education is 1.200.000, and gradually increases. The steps are taken in order to support the accession of houses and regions with limited possibilities. It is still struggled against the problems such as late enrolling to the primary school, higher absence rates, those, who leave the school before being graduated, and accession of children, notably the girls to the education in rural areas. The rate of girls in those, who are graduated from the primary school, is 48.5% during 2013- 2014 academic year, and the difference between the genders reduces as of the years (KB, 2016)



**Table 2.** Number of Student according to the Levels, 2014-2015

	<b>Number of Student</b>	<b>Gross Schooling Rate (%)</b>
<b>Pre-School Education</b>	1.156.000	46,8
<b>Primary School</b>	10.712.000	103,9
<b>Secondary School</b>	5.691.000	107,4
<b>Common High School</b>	2.902.000	54,8
<b>Vocational High School</b>	2.788.000	52,6
<b>Higher Education</b>	5.642.000	109,6
<b>Students of Informal Education</b>	9.908.000	-
<b>Total Number of Student</b>	38.799.000	-

**Source:** MoNE Education Statistics, 2015

In Turkey where the compulsory education is 12 years, the number of student exceeds 11 million in primary school and 6 million in secondary school. As the number of student approaches to 6 million in higher education, the number of student reaches to 10 million in informal education. Net schooling rate is 79.4% in secondary education. The regional differences tend to reduce in terms of schooling rate. Even though the rate of passing from primary education to secondary education is 94.8% throughout Turkey, upon increasing the duration of compulsory education to 12 years, the net increasing continues in passing from primary education to secondary education and thus, schooling rate in secondary education. Investments are still made in order to increase the learning environment qualities based on the principle of equal accession opportunity, restructure the teacher training and development system, ensure the efficiency in the monitoring and evaluation activities, ensure the conformity of curriculum to the knowledge and communication technologies, minimize the number of student per classroom and teacher, and to pass from dual education to full time education in the primary education. Number of student per classroom reduced below 30 and per teacher below 20 in the primary education. Number of student per classroom reduced below 30 and per teacher below 15 in the secondary education (MEB, 2016). The rate of primary school students, who attend the full-time education, is 46%, rate of secondary school students 53% and rate of high school students 82% during 2014-2015 academic year. As the importance giving to gaining of basic skills in education increases, the Project on Action of Increasing the Opportunities and Improving the Technology (FATİH), which is started in order to benefit from information technologies in education, is currently maintained. Turkish Professional and Technical Education Strategy Document and Action Plan (2014-2018), and Turkish Life-Long Learning Strategy Document and Action Plan (2014-2018) are implemented. The National Qualification System is created, and the procedures on developing the professional standards and evaluation and certification of students are currently maintained (MEB, 2016). The education is provided on 300 branches almost in 60 fields in our vocational and technical schools.

The interaction between the faculties educating the teachers and application of 12-year compulsory education is strengthened, the teachers' qualifications are considered as basis, and the core and external evaluation system is created.

Universities are available in all cities and total number of universities reaches to 185, 109 state and 76 foundation universities. In our universities, the education is provided by 150.000 faculty members to 3 million students (YÖK, 2016). Quota in higher education reached to 823.739 in 2015. The number of application to the Student Selection and Placement Test went beyond 2 million in 2014 (ÖSYM, 2016). One fourth of students, who are graduated from the high schools every year, may attend the university. For this reason, the attention is paid to improve the professional guidance services at secondary education level. There are 20 students per faculty member in the bachelor degree. As the rate of those, who have the secondary and higher education level in 25-64 age range, is 36% in Turkey, OECD average is 76%. The dormitory capacity at higher education level reaches to 900.000 and only half of demand is met (YURTKUR, 2016). As total number of international students in the world is about 4.5 million, the rate is 12% in Turkey. There were 155.000 applications to Turkish Bursaries during 2015-2016 academic year.

Turkey accepted 3 million refugees as a result of terror and civil war at its southeast border (AFAD, 2016). As Germany, etc. supports the immigration of those who are qualified among them to the EU countries, Turkey has to find solution for unemployed people who are not qualified. There is a Turkish community with 5.5 million populations abroad, 4.6 million of them in West European countries. Number of citizens, who live abroad and come back to the country, is 3 million (TDİB, 2016). There are 2 million of registered unemployed people despite of almost five million of registered employed people in Turkey (İŞKUR, 2016). 425.000 out of them are graduated from primary school and this is an important disadvantage. 352.000 persons attended the training programs organized by İŞKUR for the active labor force in order to improve the qualification of unemployed persons and to increase the opportunity to find job during January-May 2016, and 360.000 people the programs on training of

adults. The number of persons, who attend the employment-guaranteed training, is 88.000. During the same period, the job counseling was provided to 288.000 persons, and professional counseling to 9.000 persons. Average 50.000 persons are benefiting from unemployment fund monthly. On the other hand, despite of 2.043.000 vacancies taken from the employers in 2015, employment of 890.000 persons shows the qualification and wage problems as a result of 6 million interviews between employer-employee candidates. 1 million disabled, former convicted persons and terror victims look for the job. 12.000 operation staff is sought in agriculture sector.

**Table 3.** Data on Labor Force and Employment

		January-May 2016		
		Total	Men	Women
<b>Number of Application</b>	<b>Total</b>	1.293.386	792.427	500.959
	<b>Unemployed</b>	700.282	390.146	310.136
	<b>Other</b>	593.104	402.281	190.823
<b>Number of Open Vacancy</b>	<b>Total</b>	897.155	3.483	893.672
			<b>Public</b>	<b>Private</b>
<b>Number of Unemployed who Interviews with Employer</b>		2.603.436	1.759.115	844.321
		<b>Total</b>	<b>Men</b>	<b>Women</b>
<b>Number of persons who are employed</b>	<b>Total</b>			
	<b>Employed Disabled</b>	7.393	6.264	1.129
	<b>Former Convicted</b>	106	105	1
<b>Number of registered labor force</b>		4.683.187	2.853.396	1.829.791
<b>Number of registered unemployed</b>		1.956.226	1.055.089	901.137
<b>Number of persons who apply for working abroad</b>		1.283	1.090	193
<b>Number of persons, employed abroad</b>		10.112	10.072	40

Source: İŞKUR, May 2016

### Ambitions of Capitalist Countries on Education System of Developing Countries

It is found that the education system of Soviet Union was closely monitored in the report issued by USA in 1952 and education system of China in the report issued in 1969 (CES, 2016). World economy, which could not find the source for education of poor children, spent USD 2 trillion in the wars which 600.000 people died during 2001-2016 (Washington Post, 2006).

The countries, where accepted the qualified persons as migrant workers and employed them with low salaries in the non-qualified and risky jobs in the past, also went towards the qualified manpower later. At the first phase, the bursaries were granted and the educated people did not go back to their countries and worked on behalf of those countries or were used in order to expand the technology of developed country in their countries after returning. With expansion of global companies, the people of developing countries were educated in their countries, but with capitalist system and in the foreign language, and began to work in the global companies in their countries. Now, let's study how the global powers benefit from economic and social structures which we mention above under the headings below.

### Foreign Student Market

Education of foreign student, which is perceived as the assistance of developed countries to the developing countries in the past, turns to a big economic market today. Advanced transport and communication means increasing of foreign investments, developing of manners of making business together, global trade and technologic developments increase the international student volume. According to 2012 data from OECD, the magnitude of market of the student, who is educated abroad, reaches to 4.3 million of student and USD 100 billion of financial volume. According to OECD reports, it is expected that these figures will increase two folds in 2020. Turkey spends USD 1.5 billion for education abroad per year (OECD, 2016). As the students of less developed countries went to the developed countries in the past, China, Russia, South Korea, Japan and Asian countries are also preferred recently. The preference of Turkish students is the universities in UK, USA and Asian countries, especially in Malaysia due to developing position of China in recent years. About 12.000 students from Turkey, where is at 15<sup>th</sup> rank in ranking of country that sends the most student abroad, go to USA for attending the bachelor and master degrees annually, and about 15.000 students attend the language schools and other programs. About

30.000 Turkish students in UK and about 10.000 in Germany attend the bachelor and master degrees and language education annually. The number of Turkish student in the countries such as Russia and China is only about 1.000 annually, but increases fast (MD, 2015). The shares of USA, UK, Canada and Australia in the foreign student market are 60% and gradually increase (WES, 2016).

The tuition, which the students who go abroad from Turkey and attend the education pay, is about USD 20.000 annually and their other expenses are about USD 30.000. According to UNESCO reports, it is expected that the number of foreign student, which is 3.5 million in the world, 2009, would be 8 million in 2020. China, which is the country that sends the most student, 600.000 abroad in the world in 2012, plans to be the country that both accepts and sends the most student outgrowing than USA in 2020 (UNESCO, 2016).

### **External Dependence in Education Investments and Higher Value Added Sectors**

Total of annual public investments of Turkey is 65 billion TL, and the education investment budget is 11 billion TL. It is estimated that the education investment budget of private sector is 1 billion TL. Considering that annual tuition of private schools is about 20.000 TL in Turkey where there are 20 million of K12 student, there is big market for private school sector. Accelerating the adaptation of STEM (Science Technology Engineering Mathematics) approach to the system, increasing of use of technology, creating the new professions in the areas such as devices necessary for practical training and nanotechnology, health sciences, advanced material technologies, etc., establishing the education laboratories in the developed countries, preparing the education materials provide the significant economic opportunities in transport and accommodation services and create the new markets. We may see in many examples that the information technologies, biotechnology and similar advanced technologies are used by the global capital to maximize the profit, instead of increasing the happiness, welfare and confidence of people.

### **Making the Curriculum Dependent to Foreign Sources**

It is fact that upon making the education system dependent to the developed countries with curriculum and content, this was turned to an economic opportunity in the past. We see that the curriculum in education on economy evolves toward the capitalist economy and to training the human resources for global companies. Using English as a second language and in education on information and communication technologies in many countries provides the economic advantages to USA and UK. The open-sourced platforms, financed by the government, become, in fact, the customer for paid education services. Those countries provide the open education service via Open Universities to the students worldwide and issue the diploma and certificate on certain programs. Thus, they educate and gain thousands of youngsters whom they reach to hurdling the barriers such as visa, permission, bureaucracy, tax, etc. according to its system and expectation. All these reasons make our education system force to learn the foreign languages without learning our mother tongue.

### **Cultural Imperialism and Weakening of Using of Mother Tongue**

Cultural imperialism is that the those, who are strong, affect other less developed cultures, especially via mass media and assimilate them, and to facilitate the colonization. The possibilities, provided by the mass media, are used as an efficient control method in order that those, who are strong, communicate their cultural values to the people of other countries and in order to weaken their attachment to their values. Cultural imperialism performs the mission which creates the proper basis for implementing other imperialism methods, and reduces the reactions of communities to minimum. In Africa where the cultural imperialism was implemented first, pacification of local languages by the imperialist nations, forgetting the local cultures and finally, expansion of religious elements in south and at center regions of the continent as well as the armed actions attract the attention. The most important example of cultural imperialism in 20<sup>th</sup> century is the Anglo-American culture. It was observed that the communist parties in the member countries supported the Soviet's foreign policy and culture and Russian was the mother tongue of Turks during the Cold War era. So, the national education system of weak countries turns to the economic sub-sector of strong countries.

As giving importance to the education in foreign language increases gradually, it gradually decreases in mother tongue. The results from PISA Program for International Student Assessment support it (PISA, 2016). This means that our youngsters, who are our future, are defenseless against the cultural effect and wind of competitor countries. Considering the education qualities of schools, the quality school and school, providing education in foreign language, have the equal meaning.

The exams and comparisons made by OECD such as PISA and TIMSS reduce the nations' confidence to their national education systems and countries, and the youngsters of that country go abroad assuming that they would be educated better and would have more superior living standards.

### **Academic Research Fields**

It is observed that the students, who attend the postgraduate education on social and economic areas in the foreign countries, select their dissertation subjects about determining the social and ethnic structures, weaknesses and job opportunities of their countries. It is also attracted the attention that those students are directed to the academic studies in certain universities. The cultural programs, which aim to make the students "global citizens", except their academic studies, are implemented to the students. It is determined that the students, who go abroad, are exploited upon approaching under the vision of social aid.

It is ignored on which subjects the students, who are sent for postgraduate education abroad, should study, what kind of works are expected from them when come back, and there are significant weaknesses on qualification, and the scientific factors in determining the students.

### **Personalization of Society and Weakening of the Sense of Belonging**

The media channels, which attract the youngsters' interest with broadcasting and programs and realize the capitalist transition step by step, are considered as the symbols of imposing the capitalist education and culture to the world. According to Max Horkheimer and Theodor W. Adorno from Frankfurt School, the culture industry regenerates the targeted society at every level, infrastructure or superstructure and follows the legalization method. Standardizing the products of imperialist culture worldwide and rationalizing the promotion and distribution techniques are the important technique of cultural imperialism. As they asserted in their work, *Dialect of Enlightenment*, the media makes the human knock out, creates the virtual needs, and has the society perceive their cultural values as degenerate. (Horkheimer & Adorno, 1947) Media doesn't give opportunity to the society to select and analyze the cultural elements. As a result, the societies, subjected to the educational and cultural imperialism, become the devices of imperialist education and culture. It is found that the students, whom are sent abroad to be educated in the countries that are scientifically and culturally developed and to provide the science and technology of such countries to their citizens, turn, on the contrary, to the persons who give importance to their personal benefits only, become estranged to their society and country that send them abroad for education and training by granting the bursary with their scarce resources and turn to the instrument of global economy under the influence of aforesaid movements.

### **Global Brain Drain**

Considering the conditions and areas of bursaries granted by the developed countries, we see that the bursary application, which is introduced as the humanitarian aid, is, in fact, for the long-term objectives of developed countries. There are gradually increasing observations about which international competitions, open for participation of all countries, is for purpose of attracting the qualified students to the education market of developed countries. When the youngsters from countries such as China, etc. go to other countries for education purpose, they live together and when they complete their education, as they go back to their countries in order to use what they learnt for their countries, but the youngsters from other countries start to work for benefit of developed country under the influence of factors such as living conditions, etc. It is found that the educational consultancies are not sufficient and qualified in terms of academic studies and social environments in the countries where the students from Turkey go to. The countries that still accept the most foreign students are USA, UK, Australia, France, Germany and China. Even though the significant part of Turkish students go abroad with their resources, British Council, Fullbright, Campus France, DAAD, China Scholarship Council, Swedish Institute, Holland Nuffic come to the forefront as the institutions granting bursary. It is known clearly and transparently that economically developed countries select the successful and clever students and grant the bursary to them and aim that after those countries educate them well, they will not let them go back to their countries or will employ them as the qualified labor force in the foreign investments within their countries. After the students, who are not financially sufficient, but attend the education abroad with their resources in order to catch a good future and employment opportunities, are graduated, they don't leave and work in such countries in order to earn their lives or go back to their countries and are employed by the global companies of such countries and produce the value added on behalf of them.

Instead of educating the individuals who produce the knowledge by gaining the nature of knowledge via education programs, the individuals, who use the knowledge that is produced and transferred by others to the technology, and don't understand the nature of it, and follow the trendy concepts uncomprehendingly, are grown. It is observed in the area of Education Sciences that it is tried to transform the education system with the starry-eyed, empty

concepts. This causes that the resources of developing countries are exploited mostly by the companies and countries that manage the globalization

### **Sustainable Development Goals**

On the other hand, UNICEF and UNESCO determined the negative impact of globalization on the world and people in 17 items and aim to improve them until 2023 (WLL, 2016);

Goal 1. End poverty in all its forms everywhere

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture Goal 3. Ensure healthy lives and promote well-being for all at all ages

Goal 4. Ensure inclusive & equitable quality education and promote lifelong learning opportunities for all

Goal 5. Achieve gender equality and empower all women and girls

Goal 6. Ensure availability and sustainable management of water and sanitation for all

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all Goal

9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Goal 10. Reduce inequality within and among countries

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

Goal 12. Ensure sustainable consumption and production patterns

Goal 13. Take urgent action to combat climate change and its impacts\*

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

### **CONCLUSION**

In any case, the global capitalism is on the basis of win. With this understanding, all countries and people are perceived as the permanent market which they may be exploited, work with the low salaries for the global companies and may consume their products with higher prices, and it will not be let them getting strong and become competitor anyway, and will continue the consumption. Individually acting of countries and communities, prioritizing their personal gains rather than community and future, and cutting of their ties with the cultural values and beliefs facilitate the business of capitalist understanding.

After the civil war in Syria, the concrete example of this is the effort by developed countries of bringing 5 million people whom are sheltered in Turkey, Jordan and Lebanon and form 86% of all refugees to their countries sorting out the children and youngsters who are graduated from universities and are qualified, as the developed countries don't help them on education (World Bank, 2016).

Capitalism considers the education as "only economic" sector, and excludes the national and humanitarian senses from education. The men are educated in order to serve to the global companies rather than for welfares and futures of them. For this reason, the image and authority of the Ministry of National Education are continuously shaken by failing the FATİH Project, stealing the exam questions, frequently making changes, course books which are misprinted and not distributed in timely manner, inadequate assignments and promotions, destructive news, school buildings which are destroyed by terrorism, and the news about shuttles making traffic accidents, etc. (Küçükcan, 2002). It is aimed to disintegrate the existing mass culture, and tried to destroy the critical point of view in order to reach to a better and more valuable world. Even though significant donations and loans are used in many projects in cooperation with European Union and World Bank, as the institutional capacity could not be created in the Ministry, it is found that the action is carried out in the schools of one organization.

"USA sends MTV and Hollywood to where it cannot enter with CIA or army," said Nathan Gardels, the editor of *New Perspectives Quarterly*(NPQ) related to the cultural imperialism in the first edition of magazine published in Turkey (Gardels, 2014). The big scenario, conforming to this approach, is also performed in Turkey. The funerals of whom lost their lives in terror events, floor shows and game shows, which show that the country is very rich and companies are very generous, are broadcasted in the media. Supporting courses, which are started for the purpose of preparing the students to the student selection and placement exam due to which the demands of students, graduated from high schools, to attend the university may not be met completely, turned to the financing source of a group which brought the religious and ethical motives forefront during the course of time. This group

obtained and distributed the exam questions via illegal and unethical ways and methods in order that the students, whom they contact with, would be successful in the exams, gave the answers of such questions to some part of students during the exam, intervened to the evaluation of exam papers, etc. and directed the students to the public institutions and organizations and to the primary and secondary schools and military schools that admitted the students via exam. Said structure entered into a new era by establishing the private schools after the courses in the country. The schools, established in the country, were followed by the schools established abroad. It was understood that the amounts of these so-called charity activities, which were introduced and propagated as if they were carried by the benefactors bona fide and outright, were, in fact, were obtained from the citizens and public institutions with illegal methods and those, whom were known as benefactors, on the contrary, took advantage of them. Even though it is not so important at which phase this structure is, it turns into a structure starting from the educational activities which the global capitalism is a wild mediator to the deactivation of constitutional order and hierarchy in all institutions and organizations of the country. The students, whom were sent abroad with the government resources, were selected randomly and were made the persons who were acting against the country. Said structure destroyed the religious, ethical and cultural fundamentals with various methods in order to achieve its objective, as Nathan Gardels stated. The growth and security problems, which the country concentrates on, may be the reason of why the reaction delays. It becomes clear with the coup attempt that the children, whom have been educated by the group with outer connection with special brain washing methods in the private teaching institutions and private schools for years, are assigned to the important offices in the government and internal and external security institutions. Experiences, before and after the coup attempt on 15 July 2016, tell that the parallel government structuring starts from the education system by exploiting the cultural values of our people during 40-year period. It is seen that the aforesaid change is planned and implemented by moving away the students whom their questioning capability is destroyed from the culture of society which they are the members of it, then, degenerating the cultural values, increasing the individualism, and making the people the members of global system. Trying to stop by force the process of renovation and repairing the education system, which starts with closing of private teaching institutions by the Ministry of National Education at the point where the Ministry feels itself the strongest, makes urgent and critical that Turkey should take the important lessons from it and should strengthen its immunity system. So, the destruction that is faced at the national education system should be reconstructed by implementing an urgent Action Plan, prepared in accordance with the recommendations given below.

