



## THE USE OF ICT IN ENGINEERING DEPARTMENTS

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### ABSTRACT

This paper examines the use of Information and Communication Technologies (ICT), mainly computer, for teaching and learning purposes at the university level. The paper gives a brief overview of the use of ICT in learning and teaching at university level. It also discusses the students' perceptions on the use of ICT in their daily life and in school environment. For this purpose, a questionnaire consisting of 25 items were given to 300 students studying at the engineering departments from 2 different universities in Turkey. The result supports the necessity of using ICT for making classes more vivid, pleasant and appealing to the students.

*Key Words:* ICT, computer, technology, education, engineering.

### INTRODUCTION

ICT merely stands for Information and Communication Technologies and Blurton (1999) defines it as a "various set of technological tools and resources used to communicate, create, disseminate, store, and manage information". These technologies consist of computers, the Internet, broadcasting technologies (radio and television), and telephony. Maximizing efficiency and effectiveness by means of using the Internet and computers is an increasing interest not only for communication but also for education at all levels and in both formal and non-formal settings during recent years.

From the earliest times when computers were commercially available, they could be found in educational institutions, and educators (e.g. Bork, 1980; Carnegie Commission on Higher Education, 1977; Hernes, 2002) strongly believed that computers would support learning. Several educational institutions, including public and private schools opened CALL centers for this purpose. International dialogue and international access to educational items became possible only after ICT was developed and the Internet became available in schools. The development of ICT, particularly the Internet, has eased the development of the globalization and therefore the quality of education. With open access to knowledge and the new communication technologies, it is now possible to widen the range of opportunities for more equal education even in the poorest countries provided that they have the Internet.

The use of ICT in education provides several benefits for extending educational opportunities to groups of people. ICTs are potentially powerful tools for extending educational opportunities, for formal or/and non-formal,—scattered or/and rural populations, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, females, persons with disabilities, and the elderly, as well as all others who for reasons of cost or because of time constraints are unable to enroll on campus. It also enables students to concentrate on the lessons as well as to become aware of the developments worldwide. The benefits of ICT can be listed as:

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• ***Use of ICT requires no limit in time and space***

It is possible to use the ICTs anytime and anywhere, 24 hours a day, 7 days a week via asynchronous learning/teaching no matter what the time lag is between the delivery of instruction and its receptor. The only condition needed would be the access to the Internet. Teleconferencing, radio or TV broadcast would also be possible for those in diverse areas.

• ***Resources are no more remote with ICT***

With ICT it is possible to access a wealth of learning materials in almost every subject from anywhere at any time by unlimited number of people. ICT also facilitates access to resource persons, mentors, experts, researchers, peers, writers, poets, artists, professionals, politicians, etc. all over the world. With the Internet it is possible to find any information about any subject.

• ***ICT provides no limit in fun***

There are many Internet resources that provide fun for 24 hours. Music, comics, funny movies etc are there to help those to enjoy life. Downloadable materials also make the family gatherings become a ceremonial event.

• ***ICT brings no limit in communication***

Such communication sources as Facebook, Skype, Msn, Twitter, Google talk, Yahoo talk, and others facilitate the communication between people on the two edges of the world, which prevents isolation as well.

• ***ICT provides no limit in learning***

Technology helps schools provide opportunity to value deep understanding in the disciplines and take into account students' needs, interests, and strengths. Students with different learning styles can benefit from the facilities ICT provides.

• ***There is no excuse for not using the ICT***

ICT helps to improve the quality in education, prepare individuals for the workplace, and develop inventive thinking and effective communication. It is particularly important to use ICT to enhance the quality of education by increasing learner motivation, to provide better teacher professional career, to facilitate a student-centered environment. Distant courses, remote resources, different techniques of providing information underpin the multiple intelligent learning. Linking the traditional approaches to the Gardner's Multiple Intelligences and matching these with complementary digital strategies, tools and activities is also possible. In Gardner's Multiple Intelligences (MIs) there are eight intelligences, which is a disciplinary in itself. Every individual has his own learning style as shown in the diagram below and this could be developed by the help of ICT.

