



Research Article

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The Effect of ICT in Education and Teaching: Student Evaluation Based Verification

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Abstract

ICT, Information Communication Technology, is a course that is being taught in several different institutions. The role of this course is crucial in the teaching and grading process. The significance of this course is based on several different factors. ICT increases the mental capabilities of the students. In this study we have shown that IT based knowledge and accessibility to the internet increase the capability of students for rapid absorbing of information, fast processing, and achievement of smart conclusions. High speed modeling and simulation by digital techniques enable students to learn by doing, leading to actual and real implementation of the invented models and IT obtained knowledge. Quantified knowledge, by numerically represented data and their smart distribution, leads to deterministic and logical decision. The tests we have performed, in addition to this work, methodology we have applied, by using temporal based distribution of data and information, have shown the advantage of IT and internet, for a better and faster understanding process of absorbing and incubating the knowledge by the students, during the learning and teaching process, leading to the optimal conclusion. Our study is based on three possibilities, modes or cases: First case: The tests are performed to the students with no IST education. Second case: The test is introduced to the group of students with superficial or lack of proper ICT education or training. Third case: A group of students trained in a proper way, where thoroughly professional manner is applied. A correct representation of the data is verified by Fourier Transform Technique and frequency representation of information. Knowing how to manipulate with the computer models and platforms or programs accessible at internet, that can be used for primary and secondary school teaching, is a very important approach and possibility that is being used today in different teaching sessions.

Keywords: ICT, teaching and grading, digital world, deterministic models, temporal and frequency domain representation of data

1. Introduction

The teaching, so far in our schools, was traditional and with low learning results. This outdated teaching method should be reformed and adapted akin to ICT, Information Communication Technology. Therefore, ICT has been and will continue to have a very important or key role for education of students and will have a great impact in our everyday lives and their future education, consequently.

Everything that we do in our everyday life, our performance is inter related with the education in general and ICT education in particular. Many moments of our everyday life, at work and elsewhere, ICT is part of our activities.

By default, the role of ICT is part of processing and transmission of information. At our professional and other activities, analysis, decision making and conclusion can be faster and currently performed by using a computer. Only two decades ago the flow and transmission of the information, like phone conversation, was very expensive, particularly when phone conversation were over ocean or between two continents. The development of ICT, particularly the internet, made the transmission of conversation and verbal and image communication free by using Viber, Skype and similar means of communication. Like this communication, transmission and the skill development, for using the computer, became necessity for everybody in nowadays life. Therefore, the so-called digital literacy became a very important issue in contemporary education system. As will be elaborated at this study, the missing digital competency in Kosovian Curricula is considered to be a serious problem.

Encyclopedic knowledge and information today are accessible in the internet, where can be obtained very fast and mainly free of charge. Information increases the capacity of correct understanding, analysis, decision making and conclusion. The accessibility to the internet of the countries in the world determine the level of the technology and economical potentiality and development.

The role of ICT is related to the cognitive information processing and emotional intellegency and education.

ICT knowledge, as mentioned, enables one to obtain information and knowledge from the internet. The internet accessibility is one of the relevant parameters determining the level of development of the countries of the World.

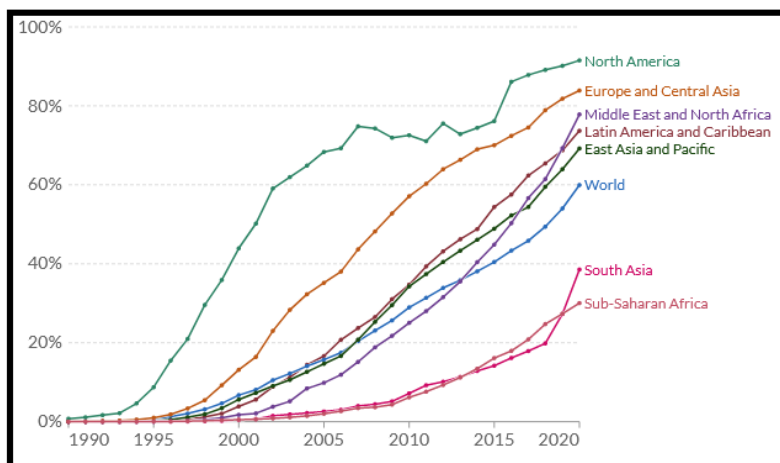


Figure 1: The Internet Users in Different continents (<https://ourworldindata.org/>, 2020)