### **RECOMMENDATIONS**

- After the coup attempt on 15 July 2016, 60.000 teachers were dismissed, and 1.017 private schools and 823 private dormitories and hostels, 283 private courses and 17 universities were closed, and about 400.000 students changed their schools (AA, 2016).
- The number of administrative actions, currently continuing against the Ministry's staff and students' guardians, is about 100.000. This shows that much more attention should be paid to the teachers and students, and the social rights of teachers should be improved. The adequacy should be considered in assignment and promotion of teachers and administrators of education institutions again.
- Misinterpretation of the concepts of competition, determining the university president by election and autonomy negatively affected the universities.
- TALIS is the international survey that offers an opportunity for teachers and school leaders to have their say in six main areas: Learning environment, appraisal and feedback, teaching practices and classroom environment, development and support, school leadership self-efficacy and job satisfaction. The findings of survey 2013 is the representative of over 5 million teachers in 34 countries. The rank of Turkey in TALIS as rating and irregularity in the distribution attract the attention. The reasons of difference in a structure, which is based on the wage system and human resources within the same legislation, should be the separate research subject. In order to recover the situation, the teachers should be able to follow both technologic developments in their fields and education technologies and it should be ensured that the teachers are able to use them in education. The laboratories that practices require, should be established and renovated. The curriculum and course materials should be improved, and the missing items of education laboratories should be supplied. The source books, which the teachers may benefit from, should be increased. The foreign language education should be improved, and the attention should also be paid to the foreign languages other than English. The curriculum and content of vocational education should be adapted to the professional standards.
- It is observed that the achievement difference between the school types, provinces, classrooms, teachers and students in education is enhanced too much. Therefore, the education quality assurance system should be established in the schools, and considering the outputs of system, the curriculum, course books and teachers should always be improved. The average age of teachers in the schools is getting younger in Turkey. Average service year of teachers in some schools reduce to 3 years. For this reason, auditing the

education and knowledge and experience supports, provided to the younger teachers in education and classroom management, should be enhanced.

- It is found that the lands that are provided by the citizens in the regions, where they are opened for settlement with a plan based on the Settlement Law without charge in order to build up the school, are given to the schools with outer connection, instead of MoNE. According to the OECD researchers, the quality of education environment may enhance the success in education at 25%. Using quality of school buildings, their outbuildings, security and conditions conforming to the health should be improved. The health care services should be provided to the students and teachers in the school.
- The difference between performing the same procedure in the different units increases much. It is found that this is used to direct the students to the certain private schools upon their guardians decide that the businesses are not conducted well in the state schools. So, the business processes and maximum processing times should be considered, completed and announced.
- FATİH Project is the prestige project of Turkish education system, and only 10% of it was completed within the period when it was planned to complete. The outputs of project become much more important today. The administrative queries about the project reveal the conscious external interventions. Therefore, the project should be revised and completed with the steps to be taken until the end of 2017.
- As Turkey takes the measures against the aforesaid external interventions, it should ensure the adaptation of Syrian and Iraqi children who are in misery to the life, attending them the education, preparing them to the future and continuing to be the example to the world leaders and international institutions.
- The number of school and classroom should be increased; the number of student per classroom should be minimized in order to ensure the efficient teaching and meaningful learning; to provide the interaction between the teacher-student, student-student, and student- material.
- The classroom, workshop, laboratory and other learning environments and teaching-learning materials should be the brain-friendly, student-friendly and teacher-friendly education environments where will ensure that the students will understand the nature of knowledge and will produce it.
- The programs and teaching environments of Education Faculties that educate the teachers should be so arranged that the teacher candidates will learn and teach their areas meaningfully.
- The comprehensive researches should be executed in each of the problem headings.

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## **ENVIRONMENTAL EDUCATION IN TURKEY**

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**ABSTRACT:** There are ongoing training requirements of people throughout their lives. This requirement is at an extreme level with regard to the environment. The environmental movement in Turkey was begun in the second half of the 1970s. During this period, for the first time, it's not powerful and effective, although it is not in the name of environmental values begun to be replaced removed to reveal the reactions. Environmental education; improving the environment in all sectors of public awareness, grown in environmentally conscious individuals to ensure the settlement of persistent behavior in these individuals, protection of naturally, historical and cultural value, ensuring active participation in environmental activities is defined as taking part in the solution of environmental problems. Article 56 of the 1982 Constitution: "Everyone has the right to a healthy and balanced environment, improve the environment, protect the environmental health and to prevent pollution of the environment and citizens is the duty of the state" is called clearly contained in our Constitution, the environment we live under this Article, the right to live in a more beautiful setting, it is necessary to ensure that the owners of all individuals. Environmental consciousness of the intellectual, emotional and behavioral dimensions are. In other words, environmental awareness; environmental decisions, the principles, the idea that contain comments, the behavior is transferred to life these ideas and is composed of various emotions regarding all this. Such development of a comprehensive concept is not, of course, it consists of a simple process. It gained momentum with the introduction of human beings interacts with the environment this process continues throughout life. In parallel to developing environmental consciousness, personality development is affected by the interaction of various factors.

**Key words:** environment, education, air, solid waste, wastewater, global changes, pollution.

### **INTRODUCTION**

Firstly, we can summarize the world's cultural and ecological stages of human development. Early hunter-gatherers are controlled by nature. Next gatherer-hunters affect the environment, but they cannot control. Agricultural people are against to the human nature and human began to control. Industry people increased to control over nature and the nature are adversely affected the nature. The man of the world that it is in harmony with nature and understand the nature to intervene.

Many authors name the 1960s as the decade when environmental education started develop in response to the world's growing awareness about environmental problems. Others believe that environment education grew from movements that existed from the beginning of the last century such as nature study, conservation and outdoor education. In general, the history of the development of the main terms and definitions of environmental education has been studied by different authors. According to Disinger (1983) the term "Environment Education" appeared for the Conservation of Nature and Natural Resources. One of the most widely accepted definitions of environment education was given in the Tbilisi Declaration which was developed at the international conference of environmental educators, sponsored by UNESCO in 1977. There, environmental education was defined as "a learning process that increases people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action" (UNESCO 1978). According to the Declaration, environmental education is seen as a life-long process that is interdisciplinary and holistic in nature and application. It concerns the interrelationship between human and natural systems and encourages the development of an environmental ethic, awareness, understanding of environmental problems, and development of critical thinking and problem solving skills. Palmer (1997, 1998) defines environmental education as "the process of recognizing values and clarifying concepts in order to develop skills and altitudes necessary to understand and appreciate the interrelatedness among man, his culture and his biophysical surroundings. Environmental education should also include practice in decision-making processes, the development of self-cognition, the formation of environmental ethics and environmental behavior, and the development of skills for environmental assessment.

Giollito et al. (1997) drew a conclusion that although in different countries of European Union the emphasis can vary from one point to another, there are four major aims of environmental education which are 1) the transmission of knowledge 2) the creation of new behavior patterns 3) the development of values, attitudes and skills necessary to protect the nature and the environment and of the complexity both of the environment and the interactions between man and nature.

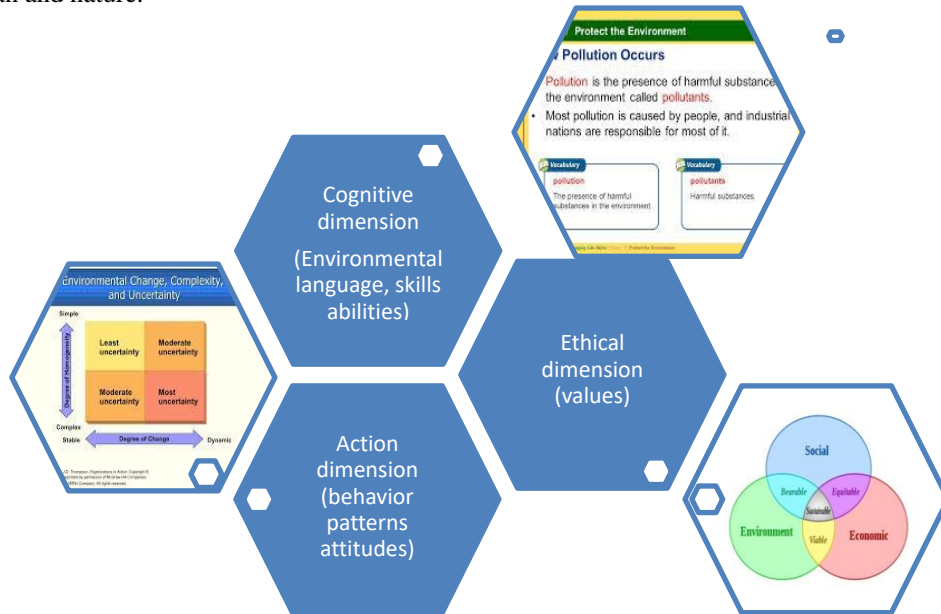


Figure 1. A model of EE by Giollito et al. (1997)

According to Environment education guidelines for Washington schools, there are four goals for environmental education in the state EE should help student:

1. To develop knowledge about the environment and its components as well as understanding of interactions between them.
2. To develop understanding of the importance of social, and natural systems “in supporting our physical lives, economy, and emotional well-being”.
3. To understanding the impact of personal decisions and actions on the environments, and
4. To develop knowledge and skills necessary to maintain and improve the environment.

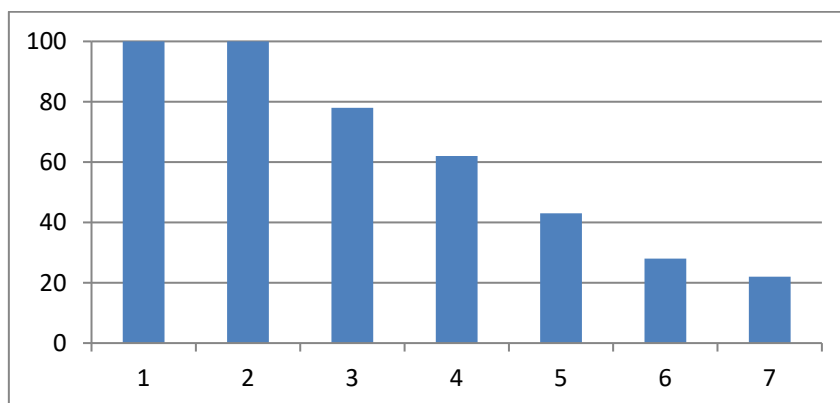
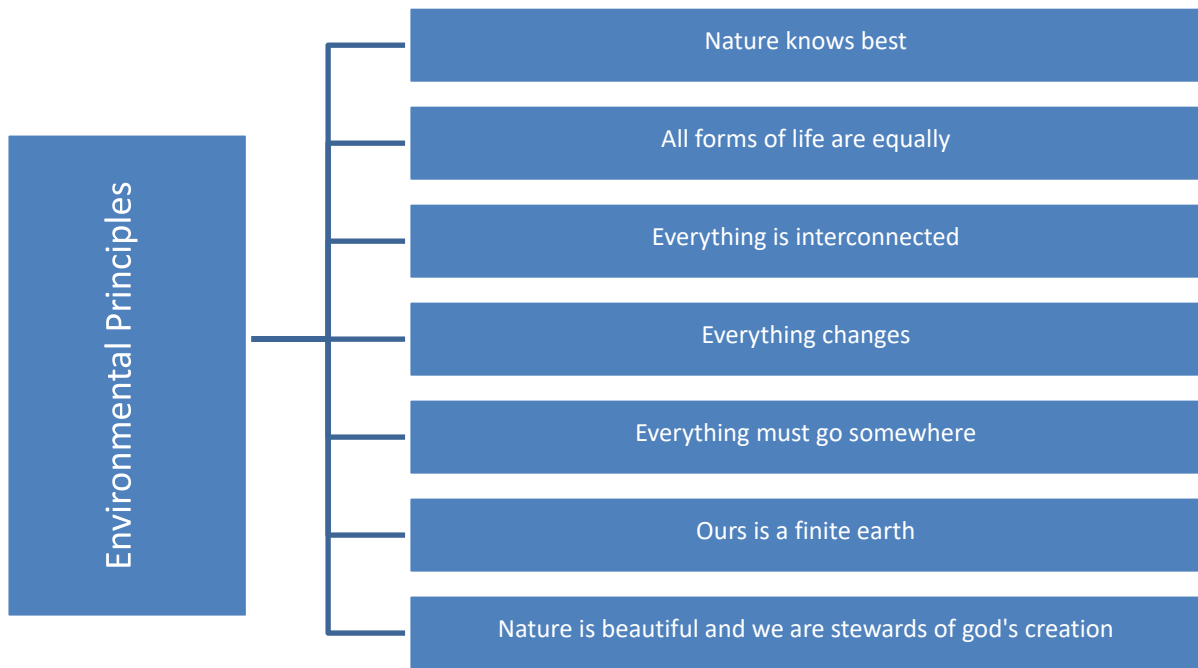


Figure 2. Distribution of environmental educational programs (%) by context in Washington State 1. Resource conservation 2. Recycling programs 3. Preservation of resources 4. Stewardship and management 5. Environmental jobs 6. Cultural and historical issues 7. Economic development

**Environmental Issues and Concern:** Environmental principles are shown in Figure-6.



**Figure 3.** Environmental principles

Today welfare level reached by mankind together with industrialization has brought environmental problems in the world. What are the environmental problems? This is some of the causes and consequences of environmental problems can be briefly summarized as follows:

1. Air pollution: Causes: Consumed fossil fuels, the burning of solid waste, radioactive rays Results: Acid rain, global warming, destruction of the ozone layer, fog formation
2. Water pollution: Causes: Over-fertilization not treated of domestic and industrial waste waters, tanker accidents, chemicals, all pests discharges to the sea. Results: pollution of rivers, mass killings of the creatures living in the sea, drinking of water pollution, increase of epidemics
3. Soil pollution: Causes: Trash and garbage heaps, acid rain, fertilization studies, pesticides. Results: Increased concentration of heavy metals in the soil, the soil's pH value change, to create the source of disease-causing, aesthetic degradation
5. The disappearance of animal and plant species: Causes: Acid rain, the plundering of the rain forest, monoculture agricultural and forestry, to eliminate direct to plants and animals, pesticides. Results: the disappearance of many plants and species, deforestation, being constantly increasing number of natural disasters due to climate change
6. The change of climate: Causes: the destruction of tropical rain forest, unlimited way fossil the consumption of fuel, the use of gas. Results: The formation of the greenhouse effect (global warming), the ozone layer in the earth harmful rays that reach the live
7. Solid Waste Problems: Causes: be consumer society, the disposable, extravagance, sufficiently cannot be evaluated, the lack of education of solid waste. Results: overuse of natural resources, energy and raw materials, depending on the extravagance degree as a result of the use of these resources to come to the point of exhaustion, and underground surface waters have been rendered unusable due to pollution, land polluting substances' harmful caused by inefficient waste and soil creatures living on or in threatening situations to come.

The Environmental Protection Agency has broken down these concerns into four major forms namely Water, Air, Waste and Land, and Climate change.

