

## **The Effects of Using Intelligent Tutoring Systems (ITSs) in Teaching English Language Grammars**

تأثير استخدام أنظمة التعليم الذكية على تدريس قواعد اللغة الإنجليزية

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## **Abstract.**

Computers are excellent machines in achieving tasks that have a repetitive nature without being tired or feeling bored. This feature enabled scientists to develop some software that mimic the role of human tutors and teach the students different subjects without being tired or bored. These software interact with the students, give them instructions and test their performance and thus, they provide the students with the suitable learning atmosphere which enables them to learn everywhere and anytime.

The computer programs that provide the students with a gainful and tireless tutoring are known as : Intelligent Tutoring Systems(ITSs). Despite the fact that intelligent tutoring systems differ in their structure and/or organization, they nearly provide the same functionalities. The differences appear due to the differences in the nature of the subject taught by the system.

Using intelligent tutoring systems in teaching English language grammars facilitates the process of teaching and learning. ITSs provide the students with the suitable instructions that help them to understand the rules , then they test the students' understanding by providing some questions and finally, give them the feedback according to their performances. This way helps the students to learn at any place they like and at the suitable time. Moreover, using intelligent tutoring systems helps teachers to concentrate on the students' weaknesses and save time and effort of repeating the parts that the students master. They also give the parents the chance to revise the topics covered in the school to their children which will benefit the process of learning. Intelligent tutoring systems are very common and effective. Thus, further efforts are required from the scientists , and educators to develop more complex intelligent tutoring systems and engage the use of ITSs in schools, universities , colleges and any educational organizations.

This research tends to study the effects of using intelligent tutoring systems in teaching English language grammars ( the present simple rule ). As a start, the research will study the effects of the ITSs in teaching grade 11 students from Um Al Emarat Secondary School , then further researches will be applied on wider ranges.

*Keywords : Intelligent Tutoring Systems (ITSs), Intelligent Computer-Aided Instruction (ICAI), Computer Assisted Language Learning ( CALL ).*

## ملخص

تعد أجهزة الكمبيوتر آلات ممتازة في تحقيق المهام التي لها طابع تكراري دون كلل أو تعب. تُمكن هذه الميزة العلماء من تطوير بعض البرامج التي تحاكي دور المعلمين لتعليم الطلاب مواضيع مختلفة، و تكرارها دون تعب أو ملل. هذه البرامج تتفاعل مع الطلاب و تزودهم بالتعليمات اللازمة لتنفيذ المهام، و من ثم تقوم باختبار أداء الطلاب لمعرفة مدى استفادتهم من هذا البرنامج، وبالتالي فإنها توفر لهم جواً تعليمياً و بيئة مناسبة تمكنهم من التعلم خلال أي وقت و في أي مكان يناسبهم .

تعرف برامج الحاسوب التي تقدم للطلاب دعماً يتناسب مع المادة التي تدرس لهم بأنظمة التعليم الذكية . هناك العديد من برامج التعليم الذكية التي تختلف فيما بينها من حيث محتوى المادة التي تدرسها، إلا أنها تشترك في بعض الصفات ، خصوصاً إذا كانت هذه البرامج المختلفة تدرس تقريبا نفس المادة أو نفس المحتوى. تساهم برامج التعليم الذكية التي تستخدم لتعليم قواعد اللغة الإنجليزية في تسهيل عملية التعليم و التعلم ، حيث تقوم بتدريس الطلاب قواعد اللغة الإنجليزية و شرحها لهم ، و من ثم تطرح عليهم بعض الأسئلة التي تساعد في تقييم أدائهم و تقدم التغذية الراجعة لهم مما يساهم في الارتقاء بعملية التعليم و رفع مستوى الطلاب، و السماح لهم بالتعلم خلال الأوقات التي يفضلونها و في الأماكن المناسبة لهم ، كما أنها تساعد أولياء الأمور بالتعرف على محتوى المادة التي تدرس لأطفالهم و بالتالي تساعد في تقديم الدعم المناسب لهم مما يعود بالنفع على أداء الطلاب.

تعتبر نظم الإشراف الذكية أنظمة مشهورة، و معروفة، و فعالة في تحسين عملية التعليم ، لذلك يتوجب على الباحثين بذل قصارى جهدهم لتطوير هذه الأنظمة و دمجها في المؤسسات التعليمية .

تبحث هذه الأطروحة آثار استخدام نظم التعليم الذكية في تدريس قواعد اللغة الإنجليزية لطلاب المرحلة الثانوية ( الصف الحادي عشر ) كبدائية و من ثم نسعى إلى تطبيق هذه الدراسة على نطاقات أوسع و مواد دراسية أكثر .

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# **The Effects of Using Intelligent Tutoring Systems (ITSs) in Teaching English Language Grammars.**

## **Chapter 1: Introduction**

### **1.1 Introduction:**

It had been strongly believed that the most useful way to give explanations and instructions to the students is done by teachers. Over time, studies showed that there are great educational achievements made by the professional and skilled instructors/coaches. Once the computers had been introduced, scientists started to think of delegating the process of teaching to these tireless machines. At the beginning, this seemed to be impossible to accomplish but, considerable changes had been made to achieve this goal. The dream has been converted into reality by the introduction of Intelligent Tutoring Systems (ITSs). VanLehn,K.(2006).

Computers were invented basically to accomplish different educational tasks due to the fact that computers are tireless machines that won't feel tired or bored when repeating the same task. Some computer software are used to facilitate the process of teaching by engaging all the students in the instructive mode. Ong,J.& Ramachandran,S.(2003)

In 1970s a new innovative and brilliant inspiration appeared, a computer program that can interact with the student by giving him/her the instructions. Human tutors are believed to be extremely efficient in providing a suitable learning atmosphere and it is strongly believed that human tutors are capable of enhancing the performance of the students by almost two standard deviations. Ong,J.& Ramachandran,S.(2003)

Intelligent tutoring systems ( ITSs) are computer software that intend to provide gainful and tireless tutoring .VanLehn,K.(2006). They can be also defined as complex systems that imitate the human teachers by giving instructions and interacting with each single student. ITSs are best used to teach some complex tasks such as : problem solving and resolving complex conditions. Similar to the teacher's role, ITSs tend to observe and

check the students' performance . Stottler,R.(n.d).. In spite of the gigantic disparity in the organizational structure of different intelligent tutoring systems, they almost provide the same functionalities according to the subjects they are concerned about. Most of the differences lie because of instructive characteristics of the systems as the nature of the tutoring system depends on the nature of the subject at hand. For example, the instructions used in math tutoring systems differ from those which are used in English language tutoring systems, as in math the system must provide instructions about how to solve the problems or equations and sometimes it needs to attach supplementary materials such as figures and shapes whereas language tutoring systems are much simpler as they provide fewer instructions VanLehn,K.(2006).