Figure 1 shows the distribution of the internet accessibility for different parts of the world and for the particular time span as shown. Here we can see that different countries have different index values. We can observe that, as we have entered the 2019 year of Covid 19, the number of internet users have increased. It is obvious that during the Covid time, everyone was dependent on the internet. Figure 1 shows that north Americans and Europeans were the highest frequency of users during that time is demonstrated. One could say that this was because many teaching and research institutions had to convert their conventional way of working to online. Sub-Saharan African countries were with different coefficient users. This was for many different reasons, such as the economic standard and technology level of the particular region. Low developed countries are characterized with lower use of ICT compared to other regions.

Technology development and its use has a great impact in teaching and general advancement of the human activities. This can be seen in the following list.

Pros	Cons
✔ Technology provides ease of access to Information	❌ Technology kills Social Skills
✔ Technology makes learning easier	❌ Technology and Students distraction
✔ Technology enhances Creativity	❌ Technology in education is hindering student's interpersonal skills
✔ Use of Technology in classrooms to enhance teaching and learning	❌ Technology affects health

Figure 2: The Effects of IT in Education (<https://techbaji.com/technology/>, 2020)

Figure 2 shows the main effects of technology in education that was noted from a website that is focused on education assignments for different students that have been facing difficulties. IT has brought more and more changes to different learning and grading models. It has also made life easier for online teaching as well as real time studies.

It would be very important to notify that different modes of teaching can be used by knowing how to use and implement the effect of ICT, information communication technology. Education can be attained via books and via different sources and information modes, but the use of ICT is one of the best ways of education and learning. This has also shown that not only we can use the ICT online technical courses but it has also shaped the world of arts and music.

The use of ICT in education is useful for different objectives to be covered. (www.sciencedirect.com, 2018).

The information obtained and the way are used, are very important factors, because the teaching models are design accordingly. It is very thoughtful to emphasize the fact that University Professors tend to use different teaching models and methods. Grading is the way of verifying and quantifying the knowledge the students obtained during the teaching and learning process. Professors grade students according to their own criteria and sometimes they would use the standard University grading scheme. The way we grade our students is also another important factor and is affected using ICT in education (www.sciencedirect.com, 2021).

Students whom have used IT, have shown different progress as to students whom have completed their studies using old methods of studying, such as the library and individual consultations. A comparison between these two methods has justified our expectation.

2. Methodology

In order to understand and focus on how ICT has actually affected education we performed three distinct fair tests. We analyzed the grades of two distinct student groups along with their standard

grades.

The first group of students, where those who studied for a university course that was primarily focused on using the books from the library and other conventional forms of learning modes apart from the online ICT.

The second group of students, formally were exposed to the computer, ICT classes, but in a week way of training or in a non professional way. This is the case corresponding to the actual school programs in Kosovian system of education, where so called digital competency is missing.

The third group of students had a proper and professional ICT education, at the level required at actual technology and Information Technology requirements. That meant that students were able to use YouTube, Google and other search engines that helped them to be able to study for the university course (www.sciencedirect.com, 2021). Using a so-called fair test, we managed to analyze many different phenomena that occurred after undertaking the results.

Our study is concentrated mainly at 2d and 3d case of studies, because the students commonly use the mobile phones or computers, but do not use them in a proper required manner.

3. Tests Performed to Kosovan Students: A Week Application of ICT

The students exposed to the test in this case are ordinary students exposed to the Kosovian system where the competency of digital education is missing. ICT is applied at the low level. That is lower level than one required by digital competency. Therefore, this case of application of ICT is the main subject of this study.