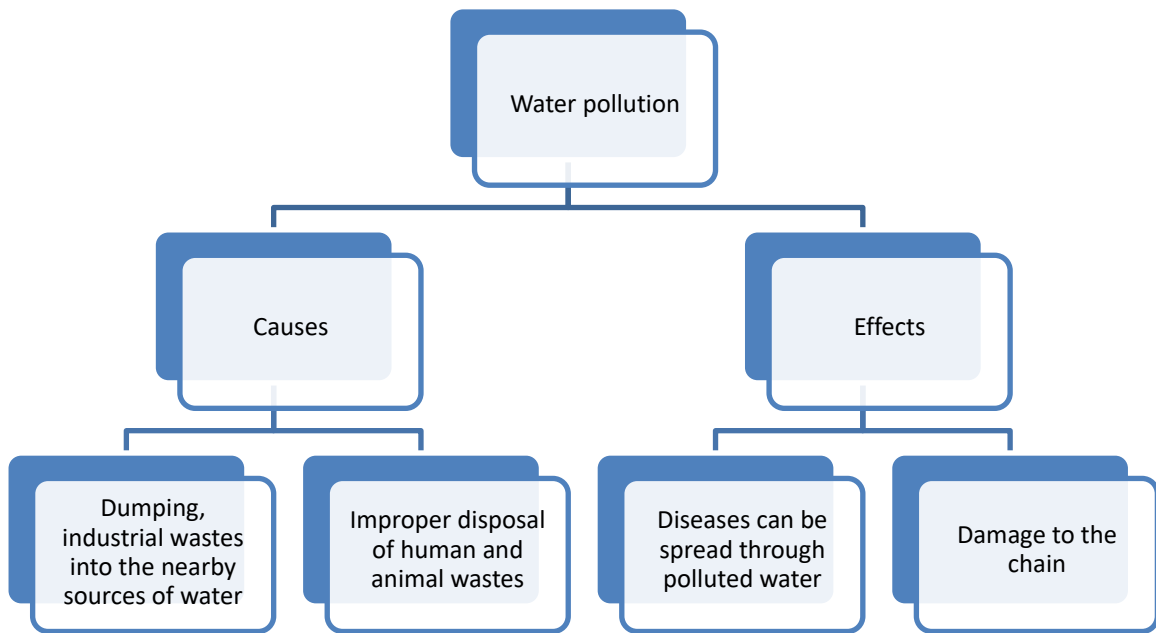


Figure 4. Water Pollution causes and effects

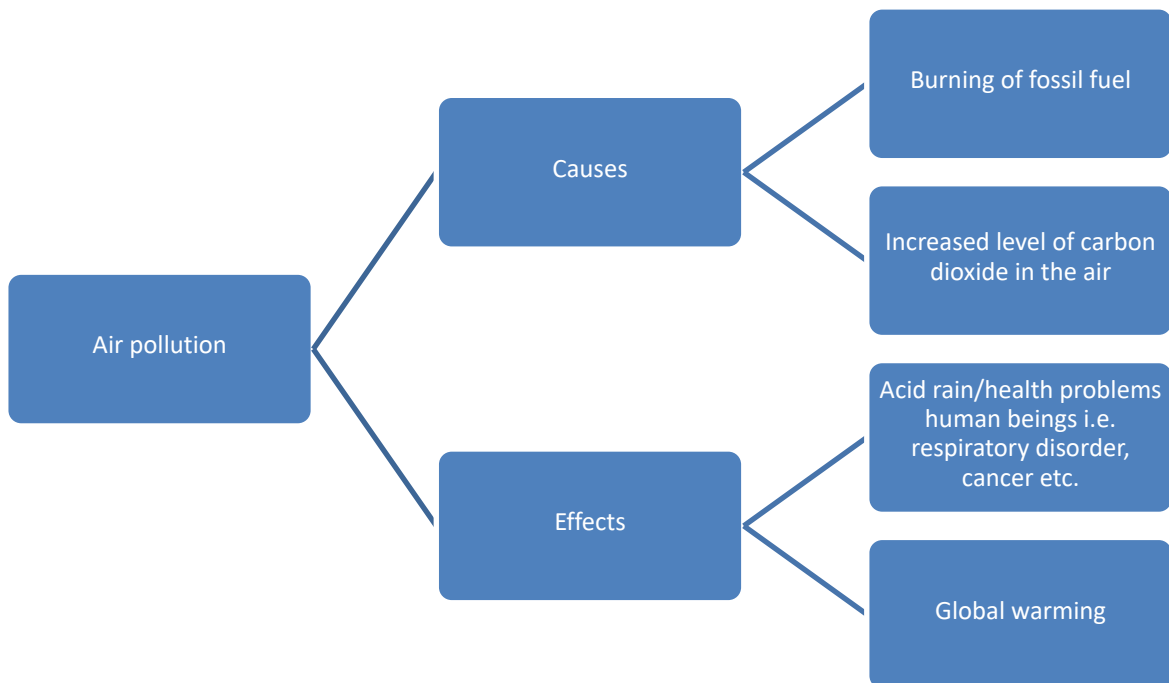
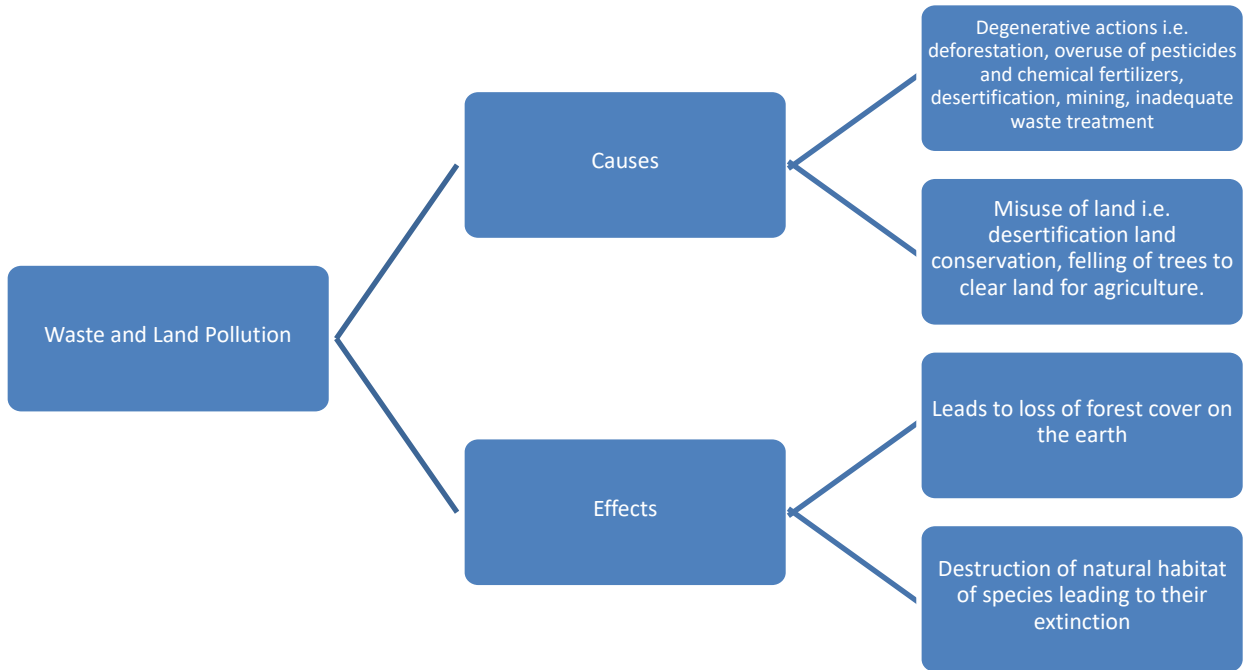
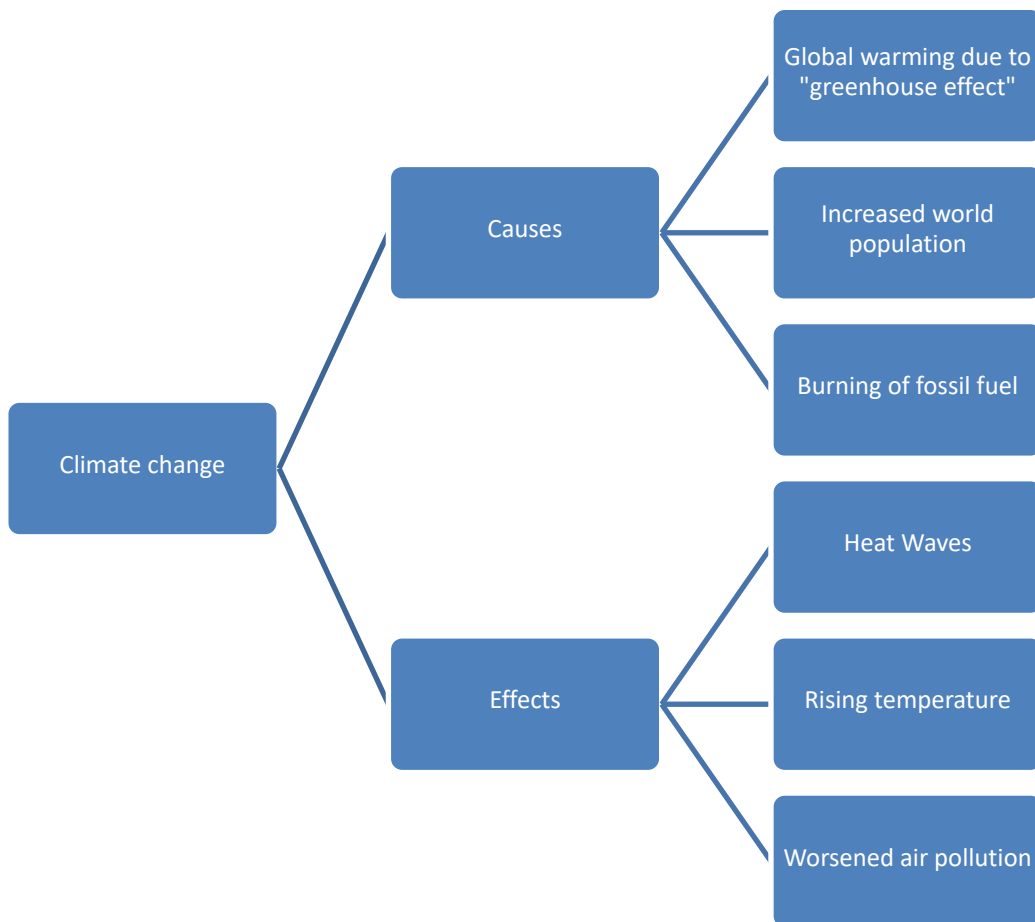


Figure 5. Air Pollution causes and effects



**Figure 6.** Waste and Land Pollution causes and effects

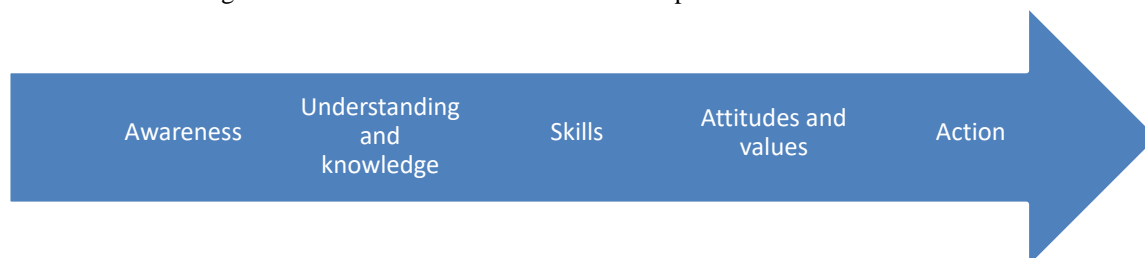


**Figure 7.** Climate changes causes and effects

### What is Environmental education?

The main goal is to develop concern and awareness among world population about the total environment and its associated problems. The objectives of environmental educational are classified as flows:

1. Awareness-acquire an awareness of and sensitivity to the total environment and its allied problems.
2. Knowledge-gain a variety of experiences and acquire a basic understanding of the environment and its associated problems.
3. Skills-acquire skills for identifying and solving environment problems.
4. Attitudes-acquire a set of values and feeling of concern for the environment and the motivation for actively participating in environment improvement and protection.
5. Participation-to provide social groups and individuals with an opportunity to be actively involved at all levels working towards the resolution of environmental problems.



**Figure 8.** A linear model by Sterling and Cooper (1992).

### Characteristics of Environmental Problems and Environmental Education in Turkey

The most important feature of environmental problems is not locally but it is obviously global. The environment issues affect everyone without distinction as religion, language, race, young and old. The role of education in conservation and in addressing the rapidly increasing environmental problems, while improving the environment, is well-known today. Education for the environment is not only a task of formal educational institutions, but also of civic organizations, mass media and local municipalities, which play a large role in increasing public awareness. Environmental problems recognize no artificial boundaries based on geography or ideology.

Environmental education has its origins in the 1960s. Through the decade of the 1970s and into the 1980s, the Environment Education movement grew rapidly. Education concerning environmental problems was recognized at the World Conference on the Environment in Rio de Janeiro in 1972. These emergences are today evident in environment education.

Agents and Environmental organizations:

2. TEMA Foundation (Turkey Combating Soil Erosion, for Reforestation and the protection Foundation)
3. ÇEKÜL Foundation (Foundation for the Promotion and Protection of Environment and Cultural Heritage)
4. TCV (Environment Foundation)
5. ÇEVKOR Foundation (Foundation for Environmental Protection and Research)
6. ÇEKÜD
7. ÇEVKO
8. TURMEPA (Clean Seas Association of Turkey)
9. TUDAV (Turkey Marine Research Foundation)
10. TÜRÇEV (Turkey TÜRÇEV Foundation for Environmental Education)
11. TÜRÇEK (Turkey and the Greening of the Environmental Protection Agency)

Education for the environment is not only a task of formal educational institutions, but also of civic organizations, mass media and local municipalities, which play a large role in increasing public awareness. Environmental problems recognize no artificial boundaries based on geography or ideology. In Turkey, the disciplines dealing with the environment are generally architectural planning, some branches of engineering (environment, construction, chemistry, physics etc.), sociology, economics, biology and geography. There is no systematic approach to environmental education. Environmental education needs a generally accepted definition, since there are different definitions and interpretations. A systemic approach to education on environmental needs must contain: environmental education must be comprehensive; it must include the inter-relations of parts and elements of natural life and global structure; and the problems and causes of pollution must be approached from the point

of view of the relations. Environmental Education is a new way of learning about human relations with the environment. The object of environmental education is focused on the relationship and impact of humanity on the environment. It is the type of education stressing an integrated way of structuring human nature and natural and physical resources. This kind of education must be interdisciplinary, lying social, cultural, economic and scientific studies. It has to provide an understanding of the basis of life, while living in a man-made urban environment, and the development of public life. This education aims to create self-confident, responsible and environmentally conscious people. It promotes new, intelligent ways to conserve and develop the quality of life. It will make future education easier, stressing that human life is biological life on earth, and that people must act emotionally with this biological life, starting from the early years of childhood. The Aims of Primary School Education is to introduce the bio-environment to students, to make them able to establish contact with living things around them and be aware of them; to teach the relationships between all living things in the ecosystem and the effects of the economic structure on these relationships; and, to establish moral judgments. The concepts of environmental education, ways of learning subjects, dealing with problems, and referring to activities in target plans would play a large role in the changing of expected behavior in children. In Turkey, today, at the primary level educational institutions, 'life knowledge courses are taken in the first term and 'social knowledge courses' in the second terms which are called central courses. According to the level of classes, subjects would be selected from protection of soil, water, air; solutions to pollution; ways of giving guarantees for living without risks; and conservation of natural resources.

Secondary school education at this stage has an important place in society, protecting and continuing culture, promoting justice and virtue for a nicer life and training honest people to modernize their life and state. The General Directorate of Secondary Education of the Turkish Ministry of National Education continues to study the implementation of environmental education at this level. The outline of an environmental curriculum will encourage specific action. Students must be able to identify their living natural resources, and be capable of consciously exploiting them for the most appropriate purposes within the framework of the new curriculum.

The leading principles of university education are research must be carried out to develop non-polluting technologies; sources must be used sensibly and equally; biological diversity must be maximized with sensible and intelligent strategies; and, population growth must be controlled for the best application of economic and bio-ecological plans. In university education, field work in different disciplines, research and examinations are most important.

## **CONCLUSION**

Public environmental awareness is considered important for successful environmental protection. There are major shortcomings in environmental education policy in Turkey, which must be eliminated. Because environmental problems are global, global solutions have to be found. Turkey has the needed institutions and legal framework, but the functioning of institutions and implementation is lacking. Environmental education in Turkey can be grouped under three main headings: formal education, informal education and in-service training. Formal education is conducted through environment-related curriculums at the pre-school education, primary, secondary and higher education levels. These programs incorporate general environmental concerns, human-environment relations, environmental issues, as well as the concept of environmental awareness. Informal training involves education of and the raising of conscious in individuals outside the formal educational system. The public in urban and rural settings fall under the purview of informal education. In-service training involves employees, managers and public officials in the public and private sectors. Universities have courses on the environment designed to educate and inform young people. These courses fall under the headings of Ecology, Environmental Issues, Environmental Law, Environmental Philosophy, Ecosystems, Environment and Human and Environmental Studies. The contribution of voluntary organizations is crucial, too, in environmental education. Voluntary organizations in Turkey working on environmental issues include: The Environment Foundation of Turkey, Turkey's Nature Conservation Society, World Wildlife Association, Turkey and the Research Foundation for Combating Soil Erosion Environmental Education, and the Environmental Problems Foundation of Turkey. There are some difficulties to effective environment education in Turkey. These can be summarized as explanation inconsistency of goals and principles in preparing education programs, because of the need for equipment, environmental activities are not practiced, and lack of expert teachers in environmental education. Government and citizenships have various responsibilities for conservation of environment and prevention of pollution. A reason of current environment problem is lack of consciousness and information about environment. A person who has not had environmental consciousness might not perceive people lives in the future.

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## **THE NOTION OF DECOMPOSITION: A DIDACTIC RESEARCH IN LYCEUM BIOLOGICAL COURSES**

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**ABSTRACT:** Soil is one of the most precious assets of humanity as it provides support and nutrients for plants, shelter for organisms that live in it, makes life possible. But it is a finite natural resource that is easily damaged so it needs protection and rational management as a result of education and public information ("Decalogue of Soil by the Council of Europe"). Decomposers are a consumer category, mainly fungi and bacteria, which mineralize dead organic matter and close the biogeochemical cycles, so contribute to the recycling of nutrients in ecosystems, protect the life. The project of teaching research, which is described in this paper, was part of the Lyceum course of Environmental Sciences aimed to the theoretical and practical approach of the concept of decomposition. For the preparation of theoretical teaching, it was utilized some school teaching tools and techniques, searched the synonymous and linked terms to decomposition into the Curricula and school books of Lyceum. In the field and in the laboratory, it was materialized measurements of paper decomposition rate, in the forest of the school yard. Measurements received in a sampling period of one school year, with a previous pilot phase, and after statistical analysis, exported conclusions concern the seasonal variations of the soil decomposers' action, in correlation to the weather conditions.

**Key words:** decomposition, school educational project, didactic research, field work

### **INTRODUCTION**

The soil is the upper layer of the earth's crust, consisting essentially of crushed rocks and decomposed organic matter, formed by the interaction of abiotic and biotic factors. Soil is one of the most precious assets of humanity as it provides support and nutrients for plants, shelter for organisms that live in it, makes life possible. But it is a finite natural resource that is easily damaged so it needs protection and rational management as a result of education and public information ("Decalogue of Soil by the Council of Europe"). The organisms which live in an ecosystem are distinguished, depending on the way to ensure their food, into producers, consumers and decomposers. Consumers and decomposers are heterotrophic organisms (Tsounis, 1993; Adamantiadou et al, 2005).

A part of the organic matter is transferred, as food, to the consumers, while another ends up as dead organic matter (leaves, seeds, twigs, etc.) in the ground and becomes food for decomposers with dead organic material of animal origin (dead organisms' bodies, secretions, excreta etc.). Thus, a wide range of organisms (earthworms, bacteria, fungi, ants, beetles, rodents, etc.) breaking the complex organic substances in simpler, alongside the roots of plants which act mechanically and chemical (Athanasakis et al, 2005). Decomposers are a consumer category, mainly fungi and bacteria, which mineralize dead organic matter and close the biogeochemical cycles, so contribute to the recycling of nutrients in ecosystems, protect the life. Decomposers also contribute to natural and artificial ecosystems' depollution (Tsounis, 1993; Adamantiadou et al, 2005). This cleavage of chemical compounds into simpler compounds and chemical elements becomes in ecosystems with many chemical, physical and biological processes, closing the biogeochemical cycles in nature (Lykakis, 1997; Sfendourakis & Korfiatis, 2002).

The soil invertebrates play, also, vital role in terrestrial ecosystems, both through their participation in the degradation of dead organic material, and thus to the nutrient recycling process, additionally, to the improvement of the soil microenvironment conditions because of their motor activity (Grammenou et al, 2008). Degradation in the forests of Mediterranean ecosystems is very fast due to the high temperatures and humidity. But all inorganic nutrients are re-absorbed fast by plants, so soil of these forests remain, finally, poor (Adamantiadou et al, 2005).

One of the major environmental problems in Greece and worldwide, is the waste management and the impact of uncontrolled or semi-controlled discarding them on the ground. The bioremediation is a general term used to describe the destruction of the contaminants located in the soil, sludge and groundwater through biological mechanisms, with the help of microorganisms. The process involves the combined use of oxygen, nutrient substrate (dirt) by decomposers, regulation of soil moisture and other environmental factors (Geneiatakis, 2005). The paper is easily degrading and, generally, does not burden the environment as other polluting materials. Also, paper industrial production does not cost in energy so much and is not so polluting to the environment. Additionally, grant quantities of paper are recycling; even recycling is not a panacea (Lambrou et al, 2005). The cellulose, the major organic component of paper, is a polysaccharide which can be renewed since it is produced in great quantities on the earth as component of the plants' cell wall (Kapsalis et al, 2000).