The main purpose of developing intelligent tutoring systems ( ITSs) is to give all the students an equal chance in explaining and doing the required activities or exercises and at the same time to respond to each one of them individually according to his/her performance in the exercise and this promised to give considerable positive effects on the process of teaching. Ong,J.& Ramachandran,S.(2003)

Different tutoring systems provide different alternatives and variations of features. They have the tendency to express similar ideas under different terms, this gave the people the intuition that intelligent tutoring systems are very complicated and can be only understood and developed by highly qualified personnel who are familiar with Artificial Intelligence (AI) concepts. The appearance of the term intelligent before ( tutoring systems ) reinforced this fake idea as intelligent tutoring systems are simple to be understood and designed if we ignore the multiple names/ terminologies and spot the light on the basic performance of each system rather than the organizational structure. VanLehn,K.(2006).

## 1.2 Overview

People all over the world started to recognize the significance of implementing technology in the process of learning and teaching thus, they started to think of a suitable way for teachers and students to provide the desired level of education and ease the life of the students. One of the systems that help in providing education and mimic the role of the teacher is the intelligent tutoring systems. These systems are computer software that employ the technology in the educational field. The main attitude behind developing such systems is to use the computers and their associated technologies such as : multimedia and animation in order to provide the students with the maximum flexibility in terms of time and location where they can express their ideas, diagnose their errors and learn. Students usually tend to learn faster and achieve better results when they are in a personal learning environment as they feel free to answer, revise and have a feedback to their performance.

## 1.3 Problem statement:

Teachers usually are capable of teaching students and explaining the topics to them way much better than the simulations provided by computers can do, as they can provide on the spot feedback and assess the students' performance. In an ideal world, the best performance in a classroom can be achieved when each student has his/her own dedicated teacher which is infeasible as this process is pricy and costs too much money. Therefore, a good solution could be to design a software that combines the required expertise with a suitable tutoring skills to impersonate the person-to person tutoring style in a cost effective way. Such types of software are known as Intelligent Tutoring Systems ( ITSs).

Another name for the intelligent tutoring systems is : *Intelligent Computer-Aided Instruction (ICAI)* this name is used to indicate the use of computers to simulate the process of teaching and giving instructions to students. Nowadays, intelligent tutoring systems are used for many different purposes in almost all aspects of life such as : in schools/ universities – including various academic levels , in military , in

flight simulations , robots' construction and for other training purposes Ong,J.& Ramachandran,S.(2003).

In this research, the consequences of implementing and using an intelligent tutoring system will be examined to check its feasibility and effectiveness when applying it on students.

## **1.4 Research Aim**

This research aims to carry out a tentative study to explore the effects of using the intelligent tutoring systems in teaching English language grammars (specifically the present simple tense) and to what extent the introduction of intelligent tutoring systems in schools will result in changing the performance of the students. The study is to be applied on grade 11 students to find out the consequences of embedding the technology in education.

## **1.5 Research Objectives**

The objectives of the research are listed below and are extended to achieve the desired research aim:

- To design and implement an intelligent tutoring system for teaching English Language grammars specifically: The present simple tense rule.
- To investigate to what extent can this intelligent tutoring system help in teaching English grammars.
- To explore the effects of using the intelligent tutoring systems in schools for non-native English speakers.
- To measure the performance of the students who use the intelligent tutoring system and the students who were taught using the traditional method in order to be able to see the difference in the students' performance.
- To draw a conclusion on whether the use of the intelligent tutoring systems will improve the effectiveness of learning or not.

## **1.6 Research Questions:**

The research aims to answer the following questions which are formulated from the proposed objectives mentioned previously:

- To what extent can intelligent tutoring systems help in enhancing the process of teaching English language grammars?
- What are the consequences of using intelligent tutoring systems in schools for non-native English speakers?
- Can intelligent tutoring systems be effectively used and implemented in schools to enhance the performance of the students?
- Is it really feasible to introduce the Intelligent Tutoring Systems in schools and universities?

## **1.7 Research Pattern and Scope**

During the research, a comprehensive review was conducted to cover all the aspects related to different types of intelligent tutoring systems , issues related to deploying intelligent tutoring systems into education, study the consequences of using them to teach students English grammars and the future recommendations toward effectively using them in schools.

The knowledge acquired by the comprehensive literature review will be used to design an intelligent tutoring system to assess the actual impact of using it to teach/explain the (Present simple tense ) rule, check the students' understanding and give a detailed feedback on their performance.

The results achieved by this study will be used to draw a conclusion about the effects of using intelligent tutoring systems in the education field. Depending on the results, this will lead either to recommend the implementation of such systems in teaching or to oppose them from being used. The experiment will only concentrate on one subject area as the nature of each subject differs from one area to another. Results can be then generalized to cover wider areas that are compatible with the area tested.

In this paper also, different papers were reviewed to stop over the strengths , weaknesses, different frameworks, layouts and structures of previous intelligent tutoring systems that were used for students, trainees , programmers and military aircraft pilots and the systems' effectiveness on improving the process of learning. The research is concerned also about the advantages and disadvantages addressed by different intelligent tutoring systems.

The structure of the dissertation will be as follows: chapter 1 will introduce the topic, chapter 2 contains the background about this topic. Chapter 3 describes the methodology used to study the effects of using intelligent tutoring systems in teaching English language grammars ( Present simple tense) and how data was collected to be analyzed . Chapter 4 contains the evaluation techniques used to test the hypothesis. The last chapter contains the findings of the study derived from both the literature review and the experiment done using the software developed.

## **Chapter 2: Background**

### **2.1 Artificial Intelligence in education**

Persistent efforts had been made over the past three decades in order to implement Artificial Intelligence techniques (AI) in the field of education. Although researchers had tried a lot to embed the AI in education but till now they didn't achieve the desired goals. There are several reasons behind this fact, first: intelligent tutoring systems costs too much money in order to be developed and the required computing power to develop them was costly. The idea of using intelligent tutoring systems was mainly revealed from the

artificial intelligence (AI) investigators rather than the educators as AI investigators believe that intelligent tutoring is one of the areas that can witness great improvements. The effectiveness of intelligent tutoring systems is evaluated in terms of its response to the artificial intelligence standards not from the education prospective (i.e.: the systems' response to the students' performance more willingly than to the educational point of view) and this is because evaluating the educational part implies testing the time and testing the accomplishment of the specified task. Ong,J.& Ramachandran,S.(2003)

## **2.2 Computers and education**

Due to their accessibility and ease of use, computers are believed to have a great impact on almost all aspects of life. When compared to other means of communication, computers are considered as the best and the easiest to use. The task of teaching English language has been delegated to the computers with the wide spread of intelligent tutoring systems. This is because users of such systems can learn, communicate and exchange their views with each other when using the internet. In accordance with some studies, technology played an essential role in education especially for those who are interested in learning a second language as there are plenty of supplementary materials available over the internet such as : Audio CDs , educational websites, electronic books etc... Khamkhien,A.(2012).

