

CHAPTER 14: COMPUTER ASSISTED EDUCATION

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INTRODUCTION

“The partnership for 21st century skills” has published a report on what characteristics an individual should have in 21st century. According to this report, an individual should improve some skills. These are as follows:

- Global awareness
- Financial, economic, business and entrepreneurial literacy
- Civic literacy
- Environmental literacy
- Learning and innovation skills
- ✓ Creativity and innovation
- ✓ Critical thinking and problem solving
- ✓ Communication and collaboration
- Information, media and technology skills
- ✓ Information literacy
- ✓ Media literacy
- ✓ ICT (Information, communication and technology) literacy
- Life and career skills
- ✓ Flexibility and adaptability
- ✓ Initiative and self-direction
- ✓ Social and cross-cultural skills
- ✓ Productivity and accountability
- ✓ Leadership and responsibility

It will not be wrong to say that all of these skills are based on the awareness, literacy and skills of ICT. In short, it will become more feasible to bring up individuals who are ready for real life by emphasizing these skills in our education system. In many countries, the ministries of education try to use the technology by shifting the paradigm in the education systems. Especially since the 1990s, with the acceptance of computers as an effective learning tool, technology integration has become a stress factor in education. So, in many countries, computer-assisted education has been included even in pre-school curricula.

Information, communication and technology are recognized briefly as ICT in the literature. We can consider the computer-assisted education, teaching or learning as the ancestor of ICT. Being so popular for all these reasons, the usage of computers in education will be discussed in this part.

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Basic Terms

In this part, how computer-assisted education takes place in the literature and some other terms related to education will be studied.

The Learning and Teaching of Computer and the Learning and Teaching With Computer

When the use of computer is mentioned, it may be its use in different areas such as education, production and communication. Theorists discuss the use of computer under two titles; education for computer and computer for education. The relationship between education and computer can be examined in Figure 1.