In contrary, plastics degrade very slowly, but hamper the decomposition of other waste present in landfills, even their biological consequences are insignificant or extremely limited, compared with other types of pollution. There are not evolved microorganisms to degrade plastics because plastics appeared as an industrial product of the recent geological years. However, in recent years, it has been developed the technology of decomposition of the plastics by the process of photo-biodegradation. This technology is based on adding a small amount disintegrator, which imported into the plastic at the raw material production process, changing the behavior of the plastic. The degradation of the plastic begins when the planned lifetime has finished and the plastic is no longer needed (Katsaros, 2006). Plastics having been deposited for a time in the sun, even in the landfill will be degraded by bacteria and fungi, preceding the disintegrator have split the macromolecules of the plastic in much smaller, so that they can be consumed as food materials by the microorganisms-decomposers. Searching in a garbage recycling factory, researchers in Japan discovered the first known bacterium *Ideonella sakaiensis* 201-F6 which breaks polyethylene PET, promising much to the anti-pollutant sustainable biotechnology (Pratikakis, 2016). Humans, with the wide range of interventions on the balance of natural ecosystems, are mortgaging the planet's future, but as long as the present generation is the root of bad, equally is the beginning of the solution (Calwell, 1989).

The project of teaching research, which is described in this paper, was part of the course Principles of Environmental Sciences of the B class of the Lyceum Meleses, Heraklion (Greece), which was a selectable and not mandatory course by 20 students approximately. Project aimed to the theoretical and practical approach of the concept of decomposition by carrying out a research project. For the preparation of theoretical teaching, it was utilized some teaching tools and techniques, searched the synonymous and linked terms to decomposition and decomposers into the Curricula and school books of Lyceum. In the field and in the laboratory, it was materialized measurements of paper decomposition rate, in the forest of the school yard. The selection of content, methodology and implementation of teachings is crucial for the achievement of the course objectives, the acquisition and cultivation of knowledge, abilities, skills, self-motivation, by the students (Chatzidimou, 2010). The interactive form of teaching is a decisive step in the further activation of students' process to think consciously and responsibly on the teaching's cognitive objects. The experimental teaching is aimed primarily at cultivating of students' skills rather than on learning.

The research projects were instituted in Greek Lyceums, for first time, in September 2011 as a distinct unity of the compulsory "New School" Program (Ministry of Education 2011: 13 Government Gazette 1213, issue. B/2011). The development of inquiry teachings is in accordance with modern conceptions of the nature and orientation of curricula with many applied practices during last decades in schools and universities of other countries. As an option of educational practice, the school research projects are organically adapted to the philosophy of the "New School", which perceives the students as young "intellectuals", "scientists" and "researchers", cooperating closely in a framework of initiatives and selections, with different ways of experiential learning, through interdisciplinary approaches, experiments and investigations (Matsagouras, 2011).

## **METHODS**

Main objective of the carried-out research was to reveal and describe an innovative teaching intervention in Lyceum which implemented in the frame of the Education for the Sustainable Development.

To serve the needs of the research, it was studied the archival material of the project in a constructed manner, of qualitative approach. It was used the content analysis of notes and notifications referred on the used curricula, schoolbooks, teacher's books and Laboratory guides of the biological courses of Lyceum, also the tables of measurements of buried in the soil paper weight and the results of statistical analysis. As the research material was studied, every phrase, paragraph, figure, photos etc., were recorded and coded in 4 main categories: Didactic Methodology, Required Material and Infrastructure, Theoretic Approach of the term 'Degradation', Measuring the Decomposition Rate. The categories were not defined beforehand but adopted in the procedure of research developing and evolving data analysis resulting in the coding of data (Cohen & Manion, 1994; Iosifidis, 2003).

In the school course "Principles of Environmental Sciences" of B class of Lyceum with a group of 20 students 16-17 years old, in order to be taught the notion "Decomposition" in the Nature, the teacher selected the essay method (Frey, 2005) and applied a research project with yearly duration, which ran parallel to the rest teaching course subjects. This innovative teaching, in theoretical and experimental base, carried out in Meleses Lyceum of Crete, Greece, during the school year 2005-2006. Students and teacher materialized a bibliographic research parallel to the experimental and the educational visits.

## **RESULTS AND FINDINGS**

For the course “Principles of Environmental Sciences” teaching demands implemented many teaching strategies, methods and techniques to cover the syllabus, in a variety of didactic ways, depending on the topic and the module. In the frame of this course, the project ‘Decomposition rate in the forest soil of our school yard’ carried out, with the students of B class of Lyceum, in theoretical and experimental base, with educational visits, indoor and outdoor activities which promote the inquiry based learning in Sciences.

### **Didactic Methodology**

The factors that influence learning and differentiate the results of teaching are classified into three main categories (Charalampopoulos, 1987). The first covers the skills, motivation and students' readiness, the second the experience, adaptation and health, in the third is the method, the school atmosphere and the teacher. Students and teacher studied in depth the curricula of the biological courses of Lyceum, the schoolbooks, the teacher's books, the Laboratory guides and the corresponding circulars with the Ministerial teaching guidelines of the courses: “Principles of Environmental Sciences”, “Biology A, B, C classes”, “Management of Natural Resources” (Argyris et al, 1994; Barona et al, 1999; Kapsalis I et al, 2000; Adamantiadou et al, 2005; Athanasakis et al, 2005).

The implemented in the classroom teaching techniques were brainstorm, at the beginning of the course teaching, the questioning-answering and discussion. In the evaluation tests were used closed and open type questions, of multiple choice, gap filling (Athanasakis et al, 1999). There were also solved numerical exercises on the growth rate of the bacterial population in closed culture of bioreactor (Kalathaki, 2005).

The theoretical approach of the decomposition developed through the following topics given to the students for inquiring: definition of the organism's decomposers, their species (with illustrations of their action), their role and importance in the Earth, developing scenarios on "how the earth would be without decomposers or what will happen if they disappear for some reason?", the food relationship with other organizations, at what level of the food pyramid would we rank them, etc. For the needs of teaching, regarding the conceptual approach of the terms, became a limited research in the content of Lyceum curricula of Science courses.

For the experimental approach of the degradation process, it was measured the decomposition rate of buried papers in the soil, following the described exercise protocol in the Laboratory Guide of Biology C Class of Lyceum (Barona et al, 1999). The speed of decomposers' work can be measured by various methods, such as the release of carbon dioxide from the soil as well as the applied laboratory exercise. During an educational excursion, they visited a biological refining station and a landfill space of the school region.

Students worked in groups, searched the school books, carried out the samplings, materialized the measurements; they co-constructed the knowledge and shared it in the team. With the mutual teaching, they re-organized the teaching material and syllabus with personal criteria, incorporating the new knowledge into the existing cognitive structures with the most convenient way, according Slavin's theory of cognitive enrichment (Mihailidis, 2003). For the formative evaluation of the following procedure and the students' participation, developed discussions with students and teachers during the school year where clarified objectives, practices and responsibilities. In the final evaluation, at the end of school year, students expressed their thoughts, aspects and suggestions for the followings based on the Evaluation Sheet of periodic student evaluation of the Educational Research Centre and Greek Ministry of Education (KEE, 1999).

### **Required Material and Infrastructure**

The measurement of the decomposition rate of paper in the soil of the school yard forest materialized during the school year 2005-2006. The previous school year measured only once (paper buried on 2/2/2005 and retrieved on 9/3/2005) indicatively and pilot, in order to clarify the procedure to be followed.

The laboratory used equipment were A4 paper, nylon bags for food packaging, a bradawl, a high accuracy weight balance and a drying oven. The bags used were not photo degradable. Each A4 paper sheet had dimensions 21x30 cm and weight 5g before burying (80g/m<sup>2</sup>). The weights of the paper before and after installation in the soil were measured in balance “Bonso 339-00” capacity 500g, graduation 0.1g. Each sheet was enclosed in a nylon bag of its dimensions with holes made with bradawl to have openings approximately 1/5 of the surface. The papers, enclosed in the perforated bags, buried in the soil to a depth of 10cm from the surface. The day that the papers were retrieved, on the same day the new papers were buried, starting from 02/02/05. The samplings were made on the following dates: 09/03/05, 13/05/05, 12/10/05, 02/12/05, 27/01/06, 20/03/06, 05/05/06, and 13/06/06. The wet

semi-decomposed sheets of paper, constituted the sample material, weighted (wet weight) in the retrieving from the soil, dried in an oven at 70oC for 10 hours and then weighted again (dry weight).

Statistical analysis of the measurements became by EXCEL and the results are illustrated in the Table 1 and Figures 1 and 2. The exported conclusions concern the efficiency of the soil decomposers, at times of the year.

### Theoretic Approach of the term ‘Degradation’

A Brainstorming, in the beginning of the project, revealed the following associated terms to degradation, combining knowledge from the rest science courses: ‘death in nature (lysosomes)’, ‘cycle of nutrients in the ecosystem’, ‘energy flow in the ecosystem’, ‘bacteria, fungi, protozoa’, ‘eutrophication’, ‘ecosystem, habitat’, ‘food pyramid’, ‘energy pyramid’, ‘food web’, ‘food chains’.

Objectives relating to ‘degradation/decomposition’ in the New Curricula of General Lyceum listed as follows: to understand the necessity of matter recycling and connects it with the degradation, to describe the basic processes of the nitrogen cycle, to identify the action of bacteria (nitrogen fixation, nitrification, de-nitrification) and the role of degradation, to describe the basic processes of phosphorus cycle and recognize the importance of degradation, to distinguish the organisms to producers, consumers and decomposers with criterion the way they ensure their food. Also, it was proposed ‘field study on the degradation observed in a typical ecosystem of the local environment’.

Very few references about ‘degradation’ were found in the searched Natural Sciences’ school books of Lyceum. In the school book of Chemistry C Class for students of Positive Direction highlighted the definition of ‘molecules degradation that the carbon chain becomes smaller by one carbon atom’, in Chemistry B Class of Lyceum had referred ‘a reaction that allows such degradation and this is decarboxylation’. In the school book of Biology of class C-Positive Direction (Aleporou, 2001) are three references to the term ‘degradation’. ‘In Gene regulation of prokaryotes, lactose itself activates the process for its degradation’. ‘Laboratory modified types of organisms have created with properties that help the breakdown, the faster degradation. They created by combining techniques of classical genetics and recombinant DNA technology’. ‘Degradation rate of oil spills by microorganisms is dependent on a range of many factors such as environmental temperature, the composition of the oil, the concentration of oxygen in the sea water and sufficient nutrients for bacterial growth’. In the school book Biology C class -General Education (Adamantiadou et al, 2005) there were 16 references to the concept of ‘degradation’ and ‘decomposition’ which are not mentioned here, for discourse and space economy.

### Measuring the Decomposition Rate

During decomposition in Nature take place many and varied changes related to, and affected by many factors. Particularly, temperature influences more the speed of the chemical reactions occurring in the degradable materials and the functions of microorganisms that carry it out. Also, moisture effect the decomposition rate, since water hydrolyzes the biological macromolecules degrading them into smaller, and offers to the environment all the demanded chemicals, which absorbing by the plants, will pass to all organisms, through the feed paths (Lykakis, 1997; Geneiatakis, 2005; Athanasakis et al, 2005).

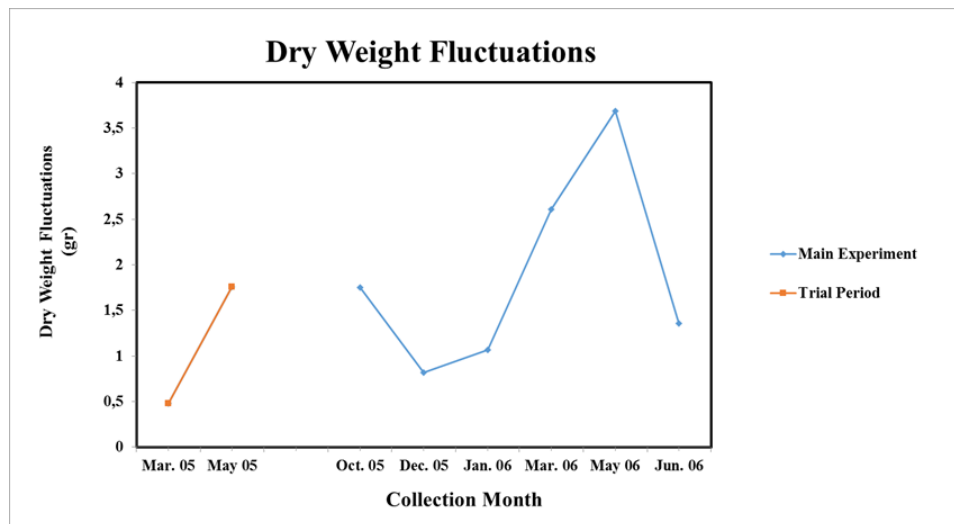
**Table 1.** Changes of buried paper weight during the research period

Bury Date	Collection Date	Days in soil	Wet weigth (g)	Dry weigth (g)	Moisture (g)	Change of weight (5gr-dryw)	% Change of weight	Decomposition rate mgr/day
2/2/2005	9/3/2005	35	7,48	4,52	2,96	0,48	9,6	13,71
9/3/2005	13/5/2005	65	4,78	3,24	1,54	1,76	35,2	27,08
18/9/2005	12/10/2005	24	4,67	3,25	1,42	1,75	35	72,92
12/10/2005	2/12/2005	51	8,61	4,18	4,43	0,82	16,4	16,08
2/12/2005	27/1/2006	56	10,68	3,93	6,75	1,07	21,4	19,11
27/1/2006	20/3/2006	52	5,43	2,39	3,04	2,61	52,2	50,19
20/3/2006	5/5/2006	46	2,17	1,31	0,86	3,69	73,8	80,22
5/5/2006	13/6/2006	39	3,98	3,64	0,34	1,36	27,2	34,87

The values of paper wet and dry weight, got during the sampling periods, are illustrated in the Table 1. The same Table contains the % changes of the weight and the concluding contained moisture also the calculated seasonal

decomposition rate of paper. The upper two rows of Table 1 contain the results of the pilot phase of the research, in the previous school year on the dates of 02.02.2005 and 09.03.2005.

The figure below (Fig.1) shows the results of data analysis regarding the changes in the weights of the buried papers during the research period (blue line). The red line corresponds to the results of the pilot phase of the research, in the previous school year, on the dates of 02.02.2005 and 09.03.2005.



As it is apparent from the values in Table 1 and the schemes in Figure 1, wet weights are higher in winter and spring, once the soil is too wet due to the rain. The column of Table 1 with the mean amount of moisture in the samples of paper can be correlated with the soil moisture, revealing its seasonal variation depending on the waterfalls and air conditions.

The soil that was stuck on the hauled papers, inside the bags, hardly could be removed, due to the moisture which made it sticky on the paper. This is another reason of increased wet weights in the autumn, winter and early spring, periods of rainfalls in Crete. Regarding the sampling of 02/12/15, it had much rain during the previous three days, therefore recorded such high wet weight values. This soil was humus, organic matter mainly plant origin, under partial decomposition in the upper soil layer. This material holds moisture and soluble nutrients to a natural fertilizer (Lykakis, 1997). The sampling papers during the winter months, was extremely wet and white, had yellowed only around the openings of the bag. In autumn, paper was all yellowed; the decomposition had progressed and spread inside the pouch, even where there were no openings.

The average dry weight of the sample ranged from 1,31g (5/5/06) to 4,18/4,52g (12-10-05/2-2-05) with the highest value of the decomposition rate to be 80,22 on 20-3-06 and 72,92 on 18-9-05 mg/day, spring and winter, when the soil moisture is high because of the rainfalls and the temperature relative high (Table 1). The lowest values were recorded in winter, obviously affected significantly by the very low temperatures, were 13.71 mg/day on 2-2-06. In Crete, January and February are, generally, very cold months. As for the variation in the seasonal rate of decomposition, it is clear that the daily rate significantly depends on the seasonal variations of temperature and soil moisture, with the prerequisite of high humidity exist, as also Argyris et al (1994) refer in an analogue research. The rate reaches at the lowest prices in winter, increases in early spring, and in the autumn, rises again significantly (Table 1). During the summer, there were no survey data because the schools were closed.

A similar experiment described in school book Biology C class 2nd Bundle (Argyris et al, 1994) where researchers sunk in the Hymettus of Attica, Greece, ground filter paper enclosed in perforated bags for measuring the decomposers' activity. The rate of reduction of the initial paper weight showed that cellulose degradation has different rates in different seasons. Decomposition was faster in the early autumn, when drought ceased to be a limiting factor and in late spring when the temperature no longer was a limiting factor.

In Mediterranean climates, like Crete, where the sun and wet winters alternating with warm, long and dry summer, intense decomposing activity observed at the time of the high temperature associated with water availability, high soil moisture, and even the moisture preceded, that the chemical bonds in molecules of paper cellulose to weaken and break down readily.

The school curriculum subjects have much to offer to the Education for the Sustainable Development, although issues related to Sustainable Development, can rarely be addressed exclusively through a single subject. Natural Sciences provide concepts and mechanisms, models and structures students to understand the complexity of life in nature and how much environmental issues are multifactorial (Flogaiti & Liarakou, 2009). As the first institutionalized application of the Research Projects in Lyceums happened long after the implementation of the discussing project, the described teaching intervention 5 years before was an innovation in school teachings. Now, teaching by Projects in Greek Lyceums, has become a substantial educational innovation, based on modern and proven pedagogical principles, introduced to Lyceums and Gymnasiums in 2011 as compulsory courses, aiming to enhance the educational role of the “New School”.

### **CONCLUSION**

The theoretical and experimental approach of the term ‘degradation’ in the course “Principles of Environmental Sciences” of B class of Meleses Lyceum aimed to a different way of teaching about the role of decomposers in the biogeochemical cycles of nutrients and energy flow in the ecosystems. In the course, during the school year, utilized heterogeneous research formats combined with qualitative and quantitative methods, such as documents’ discourse analysis, field and laboratory measurements.

The didactic research revealed very few references to the notions ‘degradation/decomposition’, dispersed and fragmented in school books, curricula and laboratory guides of Natural Sciences’ courses of Lyceum. As for the variation in the seasonal rate of soil decomposition, it became clear that the daily rate significantly depends on the seasonal variations of temperature and soil moisture, following the changes of Mediterranean climate.

### **RECOMMENDATIONS**

The implementation of Projects in Schools contributes to changing traditional attitudes of teaching, learning, practices, roles and culture in schools. Associated with teaching objectives of school curricula, can be approached subjects of other courses, of different areas in schools, with interdisciplinary approaches an contribution of different specialties of teachers and scientists. The pedagogical profit is double, as students acquire deep knowledge at functional level of understanding the studying issues, while at the same time, with their systematic involvement in research processes, develop attitudes and cognitive-methodological abilities of investigation and management issues and situations (Matsagouras, 2011).