The two tests that we did, were focused at the class of students at the Faculty of Education in Kosovo. **The first group had to read 2 books and 6 articles** that were focused on Geography and tourism. They then had to take a test that was a multiple choice followed by a short essay that they had to do.

The second group had to use the internet and youtube and then they had to take the test online using a computer connected to the university server. The results of the two groups were taken and a mathematical average along with a pedagogical calculation was taken into account in order to conclude the significance of ICT in education. Table 1 shows how the first group took the test. It can be seen here that many different factors were taken into account in order to be able to perform the test successfully. These measurable factors effected the different sources on how information was attained by the students. The time was the same, for both groups exposed to the test.

Table 1: Factors Effecting the Test taken by Group 1

Quantifier	Test Questions from Book 1	Test Questions from Book 2	Test Questions from the Articles
	%	%	%
Difficult	30 %	10 %	6 %
Easy	15 %	20 %	18 %
Middle	55 %	70 %	76 %

In total there were 20 exam question from which the first group had to undergo. Based on that students were then compelled to complete a survey, that was compared with the grades attained.

Table 2: Factors Effecting the Test taken by Group 2

Quantifier	Test Questions from Book 1	Test Questions from Book 2	Test Questions from the Articles
	%	%	%
Difficult	10 %	10 %	6 %
Easy	40 %	60 %	%
Middle	50 %	30 %	64 %

Table 2, shows the different factors that effected the exam due to the use of ICT for revision before an exam. These factors are important because they tell us the essence of using ICT for education and the importance of global application of online learning and ICT applied education skills.

4. Results for the Group of Students with an Advanced ICT Education

In this case, the level of application of ICT is higher than at previous case. A spatial ICT training is applied to the students. This kind of application should be akin to the system of education, where the digital competency is applied. Two standard differential cases were taken into account. We decided to do 6 more consecutive tests analysis concerned with minor differences that had only one idea to be taken into account akin to the different student study years. The tests results obtained from students of the first and second years of study. Students of the third year of study were not exposed to this test because they did not have ICT during that year of study.

Figure 3 shows the data taken from students of the **first year** of study.

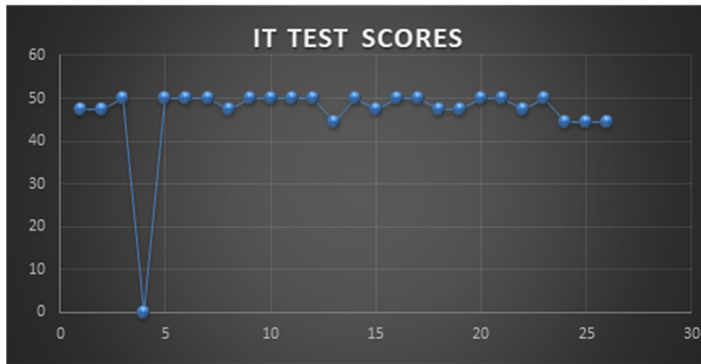


Figure 3: IT Test Scores

In Figure 3 we can see that most of the students did score high grades during the exam that was focused on an IT oriented mode. Even though this was a test taken by students of the first year of study, it would be very easy to find a similarity with students that were in the second year of study whom had taken this test as well. This can be seen from figure 4.

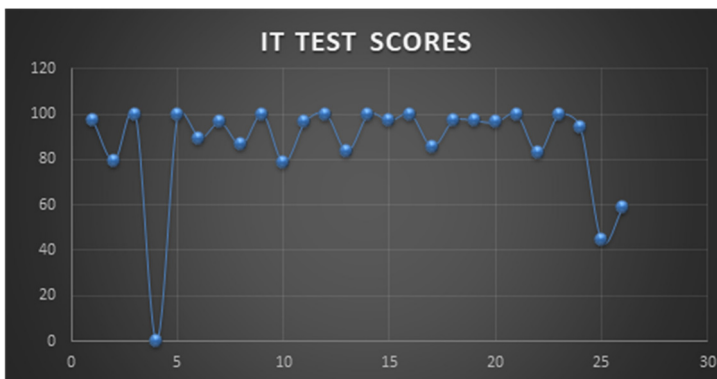


Figure 4: IT Test Scores

Figure 4 shows the mentioned mathematical similarity with students whom have taken this test in the first year of study. However, here the coefficient values higher than in figure 3 are shown. This is due to several different factors that concern the maturity, the mode of teaching and some other teaching and pedagogical factors.