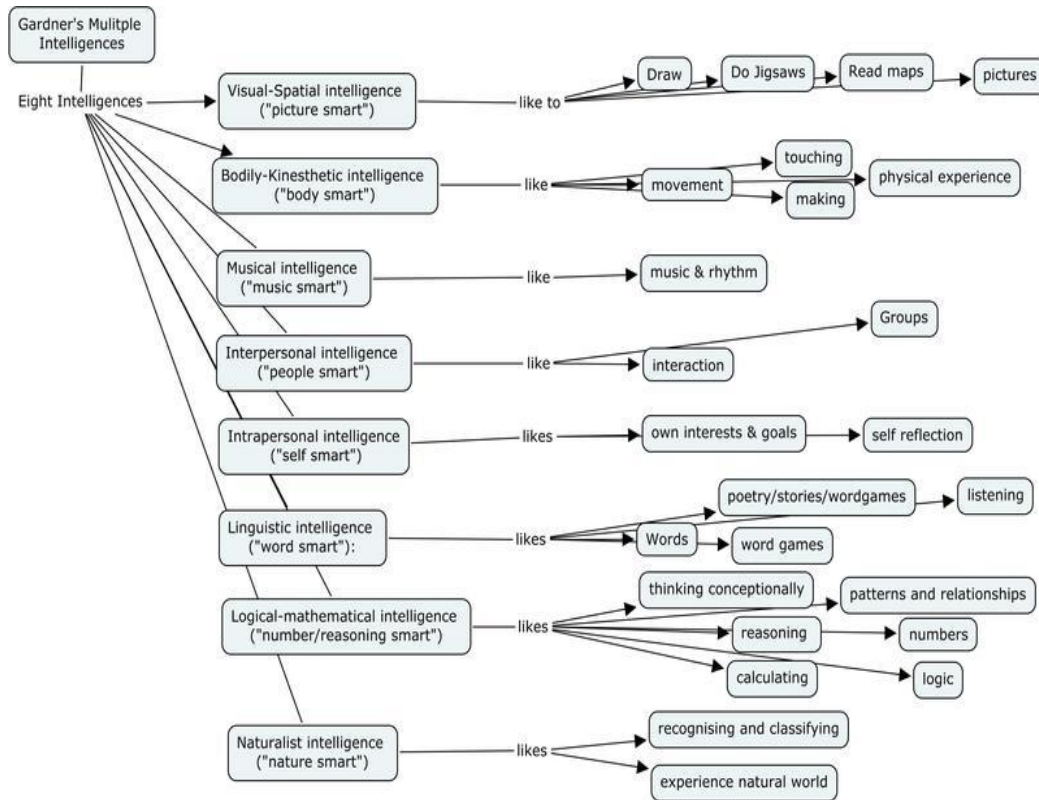
Gardner (1999) claims that "the computer revolution is already changing how students acquire and use information; if schools do not rise to this technological opportunity and challenge, they risk becoming completely anachronistic". Gardner's Multiple Intelligence theory can best be fed and put into practice by the ICT, which might provide opportunity to blend the MIs disciplines given in Figure1.

If designed and implemented properly, ICT-supported education can promote the acquisition of the knowledge and skills that will empower students for lifelong learning no matter which type of intelligence he or she has. It is, therefore, required to employ ICT in education.

Cradler (2002) gives seven requirements for effective use of ICT in education:

- Suiting technology to education goals and standards
- Having a vision for the use of technology to support curriculum

- Providing for both in-service and pre-service training
- Ensuring access to appropriate technology
- Providing for administrative support for technology use
- Providing time for teachers to plan and learn how to integrate technology
- Providing for ongoing technical support for technology use



**Figure 1.** Gardner's Multiple Intelligences  
(<http://edorigami.wikispaces.com/Gardners+Multiple+Intelligences+and+ICT>)

In general, these requirements fall into five areas of impact:

- providing the infrastructure of hardware and software,
- providing curriculum and technical support for teachers,
- school organization, design, policies and practices,
- schooling,
- management support.

The British Educational Communications and Technology Agency (BECTA) suggest that the effective use of ICT can lead to benefits in terms of:

- greater motivation
- increased self-esteem and confidence
- enhanced questioning skills

- promoting initiative and independent learning
- improving presentation
- developing problem solving capabilities
- promoting better information handling skills
- increasing ‘time on task’
- improving social and communication skills (BECTA 2002).