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## **UNDERSTANDING OF POPULATION GENETICS AND EVOLUTION AMONG UNIVERSITY STUDENTS**

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**ABSTRACT:** This research examined university students' understanding about various concepts of population genetics and how they integrate that knowledge to explain the theory of Evolution. A mixed study method was used to explore the students' understanding of different factors that affect evolution. Data were collected by questionnaire and interview and were analyzed qualitatively. The results indicate that the majority of students know how can natural selection and mutation affect allele frequency in a population but they have difficulties to understand how act Genetic drift on the evolution of allele frequencies. They had also misconceptions of some concepts related to evolution like speciation. The majority of students don't believe to Human evolution but they accept the theory of evolution for the other species.

**Key words:** genetic population, misconceptions, evolution, natural selection, genetic drift.

### **INTRODUCTION**

The scientific and technological developments in genetics have had a considerable impact on different areas of everyday life (agriculture, medicine...). A scientifically literate public is essential if citizens are to engage effectively with policymakers on issues of scientific importance (Dougherty 2009). Genetics is also one of important biology basic courses, it is very important to many other subjects. Genetics is one of the most difficult subjects in the biology curricula at university levels (Agorram, 2010, 2015; Kindfield, 1994). Studies in other countries have shown that understanding of genetics and its various aspects is poor among students of various levels (Lewis and Wood-Robinson, 2000).

The Population genetics field develops more quickly. However, many Students find numerous difficulties in assimilating this course because it is a specialized course with abstract and difficult knowledge (Agorram 2015). Population genetics is a field of biology that studies the genetic composition of biological populations and the changes in genetic composition that result from the operation of various factors, including natural selection. Population geneticists pursue their goals by developing abstract mathematical models of gene frequency dynamics, trying to extract conclusions from those models about the likely patterns of genetic variation in actual populations, and testing the conclusions against empirical data (Okasha 2015). Population genetics is concerned with the genetic basis of evolution. It differs from much of biology in that its important insights are theoretical rather than observational or experimental. It could hardly be otherwise.

To the best of my knowledge, almost no reports in Morocco have examined students' knowledge and understanding of biology topics related to population genetics. Hence the importance of this research, which aims to analyze Moroccan university students' understanding of population genetics, is to identify their most common misconceptions.

### **BACKGROUND**

Population genetics is concerned with the origin, amount, and distribution of genetic variation present in populations of organisms and the fate of this variation through space and time. Population genetics has always played a central role in evolutionary biology as it deals with the mechanisms by which evolution occurs within



populations and species, the ultimate basis of all evolutionary change. However, despite its importance, genetics is considered difficult to teach and difficult to learn (Finley et al. 1992). Students typically dislike learning about Hardy–Weinberg equilibrium as they frequently find it confusing, boring, and irrelevant to their lives (Soderberg & Price 2003).

In contrast to classical genetics and molecular genetics, the population genetics is more difficult. This impacts negatively on learning because (i) a proper understanding of microevolutionary processes requires some understanding of Population genetics beyond Hardy Weinberg equilibrium; (ii) Population genetics offers opportunities to generate and test hypotheses using quantitative methods; and (iii) Population genetics is one of the few subjects that introduces students to stochastic processes. Also, with the arrival of the "post-genome" era, Population genetics methods are increasingly important in medical genetics research (Reich et al. 2001). Misunderstanding of Population genetics is widespread, and part of the problem can be attributed to lack of appreciation of stochastic processes (Kliman 2001).

## **Population Genetics and Microevolution**

### ***Hardy-Weinberg Equilibrium Law***

It's the central law in population genetics. The Hardy-Weinberg equilibrium principle describes the unchanging frequency of alleles and genotypes in a stable, idealized population. In this population, we assume there is random mating and sexual reproduction without normal evolutionary forces such as mutation, natural selection, or genetic drift. In the absence of these evolutionary forces, the population would reach equilibrium in one generation and maintain that equilibrium over successive generations. By describing specific ideal conditions under which a population would not evolve, the Hardy-Weinberg principle identifies variables that can influence evolution in real-world populations. If a population is not in a state of equilibrium, at least one of the evolutionary forces is at work causing change in the population. Further investigation can determine which variables are influencing the changing population.

The Hardy-Weinberg equilibrium principle is also one of the more difficult topics for biology students to understand and for teachers to teach. One reason for this difficulty is the students' mathematical background. More problematic than lack of manipulative skill is the difficulty of understanding why the principle is true and understanding how the principle applies to specific populations or more importantly, the value of its application. Many of these students wonder about the relevance of the Hardy-Weinberg principle to understanding evolution.

### ***Natural selection***

Natural selection as a mechanism of evolution is a central concept in biology, it is a non-random difference in reproductive output among replicating entities, often due indirectly to differences in survival in a particular environment, leading to an increase in the proportion of beneficial, heritable characteristics within a population from one generation to the next. It is one of the core mechanisms of evolutionary change and is the main process responsible for the complexity and adaptive intricacy of the living world (Gregory 2009). A growing list of studies indicates that natural selection is, in general, very poorly understood—not only by young students and members of the public but even among those who have had postsecondary instruction in biology.

Natural Selection is so difficult to understand for two reasons: The first is that understanding the mechanism of natural selection requires an acceptance of the historical fact of evolution, the latter being rejected by a large fraction of the population. Numerous studies indicate that rates of acceptance already are much higher than levels of understanding. And, whereas levels of understanding and acceptance may be positively correlated among teachers, the two parameters seem to be at most only very weakly related in students (Shtulman 2006).

The second reason is that most people simply lack formal education in biology and have learned incorrect versions of evolutionary mechanisms from non-authoritative sources (e.g., television, parents). Inaccurate portrayals of evolutionary processes in the media, by teachers, and by scientists themselves surely exacerbate the situation. However, this alone cannot provide a full explanation, because even direct instruction on natural selection tends to produce only modest improvements in students' understanding (Finley 1992; Nehm and Reilly 2007).

### ***Genetic Drift***

Genetic drift is defined as random changes in allele frequencies in a population. The mechanism is so named because the pattern shows the drift of allele frequencies, up and down over time—there is no predictable directional

component to change from generation to generation. Genetic drift occurs in all populations that are not infinitely large. It has especially strong effects when populations are small over several generations. Because genetic drift is based on a random sampling process rather than deterministic process, students often have a difficult time understanding and appreciating its role in Evolution (Staub 2002).

There are numerous misconceptions cited in the literature as:

- “Genetic drift is due to random mutations; genetic structure can change over time.”
- “Genetic drift is when the population moves to a location more suitable to its characteristics.”
- “Genetic drift occurs due to isolation of a population or species by whatever means.”
- “Genetic drift occurs when a sect of a species is separated from the other and changes to adapt to their new environment.”
- “Genetic drift is a change in genes caused by an isolated event, often a catastrophe.”
- “Genetic drift is genetics in a smaller population.”
- “Genetic drift generally happens when part of a species population is separated and become distinguished and change” (Andrews et al 2012).

### **Misconceptions of and attitude toward Evolution**

Students bring a diverse array of ideas about natural phenomena to their science classes and many of these ideas are often at variance with the scientifically accepted views. Numerous studies conducted in recent decades identify multiple biological evolution-related misconceptions held by select groups of students. These groups include secondary students (Kampourakis & Zogza, 2009) or undergraduate students (Nehm & Reilly, 2007; BouJaoude et al, 2009). These studies repeatedly indicate that students of all ages and with varying educational backgrounds have difficulties accurately understanding the concepts constituting Evolution. These misconceptions are tenacious and pervasive ranging from minor misunderstandings to complete theory rejection. Common biological evolution misconceptions seem to have a life of their own with some of the most pervasive ones having persisted for decades despite all efforts to correct them (Mead, 2010; Yates & Marek, 2015).

Use and Disuse is one of the common misconceptions: Many students conceive of evolution as involving change due to use or disuse of organs. This view, which was developed explicitly by Jean-Baptiste Lamarck but was also invoked to an extent by Darwin, emphasizes changes to individual organisms that occur as they use particular features more or less. For example, Darwin invoked natural selection to explain the loss of sight in some subterranean rodents, but instead favored disuse alone as the explanation for loss of eyes in blind, cave-dwelling animals: “As it is difficult to imagine that eyes, though useless, could be in any way injurious to animals living in darkness, I attribute their loss wholly to disuse.” This sort of intuition remains common in naïve explanations for why unnecessary organs become vestigial or eventually disappear. Modern evolutionary theory recognizes several reasons that may account for the loss of complex features, some of which involve direct natural selection, but none of which is based simply on disuse.

Other misconceptions were inventoried : Change due to need, tendency toward improvement, inheritance of acquired characteristics, mutations caused by environmental changes, adaptation as positive change rather than selection against maladaptive traits, individual organisms change, Primarily change in response to need, Organisms changing in response to need or in an attempt to adapt, “fitness” relating to physical condition, minimal variation within populations, only beneficial traits are passed on, Beneficial physical changes in parents are passed on to offspring, Heritable differences between parents and offspring are due to improvement in response to needs. Organisms change over their lifetimes to become better able to survive and pass these changes on to offspring. Any differences between parent and offspring will be in the direction of further improvement. The entire species transforms in response to need (Demastes et al 1995; Bardapurkar 2008; Gregory 2009; Nehm & Reilly 2007).

### **Population Genetics in Moroccan curriculum**

In secondary school, a course of Population genetics was integrated in the last reform of the educatif system. The concepts treated in this course are: Genetic Variation in natural populations and its estimation; Hardy-Weinberg Law; deviations from Hardy-Weinberg equilibrium; evolutionary forces (Mutation, Migration, Natural selection and Genetic drift); speciation; example of microevolution (evolution of Horse). The Human evolution is not mentioned in the curriculum or in textbooks.

In the university level, Populations genetics is treated in the third year (baccalaurat + 3 years) as a complete course of 50 hours. The program is the same as that taught in secondary education but more in detail with some lab. Human evolution is treated in some courses of the university curriculum.

## METHODS

This study is mainly qualitative, our methodology was mixed. We used a questionnaire and interview. These qualitative analytical methods were supplemented with statistical analysis to identify students' misunderstanding in Population genetics.

**Students sample:** All students surveyed in the study were enrolled in a graduate science program at the University, the sample is composed of 86 Graduate Students (baccalaureate plus 3 years of study) and 20 Master' students (baccalaureate plus 4 or 5 years). The mean age of students was 24 years (range: 22 to 37 years). Females comprised 46 percent of the sample.

**The questionnaire:** We composed a questionnaire to acquire information on several key issues: (a) the students' understanding of population concept, Hardy-weinberg law, genetic structure, (b) the students' understanding of the mechanisms by which evolutionary change occurs, and (c), the level of acceptance of evolution among science graduate students.

Some of the questions were inspired by previous studies (Shtulman 2006, Kampourakis and Zogza 2009); however, we developed many new questions appropriate for students at the graduate level. In this article, we only analyze the students' responses in respect of two evolutionary forces: natural selection and genetic drift.

**The interview:** Interview was conducted on eight voluntary participants. The interviews lasted approximately 30 minutes. Thematic interview questions are used to explore in greater detail the most commonly held misconceptions identified by the questionnaire analysis. The Interview was recorded and a coding rubric was used to score student responses.

## RESULTS

### Genetic variation and Hardy-Weinberg law (equilibrium law)

Genetic variation describes naturally occurring genetic differences among individuals of the same species. This variation permits flexibility and survival of a population in the face of changing environmental circumstances. Consequently, genetic variation is often considered as an advantage for populations (Klug and al 2012).

Nearly half of students think that existing variation among individuals are rare and unimportant for Evolution. The existing genetic variation within and between populations is an important factor for Evolution, without variation, there isn't Evolution. For these students, the fact of belonging to a species is opposed to the existence of genetic variation between individuals of this species.

Students are familiar with the statement of the Hardy-weinberg law (H-W) and the conditions of its application but a student out of four believes that this law is only valid in the case of diploids organisms (table 1). In interviews, we asked the students to show and explain this central law of population genetics. Over a third of students are unable to link this law to reproduction and they are unable to use the chessboard of gametes (Punnet square) to find the genetic structure of the offspring. Other students do not understand why they use gametic frequencies different of the Mendelian ones ( $1/2$ ;  $1/2$ ).

The genetic variation of natural populations is constantly changing from genetic drift, mutation, migration, and natural and sexual selection. The Hardy-Weinberg principle gives scientists a mathematical baseline of a non-evolving population to which they can compare evolving populations. If scientists record allele frequencies over time and then calculate the expected frequencies based on Hardy-Weinberg values, the scientists can hypothesize the mechanisms driving the population's evolution (Boundless Biology 2016).

Seven students out of ten think that the Hardy-Weinberg law cannot be applied in the case of natural populations. This is can be explained by the fact that no natural population does comply with the conditions of the ideal population described by Hardy-Weinberg law (natural populations are a finite size, there are mutations, gene flow and selection) One of the specific difficulties of the H-W law is that it is what would happen to allele frequencies in the absence of any evolutionary parameter. This is counterintuitive for most students. H-W law is the standard by which evolution can be measured.

It is a strange fact that the most basic law of population genetics, which is attributed to Hardy and Weinberg, is poorly understood by majority of students and many scientists who use it routinely. One of misconceptions is that

random mating and Hardy-Weinberg proportions are inextricably linked. Stark (2006) shows that, provided the population has discrete and non-overlapping generations, Hardy-Weinberg proportions can be attained in one round of non-random mating and that random mating is a single point in a continuum of such possibilities.

**Table 1.** Students' Understanding of Variation and H-W Law (In %)

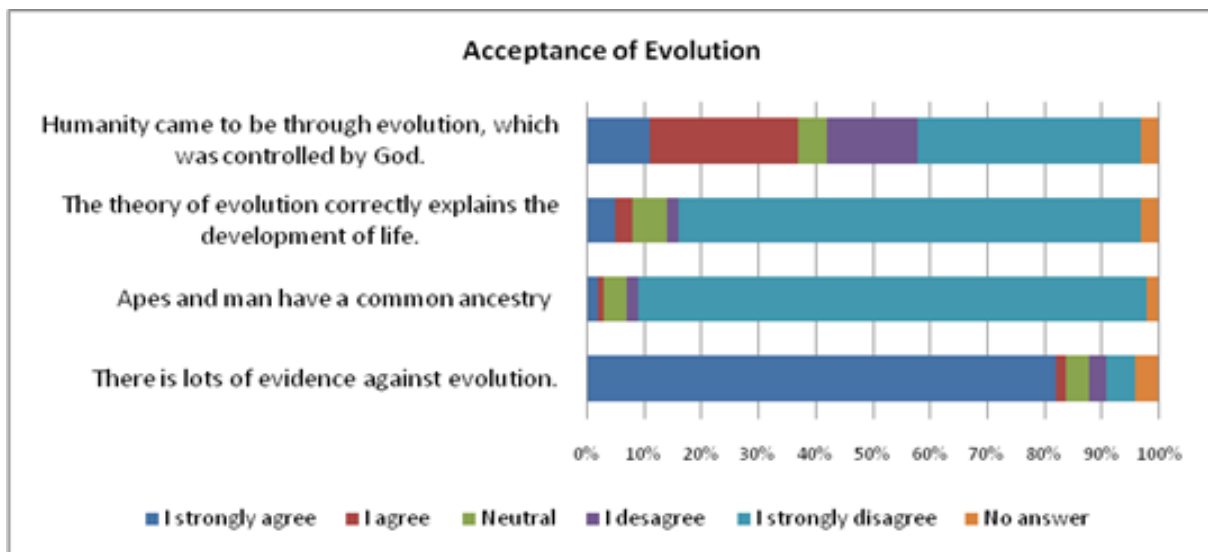
Statement	1	2	3	4	5	6
<b>Q 6</b> Variation among individuals within a species is important for evolution.	12	33	12	8	22	13
<b>Q 27</b> Existing variation among individuals are rare and unimportant for Evolution.	19	29	2	35	12	3
<b>Q 32</b> The Hardy-Weinberg law can not be applied in the case of natural populations	22	45	9	14	8	2
<b>Q 33</b> In the Hardy-Weinberg law, $p^2 + 2pq + q^2$ are the genotypic frequencies	28	54	7	4	7	0
<b>Q 36</b> HW Law is valid only in diploids	5	37	13	17	23	5

1 I Strongly agree 2 I agree 3 Neutral 4 I disagree 5 I Strongly disagree 6 Non-answer

**Acceptance and understanding of Evolution among students**

About 84 % of the students who completed the questionnaire don't identified Evolution as an established scientific fact supported by overwhelming evidence and think that there is lots of evidence against Evolution. More than 92% of students surveyed assert that Apes and man have not a common ancestry and that the theory of Evolution doesn't explain the development of life (about 86% of students surveyed). Nevertheless, they accept the statement that Humanity came to be through Evolution, which was controlled by God (37%) (Fig 1).

This attitude toward the theory of evolution is explained by the fact that all these students are Muslims and that the majority of them are believers. Many researches have found similar results (BouJaoude et al, 2009; Clément & Quessada, 2008; Miller et al, 2006).



**Figure 1.** Students' Attitude Toward Evolution Theory

**Evolution: Lamarckism versus Darwinism**

**Table 2.** Students’ Understanding of How Evolution Occurs (In %)

Statement	1	2	3	4	5	6
<b>Q 5</b> If two light-skinned people moved to a sunny location and got very tan, their children would be more tan than they (the parents) were originally.	3	16	11%	7	59	4
<b>Q 8</b> A species evolves because individuals want to.	2	14	8	12	58	5
<b>Q 24</b> Evolution is always an improvement.	20	32	8	18	10	12
<b>Q 10</b> A species evolves because individuals need to.	20	34	8	5	25	8
<b>Q 18</b> All individuals in a population of ducks living on a pond have webbed feet. The pond completely dries up. Over time, the descendants of the ducks will evolve so that they do not have webbed feet	14	33	11	12	23	7
<b>Q 30</b> “Survival of the fittest” means basically that “only the strong survive”.	11	39	6	11	26	7
<b>Q 13</b> New traits within a population appear at random.	8	25	10	43	9	5
<b>Q 14</b> The environment determines which new traits will appear in a population.	11	41	11	12	18	7
<b>Q 22</b> Evolution cannot work because one mutation cannot cause a complex structure (e.g., the eye).	17	31	10	22	12	8

1 I Strongly agree   2 I agree   3 Neutral   4 I disagree   5 I Strongly disagree   6 Non-answer

- One student out of five imply that acquired traits can be inherited (19 % for question Q5), and more than the half of students (54%) think that a species evolves because individuals need to. About one student out of two implies that a trait is developed as a result of loss through disuse of the trait (Q 18). The ideas of “use and disuse” and of “the inheritance of acquired traits” are associated with Lamarck. “Lamarck asserts that the need of organisms to adapt to environmental demands and their innate drive towards better, more complex, organizations drive the evolution of new species”(Samarapungavan & Wiers, 1997).Numerous elements charachterizes lamarckian conceptions : individual organisms are changing in response to “need” ; change through conscious efforts toward improvement, and enhancement or loss of features as a result of use or disuse ; inheritance of acquired characters (Gregory, 2009 ; Kampourakis and Zogza 2009).
- Only one student out of three states that new traits within a population appear at random (33% for Q13).