Figure 5 shows the scores of the first year of students, whom did not use the ICT mode prior to the exam. It can be understood that the grades were not high compared to the other two cases. It is very obvious that the scores were not even as high as the worst score of those students that have used the ICT mode of study.



Figure 5: The Scores of the First year

In order to further deepen our research we did the same test on the second year

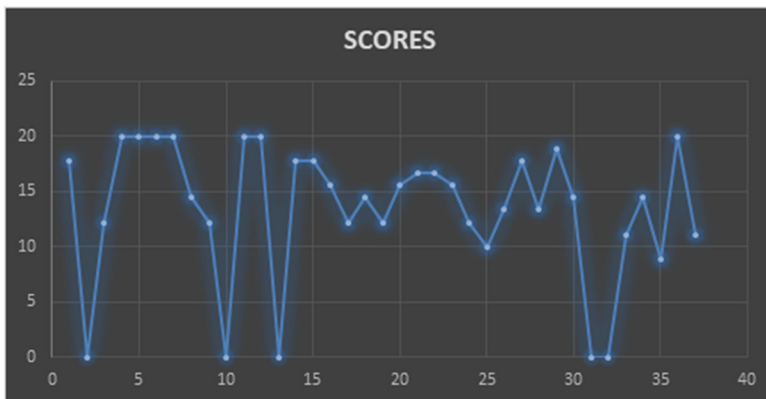


Figure 6: The score of the Second year

Students. They have shown a big change in results, especially in the average grade. In accordance to figure 6, it can be seen here that the number of students whom have taken the test, has turned out that their scores, vary different from those that have used the ICT model of study. Although the second year students are known to be mature, we would understand that the values are still not as qualifying as those that have used the ICT mode of study. We can see here that the outcome scores of students with ID numbers 15 20 25 respectively, turned out with a big jump in the grade scores. This have shown a similarity with the scores of figure 5.

Data processing and analysis using Fourier Transform: The case applied to ordinary or not advanced application of ICT

This kind of data processing is applied for the ordinary case of ICT application. The data for this case are obtained from the students that are part of the education system of Kosova, as is mentioned above. Is mentioned that Curricula, and course programs are based on 6 competencies. However, the digital competency, which requires special level of digital knowledge akin to actual revolution age, called Information Technology Revolution (ITR), is missing.

Fast Fourier Transorm (FFT)

Theory of the data processing is known to have the time or spation representation of data. This representation is called time or spatial domanin . However the same can be transformed by a mathematical operation known as Fourier Transform operation, or in digital application is kown as a FFT, or Fast Fourier Tarsform. This is called the frequency domain of representation. The trasformation is performed in order to deduct some more or detailed information or conclusion from the representation or distribution of data obtained.

In order to further evaluate our Tests and Results of the grades we decided to take an FFT, Fast Fourier transform of the test Results of the two groups that had a similarity. This is performed in order for us to be able to achieve a better interpretation of our grades.