The effectiveness of the material taught by intelligent tutoring systems counts on how effectively such systems are used. Computers facilitate the process of learning by providing feedback that reflects the students' performance of the tasks done. There are different types of questions provided such as : multiple choice questions (MCQs) , fill in the blanks questions that requires the user to fill with a suitable word from a collection of given words, matching and writing questions that can be used for enhancing both grammars and writing skills. The type of the questions used varies according to the skills being taught/ tested, this variation guarantees that the student master all the required skills. Khamkhien,A.(2012).

Intelligent tutoring systems are very common and well-known in a way that makes the ones who are not familiar with them to be “outdating”. These programs proved

to affect almost all aspects of life specially those related to education, economy and business. As time passes, the computer hardware started to cost less money, become easier to deal with and more adjustable hence , the reliance on such tutoring systems become wider.

Computers nowadays are considered as powerful tools in the field of education as most educators depend on them due to their enormous competences and the unlimited efficiency they possess. Peoples' reaction toward the use of computers in education ranged between acceptance and opposition. Acceptors believed that the widespread use of computers in almost all aspects of life will ease the process of integrating it in teaching , while some people feel that computers can't really mimic the role of the human teachers and do the same job . They believed that the response to human teachers will be better when compared to their response in case of using the intelligent tutoring systems. Moreover, they have some fears toward replacing human beings with machines and they have also have some fears regarding their professions in case of computerizing the process of education. Gündüz,N.(2005).

Intelligent tutoring systems (ITSs) are computer programs that simulate person-to-person teaching. Alpert,S. , Singley,M.&Fairweather,P.(1999). These programs are used as follows : students are introduced to the topic at the beginning in which the general rule and some illustrative examples are provided. The students are then asked to solve a sequence of questions to assess their understanding of the material explained. The tutoring system will then provide a feedback that informs the student with the areas of weaknesses and strengths. Gündüz,N.(2005).

The feedback received from the system to the students should be provided at a suitable time in a way that the feedback do not disturb the student or prevent him/ her from answering or thinking. The feedback also has to keep all the requirements related to the task as they are with no changes which will guarantee that the required skill is fully understood by the students/users of the system. In general, the quick feedback should be given to students directly when doing the task as it was agreed from previous researches that giving the students the feedback instantaneously is better and helps in obtaining the information faster than those who didn't get instant feedback. This is not always the case

as some researchers found out that immediate feedback could be unfavorable in some real time tasks such as monitoring the radar. Ong,J.& Ramachandran,S.(2003).

Intelligent tutoring systems differ from other simulations that provide training using the computer as ITS judge the users' performance and tailor the feedback in a way that suits each situation, which means that each one will get a different feedback according to his/her performance . Ong,J.& Ramachandran,S.(2003).

Generally, it is notable that the performance of the students not receiving the feedback instantaneously is considerably worse when compared to others who receive the feedback directly on the spot. An overall agreement that appears to be pleasing on the feedback context is that the system should only sign the presence of errors without mentioning the error or correcting the answer immediately, this is usually preferable in order to give the student the greatest chance to revise the answer and to think about the mistake he/she did. Ong,J.& Ramachandran,S.(2003).

Intelligent tutoring systems that are used to teach language are known as : Computer Assisted Language Learning ( CALL ). CALL systems are used to explain specific topics , support the understanding of the items explained and test the understanding of students. The student will first be exposed to the rules supported by some examples to clarify the rule at hand. Then, the student will be asked to answer the related questions to test his/her understanding of the explained rule. At the end , the computer will generate a suitable feedback according to the students' performance. Scientists used to point to CALL systems as a helpful tool that can be used by tutors and students in different ways either in the class or at home though the use of CALL systems need to be well-planned. Gündüz,N.(2005).

According to Gündüz,N.(2005). ,there are various types of CALL systems that are used to teach language such as: the *behaviouristic CALL* , the *Communicative CALL* and *Interactive CALL*. The first CALL was the *behaviouristic* as it was produced at the end of 1960s . It depended on the *Audio-lingual* teaching style. This type of CALL systems focused on recurring language exercises. *behaviouristic CALL* systems didn't allow

students to work individually which encouraged the team work and created the inspiration. *Behaviouristic CALL* systems contains wide-ranging grammatical exercises and translation examples.

However, as personal computers became much more complicated in a way that allowed the students to work separately, the *communicative CALL* systems started to replace the *behaviouristic CALL* systems specially after the eliminating the former. Communicative CALL systems emphasized that learning should always be a serious of interrelated activities that include : discovering , communicating and improving thus, the supporters of the *communicative CALL* systems always encourage the introduction of using the forms. The *communicative CALL* systems focused on the cooperative learning instead of the independent learning (i.e.: *communicative CALL* systems spotted the light on what each student did with his/her colleague rather than what he/she did individually). Gündüz,N.(2005).

On the other hand, *Interactive CALL* systems were first introduced by the 1990s were new sights were established such as : the centralization of the learning process and the engagement of the student into the social life for socio-knowledge acquisition. *Interactive CALL* systems also encouraged the integration of the students in the genuine life by exposing them to both project and content-based approaches, this will also guarantee that the student will be familiar with almost all the required language skills. In *Interactive CALL* systems students were allowed to use the technologies associated with computers wherever and whenever they need to. The following timeline shows the stages of CALL systems development. Gündüz,N.(2005).

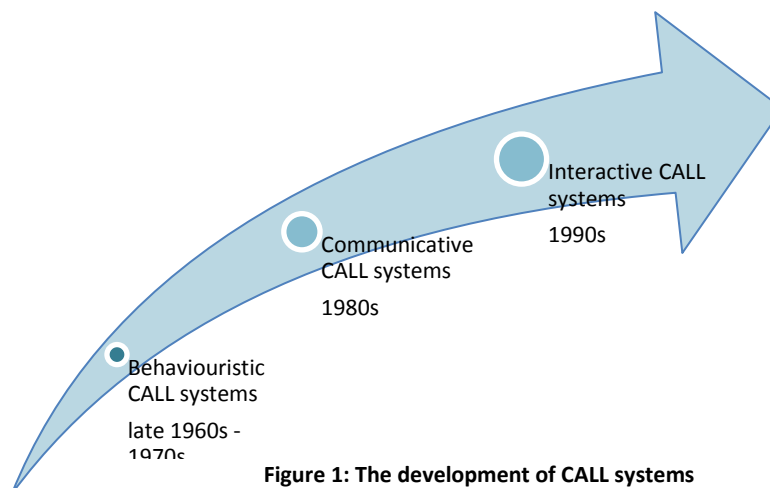


Figure 1: The development of CALL systems

The main differences between various CALL systems are listed below in table 1.