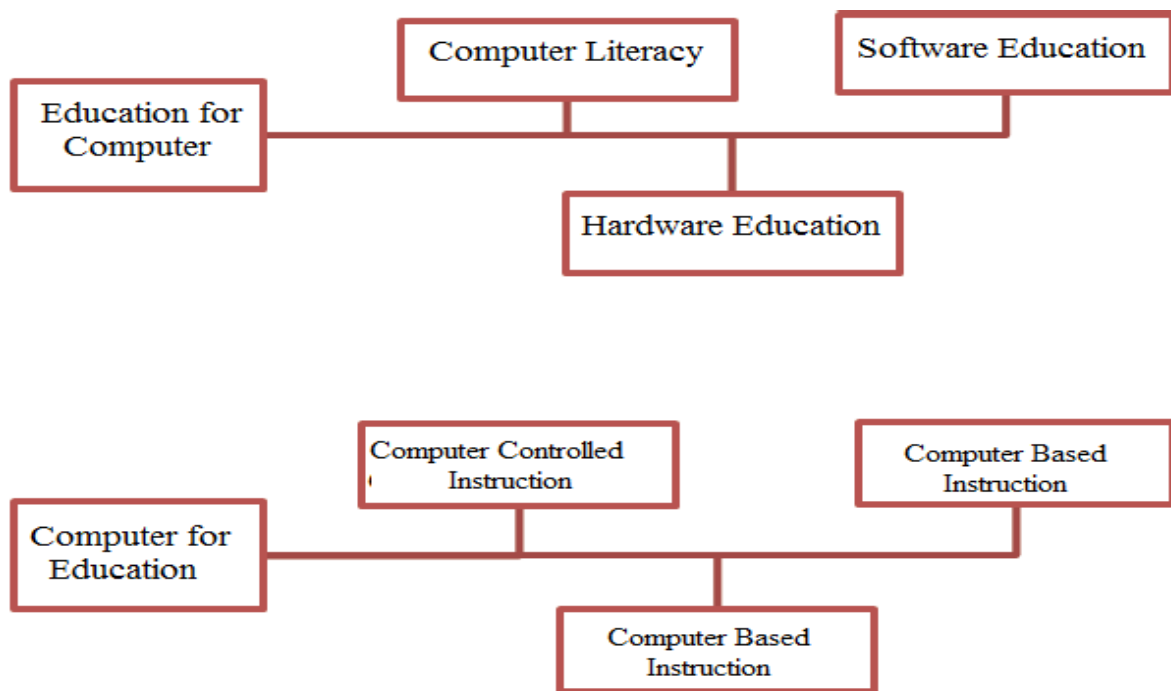


Figure 1: Computer- Education Relationship

Education for computer includes computer literacy and software and hardware training. These titles do not need explaining as they express themselves. When it comes to *computer for education*, it differs from the other one with the statements "supervised", "based" and "supported". The processes of learning and teaching are carried out and managed through a computer and it can be described as "supervised". Using computer as a teaching resource can be described as "based". And using computer as a complement system in education can be described as "supported".

The integration of information and communication technologies in education requires teachers to take part in this process. Naturally, in order to shorten this process, it would be more appropriate for teachers to learn computer/technology during undergraduate education before meeting with students during their service. Kay investigated 68 studies examining the integrating teachers with technology in undergraduate education (in other words, examining the use of computer and similar technologies in lessons). As a result, he found out two approaches. In the first approach (%44), a separate lesson in which basic computer skills are taught is not given. The main advantage of this approach is that teachers learn to use computers in context. The second approach reflects the situation of our country better. %29 of the studies examined by Kay prefer this approach. This approach includes the discussion of basic computer skills in a lesson and the main advantage of this approach can be summarized as increasing self-sufficiency in the use of computer, strengthening technology skills and developing a positive perspective on the use of technology in education. However, the disadvantage

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of this strategy is that it is detached from the context. The ideal approach in teacher training is a blend of both strategies. Moreover, this strategy should be not only in teacher training but also in primary schools.

Computer-assisted instruction is the use of computer software developed by experts in teaching a subject, concept or behavior to the students or reinforcing the previously acquired knowledge or behavior.

In order to qualify the materials presented in a computer environment for educational purposes must include learning materials and activities which are including a- learning objectives, b- teaching strategies (properties necessary for the selection and ranking of activities and events in the learning environment), c- student assessment and/or feedback. It is recommended that teachers, parents or students at a certain age should pay attention to the value and teaching aims, contents, formal compliance, software-user interaction, usefulness and technical specifications of the educational software while evaluating this kind of software.

Computer managed instruction can be defined as the use of computer systems in planning, organizing and programming the education, measuring the students' learning levels, recording and re-using of data related to the students and making statistical analysis based on these data, in short it can be defined as the use of computer systems in managing all kinds of educational activities. The most appropriate example for this concept is Learning Management Systems being used nowadays by institutions to monitor the functioning of training programs conducted on the Internet.

Considering that the computer is a communication tool, it can be seen that social media have embraced the education. With the blessings provided by the internet, people can reach the files they want instantly on the internet, chat, share audio, visual and video: create whiteboard applications, send text messages and notice the changes in news sources. People can transfer all of these applications into education.

There are many benefits of computer-assisted education to interact with students:

- a. Easy to use
- b. The ability to conduct research and to provide supportive information
- c. Question-and-answer interaction
- d. Progress in accordance with the individual characteristics
- e. Games for educational purposes
- f. Different assistive equipment for different disciplines
- g. Free test environments
- h. Evaluation

Computers can also be used in teacher-parent communication and sharing assignments tasks or other information. The use of computers is much more effective and immediate than phone calls and at the same time it can prevent unnecessary communication or misunderstandings.

The impact of computer as a tool of production is felt more today. The students of this generation do not experience the problems faced by the teachers in the past. Today, while studying or doing their homework, students benefit from computers more than their teachers do. For instance, word-processing and presentation programs are considered obsolete. Today's students are able to use desktop publishing, visual, audio and video processing programs easily at least at the level of arrangement.