Since students enjoy spending time on the computer and sharing their interests in social platforms, the Internet, it should be considered wise to get them involved into the ICT used educational environment. The British Educational Communications and Technology Agency (BECTA 2002) also claims that ICT can enable children to:

- combine words and images to produce a ‘professional’ looking piece of work
- draft and redraft their work with less effort
- test out ideas and present them in different ways for different audiences
- explore musical sequences and compose their own music
- investigate and make changes in computer models
- store and handle large amounts of information in different ways
- do things quickly and easily which might otherwise be tedious or time consuming
- use simulations to experience things which might otherwise be too difficult or dangerous for them to attempt in real life
- control devices by turning motors, buzzers and lights on or off or by programming them to react to changes in things like light or temperature sensors
- communicate with others over a distance.

On the other hand, the use of ICT might of course cause some handicaps in teaching especially in overcrowded classes. Schacter (1999, p. 5), for instance, claims that the “level of effectiveness of educational technology is influenced by the specific student population, the software design, the educator’s role, and the level of student access to the technology.”

Teachers’ competence for the use of ICT might be another problem. Clearly with the critical role played by teachers, education systems need to take account of the needs of teachers first (Lankshear & Snyder, 2000). The problems teachers have with the use of computers may be viewed in terms of: access to adequate infrastructure, and access to support for implementation using that infrastructure. BECTA (2002) points out that the user problems are mainly due to the lack of experience of teachers and the lack of consideration of appropriate educational problems to solve. All of these barriers may be addressed by considering technical and curriculum support for teachers.

In his book entitled “*Managing Technological Change: Strategies for college and university leaders*”, Bates (2000) draws attention to the points discussed above and states that:

“Although technology infrastructure plans are essential, they are not sufficient. It is equally important to develop academic or teaching plans that specify the ways in which technologies will be incorporated into teaching learning activities” (p. 46).

Bates (2000) also emphasizes that “it is important for universities and colleges to achieve high quality in any technology-based teaching and learning materials and programs that they develop.” (p. 64). He further stresses the necessity of computer access in departments:

“The real challenge for a department considering requiring students to have computer access is in ensuring that the computer will provide genuine value-added teaching. The worst policy is to make computer access optional.” (p. 90).

### The **RATIONALE** of the STUDY

Since ICT has so many advantages in teaching and learning, it becomes mandatory to use ICT in education. With this reason in mind, we have questioned whether ICT is used at the university level and the perception of students regarding the use of ICT. We gave the questionnaire to the engineering students at the departments of computer engineering, electrical and electronic engineering and marine engineering.

The reason why we chose the engineering departments is due to reports published by UNESCO in 2010 and 2011. The report published by UNESCO in October 2010 was a comprehensive report on engineering and development, which spells out the great importance of engineering for human society in addressing and solving global issues. ICTs are a series of instruments that transform the way human collectively produce and consume information on a global scale. While many teachers and students are already utilizing some of its capabilities, school and government agencies must design appropriate resource allocation policies to better capture these revolutionary opportunities.

The report in 2011 sheds new light on the need to:

- develop public and policy awareness and understanding of engineering, affirming the role of engineering as the driver of innovation, social and economic development;
- develop information on engineering, highlighting the urgent need for better statistics and indicators on engineering;
- transform engineering education, curricula and teaching methods to emphasize relevance and a problem-solving approach to engineering;
- more effectively innovate and apply engineering and technology to global issues and challenges such as poverty reduction, sustainable development and climate change – and urgently develop greener engineering and lower carbon technology (UNESCO, 2011).

Today’s “digital native” students are the most effective source of innovation in the formats and content of ICT-enabled educational services and products. Therefore, engineering schools should be the operating base for the learning activities that systematically involve engineering students and other appropriate participants in the creation and refinement of ICT-enabled educational programmes and infrastructures. The design and implementation process of these “learning activities” should be guided by appropriate technology-independent quality standards (UNESCO, 2010).