	<b>Behaviouristic CALL systems</b>	<b>Communicative CALL systems</b>	<b>Interactive CALL systems</b>
<b>Emphasis :</b>	Depends on audio-lingual teaching style.	<ul style="list-style-type: none"> <li>- Encouraged the cooperative learning.</li> <li>- Emphasized that learning should be a serious of interrelated activities such as: discovering , communicating and improving</li> </ul>	<ul style="list-style-type: none"> <li>- Encouraged the socio-knowledge acquisition.</li> <li>- Encouraged the integration of the students in the genuine life.</li> <li>- The learning process in student-centered.</li> </ul>

**Table 1: Different CALL systems**

At present, great efforts are put to develop and deploy intelligent tutoring systems over the World Wide Web (WWW) and this is usually due to the enormous effects and benefits of doing so. By deploying such systems over the internet, the process of teaching and learning can be easily done independent of the location and the time which will provide the students and the tutors with the maximum flexibility. Another significant benefit of using the internet is that it helps to run the programs regardless of the user's platform or operating system. Virvou,M. & Tsiriga,V. (2001).

Due to these benefits, the viewers of internet –based intelligent tutoring systems are much more than the viewers of the traditional ones. On the other hand, most of the internet-based ITSs are simple in their design and they are short of complexity and interactivity when compared to the ordinary ITSs. However, the use of the web is believed to attract more users to the ITSs and the learning process can be really enhanced by the use of ITSs hence; the educational systems can be really influential if we merge both technologies: the intelligent tutoring systems and the World Wide Web. Scientists believe that ITSs are getting more and more popular though, web-based intelligent tutoring systems still compromise a small area contained by a larger steam this situation is applied to the *Computer Assisted Language Learning systems (CALLs)* deployed over the internet. Virvou,M. & Tsiriga,V. (2001).

Anyways, ITSs are powerful systems that can't be accessed by so many people/students as in most cases; they are designed for research purposes only. Thus, the

deployment of such systems over the internet / web is believed to attract more viewers. The presence of small number of internet-based CALL systems doesn't weaken the fact that these systems are influential but generally, people are not really interested in this area or because most of these systems are limited to the subjects they handle. Virvou,M. & Tsiriga,V. (2001).

### **2.3 Evaluating the effectiveness of the Intelligent tutoring systems**

Till now, slight concentration had been given to evaluate the effectiveness of intelligent tutoring systems as most of the efforts had been directed toward visualizing the prospective of the ITSs such as: implementing and enhancing such systems. Due to the fact that ITSs started to strongly penetrate into our daily life in many fields specially in educating people, in military issues and in business matters the need to evaluate these systems emerged strongly. Evaluating an intelligent tutoring systems requires collecting data and convert it into a form that helps to make a decision. Two common ways for evaluating the effectiveness of such systems are used : the Summative and Formative evaluation. Evaluation Methodologies for Intelligent Tutoring Systems

*Formative evaluation* takes place while designing and developing the system and it is used to enhance the design of the system and it studies the relationship between the structure of the ITS and its behavior. It helps to collect useful information that helps in enhancing the system's functions. It can be considered as a part of the programming phase. ITSs researchers often advocate that the formative evaluation has to start at the early stages of development as the results of this evaluation can significantly help in improving the system. However, Summative evaluation studies the effect of the system after being completely implemented to figure out the impact of such systems on the students' performance. It tries to either confirm or disconfirm some facts about the system. Due to their nature, *summative evaluations* are believed to be more practical than the *formative evaluations*. Mark,M. & Greer,J.( 1993)

Numerous number of evaluation techniques that are used to evaluate the expert systems can be also used to evaluate the intelligent tutoring systems. Complicated systems such as the intelligent tutoring systems (ITSs) can be evaluated with regards to

the whole system, parts of the system or some specified characteristics of the system. The usefulness of the evaluation technique depends on what is really important or significant to the researchers, therefore; several evaluation techniques are needed to meet the evaluation purposes. Mark,M. & Greer,J.( 1993)

The behavior and the structure of the program can be verified and validated. The difference between verification and validation can be illustrated in the following table.

Points of comparison	Validation	Verification
<b>The task :</b>	It tests whether the system's behavior meets the goals and does what is required.	Tests the connection between the system's structure, attitudes and the specifications determined before designing it. It checks the system's ability to meet what it was designed for.
<b>Answers the question :</b>	Does the system do what it should ?	Does the system perform what it was designed for?

**Table 2: Evaluation techniques**

However, in some cases ordinary computer programs are verified and validated using the traditional *proofs of correctness* but this is not the case with the programs that embed some Artificial Intelligence (AI) techniques such as intelligent tutoring systems (ITSs) as these programs can't be traced analytically.

Frequently, ITSs researchers refer to some experts especially if their system is designed to teach other languages, as human experts are capable of judging the program against the language standards and rules; this is usually done during the formative assessment. The assessment done by the human experts is best used with the programs that have a steady and a predictable behavior, thus in some cases this might not be suitable for ITSs that implement complex Artificial Intelligence (AI) techniques.

The subject standards is also considered as one of the measurements used to evaluate the effectiveness of the ITS. The student will be provided with different types of information such as : Texts , figures , graphs , problems to be solved and much more. The

information provided should be accurate and precise. Therefore, the *Formative* assessment is of a greater significance for the intelligent tutoring systems designers compared to the Summative assessment as they only refer to it if they feel that the domain knowledge is erroneous. Mark,M. & Greer,J.( 1993)

The knowledge of the domain can be possibly evaluated using two techniques: the domain experts' feedback and the *turning tests*. The applicability of these two techniques varies depending on the system, the domain knowledge , the purpose of the system and the way the information is presented in the system ; as ITS researchers find it easier to evaluate and assess a system that has a simple and easy domain knowledge. In cases of complex domains where researchers face difficulties in developing test cases and/or other accuracy measurements experts' assessment may not be advantageous. On the other hand, Turning tests are desirable as means to provide a good judgment for the area of the knowledge examined. Mark,M. & Greer,J.( 1993).