These results show the existence of two antagonistic conceptions:

- Individual organisms are changing in response to “need”; change through conscious efforts toward improvement, and enhancement or loss of features as a result of use or disuse. These changes are passing on to the offspring (more than 50% of surveyed students): “Lamarckian” conceptions (Gregory, 2009; Kampourakis and Zogza 2009).
- Species evolve by mechanisms, which are based on over production, chance mutation, and nonrandom survival and reproduction as influenced by the heritable traits of organisms. Only random processes produce new traits or a change in existing traits. The following environmentally directed influences do not cause a change in genetic traits (Darwinian conceptions).

**Mechanisms of Evolution**

*Natural selection*

Four students out of ten say that the two most important factors that determine the direction of Evolution are survival and reproduction (Q12) wich are the cause of the various fitness (66% for Q38). But, the majority of surveyed students do not understand the differents models of selection and their actions on genetic variation (Q35). They confound these different types of selection (Directional, Disruptive, and Stabilizing). They also say that dominant alleles are always selectively advantageous (63% for Q31), “Survival of the fittest” means basically that “only the strong survive” (50% for Q30), they also say that Natural selection can not act when genetic drift occurs (37% for Q23) (Table 3).

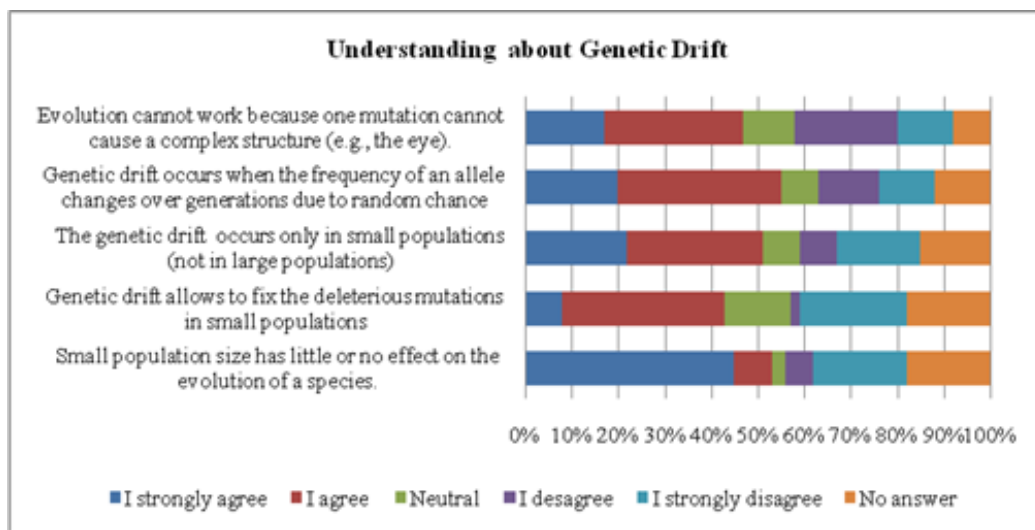
Survival in the struggle for existence is not random, but depends in part on the hereditary constitution of the surviving individuals. Those individuals whose surviving characteristics fit them best to their environment are likely to leave more offspring than less fit individuals. The unequal ability of individuals to survive and reproduce will lead to gradual change in a population, with the proportion of individuals with favorable characteristics accumulating over the generations.

**Table 3.** Students’ Understanding Of Natural Selection

Statement	1	2	3	4	5	6
<b>Q 24</b> Evolution is always an improvement.	20%	32%	8%	18%	10%	12%
<b>Q 11</b> I have a clear understanding of the term “fitness” when it is used in a biological sense.	2%	25%	5%	43%	8%	16%
<b>Q 12</b> Two of the most important factors that determine the direction of evolution are survival and reproduction.	16%	24%	10%	27%	11%	11%
<b>Q 15</b> Directional selection occurs when natural selection favors both the homozygous genotypes	16%	27%	23%	7%	11%	16%
<b>Q 16</b> Disruptive selection can lead to two new species.	14%	29%	14%	17%	11%	14%
<b>Q 21</b> Stabilizing selection occurs when natural selection favors the intermediate states of continuous variation.	34%	10%	6%	23%	16%	11%
<b>Q 23</b> Natural selection can not act when genetic drift occurs	10%	27%	11%	20%	13%	18%
<b>Q 25</b> If webbed feet are being selected for, all individuals in the next generation will have more webbing on their feet than individuals in their parents’ generation.	14%	26%	12%	16%	24%	8%
<b>Q 28</b> Disruptive selection occurs when natural selection favors both extremes of continuous variation.	9%	27%	10%	14%	23%	16%
<b>Q 30</b> “Survival of the fittest” means basically that “only the strong survive”.	11%	39%	6%	11%	26%	7%
<b>Q 31</b> Dominant alleles are always selectively advantageous	24%	39%	2%	10%	17%	8%
<b>Q 34</b> The mutation is an effective evolutionary strength	35%	22%	7%	21%	13%	2%
<b>Q 35</b> Natural selection always decreases genetic variation	24%	41%	7%	7%	21%	0%
<b>Q 37</b> individuals have different fitness because of their different phenotypes	19%	28%	21%	10%	15%	7%
<b>Q 38</b> survival rate and fertility are the cause of the various fitness	23%	39%	6%	12%	11%	9%

1 I Strongly agree 2 I agree 3 Neutral 4 I disagree 5 I Strongly disagree 6 Non-answer

**Genetic Drift**



**Figure 2.** Students’ Understanding About Genetic Drift

More than half of surveyed students say that the genetic drift has no effect in small populations (53%) and that the drift does not occur in large populations (51%) (Table 3). This is strange because more than half of the students

correctly identify Genetic drift as a random phenomenon which causes a change of allele frequencies over generations.

The effects of genetic drift are all the more important as the population is small, because the observed differences of allele frequencies from one generation to the other are all the more noticeable. Genetic drift concerns mainly neutral alleles that confer no selective advantage or disadvantage. Genetic drift is a major mechanism of Evolution.

## **DISCUSSION AND CONCLUSION**

The results show that the majority of surveyed students reject the theory of evolution, this can be explained by the fact that these students are Muslims. These results accord well with recent polls regarding the acceptance of evolution in numerous countries despite the differences in cultural and religious contexts between these countries (Clément, & Quessada 2008; Angus Reid GlobalMonitor 2007; Miller et al. 2006, Gallup 2009).

Among the factors contributing to students' low score in accepting Evolution are poor understanding of Population genetics, the politicization of science and the literal interpretation of the sacred books of each religion (Miller et al. 2006).

The results show also that the majority of surveyed students have difficulties in understanding the basic concepts of Population genetics. Analysis of the questionnaire results and interviews allow to identify some misconceptions. Thus, the most common students' misconceptions relate to the fact that if an organism changes during life in order to adapt to its environment, those changes are passed on to its offspring, these changes are made by what the organisms want or need. Evolution happens according to a predetermined plan and that the results have already been decided. Such views have often been labeled "Lamarckian".

But, this was commonly mixed with a semi-Darwinian notion of "advantage," implying at least a basic appreciation of variation among individuals and competition for resources. Numerous students say that organisms, even of the same species, are all different and that those which happen to have variations that help them to survive in their environments survive and have more offspring. The offspring are born with their parents' helpful traits, and as they reproduce, individuals with that trait make up more of the population. Such misconceptions have been identified in students by other researches (Gregory 2009).

Most students had a basic understanding of the process of Evolution by Natural selection. Their ideas about how and why Evolution occurred differed from those accepted by biologists. Biologists recognize that two distinct processes, fundamentally different in cause and effect, influence traits exhibited by populations over time. New traits appear by random changes in genetic material (random mutation or sexual recombination) then these traits survive or disappear due to selection by environmental factors (natural selection). The results of this study show that many students fail to recognize the existence of two processes and they fail to make a distinction between the appearance of traits in a population and their survival over time.

The results show also the existence of many misconceptions about Genetic drift. Misconceptions about random processes" emerged as factors contributing to student difficulties in learning evolutionary and molecular biology (Garvin-Doxas and Klymkowsky, 2008). This is not surprising, because probability and randomness perplex students of all ages (Lecoutre et al., 2006). Students are challenged by both the terminology associated with random evolutionary processes and the conceptual complexities of these processes (Mead and Scott, 2010). Despite these obstacles, understanding random processes such as genetic drift is essential for a deep understanding of the theory of evolution. In contrast to natural selection, Genetic drift is nonselective and therefore results in nonadaptive changes in populations. Genetic drift occurs in any finite population and therefore occurs in every population all the time (Staub 2002).

The Population genetics is a challenging topic for students to learn. These students have complex and strongly held scientific misconceptions which are an obstacle to understanding Evolution. Genetic drift and Natural selection are the most topics which present learning difficulties for students. The results suggest that most presently used methods of teaching about Evolution by natural selection are ineffective for this population of students. Even university students who had taken more than three years of biology generally showed little understanding of the evolutionary process. Efforts should be made by instructors to develop strategies to facilitate student learning of Population genetic.



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# LEARNING MATHEMATICS WITH EDUCATIONAL DIGITAL GAME PROGRAMMING

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**ABSTRACT:** Game may help those who play to acquire spiritual and cognitive skills. Acquiring these spiritual and cognitive skills stems from educational power of game because game educates while it is being played. It has a certain purpose. Persons try various ways for achieving this purpose. Each way experienced teaches persons' new things. Thus, the game may help to acquire spiritual and cognitive skills. Variety of game has increased by technological advancement. The first thing that comes to mind is digital games anymore. Such an increase in digital games seems to decrease concern of students for lessons. Associating lesson with game is aimed in this study in order to turn this situation into advantage. Thus, it has been considered that motivation and education of students would be easier. A model application has been created for this. Mathematics has been selected for this application which is the most difficult lesson for students. A game has been designed by the software named Scratch which was developed by Massachusetts Technology Institute (MIT). The game designed includes four operations. The game starts with addition, subtraction, multiplication or division that is chosen by student. Fishes with different colors drop according to the operation selected. Penguin eats these fishes dropped. Student is required to give correct answer to the operation asked in order that penguin eats the fish. Therefore he/she may increase the total point as score. Thanks to this application it has been seen that concern of students for lessons was increased and education became easier. Furthermore, total points may feedback teacher regarding to what extent the students comprehend the operation selected. These examples may be raised and brought in compliance with all lessons.

**Key words:** Scratch, Game programming, Enjoyable mathematics

## INTRODUCTION

### What is Game?

It can be said that game concept is an activity that improves cognitive and spiritual skills and made by people entertainingly, in a suitable period of time, within periods other than that of interests of people (Erkan, 2012). When describing the game as articles;

- *Game is an out picture of joy in life.*
- *Game is a fact that attributes its existence to life.*
- *It is a very serious interest for children.*
- *It is the most natural environment for learning. Because game is a laboratory environment in which children test and try what they heard and experienced; reinforce what they learned.*
- *It is realm of freedom. Game reflects inner world of children and dominates that world. It sets up rules itself and may change these rules.*
- *It is an environment in which children improve their skills.*

Game, in brief; may be classified as an activity that no one can have idea about end of it, based on will and is far away from external constraints and stress (Anonym, 2015). Activities as reading book or watching film are not active actions as active as playing computer games. Computer game is a virtual world in which you can animate your choices in games, designs in our minds and characters in games (Bostan and Tingoy, 2015). Games of such a virtual world have considerably drawn interest as advancements in technology. It is possible to say that the studies on improving and designing these games have increased.

It led to changes in quality of game, fun and spare time activities, as well. The fact which humankind uses to fill in time and to communicate each other has been influenced by changes. Change of game concept has led to some problems and implied some seeking for solutions to these problems as well.

### **Difference of Digital Game from Other Games**

Digital game refers to adaption of a story system including a scenario by coding with visual elements and adding voice. Television and game console which is called as video control system presents various aspects to user. This case enables users to manage with bringing them into forefront (Yengin, 2012).

When we look at progress of digital games, it appears to have been advanced with entertainment purposes. It started to be used, over time, with education purposes not only with entertainment purposes. This case has increased gradually. Thus educational digital game concept has come into our lives. This concept may be described as game which includes cognitive, social, behavioral and emotional dimensions for a certain purpose and is prepared with technology and provides learning (Cetin, 2015).

Digital games have a different structure among other games. That being a software product is the primary difference. Cultural differences and age criterion is not taken into consideration for being a software product. This case gives rise to psychological problems. It also became an important issue to enable classification system according to age groups in order to remove these problems (Ozhan, 2012).

### **Issues to be Regarded While Developing Game?**

Target group that will play the game is the first to be taken into consideration because this group gives imaginary opinions to game designer about how to design the game (Lobão and et al, 2008). We frequently hear educational game concept among education and learning concepts in an improving and changing world. When considering educational theories, it seems that educational games promote these theories. For example, according to cognitive educational theory, designer educators used strategies which particularly facilitate learning, stimulate prior knowledge, enable learning by setting cognitive links and gather attention (Simsek, 2009). Games which target entertainingly learning and are established connections with learning must be advanced by planning (Anonym (1), 2015). Therefore, it is critical to prepare educational game by considering properties of platforms which are used during design of educational games, the things that game motor to be selected can do and properties of platforms that it supports (Coban and et al, 2011).

### **LITERATURE SURVEY ABOUT EDUCATIONAL GAME**

Firat S., in his master's thesis, has examined effect of mathematical education by way of computer driven educational games on cognitive learning concerning some probability concepts. Pretest and posttest comparison, that is to say, quasi-experimental research model was used. Pretest and posttest comparison was used in order to come to a conclusion. The notion was reached that generalizing the use of computer driven educational games in mathematical learning is suggestible (Firat, 2011).

Kebritcki and Hirumi (2010) studied effects of computer games on mathematic success and motivation of students. Initially, computer knowledge, English grammar and mathematic knowledge of students were examined. A group of student received their learning in ordinary class environment, while another group received their learnings with computer in laboratory environment. It has been observed that motivation of those with computer driven learning was better (Kebritcki and et al, 2010).

In the paper published by KULA A. et al. in 2005, they reveal effect of educational computer games on progress of basic arithmetic operation skill. Pretest and posttest comparison were applied fir 4<sup>th</sup> and 5<sup>th</sup> class students. Change was examined in tests. Looking at the change, some positive results were obtained regarding motivator and educative effect of game (Kula and Erdem, 2005).

In Çankaya S. master's thesis, some studies were conducted about primary education students regarding effects of educative computer games, which were designed for ratio and proportion, on students. A questionnaire was prepared and applied to students for this study and a positive relation between educational computer games and mathematical learning was observed (Cankaya, 2007).

In study of Erman Yükseltürk and Serhat Altıok, education game design was focused by using Scratch program of preservice teachers of information technologies. Examining the games prepared, it has been seen that it applies to the subjects in math class and games designed are reasonably good and very well (Yukselturk and Altıok, 2016).

Marina Papastergiou (2009), in a study, researched effects of digital game database on education effectiveness and student motivation. Students were observed during playing. A feedback questionnaire was made at the end of the playing out of observation. It has been observed that motivation of students regarding learning increased (Papastergiou, 2009).

An article was made, in 2015, in order to establish effect of game driven education environments on student success and views. Experimental and control groups were set up within the research. Educational games on vitamin education portal supported by Ministry of National Education were used. They were evaluated according to the criteria determined by researcher and compared with views of teacher. It has been observed that it influenced learning positively according to the evaluation. However, it was of the opinion that games must be improved by considering imperfections of learning (Akin and Atici, 2015).

Ron Owston et al., made some studies concerning advancement of computer game in order to learn pedagogical and literacy activities. Students were divided into 2 groups as developer and control group. Control group controlled the game that was designed after 10-week-period and finally positive effect of computer game on learning was found (Owston et al, 2007).

In article published by Bakar et al., views of students regarding used of educational computer game were revealed. Qualitative research methods were used with 6<sup>th</sup> class students for this view. As a result, it has been observed that the students appreciated educational game environment and motivation of them was increased (Bakar et al, 2008).

### **Model Application regarding Educational Digital Game**

A game was developed in order to resolve the problems of children at elementary school regarding four operations and make learning enjoyable. Generally looking at the principal philosophy of this game, we can say that it improves skills of users on four operations.

When examining content of the game, it can be seen that the aim is to make students enjoy mathematics by both colored characters and game. An educational game has been developed for these operations through Scratch which is a web based programming language developed by Massachusetts Institute of Technology (MIT) (Anonym (2), 2015). So the games were enabled to reach the users quickly and easily. Furthermore, this game will contribute students to improve their skills regarding their hand-eye coordination.

### **Method and Procedure used in Education Digital Game**

It is not an easy effort to develop game. Some stages should be completed to be able to develop game. These stages enable game to be playable, reach target group and reflect desirable features. Therefore, the stages must be carried out during developing the game in turn. This procedure consists of 5 stages.

#### ***Concept Creation***

The aim, with developed game, is to make four operations in math enjoyable for primary school students. This aim constitutes fundamental philosophy of the game. Even though children are thought to play this game in parallel with this purpose, it enables persons with older ages to increase their achievements regarding four operations. This game leads to teachers to test what their students learned and to make lessons enjoyable.

Although each successful game is unique in itself, almost all of them will fall into a certain type. The game to be created is decided and other games of the same type are consulted (Anonym (2), 2015). Education game, as type of game, has been chosen within our study.

As to financial analysis, this game does not require a serious cost because software platform is presented to users free of charge.

#### ***Game design***

Story creation should be a few pages. Story created will be heart of the game (Anonym (3), 2015). There is penguin character trying to eat fishes falling in our education game. The cause of choosing penguins and fishes is to attract attention of children to the game and identify difficult operations for children with favorite characters. User starts the game by choosing four operations. This character takes a standard point for each fish that it eats but if it tries to eat different colored ones among falling fishes, four operations are asked depending on chosen operation. If he

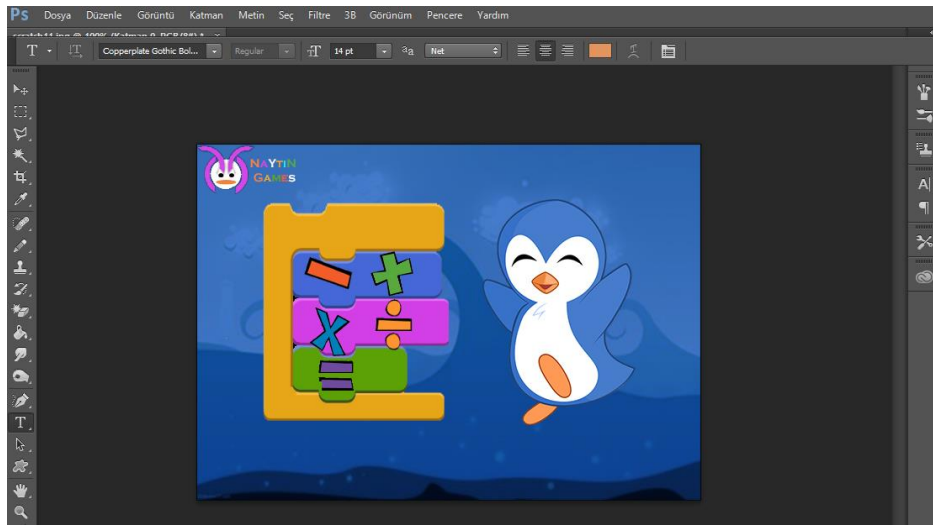
gives correct answer to the question, he takes ten points and continues the game but if he cannot know the question, the game ends. Moreover, the game also ends if different colored fishes are not caught. Thus, total scored points within the section of the game demonstrate to what extent he learned the subject.