### **FOCUS and METHODOLOGY**

The study focuses on the use of ICT and the perceptions of the students on ICT in engineering departments. The study is based on a questionnaire given to the students mainly at the engineering departments at 2 different universities in Turkey. The questionnaire is adopted from the OECD Programme for International Student Assessment (PISA, 2009). 300 students answered the questionnaire in total. The students from computer engineering, electric - electronics engineering and marine engineering departments answered the questions voluntarily. The questions were mainly related to the frequency of using the ICT in classroom or at home, their perceptions on the use of ICT and their attitudes towards the use of ICT. The results of only seven questions are discussed in this paper because of the scope and framework of the research. Due to the scope of the study, the picture painted of the

general situation in Turkey is very broad-brush. Finally, again, due to the scope of the study, the findings of the research are mainly trends and should not be considered as representative “hard facts”.

## FINDINGS

Since the survey was carried out at the engineering departments, particularly Computer Engineering, Electric - Electronics Engineering and Marine Engineering, our expectancy was to get highly positive answers to the questions related to the use of ICT both in social and private life. We also expected very high rank of the use of ICT related to school. The findings, however, were surprisingly different from what we had been expecting, as seen in the following tables. The tables show the questions asked and the number of the students marking the choices. The numbers in parentheses show the total percentages of the students' perceptions in all three departments.

**Table 1.** The frequency of ICT use for the activities out of the school

	<i>Never or hardly ever</i>	<i>Once or twice a month</i>	<i>Once or twice a week</i>	<i>Everyday or almost every day</i>
Play one-player games	88 (29.3%)	64(21.3%)	79(26.3%)	51(17%)
Play collaborative online games	119(39.6%)	70(23.3%)	62(20.6%)	39(13%)
Do homework on the computer	24(8%)	105(35%)	114(38%)	31(10.3%)
Use e-mail	17(5.6%)	26(8.6%)	103(34.3%)	155(51.6%)
Msn, chat in the facebook, twitter etc	18(6%)	29(9.6%)	72(24%)	169(56.3%)
Browse the Internet for fun (such as watching videos, e.g. you tube)	12(4%)	37(12.3%)	79(26.3%)	170(56.6%)
Download music, movies, games or software from the Internet	33(11%)	67(22.3%)	91(30.3%)	91(30.3%)
Publish and maintain a personal website, weblog or blog	154(51.3%)	51(17%)	31(10.3%)	39(13%)
Participate in online forums, virtual communities or spaces(e.g. second life or my space )	93(31%)	64(21.3%)	66(22%)	91(30.3%)
Communicate with family and friends	52(17.3%)	41(13.6%)	74(24.6%)	147(49%)

Table 1 reflects the use of ICT out of school environment. Students usually use ICT for fun, listening to music, watching movies, using Msn, skype or Facebook for chat as highlighted in the Table. They make use of ICT at home for social and entertainment purposes rather than participating forums, conducting personal websites or doing homework on the computer. This might be due to the lack of responsibility of surfing the Internet for the purpose of research or assignments or it might be because their class teachers do not give them responsibility of doing homework related to the ICT.

The departments in which this research was conducted allow students access the Internet for free almost everywhere in and around their departments. Therefore, we asked the following questions related to the frequency, time and effective use they devoted on the use of ICT, as shown in table 2,3 and 4.

**Table 2.** The frequency of ICT use for the activities at school

	<i>Never or hardly ever</i>	<i>Once or twice a month</i>	<i>Once or twice a week</i>	<i>Everyday or almost every day</i>
I chat online at the department	131(43.6%)	55(18.3%)	29(9.6%)	8(2.6%)
Use e-mail at the department	113(37.6%)	79(26.3%)	52(17.3%)	12(4%)
I collect information for homework and study of the draft project from the Internet	98(32.6%)	100(33.3%)	53(17.6%)	11(3.6%)
I download materials or documents	81(27%)	95(31.6%)	61(20.3%)	13(4.3%)
I send my homework or project to my department's website	75(25%)	105(35%)	50(16.6%)	6(2%)
I play simulation games	153(77.6%)	59(19.6%)	27(9%)	5(1.6%)
I do practice with ICT at subject of courses	103(34.3%)	51(17%)	37(12.3%)	10(3.3%)
I study and do my homework as an individual	132(44%)	74(24.6%)	39(13%)	2(0.6%)
I join the group works and communicate with other students	121(40.3%)	73(24.3%)	37(12.3%)	11(3.6%)
I use ICT for project work and necessary to department lectures.	95(31.6%)	79(26.3%)	46(15.3%)	4(1.3%)
I play computer games.	148(49.3%)	58(19.3%)	21(7%)	13(4.3%)
I use database	114(38%)	57(19%)	33(11%)	5(1.6%)
I use Table programs	117(39%)	56(18.6%)	30(10%)	5(1.6%)
I use word processor	117(39%)	59(19.6%)	33(11%)	4(1.3%)
I use desktop publishing	121(40.3%)	66(22%)	23(7.6%)	4(1.3%)