Due to their complex nature, traditional evaluation techniques that are applied on simple computer programs are not always applicable on the intelligent tutoring systems. Usually, the shortage of required knowledge makes the process of evaluating the ITSs a complex process and hence, detailed information must be collected before and during the process of developing an intelligent tutoring system to assist the systems' evaluation and adaptation. Mark,M. & Greer,J.( 1993)

Another way to evaluate the ITSs is known as *criterion-based evaluation*. Scientists consider a system to be successful if it is free of failures. The tester of the systems is responsible to look for all the failures in the system and report them taking into consideration all the standards that were put before developing the system. These types of tests are best used during the *formative assessment* where the developers of the system care about the overall system rather than the small details such as designing the interface. In such evaluations, the judging team will use a general strategy to check the validity of the components of the system, its structure and behavior. They will be provided with checklists and general guidelines to compare the characteristics of the system against the criteria they have at their hand. Mark,M. & Greer,J.( 1993).

Sensitivity Analysis can be also used to evaluate the ITSs. Generally, it is used to test either a part or a whole system to check its ability to act in response to different

input. In ITSs terms , this type of tests is useful to evaluate the systems that offer the students different instructions and guidelines. Scientists usually use the *sensitivity analysis* to assess the need to add additional teaching materials to the system. A system behavior seems to be acceptable if it shows a reasonable reaction to the students' input(i.e.: a system that shows the same response to dramatically different behaviors is said to be a useless system). The use of the sensitivity test to evaluate the ITSs is usually limited to what people consider it a reasonable behavior. Mark,M. & Greer,J.( 1993)

*Pilot testing* is another way of evaluating the ITSs. It is used to decide whether the ITS behaves as expected or no and to make sure that all the system's outputs are reasonable. Three types of Pilot testing are applicable : *one-to-one* test , *small-group* test and the *field test*. In *one-to-one* test, the tester observes how students react with the intelligent tutoring system at hand thus, the testers will be able to recognize the students' aptitude and identify the unclear questions or information. *One-to-one* test is usually performed at early stages of system's development to reduce the costs of improper development. On the other hand, *small-group* test is performed afterwards in the development cycle when the components and the overall structure of the system start to be steady. In the *small-group* test, a group of students –usually are chosen to represent a greater number of students – are examined before using the system and after using it to evaluate the impact of the system on the students. This usually helps to indicate whether the information explained by the system is fully understood by the students or no. However, the *field test* is used to figure out all the problems that may occur when the system is being used. It checks whether or not the students will behave as expected and show a good understanding to the topics clarified. It also assists in collecting information about the unexpected outcomes. The following table summarizes the differences between different types of *Pilot tests*. Mark,M. & Greer,J.( 1993).

Points of comparison	One-to-one test	Small-group test	Field test
<b>Goal of the test</b>	Examines how each student interacts with the system.	A group of students are examined before and after using the system	The researchers try to figure out all the weaknesses of the system so as to prevent unexpected behaviors from the systems or the students
<b>Time</b>	At early stages of the systems' development	At later stages of systems' development	At later stages of systems' development

Table 3: Pilot tests

Experimental research proved to be one of the most suitable ways to evaluate the educational programs such as: the intelligent tutoring systems (ITSs). The reason behind this fact is that the experimental research does not only facilitates the process of studying the link between what had been taught to the students and the results of the students but, it also helps to attain statistical measurements that show the importance of this relationship. The experimental research is not always important in the *formative* assessment but it can be used if the researchers want to test some specific features of the system. On the other hand, experimental research is important in the *summative* evaluation when a final overview of the system is needed .Mark,M. & Greer,J.( 1993)

The experimental research starts as follows : first the research questions must be identified as in this step the goals of the designing an ITS must be answered. Then, a reasonable hypothesis will be formed taking into consideration the research questions. After that, a good design for testing the hypotheses will be selected. Once the research design is selected, the researcher can start collecting data and information and analyzing it. In case of having a contradiction between the results and the hypotheses formed, the researchers must be able to give an explanation and clarify the situation. The experimental research has many variations this includes but not limited to: the single group and a control design. The following figure shows the steps of performing an experimental research. Mark,M. & Greer,J.( 1993)

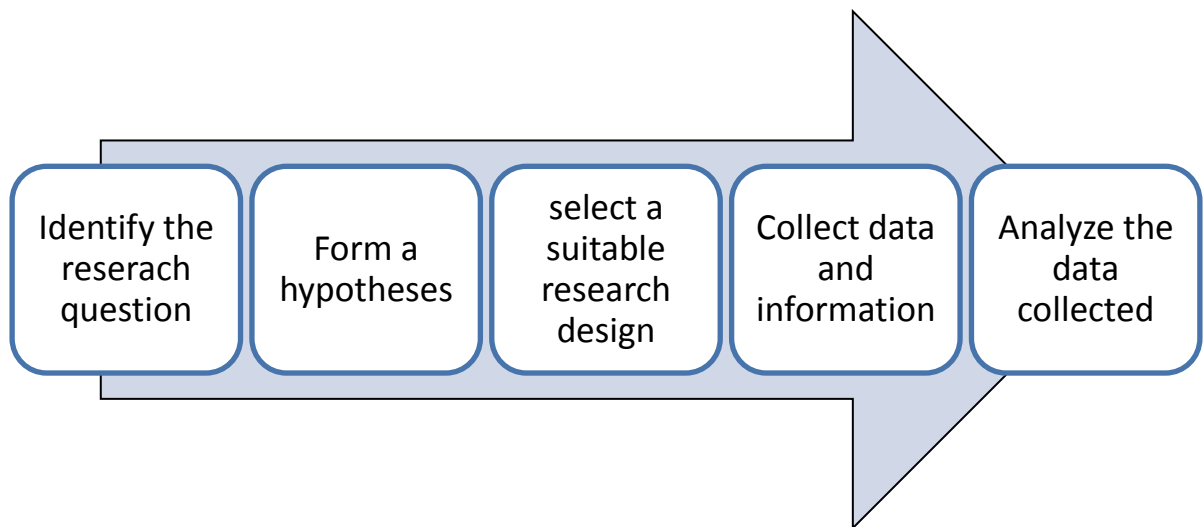


Figure 2: The steps of performing an experimental research

To perform the experimental research we must answer the research questions stated previously:

- To what extent can intelligent tutoring systems help in enhancing the process of teaching English language grammars?
- What are the consequences of using intelligent tutoring systems in schools for non-native English speakers?
- Can intelligent tutoring systems be effectively used and implemented in schools to enhance the performance of the students?
- Is it really feasible to introduce the intelligent tutoring systems in schools and universities?

The next step implies that a hypothesis should be formed in order to test it thus, the hypothesis to be tested in this research is :

Using intelligent tutoring systems to teach English language grammars improves the students' performance compared to traditional teaching techniques.