Table 3: FFT outcome of grades from Group 1

Students	Scores under 10	Scores above 10	Error effect
	%	%	%
Top Students	6%	10%	6%
Average Students	10%	60%	30%
Under average students	50%	30%	64%

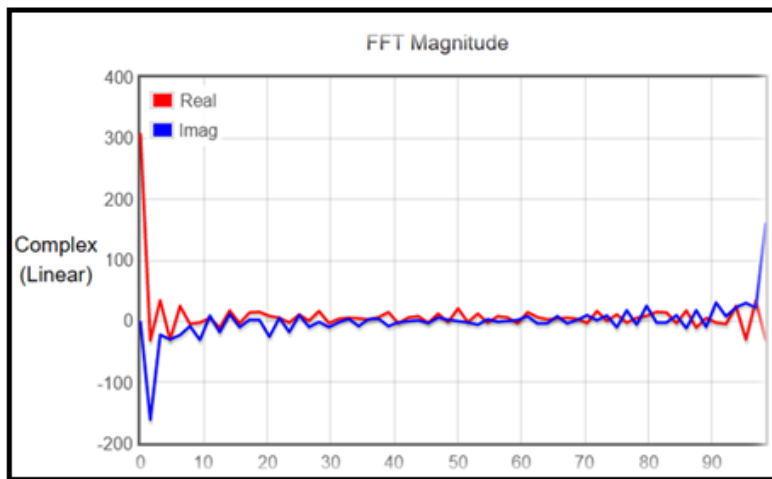


Figure 7: The FFT model from group 1

The data results that had to undergo a Fast Fourier Transformation of the group 1 scores are presented in Table 3 and shown graphically in Figure 7. The idea that we use Fast Fourier Transform is important because enable one to understand were we can find the errors and expected outcome from the data results (<https://ieeexplore.ieee.org>, 2016). Methodology of digital data processing requires that time domain or convetional represatation of data, to be transformed in the frequency or

Fourier Transform domain. As mentioned, different and usually detailed features of the phenomena to be studied, can be extracted.

In Table 3 and Figure 7 one can see in detail, how we could make modifications to be able to change the mode of teaching for better scores in the tests to come. This model helps us to define accurate score results (www.sciencedirect.com, 2019).

Table 4: FFT outcome of grades from Group 2

Students	Scores under 10	Scores above 10	Error effect
	%	%	%
Top Students	10 %	10 %	6 %
Average Students	40 %	60 %	30 %
Under average students	50 %	30 %	64 %

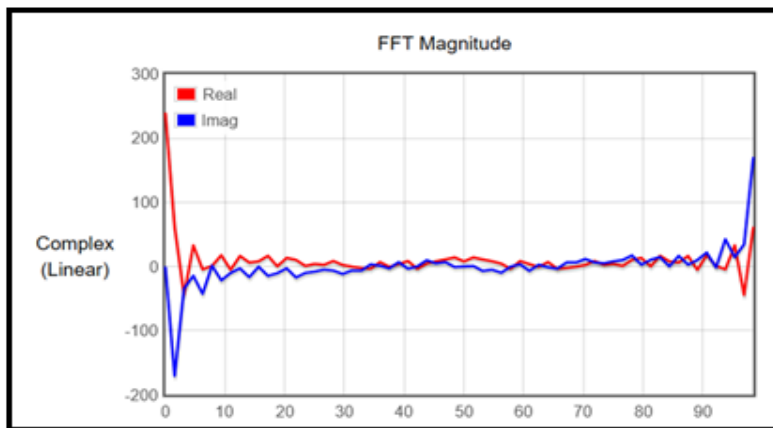


Figure 8: The FFT model for group 2

The data results, of the group 2 scores, that had to undergo a Fast Fourier Transformation are presented in Table 4 and shown graphically in Figure 8. We did use a method of genetic error detection to detect the changes in the scores so that we could see the drastic educational impact (<https://ieeexplore.ieee.org>, 2016).

The idea that we use FFT here, as mentioned above, is to see the errors and expected outcome from the data results. From Table 4 and Figure 8, we are able to figure out where we could make modifications to be able to change the mode of teaching for better scores in the tests to come.

From the Figure 7 and Figure 8 the FFT results **are higher for the case of group 1 than for the group 2.**

5. Discussion

We would argue with the idea that the students who have used ICT for studying, managed to have a better basic understanding of the course that they had to study for. We did come across another important phenomenon, that education that is based on ICT has brought to us better understanding and to the feedback that we get from the teaching. The key important factor that we have to underline is that, ICT is the solution to the way we teach and how we overcome the difficulties of teaching and pedagogical activities in general.