Each character in a game that we could direct and play is a player character. Our character in our game is penguin. Each character which interacts with player character during the game is given character name which is not player. If we look at the character not player in our game, it is possible to say that these are fishes within the game.

The platform chosen for developing game will considerably influence the development. Platform determines the game in a controlled way; smart phone games are generally used with touch and slope basis, PC games, particularly keyboard, mouse, console games and game pad (Anonym (3), 2015). It is a PC based game and played with keyboard and mouse.

### **Art design**

It is design of environment and character appearances. Penguins and fishes are designed in various colors in this game. These designs are designed with Adobe Photoshop software.



**Figure 1.** An appearance of game design

During adjusting voice and music, a voice is available that indicates eating action while penguin eats fishes. Also, there is another voice reporting wrong answer in the game.

### **Programing design**

Scratch program was used in order to develop education game. This program can be downloaded from [scratch.mit.edu.tr](http://scratch.mit.edu.tr) address. It has a design supporting forty-two foreign languages. Scratch was developed as a project supported by American National Science Institution in MIT University.

The project started in 2003 and completed in 2007. It aims to make youngsters who spend time in centers which operates in society, except for school in countries whose economic level is low, it means that it aims to increase technology use (Resnick et al, 2003).

When this new programming environment is being designed, following key features has been considered:

*Programming with block structures:* It has been provided that students can make program parts by swiping and dropping the graphically block structures.

*Use of rich media as programmable:* First activities in traditional programming teaching are structured on boring number, string and basic graphic processes. However, in this new programming environment, processes can be on the pictures, animations, film parts and sounds.

*More shareability:* Youngsters can share their projects and compare notes with their friends on web.

*Integration with the real world:* they can control machines in the real world also via some kind of hardware equipment which can be connected to computers.



## RESULT AND RECOMMENDATIONS

Educational game can be defined as the most appropriate device for learning. With educational game, individuals can learn concepts which told to them more easily and those concepts are not erased from the memory in very long time. It can be said that the learning is healthy and clear because the learning was realized by entertaining (Anonym (4), 2015). In educational games, the individual faces with a goal and it is required to achieve this goal. The goal may be overpassing a certain point, completing the mission in a certain period etc.

Most children have a prejudice against math course. In order to break this prejudice, with educational computer games, it is provided that students create a positive concept. With this developed educational game it is understood that students move off from negative thinking by entertaining. It is observed that this game which is not limited with just students, helps reinforcing of four operations subjects learnt by elderly individuals. It also provides that teachers can take feedback of the taught subject from students. The achieved score may inform the teacher about how much of the taught information is learnt. In this way, it is provided that both reinforcing and feedback processes are realized by entertaining.

Our developed game will be able to help in learning and reinforcing of challenging subject by developed. Moreover, in the context of learning of all subjects, use of computer games will increase the quality of education.

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## ADDRESSING RACISM FROM CLASSROOM TEACHING

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**ABSTRACT:** As teachers striving to create a democratic and safe classroom ‘space’ that is open to varied views and perspectives we often struggle when it comes to discussions on racism and islamophobia. Some students withdraw from classroom debate and remain silent, whilst others, speak out those personal views on specific ‘race’ debates. As an educationalist, I see my job as a teacher in the classroom to help students to challenge racism and to encourage changed thinking. I argue that our students should be directed to anti-racist, anti-sexist, indeed against all sorts of oppressive ideas. I ask in this paper, “What can educationalists do to undo racism that emerges from teaching and learning moments? This paper offers examples of teaching exchanges from classroom teaching that explores ways of teaching against racism. It underlines the importance of anti-racism as it emerges organically within classroom engagement and exchange. This paper explores student views and perspectives on ‘race’ sensitive issues and examines the benefits in drawing out racialised comments that emerge from classroom debates. The underlying interest for the writer is to examine the ways in which such classroom interaction, dialogue and exchanges can inform anti-racist thinking and critique. Student centred learning, where student voice and perspectives are welcomed in the critique against racism, is about opening up new and important debates about ethnicity and identity in education. I argue here, that classroom debates can interrogate the common-sense racism that exists in ones thinking. This article draws from a seminar discussion *moment* when a small number of students shared their views on religious dress and educational issues.

**Key words:** racism and education

### INTRODUCTION

This paper critically explores student dialogue and counter dialogue that emerge from class discussions. I argue here that minority common sense voices can act as counter narrative to mainstream views on racism and other issues. It is suggested that classroom exchanges can help provoke in students critical thought and self-reflection. Such dialogue can become the material that informs anti-racist thinking in Higher Education. This article suggests that as teachers we have to make use of the varied student comments as ways of challenging racist thinking. Students’ engaged participation in class is paramount to this endeavour.

Teaching race and racism is probably the most difficult subject I teach. Why? Because minority ethnic students come to class with their own version of history, their own understanding of social inequalities and own experiences of discrimination. These students common –sense voice, is often presented as all knowing, as real and authentic. These sentiments are often loaded with ‘our racism is more serious and damaging, than yours’. I have heard African-Caribbean students say, ‘nothing compares with the days of slavery’, Muslim students say, ‘it’s the Muslims that are now being criminalized, and failed by the school system, this racism is more perverse’. These students draw from personal experience, sometimes informed by crime survey statistics, and headline news, but in the main from their own lived experience of racism. They speak with authority. The majority white students *sometimes* interject these discussions with less confidence. This paper explores ways in which student centered teaching and learning methods can best be used for educational gains. I argue that the student voice articulated via common-sense experiences could be woven into our critical understanding of our worlds and give them value. The challenge for teachers/lecturers is to help make the shift from the ‘gutsy’ emotional common sense knowing to a more rational sociological critique of the issues.

One of sociology’s tasks is to challenge ‘common sense’ thinking. C. Wright Mills made this claim in 1959 when he said

“The Sociological Imagination’ enables us to grasp history and biography and the relations between the two within society. That is its promise” (6)

The critical nature of thinking sociologically, he argued, is the ability to connect ‘the personal trouble of milieu’ to the historical forces and social processes of the societies and people that produced it. This sociological imagination then is presented as the fruit of years of rigorous nurture and disciplined pruning by academics. I argue here that if we accept this pruning, the classroom becomes as hooks says a ‘field where we all labour’ (1994)

Too often, in my experience, the concern to encourage rigorous sociological thought has supported what Freier (1972) has called banking model of learning and teaching – where the class is the one-way depository of knowledge from teacher to student. As a result of critical pedagogy, I work to challenge this conception and the classroom practices it encourages. Through student led seminars and group work, I make space for more reflective and evaluative teaching and learning experiences. The aim is to construct the classroom as less of a one-way information-giving depository to more of a space of knowledge exchange and creation.

My efforts at engaged pedagogy, where communication flows around the group through the facilitator; would not suit all students and staff. However, my experience of it suggests that collaborative and interactive teaching and learning can do two important things. It can encourage more wide-ranging sociological imaginations and can validate critical elements in ‘common sense’ thinking. This is because student-centred teaching methods have the potential to reshuffle the power between and within student grouping and lecturers/teachers. This approach also opens up the room to comments, stories and worldviews that can develop analysis way beyond the textbooks. By drawing from their own ‘cultural reservoirs’ – students can be transformed into active learners. Engaged dialogue, albeit from common-sense ‘knowing’, can be used to inform the formal teaching and learning exchanges in class and allow for a reflective and critical stance on broader social realities.

My concern as a ‘teacher/facilitator’ is to make our classrooms reflect the world as we would have it. They should be interactive and collaborative arenas, where the teaching and learning methods and processes are interchangeable places where we all create knowledge. As social science academics, we need to hear the stories of the people we teach, study, and theorize. These narratives might run counter to our sociological imaginations, and ‘common sense’. In this they are to be welcomed. Issues around race and racism are one area where, in my experience, everyday, non-academic narratives will run counter to our academically correct ‘*knowledge*’. I have developed a method that allows for people to be heard and to be critical of the ‘common-senses’ of themselves and the powerful. It draws on my own experiences and insights gathered from critical pedagogy perspectives which demands that all knowledge, not only ‘official knowledge’, be taught critically.

To share that method, I have focused on a particular critical classroom moment. The comments cited are drawn from my field/dairy notes of student discussions. I want to show how classroom exchanges can provoke critical thought and self-reflection in a group. In this, the classroom dialogue, debate and disagreement can be the material that shapes anti-racist thinking in Higher Education. Part of this process of provoking syntheses is using students’ experiences of racism and making visible systems of exploitation, privilege and oppression. This critical uncovering of the structures, processes and experiences that underpin, maintain and challenge ‘common-sense’ is a key part of sociological imagination.

The question is, how does one interrogate these student views? And what can teachers/facilitators do to bring out the counter race talk, /the ‘Islam phobic’ / anti-Muslim racism that *may* exist in our student’s minds? Clearly, the most challenging moment in a race based classroom is the opening out of these views. This has to be done in a safe environment and respectable manner, with clear ground rules.

The first task for any tutor is to break the silence on the ‘race’ debate, once we have opened out the debate to students’ dialogue, we then allow for the free-flowing contributions. Some silences suggest that some students are not so sure perhaps whether their ‘common-sense’ views are to be aired in university classrooms or whether they should have them at all. Given this, my efforts to engage students in discussions around ‘everyday’ racism, on the streets, on the buses, in the shopping malls, indeed on campus usually provoke a variety of silences. Some students both ethnic minority and majority white avoid speaking at all or do so very *uneasily* about racism. Some are too angry, others too scared and others simply anxious. (see Housee 2006) It seems that the degrees of emotional engagement and confusion combine to disconnect students from the learning environment and create silence. Others will say their ‘piece’ via emotional outbursts that although *can be* legitimate in their views, requires sensitive manoeuvring in an educational direction.

As a teacher committed to pedagogy rooted in critical race and feminist theory, I am continually seeking ways to interrupt these silences, and voices in an attempt to make sociological sense of students’ dialogue.

I strive to create learning strategies that offer all students a safe space to voice their views and share their experiences. This is particularly important because I teach sociology classes on gender and race issues. Cultivating a learning environment where all students feel comfortable exploring these potentially explosive issues is a precondition for achieving my pedagogical goals. I argue that student engagement in the classroom can be the

beginning of changed thinking that can lead to actions against racism and sexism and other inequalities and injustices.

### **British Context: From Multicultural Education to anti-racist education**

Britain is a socially and culturally plural society. Today the 'ethnic minority' population is diverse, with origins from countries including Pakistan, India, Bangladesh, Sri Lanka, the Caribbean and several African countries, and more recently, from Eastern Europe and the Baltic States. The 1970s-multicultural debate in education spoke of co-existence, integration, tolerance and diversity. In the British school curriculum, these ideas were articulated in the three 'S's' slogan of "Samosas, Steal bands and Saris", through fashion, food, and music, difference was celebrated. This multicultural education offered tokenistic changes in curriculum, it did not link the failures, exclusions and alienation of ethnic minority children in education with the overall structures of racism within which schools' function, but instead, as said by J Solomos (in Cashmore, P and Bains, H 1988) multicultural education was

"...a reflection of the common-sense and policy notion that black pupils are the target group which policies should aim at since it is their (blackness) 'deficiencies and 'problems' that have to be overcome. Even when clothed in progressive language, this view tends to support the notion that it is West Indians or Asian children cause problems for schools and not vice-versa" (p171)

Such critiques of multicultural education led the path to what became known as the anti-racist movement in education. The anti-racist critique of the 1980s advocated that schools not only develop a policy statement, which unequivocally condemned all racist behavior, but also conducted open discussions including 'race awareness' workshops, and ensured that curriculum content and process help pupils to comprehend past and present racism. Educational inequality of ethnic minorities was squarely placed within the wider socio-economic inequalities that disproportionately failed and excluded Black and ethnic minority children in education. In going beyond the educational system, the anti-racist critique argued that structural and societal inequalities and institutional racism was key to the understanding of ethnic minority educational inequalities. Gillborn 1995, Troyna and Carrington, 1990)

There has been a great deal of disagreement about multicultural and anti-racist education in Britain. The relevant literature is extensive, and it is not possible to review it here, however, some of the fundamental issues are essential here to make sense of the debate of this paper. Figueroa (1999) suggests that there are three major features of society that are central to the anti-racist education debate, these he argues concerns: diversity, inequality and racism. The work for progressive educationalist he suggests is to challenge these concerns through three relevant sets of fundamental social and educational values: *pluralism* which is about acceptance and valuing difference, *diversity*: which is for equity, justice and human rights and *anti-racism*: that invites open-mindedness, inclusiveness and critical thinking. Education he suggests must address all of these aspects:

"...the promotion of educational equality and quality, especially for ethnic minorities; but equally to the deconstructing and reconstructing of racist and ethnicist frames of reference, perceptions, stereotypes, prejudice, and patterns of relations and actions,...It must likewise focus on institutional and structural racism and the conditions that support as well as those that might help to overcome such racism. (286)

The work in this paper follows these three values as a way of promoting anti-racist teaching strategies.

### **How is this to be done?**

In this part of the paper I explore the theories and strategies that have developed my thinking on anti-racism in classroom.

The contribution of critical pedagogy to multicultural education has been important here. The insistence that students must be involved in the process of their own education is a central tenet of critical pedagogy, and it has inspired the inclusion of student voices that are often missing from most discussions on multiracial and anti-racist teaching.

Researchers such as Ladson-Billings and F.W Tate (1995) and Lynn (1999) have attempted to explore the links between race, culture and educational inequalities. Putting 'race' into critical pedagogy has provided ways of looking at the interrelationship of race, gender, class, culture and pedagogy, whilst, also placing the importance of theories of race and racism to teaching and learning. This inclusion of 'race' argues Lynn (2004) gives a clearer picture of black educational issues because it provides

“an analysis of racial, ethnic and gender subordination in education that relies mostly upon the perceptions, experiences and counter-hegemonic practices of educators of color” (: 154)

Furthermore, because critical race pedagogy recognises the political nature of education and the need to challenge its content and form, anti-racist and multicultural education becomes a critical assessment of curricular, policies and practices on students. This is clearly presented in Nieto’s (1992) suggestion that:

“multicultural education must permeate the curriculum and instructional strategies..., as well as the interactions among teachers, students and parents, and the very way that schools conceptualizes ... teaching and learning” (208)

Critical race pedagogy then, centers its concern with the continued racial discrimination and pedagogic issues, and highlights the importance of black cultural identities in its analysis of such issues. This is the view articulated in this article.

My argument here is, that multicultural and anti-racist education must examine not only the macro picture of policies, strategies, programs, and related practice across the entire educational endeavor, but also focuses on the micro picture of interpersonal behavior, classroom interaction, participation, and related matters. This is where student voice and the use of Black and ethnic minority experience become imperative.

Making use of individual views and experiences from classroom dialogue and exchanges are important in this attempt to create other ways of knowing (knowledge), especially when they allow for marginal voices to be heard. Such discussions, however, need to be taken further if they are to have an impact on educational experiences. These voices/stories need to be given importance by giving them educational credibility. It is not, therefore, just a matter of exchanging discourse and experiences, although this may be illuminating and interesting, it is about giving value to these exchanges, using the stories to further clarify and critique the social reality that is discussed.

In the multi-cultural/racial class of the new millennium, interactive participation and the use of marginal voices is necessary if we want to encourage democratic teaching experiences.

Students’ perspectives about their educational experiences are a relatively new and growing field of enquiry. Such research is especially significant in cultural diverse classrooms. Thus, listening to what students have to say about their experiences can result in a more critical conception of multicultural education. This is not to suggest those students’ views should be adopted uncritically, but to suggest that if students’ views are sought through critical and problem –posing approach, their insights can be crucial for developing meaningful, and engaging educational experiences. Indeed, my own previous research on student perspectives (Housee, 2006) has suggested that students’ welcome classroom interaction, input and feedback and would often make suggestions for debates in the classroom.

One way to use the experiences of students is to focus on the kinds of issues that they live with every day, in the case of minority students, this means to bring the talk of ‘race’, racism and discrimination to the class. Critical race pedagogy that welcomes the experiences of racialized minorities is paramount here. Maintaining safe spaces and nurturing voices and stories in the classroom is the responsibility of everyone, but most especially the teacher. In the first instance, safety and nurture reside in the skills of the teacher in providing structure for the debate and facilitating non-judgmental storytelling. Such engaged dialogue offers powerful tools for bringing out the ‘racisms’ in the classroom that simultaneously connect the stories of the participants with those of commentators, academics, communities and social movements.

### **Why should we make use of the student Voice?**

Proponents of Critical Race Theory argue that the common-sense *knowledge and experience* that the minority student voice brings to class, is the counter-voice to dominant views. Ladson Billings (1995) argues that the use of ‘voice’ provides a way to communicate the experience and realities of the oppressed; this she continues is a first step to justice. The link between CRT and education suggests that the voice of minorities is required for a complete analysis of the education system.

Marginal voices provide, in Dixson and Rousseau’s words (2005)

(a) ‘Counter-story – a means to counteract or challenge the dominant story’. Such counter stories ‘can be used as a tool for exposing, analyzing and challenging the majoritarian stories of racial privilege’ ( 11).

Many critical race theorists argue that the black voice is paramount if we are to interrogate and disrupt the dominant voice. Delgado (1989 cited in Ladson Billings and Tate1995) suggests that this is important for the following reasons:

- Much of reality is socially constructed
- Stories provide members of outgroups a vehicle for psychic self –preservation
- The exchange of stories from the teller to listener can help overcome ethnocentrism and the dysconscious conviction of viewing the world in one way.

(57)

Giving validity to counter-stories is based on a social constructionist paradigm, which argues that individuals socially construct reality. Individual perspectives and experiences are, in this view, essential to understanding the reality of a given individual. Here the use of narrative or voice is imperative to the making of knowledge. CRT’s emphasis on individual experience makes use of epistemologies that welcomes experiential knowledge of reality. This is a controversial point. Although CRT holds a firm stance against notions of racial essentialism, CRT contends that the social realities of African Americans nevertheless give them experiences, voices, and viewpoints that are likely to be different from mainstream, dominant narratives. It therefore becomes imperative that African Americans advance their own counter-narratives, often via story –telling modes that fall outside the usual confines of academic discourse. This is most important when such knowledge is drawn from marginalized voices. To accept black folks sense of the world; is to accept that there are other ways of knowing that are different from the dominant, white view.