An experiment was designed to test the hypothesis and the data was collected. The details of the experiment are mentioned in chapter 3 : the methodology.

## 2.4 Previous work

During the research, several intelligent tutoring systems were reviewed and here are some examples of the systems reviewed :

- The Object-Oriented Design Learning Environment (OODLE) which is an intelligent tutoring system that is used to teach the design of the object oriented programming concepts. The system was used by college students to facilitate the process of learning a programming language. Each student is given a set of problems and is asked to solve the problems. Figure 3 shows the interface of the system. The interface displays a space to give the instructions for the students and receives the students' response. The system is designed only for the preliminary level, thus the system is not suitable for the advanced users. Stottler,R.(n.d).

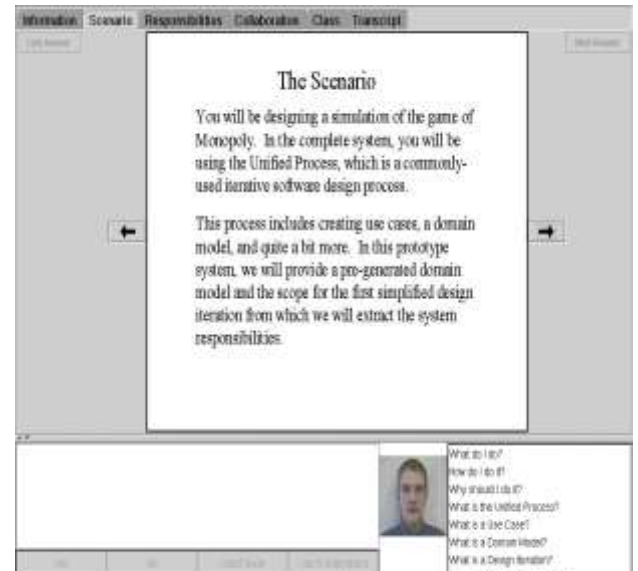


Figure 3 : The OODLE system

- NeuroTutor which is an intelligent tutoring system that helps students to understand the topics related to neurobiology field. The system is used by secondary schools' students and college biology students. It helps the students to simulate the experiments to explore new facts about the neurons. NeuroTutor focuses more on experiments rather than facts and lectures.

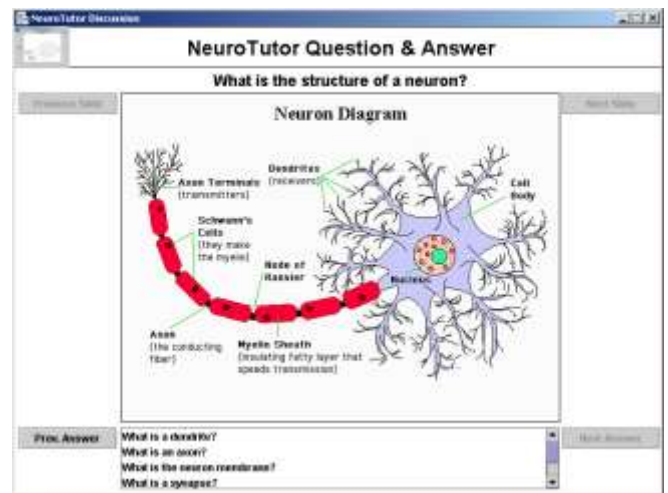


Figure 4: The NeuroTutor

- Steve : is a tutoring system that teaches tasks that need steps . It simulates some tasks such as : starting the air compressors. The intelligent tutor shows a virtual reality environment and describes the steps for the users. The users will start doing the task required and the tutor will provide the feedback immediately. The tutor can also give clues and do some steps in case the users find any difficulties in performing the task at hand.

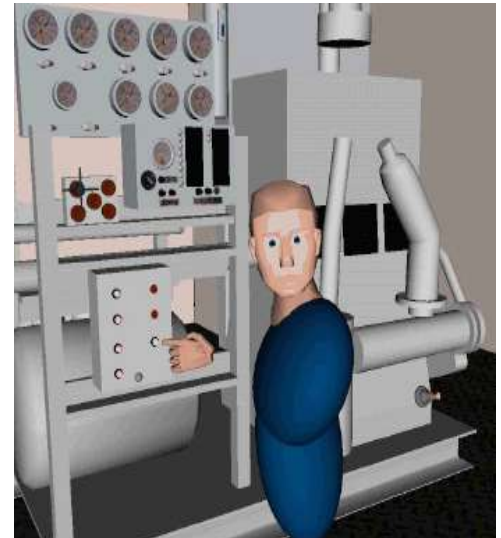


Figure 5: Steve tutoring system

- Andes : an intelligent tutoring system that teaches the students physics concepts. The students will follow the same steps as if they are solving the problems using the traditional way. It enables the students to sketch figures , solve equations and use the Cartesian coordinates properly. Andes will provide an immediate feedback once the student perform any step.

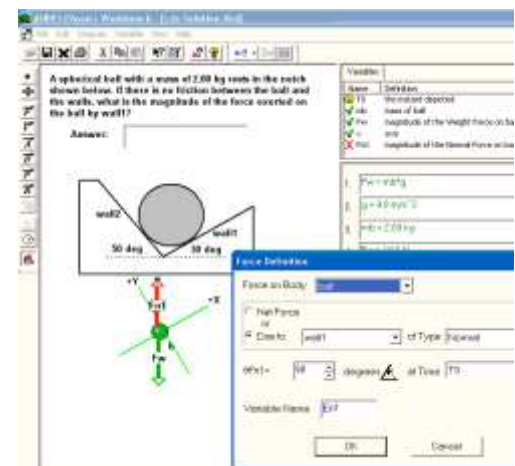


Figure 6: The Andes tutoring system

## 2.5 General comments on the systems reviewed :

In general the systems reviewed didn't mention whether or not the technologies used can be generalized to all subjects in all circumstances. Authors also didn't mention whether students with special abilities and needs can use these systems easily. Moreover , the percentage of the systems' reliability is not mentioned exactly. In addition , authors didn't mention whether their systems are portable or they need some special systems' requirements to be run on the users' computers. Some of these systems can be run on the

internet and some are not. Authors didn't mention whether their systems can be accessed by anyone.

## **Chapter 3 : Research Methodology**

### **3.1 Data collection**

The experiment was applied to a sample of (100) students form grade 11. The students were from both the art and the science sections in Um AlEmarate Secondary School. The computer labs in the school are well equipped with the computers and the students are familiar with them. The students were divided into two groups: an experimental group and a control group. The first group (the control group) were taught the present simple rule by the usual way (i.e.: a human teacher lectured and explained the rule) while the second group ( the experimental group ) were taught the rule by the use of the intelligent tutoring system.