Our obtained data and results, has shown advantages of ICT compare to the conventional teaching. This can be shown by comparing Test results, respectively Table 1 and Table 2.

The rows of the both tables seems to have the same values: 10% and 6%. Unexpected exception is shown to be for the Book1 of the Table 1, where the value is 30% in Table 1, compare to 10 % in table 2.

The obvious advantage of using ICT or internet and youtube is shown by comparison of the Rows "Easy" of both Tables. The values of those rows at table 2, ICT case, seems to have an obvious higher percentage of the values of the Books and Internet columns.

The results of rows of the both Tables, corresponding to the "Middle". leads to an interesting output. They are higher compared to the case of the Table 1, correspondig to the case when ICT is not applied.

6. Conclusion

Teaching and grading is a very important development for the students and our society in general. In addition of the contemporary world of Information Technology age, we depend on ICT and in the way we use it. The different tests that we undertook and the outcome that, we gave rise to us several different conclusions are deducted.

It was very reasonable to us that Group 1 whom did not use the ICT sources, did not score average high, in the test, comparing that to the other groups. The average scores where so different. This was because the information they got, using ICT was updated instead of having to study for a test that does not require the use of ICT. The several tests that were carried out showed to us that, using the ICT students were keen to grasp more information and it was much easier for them to be adapted to the working mood.

A significant conclusion is associated with the last comments of Section 5. This comment is related to the comparison of Table 1 and Table 2, where the role of using ICT is shown. At both tables of the "Average" rows are discussed. Is shown that the row of table 2, for the case of application of ICT, the ouput percentage is shown to be lower.

Lower percentage representing lower knowledge of the students where the ICT is applied, is attributed to the students exposed to the test, but previously were not properly prepared. This indicated the need of using properly and professionally the ICT.

When the ICT training or education was not professional, a consequence or impact is shown, causing fragmental and simulation of ICT application, causing low outcome on teaching and learning desired results.

Moreover, one should emphasize that, this is the case for all the students of the system of education in Kosovo. This is associated with the Competencies of the actual Curriculum applied in education system of Kosova. (Education GPS - Kosovo - Student performance (PISA 2018) (oecd.org), 2018).

Namely the Core and Framework Curricula at the system of education of Kosova, are based on only 6 competencies, where the 7th and relevant competency associated to digital education is missing. This point of the conclusion shows the urgent need of introduction and use of the new 7-th competency, digital related competency. The need of application of the digital competency as an urgent requirement, indicated and shown by this study, was shown with results of PISA (ducation GPS - Kosovo - Student performance (PISA 2018) (oecd.org), 2018) tests, applied in the several last years. We consider that introduction of the 7-th or digital competency will increase the outcome results of Kosovian students exposed to the PISA tests, which so far seems to be very low.

Conventional teaching, without application of digital techiques and IT technology nowadays are not attractive for students.

The use of ICT in teaching and education enables us to be capable of using multimedia techniques. Using such techniques in education, the courses that seems to be tough, complicated or difficult, become easier, by reaching the way how to overcome those difficulties.

Conventional representation of data (known as a time or spatial representation), in this study, has shown some fluctuation. This kind of representation of data, made the conclusion not obvious.

However, by using FFT, shown in Figure 7 and 8, an obvious difference and conclusion can be understood. Students exposed to the tests where ICT is applied, not in proper manner, has scored lower. While the maximum value of the peak in Figure 6 is 300, this maximum, or peak in case 7, is little more than 200.

This urges the need of successful and professional application of ICT for the students exposed to the tests. This is indicated by the PISA test, to the students in Kosova, as mentioned above.

Based on the Fast Fourier Transform, from the modes of scores, we understand that the errors that we detected came from the different students whom finished the tests on the exact time.

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