In my mind, it is important to recognize that there are many legitimate ways to construct knowledge. Feminists have long argued that epistemologies vary for people with different experiences. Women see the world from different perspectives and ask important questions, which are often specific and relevant to their lives. Our social world experiences are based on ones gendered as well as racialized, class and other social experiences. Similarly, Critical Race theorist urges us to center the experiences of black minority ethnic folks in our thinking of social knowledge. The use of black experience argues Bergerson (2003) should be seen as a legitimate method and lens for studying racism, if educational research offers only one way of understanding the world, which is

*“grounded in the positivist or post-positivist research paradigm (then) racism, sexism, homophobia and classism in education cannot be adequately addressed. ... (therefore) it is necessary to look at educational structures and institutions through the eyes of all participants, relying on their lived experiences to ensure that our research questions and methods address these difficult issues”* (60)

Teaching moments, where students and lecturers engage in critical exchanges regarding our social and political realities, can be the very material that can be used to clarify and unpick such debates.

My student responses to government-inspired hysteria over ‘the veil’ are evidence of this. In itself, it is no surprise that I have had exchanges with hijab (headscarf) wearing students and non-Muslim students who have brought to class critiques that have interrogated and deconstructed common sense racism, in ways that mainstream media have not attempted. However, the depth and breadth of the sociological analyses developed from critical observation, that drew on a range of personal experiences and cultural/religious positions are important in the work of anti-racism.

Active engagement in the class can challenge students’ perceptions of who speaks and whose voice has value. Asian women generally, and in a post 9/11 world, Muslim women have been theorized as the most oppressed and victimized marginal group of all. Within the current climate therefore, it is important that such Female Muslim voices are heard and viewed as empowered. (Zine 2006) As a teacher committed to critical and feminist pedagogy; I am continually seeking ways of opening out the classroom to the ‘race’ talk, and bringing in the student experience. This is especially important to the sociology class that includes students from all walks of the racialized world that we come to belong. Indeed, I believe it is my political obligation to make possible the anti-racist thinking in class, to open up the spaces for counter narratives that offer other ways of knowing.

Students have the capacity to challenge ‘master narratives’, whether they are government inspired furors or the ‘disengaging’ curricula of institutions of higher education. Of course, this involves an element of risk. However, the real risk is not classroom management – dealing with lively debates - given appropriate group and material

preparation. For me, the larger risks involve opening out the classroom to students, and inviting them to speak from their experiences. This open forum inevitably allows for the sharing of the many perspectives that may exist in the student body. The risk here is not to share my not-fully formed views, but to allow students to gain confidence in their own thinking aloud. This of course opens out the debates to the varied views; my job at this juncture is to play the referee.

**To veil or not to veil – the case of students from my class**

In this part of the paper I refer to a discussion on faith schooling during my teaching on the Global Education Issues Module. This module explores gendered and racialized inequalities in education, with particular attention to the demand for separate gendered and religious education facilities. In the Class of 2007 there were 9 students (out of 48) of Muslim background. Islamophobia – anti-Muslim racism was real for many of these students. In speaking about the veil one had to be conscious and sensitive to the racism within society and the current race debate surrounding issues like the veil and Muslim faith schooling. In a climate of Islamophobia this can be very tricky. I do not want to feed the Islamophobia that may be in some of our students' mind, and I certainly do not want to alienate the Muslim students who need to be re-assured that it is safe (in class at least) to be Muslim now.

Religious dress has been the subject of great controversy in the West. France and several towns in Italy have opted to ban the hijab (headscarf) in schools, while the Dutch are considering banning the veil/ burkha or jilbab (which covers the entire head, face and body) (see C Raissiguier (2008), J. Zine 2006). The wearing or indeed of not wearing the veil has a lot of political currency. My Global Education Issues module has raised issues surrounding Identity, Multiculturalism and separate education. Our seminar discussions would often take us to these debates.

This class had spent two weeks on lectures and seminar sessions on multi-cultural and anti-racist education; we had explored separate faith school provisions with specific reference to the Muslim rights. The veil debate and the racism surrounding it had been with us since 9/11, but the interesting aspect with this case of the veil and schooling was particularly relevant to my module. Students had been raising 'race' specific comments about their schooling experience. Some of the students had argued for the need for separate schools because of the endemic racism in mainstream schools, commenting on underachievement of minority children and the lack of respect for difference. Others (some Muslim and non-Muslim students) were arguing for the importance of integration. Schools they argued should be part of the project of a multicultural education, suggesting that children should be schooled together as a preparation for diversity in society. These varied voices and issues raised from the previous seminar formed the background to the following seminar discussion.

The student narratives below are drawn from my reflective classroom diaries notes from a seminar discussion during the debate on separate schooling for Muslim children. Students were invited to comment on the subject of religion and schooling. Using the article below, I invited students to consider whether religious dress such as the headscarf ( hijab) or the full veil impedes the student/pupil learning experience.

The following is a summary of the discussion that took place during the seminar on faith schooling, religious dress wear and educational experience. The article from The Sun (March /3<sup>rd</sup> 2007: 20) newspaper was taken to class. Students were asked to think about the issue raised from the text.



The headlines refer to a High Court ruling allowing schools the right to ban Muslim girls from wearing the full-face veil in lessons. The article speaks of two main issues that are quoted from the then (2007) Education Secretary Alan Johnson :

*It's (the veil) a problem for security and it's also a problem for learning because the teacher can't see whether or not a child is understanding what's being taught."*

The article continues by making its own comments as seen in the following:

- the veil was a security risk as teachers could not instantly recognise visitors,
- it could lead to peer pressure on other Muslim girls to wear the veil,
- it made learning difficult by hiding the pupil's expression from teachers,
- it was at odds with the school's ethos of equality.

### **Critical Incident – classroom session.**

The above article was handed out to students and used to kick start the seminar discussions. Like many teachers, I shifted between my thoughts about this issue, its importance to the learning about the freedom of dress, with the fear of the consequences that such debates could raise – such as the Islamophobic –anti-Muslim racist reaction from some students. By making use of minority ethnic voices the teacher hopes that students would be able to share and explore the many voices that emerge from class. I wanted to use this moment to explore and critically challenge any racism that may emerge from the classroom debate. I argue here, that if we want to encourage students to speak on sensitive issues, such as veiling to a multi racial classroom, like this class, where there was a full veil wearing student with 8 other Muslim students in the class, some wearing the hijab and others not, then we take the challenge and speak openly to these issues.

The discussion below is drawn from diary notes taken from this seminar class on the veil in schools. Class was given the above handout from the Sun and given 10 minutes to read this article. The class was divided into small discussion groups and asked to consider these questions:

- In what ways does the veil impede educational experience?
- In what ways, did they see the veil being a health and safety issue?
- What were their views on the removal of the veil in class?

The class broke up into groups of four or five for small group discussion. I circulated and spoke to the smaller groups, group discussion continued for around 20 minutes. The class was then asked to resume to a plenary for a full discussion with their comments:

### ***Students and tutor speaks out:***

The following are reflective diary pieces, which includes my thinking and feelings as well as my student's comment. The class began with my mixed views on veil wearing. Firstly, I stated that wearing or not wearing the veil is an individual right and choice. I then moved on to the more educationally specific issue of whether it was appropriate dress in educational institutions, and whether such dress wear impedes ones' educational experience.

The discussion began with an invitation to the whole class to speak. Interestingly, the first student to speak was a white student, saying: *I don't mind what people wear, it's their business, but....* and there was a silence, seconds after the silence, she makes the following comment with reference to the school teaching assistant Aisha Azmi (appendix 1).

*I don't see why in a primary school where children need to see their teachers face she had to wear the veil.*

A Muslim student stepped in and said

*Well, she does not, she would lift the veil, at primary age Muslim women are allowed to show their face to young(male)children. She would only wear the veil outside the class and on journey's from home to school;*

The white student responded with the following comment:

*I don't know about that, but didn't she go for her interview without wearing the veil?*

There was an embarrassing muttering going on by some students, saying they were not sure that A Azmi did go for her interview without the veil. One student said that Muslims do interpret Islam differently, and that Azmi, may have chosen to be more traditional after she had started her Job. Her arguments were that Islam was not homogenous, and people lived Islam differently, as said below:

*Hey look, there's us here (referring to a group of Muslim women) right, some of us do not cover our heads at all, some wear a hijab, (head scarf) and she (referring to the full veil wearing student) due to her own interpretation of Islam, has chosen to wear the full veil. I don't see what business it is to any of us how we dress.*

This was an important learning moment for this class, obvious, as it may have sounded; the majority white and the non-Muslim students were now exposed to the different Muslim dress codes. Unlike the homogenous view so often found in the popular texts and newspapers, the class was now told by this Muslim student that Islam as with many religions was interpreted and practiced in many ways.

The second non-Muslim student to speak was a mixed heritage student who shared the following:

*"yeah but why, I'm catholic and the only time I have worn a scar, is when I visited a catholic church in Europe out of respect, anyway we had to. You're not in a religious place now; so why do you wear one, she sniggered.*

This comment was met with a long drawn out silence; the majority white students looked uncomfortable, whilst the minority Muslim students began to appear agitated and looked at each other in disapproval. It was not so much what was said in the above quote, but the dismissal and mockery in her voice that seemed to agitate the other students.

This was an uncomfortable moment for me, as the tutor I remember thinking I must wait for a challenge from the class, when this was not forthcoming, I thought, should I let this pass or should I intervene with a comment, I decided to step in and made the following comment:

*"surely this is their freedom of choice, why should it matter to others, if they wear the veil, freedom of dress whether of wearing a mini skirt or a hijaab should be a universal freedom, - one should be free to dress as one pleases, so long as we are all free to do so".*

This comment seemed to be met with support from the class. On reflection, I see the importance of the tutor interjection. The tutors voice is often needed to neutralize and indeed to throw in another perspective, this is not to say that *we are the all-knowing* but to say that there is a need to steer the debate so political connections are made. I argue that we should try to stretch the debate beyond the classroom themes and emotions, so that wider socio-political issues regarding anti-racism are raised. Student voice here is important, albeit a commonsense reaction, it allows for the not so formulated ideas to surface, in this case it was white and mixed heritage student who spoke, it allows for counter voices, as with the Muslim women who interrupted the dominant stereotypical views. Student engagement can be difficult, but I argue necessary, if we are to encourage that much needed critical student voice to appear as seen in the following comment from a Muslim female student:

*I don't understand what the fuss is about; the media just hypes it up. It is (wearing the veil) a human right, and as for the health and safety argument, isn't a tie just as dangerous in class. Pupils have been known to strangle each other with it and they could dangle (the tie) over the fire burner in the science labs.*

This class ended with a mixture of approval and discomfort to the above comment. I felt the tension in this seminar session. Non-the less I believe that the *race talks* need to be aired, if we want to explore and expose the often-confused views that exists in students' minds. These were important moments for all the students. This exchange offered other ways of knowing, non-Muslim students were able to question, clarify and indeed challenge some of these ideas. For the Muslim students, these were important empowering moments as it allowed for the correcting of some of the stereotypical views.

Reflecting on this critical moment, I am able to work out the learning outcomes of this class exchange. The first point to note here is that these discussions develop organically. We like the tide in the sea have little control of the direction of the waves. So, we often react spontaneously. My guide is my respect for the aforementioned concepts of diversity, equality and anti-racism. My job is to steer the debate to a more positive outcome. This as seen above is not easy. The question here is - how do we make best use of the student dialogue? Here I make use of Figueroa's



(1999) concepts of ‘*situational*’ and *educational* tasks, to show how this can be done. Figueroa suggests that we open up spaces in the class for students to challenge the common-sense views as they arise. A *situational* task argues Figueroa (1999), can be corrected and directed to form a positive experience which becomes an *educational* task, as said here (a)..

‘*situational*’ task is about dealing with realities, as they arise in class,...  
 “an *educational* ‘ task .. help(s) individuals and groups to develop the relevant knowledge, understanding, values, affects, skills, habits and patterns of behavior ... ‘*situational*’ and ‘*educational*’ task...( together leads to) ‘*correcting faults, making good deficiencies, combating errors*’ ....., or it may be one of promoting positive interaction. (:287)

In the following I develop Figueroa’s matrix to make sense of some of the above comments from the student narratives.

	<i>Situational</i>	<i>Educational</i>
<b>Resource using clip from the sun Newspaper</b>	Dealing with misconception as they arise in class	Connections between the Sun News paper article with wider socio-cultural issues, policies, and the politics of freedom of expression and dress wear.
<b>Negative( thesis)</b>	A white student said: “ <i>I don’t know why in a primary school ... she had to wear a veil?</i> ”	Discussion of human rights cases, Race Relations Acts, equal opportunity policies.
<b>Corrective( antithesis) Counter-hegemonic narrative</b>	A Muslim student replied: <i>Well, she does not, she would lift the veil, at primary school, Muslim women are allowed to show their face to young.. (male pupils before puberty)</i>	Dismantling ethnocentrism, ethicist thinking and stereotypes, in this case with particular attention to Islamophobia.
<b>Positive Re-constructive (synthesis)</b>	Utilizing diverse cultural resources, including student experience from class, school and community.	Using educational sources from feminist, anti-racist and critical pedagogy literature to form alternative arguments/views. (e.g. article by J Zine)

The matrix above is a useful method for directing student (*situational*) dialogue from class discussion towards broader societal anti-racist (*educational*) thinking. The aim here is to elevate the discussions so the wider socio-political connections are made with the ‘*situational*’ contributions that emerge from class. In this, my aim is to promote positive growth. Making use of ‘*situational*’/educational and corrective/positive dimensions as shown above has enabled me to turn the *situational* dialogue moment into a positive educational critique. Such teaching strategy, which is inclusive of the student voice, I argue here, can be the vehicle that promotes a multicultural and anti-racist teaching and learning experience.

This paper argues that despite the difficulty that *the race talk* brings to class debate, student’s comments are important and they can become the material for the *anti-racism*. I am not suggesting that all we do is to expose student authentic experiences as the only voice for educational input. What I am suggesting is that we can make use of student experiences as *one* of the tools that explores the political and sociological content of the race debate. Anti-racism involves more than simply recording and re-counting stories and counter stories in the classroom. Introducing counter narratives into the classroom opens the class to other ways of knowing and living racism – through such student interrogation the class discussions can become the challenge to the racism that may arise from the classroom dialogue. Such *interruptions* I argue, can lead to the challenges that may lead in a small way, to the path to bigger transformations.

The student voice that critiques mainstream thinking is a starting point for this political work. On a small micro scale these classroom exchanges can be the moment for changed thinking and who knows, that on a larger scale these exchanges become the awakening of bigger political thinking that connects the world of the class to the outside world. Critical race pedagogy and feminist theory, as said above, has the potential for directing learners to this end. D Gillborn (1996) insists that

“ there is a great deal to be gained by a dynamic understanding of how antiracists and critical race theorists have approached certain issues and dilemmas. Both share a concern not merely to document but to change; they are engaged in praxis. (“ p258)

### CONCLUSION

As teachers, we should make use of classroom dialogue, I argue that students' self-formation is linked to these discussions in the classroom. By recognizing student voice as legitimate experiences of racism, we open the space for student dialogue that can provide a starting point for anti-racism. My goal is to teach in ways that engages students and leads to student reflection of the socio-economic political /religious issues that surrounds theirs (our) lives. My aim is to create moments in the classroom that opens out the space for such counter (hegemonic) narratives. Making use of classroom dialogue can become the trigger for these exchanges. In conclusion, I argue that the classroom where critical race exchanges and dialogues takes place, is the classroom where students and teachers can be transformed into active participants, creating, changing and re-creating their narratives as they progress. In my view, good anti-racist teaching must draw from the common-sense topics of our classroom talks and conversations, students experience of their socio-political world becomes our teaching plan for our classroom material.

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Ms Azmi is appealing against the dismissal of her claims  
**Ms Azmi's reaction**

**A Muslim classroom assistant suspended by a school for wearing a veil in lessons has lost her claim of religious discrimination at a tribunal.**

Aishah Azmi, 23, was asked to remove the veil after the Church of England school in Dewsbury, West Yorks, said pupils found it hard to understand her.

The tribunal dismissed her claims of religious discrimination and harassment on religious grounds.

But Kirklees Council was ordered to pay her £1,100 for victimising her.

Mrs Azmi, a married mother-of-one, said she would be appealing against the decision to dismiss her religious discrimination claims.

In a statement she criticised ministers who had intervened in the case and said it made her "fearful of the consequences for Muslim women in this country who want to work".

She said: "However, I am pleased that the tribunal have recognised the victimising way in which the school and the local education authority have handled this matter and the distress that has caused me."

**Muslim women who wear the veils are not aliens**  
Aishah Azmi

The case attracted comments from the prime minister, who backed Kirklees Council for suspending Mrs Azmi.

Tony Blair said the wearing of a full face veil was a "mark of separation" and made some "outside the community feel uncomfortable".

The government's race minister, Phil Woolas, demanded Mrs Azmi to be sacked, accusing her of "denying the right of children to a full education".

Mrs Azmi, who is originally from Cardiff, said: "Muslim women who wear the veils are not aliens, and politicians need to recognise that what they say can have a very dangerous impact on the lives of the minorities they treat as outcasts.

"I will continue to uphold my religious beliefs and urge Muslims to engage in dialogue with the wider community, despite the attacks that are being made upon them."

Headfield Church of England Junior School, which has 546 pupils, suspended Mrs Azmi because it said pupils found it hard to understand her during lessons.

Kirklees Council said the decision was taken after a monitoring period in which the impact of wearing the veil on the teaching and learning was studied.

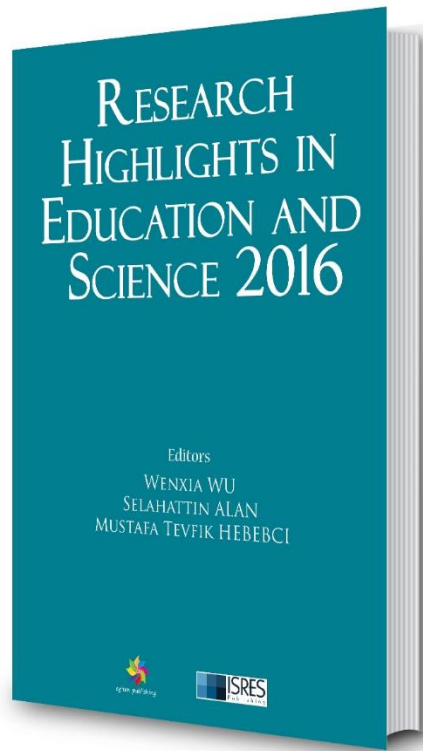
It said: "In this case the school and local authority had to balance the rights of the children to receive the best quality education possible and Mrs Azmi's desire to express her cultural beliefs by wearing a veil in class.

"The education of the children is of paramount importance and it is disappointing that the school was unable to reach a compromise with Mrs Azmi in this case."

Story from BBC NEWS:

<http://news.bbc.co.uk/go/pr/fr/-/1/hi/england/bradford/6066726.stm>

Published: 2006/10/19 17:26:01 GMT



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