To achieve the experiment, two types of tests were developed: a paper-based test and a computer-based test. The paper-based test was given to the first group (the control group) and the computer-based test was given to the experimental group to assess their performance after using the ( Easy E ) which is an intelligent tutoring system that was developed to be used in this experiment. The paper-based test was designed by an English teacher. It consists of twenty multiple choice questions that cover the three subtopics:

- 1- The present simple tense.
- 2- Forming questions in the present simple tense.
- 3- Negation in the present simple tense.

Similarly, the computer-based test covered the same three subtopics as students were asked to choose the correct answer from the alternatives given. Both tests have the same level of difficulty to ensure the credibility in the results. The paper-based test and the computer-based were equally marked out of twenty as each question was given a mark.

The aim of this study is to assess the students' performance and response to both teaching techniques: the traditional and the computerized one to draw a conclusion regarding the most effective technique of teaching. This will help in enhancing the students' performance and will give an overview about the impact of each technique.

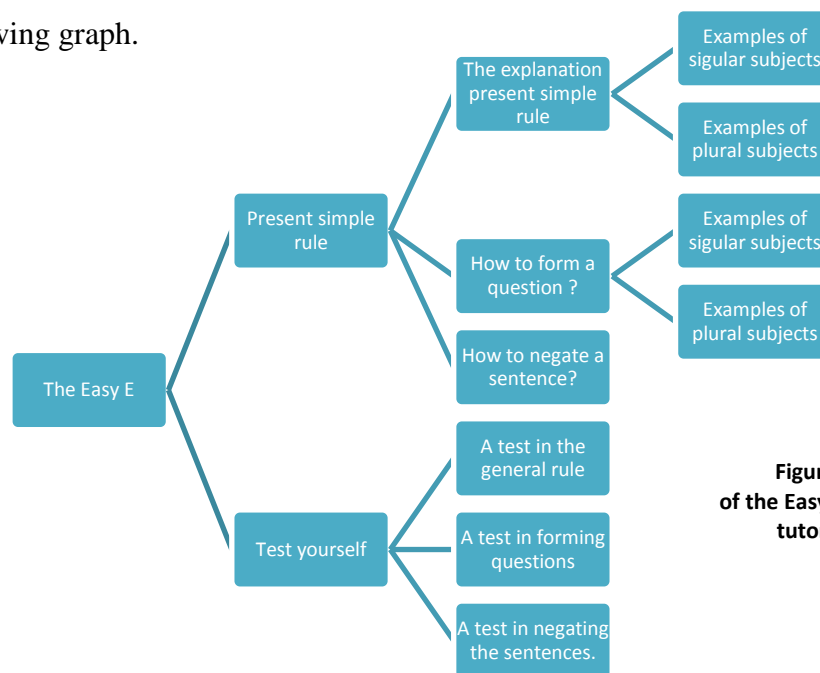
Both tests were checked by an English teacher to ensure their validity and applicability on the students. The experiment was repeated twice to guarantee the experiment's trustiness and credibility.

### 3.2 The Methodology

An intelligent tutoring system was designed and developed to perform the experiment. It was designed to teach the present simple tense with the following subtopics :

- 1- The present simple rule.
- 2- How to form a question in the present simple tense?
- 3- How to negate a sentence in the present simple tense?

The software ( the Easy E ) was developed using visual basic 6.0 ( vb 6.0). It consists of twenty three forms and three modules. The structure of the program will be explained in the following graph.



**Figure 7: The structure of the Easy E ( An intelligent tutoring system)**

The program also provides a feedback on the student's performance after doing the exercises and it also gives a final score out of twenty. The feedback will help the student and the teacher to point out the areas of strengths and weaknesses which yields in better analysis of the results of the students. This will also help the teacher to concentrate and focus on the areas of weakness and figure out the topics that the students fully understood and the topics that need to be re-explained and clarified. When doing so, the

performance of the students is expected to be better and at the same time the teacher's time won't be wasted in repeating topics that the students already grasped.

The Easy E is very user friendly and easy to be used by the students at anytime and anywhere as the software is converted into an executable file that is easy to be portable and is platform free. It contains illustrative pictures and it uses colorful fonts. The students are free to move and select the most suitable choice according to their situations (i.e.: the student can start with the explanation of the rule or with the tests directly. Moreover, the student can freely choose the type of the test that suits his/her state as doing all the types of tests is not compulsory due to the fact that each section of the tests has its separate window and separate marking scheme. The feedback will directly appear to the students after doing the test.

The software was tested and checked by two software engineers to make sure that the program is error-free and always produces correct results, they both agreed on the software's credibility and truthfulness.

## **Chapter 4 : Evaluation**

### **4.1 Results and findings**

The experiment was applied on ( 100 students ) , the students were divided into two groups each of which consists of 50 students. The first group : the control group were exposed to the paper-based test while the second group : the experimental group were exposed to the (Easy E) system where the students first used the system to understand the rule then used it to take the computer-based test. The control group took the test after listening to an English teacher explaining the present simple tense rule using the traditional way in teaching. The following table compares the results of the two groups the control and the experimental group. The test was conducted twice to ensure its credibility.

Type of the test	Mean / 20	Standard deviation
Paper-based test (control group )	9.2	4.185299833
Computer-based test ( experimental group)	14.44	3.790428332

Table 4: The performance of the students

The table shows a comparison between the means and the standard deviations of the students from both groups. The results show that the experimental group outweigh the control group as the students marks after using the intelligent tutoring system : the (Easy E ) improved.

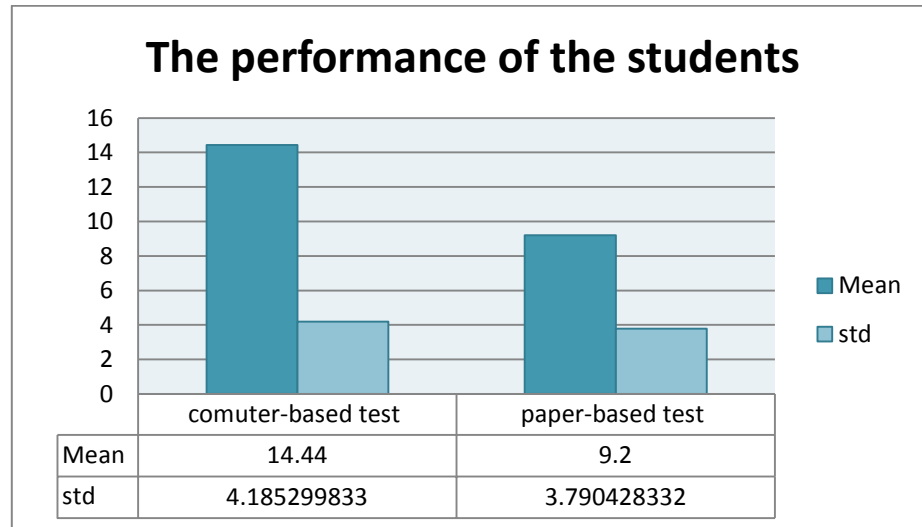


Figure 8: Comparison between the two groups

## 4.2 Analysis of the results

The results showed a difference in the students' performance when using the intelligent tutoring system : the Easy E. To analyze these results a F- Test was conducted to figure out which technique is better in teaching English language grammars specifically the present simple tense rule. The data was collected and entered into an Excel sheet to be analyzed. Then, a QI macro was used to perform the F-Test. The following table shows the results of the test