Table 2 shows that the frequency of using ICT, mainly computer, at the campus is rather low, even for fun; the highest percentage is 13 % which is for downloading materials or documents to department's website and playing computer games. This fact is surprising when it is considered that these students are candidates of engineers and they are somehow involved in technology. Table 2 puts forward the fact the percentage of ICT use by students is very low.

A question might arise related to these results, inquiring the ICT literacy level of students. Table 3 clarifies the question of students' knowledge level of ICT.

Engineering students can manage average tasks on computer namely creating file, preparing PowerPoint presentations, using windows, copying shapes etc. However, they have difficulty in more subtle tasks such as creating database, using spread sheet for creating graphic, web authoring tools. Creating and editing files have the highest frequency of using the computer. Yet, following online courses or getting involved to the scholastic forums or carrying out research using ICT requires minimum knowledge of handling computer tasks.

**Table 3.** The literacy level of using the ICT

	<i>Cannot</i>	<i>low</i>	<i>Moderate</i>	<i>High</i>
I can copy digital photography or graphic shapes.	21(7%)	55(18.3%)	86(28.6%)	111(37%)
I can create a database	60(20%)	68(22.6%)	84(28%)	66(22%)
I can use spreadsheet for creating a graphic.	137(45.6%)	64(21.6%)	59(19.6%)	27(9%)
I can use a PowerPoint presentation	10(3.3%)	20(6.6%)	104(34.6%)	161(53.6%)
I can prepare a Multi-media presentation	29(9.6%)	56(18.6%)	94(31.3%)	104(34.6%)
Windows /other operating systems	26(8.6%)	48(16%)	99(33%)	104(34.6%)
File (Creating a new file-editing etc.)	6(3%)	41(13.6%)	68(22.6%)	168(56%)
Word processor	55(18.3%)	52(17.3%)	84(28%)	90(30%)
Web authoring tools	61(20.3%)	66(22%)	74(24.6%)	45(15%)

When asked how much time the students spend on computer apart from their academic studies, the percentage of the answers was evenly distributed, as seen in Table 4.

**Table 4.** The time spent on ICT apart from academic studies

	<b>No time</b>	<b>30 minutes</b>	<b>31-60 minutes</b>	<b>More than 60 minutes</b>
Use of ICT in one day	43(14.3%)	46(15.3%)	41(13.6%)	34(11.3%)

Students' answers show an interesting distribution to this question. When asked the time they devote on the ICT every day, almost equal number of students answered evenly. Yet, students claim that they do not spend too much time on computer even when it is not related to their academic field.

**Table 5.** The necessity of the ICT (including Internet access) at the following locations

	<b>Not needed</b>	<b>Maybe</b>	<b>Needed</b>
In a computer lab.	14(4.6%)	27(9%)	204(68%)
In classrooms at the school	20(6.6%)	100(33.3%)	176(58.6%)
At student's home	7(2.3%)	27(9%)	245(81.6%)
At dormitories	10(3.3%)	28(9.3%)	241(80.3%)
At the lecture halls	27(9%)	76(25.3%)	179(59.6%)
At libraries	12(4%)	30(10%)	239(79.6%)
At canteens	39(13%)	75(25%)	161(53.6%)

Students were asked to value the necessity of ICT in their daily life and school environment. A very high percentage of students answered to this question positively. Students believe that ICT, including the Internet access, is useful in their life although 81.6% believe that they need it at home or at dormitories 80.3%.