Points of comparison	Computer-based test	Paper-based test
Mean	14.44	9.2
Variance	17.51673	14.36735
Observations	50	50
df	49	49
F	1.22	
P(F<=f) one-tail	0.245	0.490
F Critical one-tail	1.61	1.76

Table 5: the results of the F- test

With reference to the previous results we can notice that the P value is greater than the  $\alpha=0.05$  which approves the hypothesis (i.e.: the students' performance when using the intelligent tutoring system : the Easy E are better than the students' results when taught by a teacher).

## **Chapter 5 : Discussion and conclusion**

### **5.1 Conclusion**

As mentioned previously, the results showed that the performance of the students who used the intelligent tutoring system are better than the results of the students who were taught by a human teacher. This is possibly because of the freedom students can have when using the intelligent tutoring system as they can concentrate on the subtopics they feel that they are weak in. The students also can freely navigate the system and go back and forth on the topics they are interested in. Students also can revise the examples at anytime and anywhere, this can also prevent them from being embarrassed when repeating the same question. Simply, students are encouraged to ask anytime without corrupting the teacher and at the same time this can give a better chance for outstanding students from repeating the same topics again and again, which helps in enhancing the performance of both : weak and outstanding students. By implementing intelligent tutoring systems in schools and in English language classes, the performance of the students will be enhanced and the classes will be more effective by the use of the computers, and this is because of the fact that all the students will be well-engaged in the lesson and all of them will be equally participating in the lesson which gives the lesson the vitality and the usefulness. The implementation of the intelligent tutoring systems will be reflected on the students' performance and their progress level. This implementation can also help the teachers themselves in having a better classes and a better results. Students can also take the software with them to their homes which gives the parents the chance to revise with their children the topics covered in the classes and gives them a clue about the different types of questions that their children can have in the tests.

During the experiment , it was noticed that some students' performance was worse when using the computers and the ITS , this can be possibly explained due to differences in the mental abilities of the students(i.e.: some students can't concentrate well without the interaction with a human teacher (person-to-person) )which is considered a drawback in the implementation of the ITS systems in schools , Thus it is better to carefully choose the subjects as well as the topics that can be taught using computers prior to implementing them. It is also important for both the students and the teachers to be trained to use the computer effectively to guarantee that the students will have the maximum benefit from the resources at their hand. The idea of integrating computers into the education field must be introduced to the students and their families to have the required amount of support.

The results got can't be generalized to all the subjects and all the topics as the nature of each subject differs from the other, this can yield in a dramatic changes in the results. For example, the math section can't really depend totally on the intelligent tutoring systems as the students usually prefer to have a teacher and to interact with him/her personally, since the nature of the subject requires that.

## **5.2 Recommendations and future work**

Schools and educational organizations are advised to implement intelligent tutoring systems in their curriculums. They can be implemented and used for various subjects as they proved to augment the students' performance when used to teach English language grammars. Another issue that deserves to be enhanced is the implementation of the ITSs over the internet , which for sure can make the lives of teachers, students and parents much easier. As a future work, the Easy E system will address more topics and more examples as well as more exercises.

The intelligent tutoring systems can also be used as a testing systems for the teachers to wrap up their lessons. For the distinguished students, ITS systems can be supplied with a higher level of thinking activities to occupy their free time. At the same time, weak students can have extra activities that help them in enhancing their abilities

and improving their performance which will help the teacher to guarantee that all the students have an equal amount of attention and that all the students understand the subject effectively. Intelligent tutoring systems can't be only used in educational fields but it also can be effectively used in professional careers to illustrate for the trainers the steps of doing a specific task. Finally , Technology is a grace so , let us all use it effectively and employ it in the societies' benefit.

## References:

Abu Naba'h,A., Hussain, J., Al-Omari,A. and Shdeifat,S. (2009). The Effect of Computer Assisted Language Learning in Teaching English Grammar on the Achievement of Secondary Students in Jordan. *The International Arab Journal of Information Technology*.Vol.6.

Alpert,S. , Singley,M.&Fairweather,P.(1999). Deploying Intelligent Tutors on the Web: An Architecture and an Example. *International Journal of Artificial Intelligence in Education*.P.P 183-197

Corbett ,A., Koedinger,K.and Anderson,J.(1997). Intelligent Tutoring Systems. *Handbook of Human-Computer Interaction, Second, Completely Revised Edition*. Chapter 37

Gündüz,N.(2005). Computer Assisted Language Learning(CALL). *Journal of Language and Linguistic Studies*. Vol.1

Khamkhien,A.(2012). Computer Assisted Language Learning and English Language Teaching in Thailand: Overview. *Mediterranean Journal of Social Sciences*. Vol. 3.

Mark,M. & Greer,J.( 1993). Evaluation Methodologies for Intelligent Tutoring Systems. *Journal of Artificial Intelligence in Education*. Vol.4.

Ong,J.& Ramachandran,S.(2003). Intelligent Tutoring Systems: Using AI to Improve Training Performance and ROI. *Stottler Henke Associates*.

Stottler,R.(n.d).Tactical Action Officer Intelligent Tutoring System (TAO ITS).*Stottler Henke Associates*.

Stottler,R.(n.d). The Object-Oriented Design OODLE Learning Environment Stottler Henke. *Smarter Software Solutions*

Tsiriga,V. & Virvou,M.(2002) . *Transferring a Standalone Intelligent Algebra Tutor over the WWW*. Ph.D. Thesis. University of Piraeus.

VanLehn,K.(2006). The Behavior of Tutoring Systems. *University of Pittsburgh*

Virvou,M. & Tsiriga,V. (2001). Web Passive Voice Tutor: an Intelligent Computer Assisted Language Learning System over the WWW .*University of Piraeus*.

\*The QI macro is available at : <http://www.qimacros.com/qiwizard/t-test.html>