**Table 6.** Producing assignments using ICT related tools and resources

	<b>0-25 %</b>	<b>26-49 %</b>	<b>50-75 %</b>	<b>76-100 %</b>
Word processor	135(45%)	86(28.6%)	38(12.6%)	17(5.6%)
Spreadsheet	114(38%)	88(29.3%)	46(15.3%)	8(2.6%)
Databases	99(3%)	80(26.6%)	57(19%)	24(8%)
PowerPoint	57(19%)	81(27%)	87(29%)	52(17.3%)
Publisher	18(6%)	39(13%)	98(32.6%)	114(38%)
References from the Internet	24(8%)	38(13.6%)	89(29.6%)	128(42.6%)
Teacher moderated online discussions	161(53.6%)	63(21%)	52(17.3%)	31(10.3%)

When students were asked which ICT related tools they make use of while preparing the assignments, publishers (38%) and references from the Internet (42,6 %) got the highest percentage. Students get references from the Internet while they avoid using it as databases. Preparing PowerPoint presentation and teacher moderated online discussions are also used as ICT related tools although the frequency is lower.

**Table 7.** The need for using ICT

	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly agree</b>
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
It is very important for me to work with a computer	14(4.6%)	14(4.6%)	148(49.3%)	104(34%)
I think playing or working with a computer is really fun	13(4.3%)	24(8%)	122(40.6%)	114(38%)
I use a computer because I am very interested	9(3%)	28(9.3%)	161(53.6%)	114(38%)
I download music, film etc.	9(3%)	20(6.6%)	130(43.3%)	127(42.6%)
I communicate with my family and friends	5(3.8%)	18(6%)	125(41.6%)	118(39.3%)
I search my lesson topics	8(2.6%)	16(5.3%)	136(45.3%)	111(37%)
I lose track of time when I am working with the computer	18(6%)	73(24.3%)	103(34.3%)	81(27%)
I believe that using computers cause health problems.	23(7.6%)	84(28%)	128(42.6%)	57(19%)
I think computer usage is not safe	73(24.3%)	117(36.9%)	72(24%)	17(5.6%)
I am very busy. I have no time for using computer	130(43.3%)	106(35.3%)	29(9.6%)	9(3%)
I am not interested in computer usage	70(53.8%)	87(29%)	31(10.3%)	14(4.6%)
Internet usage is too expensive	143(47.6%)	81(27%)	88(29.3%)	38(12.6%)
I haven't got a computer	191(65.3%)	57(19%)	15(5%)	13(4.3%)
I can't use a computer	187(62.3%)	41(13.6%)	19(6.3%)	4(1.3%)

In order to measure students' attitudes towards the ICT, the statements above were asked to be graded. Most of the students agreed that it is very important to work with a computer. The most frequent reason was given as "I use computer because I am very interested" (53.6%). Students also claim that they use computers in order to make research on their subject areas (45.3%). However, this result contradicts with the result in Table 1. This might show that students are not working systematically on computer and therefore they are not guided to work on computer but they do use the computer for self-study.

## CONCLUSION

Technological developments and communication technologies help both students and teachers ease learning and teaching process. ICT has become a very important tool in education. For the last 20 years, many books, articles have been written, many researches have been made. Yet, the importance of ICT has not been fully understood and not enough attendance has been given to the implementation of ICT in education.

The main purpose of this research was to find out whether students devote time on technological means and if they do, how much of the time devoted to computer is spared to educational activities. Since the students were purposely selected from the engineering departments, the expectancy was that the level of ICT literacy and use would be quite high.

The result of the research did not meet our expectancy. Contrary to our expectancy, the students mainly use the computer at home for fun. Using the ICT for education purposes is not given the value it deserves. The new trend “Blended Teaching Method”, mixing the traditional classes with ICT, is still not used adequately in our schools.

In traditional teaching method teacher is the center of the learning process, controlling each factor in the process. Students focus on what they learn from the teacher and course books, thus they have difficulty in expressing themselves freely and creatively. In blended teaching, on the other hand, ICT is regarded as a compulsory element to support the process.

While preparing the students for the technological requirements of the time, ICT not only enriches these two sources but also enables the process contemporary, contribute the classes being more vivid and fruitful. However, there is a shortage of qualified and competent teachers who will be able to use ICT in their classes or who can guide students use the computer in their subject areas. Therefore, it is important to give teacher training courses based on digital teaching. Teachers uploading digitalized lectures, and students downloading those lectures might even help reviving, saving and learning. Bringing forth these lectures into the class atmosphere might make the teaching effective, participatory and enjoyable.

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