The Definition of Computer Assisted Education

Computer assisted teaching/learning is a system of teaching, evaluation and rules which is online direct and interactive. It is also referred as computer-assisted education in the literature. Fine distinctions between terms are ignored in the literature and have been used interchangeably.

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Students benefit most from computers in the use of word-processing. In addition database, spreadsheet, drawing/painting/graphics/photo processing, presentation, writing, concept mapping and planning activities follow it. Students use a web browser, CD source of reference and communication as Internet/research software; direct teaching, team teaching, collaborative teaching and individual teaching in orienting the teaching; high-level feedback, integration of subject areas, project-based learning, high-level questioning strategies, teachers working as a facilitator and an assistant and family/community involvement as a teaching strategy; independent study, experiential learning, systematic individual teaching, uninterrupted text/composition, uninterrupted reading, independent questioning/research and debate as student activity.

Today, in the distribution of many teaching materials presented in text, CD Rom or the internet is preferred most. For example, many open universities in Asia follow this method in the distribution of course materials.

Individual? Collaborative?

The word, computer, is widely known by the acronym PC (Personal Computer) in English. Indeed, computers are initially aimed at the world of education and the personal use of students. Then, with the reflection of globalization to the computer world, personal computers gave a start of beginning of interpersonal communication. The effect of this socialization was felt in education in a short time.

Multimedia, hypertext and Hypermedia

The three terms have to be discussed in CAE. These three terms are described briefly below: Multimedia is a computer-assisted, interactive presentation including at least two of text, audio, static or active images and animations.

Hypertext began to be discussed in 1945 by Vannevar Bush and invented in the 1960s by Ted Nelson. Texts, whether printed or displayed on the computer, follow a linear sequence and they are read from the first page. Considering that the information presented in a group of texts is a node, hypertext is the connections of these nodes linked to each other. Hypertext is not linear. In hypertext, there is not only a way to read the texts, the reader decides on the order while reading.

With the installation of multimedia features such as graphics, audio, video to the plain text by the developing technologies, hypertext has become hypermedia. However it will not be proper to describe each multimedia as hypermedia. Hypermedia, linking the nodes with different environments, is the natural supporter of multimedia interfaces. In this case, in distinguishing between multimedia and hypermedia, the key point is the connection of nodes to each other. If a teacher opens videos, plays music on the computer to his students and brings some visual materials to the class, it shows that he benefits from multimedia. If the teacher reflects a webpage using projector, opens a video by clicking a link on this webpage and then accesses the visuals and a song by clicking another link on the same page and if he has a chance to jump from this media to another, it shows that he benefits from hypermedia with which he has supported with multimedia.

Adaptive hypermedia is a system as a result of the combination of hypermedia and user modeling. This system puts forward a model in accordance with the each user's goals, preferences and knowledge and it adapts with this model according to the needs of the user as it interacts with the user. These systems will be the apple of the eye at today's distance education.

The Use of CAE in Different Branches

CAE, since the 1960s, have been used in preschool, higher education, in-service training at different levels in different disciplines. For instance

- Mathematics
- Trigonometry
- Science
- Physics
- Chemistry
- Social studies
- Articulation
- Environment

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- Traffic
- Geography
- Crafts
- Fashion design
- Physical education
- Pre-school
- Second language teaching
- Programming language
- Multi-task programs
- Special education
- Nursing
- Anatomy
- Cardiology
- Gynecology
- Nutrition
- Music

Since the 1970s, computers have been used in educational assessment and evaluation. Many researches on computer-assisted assessment can be found in the literature. Factors affecting the use of computers in educational assessment and evaluation are computer experience, socio-cultural factors, race, ethnic origin, sex, screen quality, network quality and student preferences.

Computer Use in Preschool Education

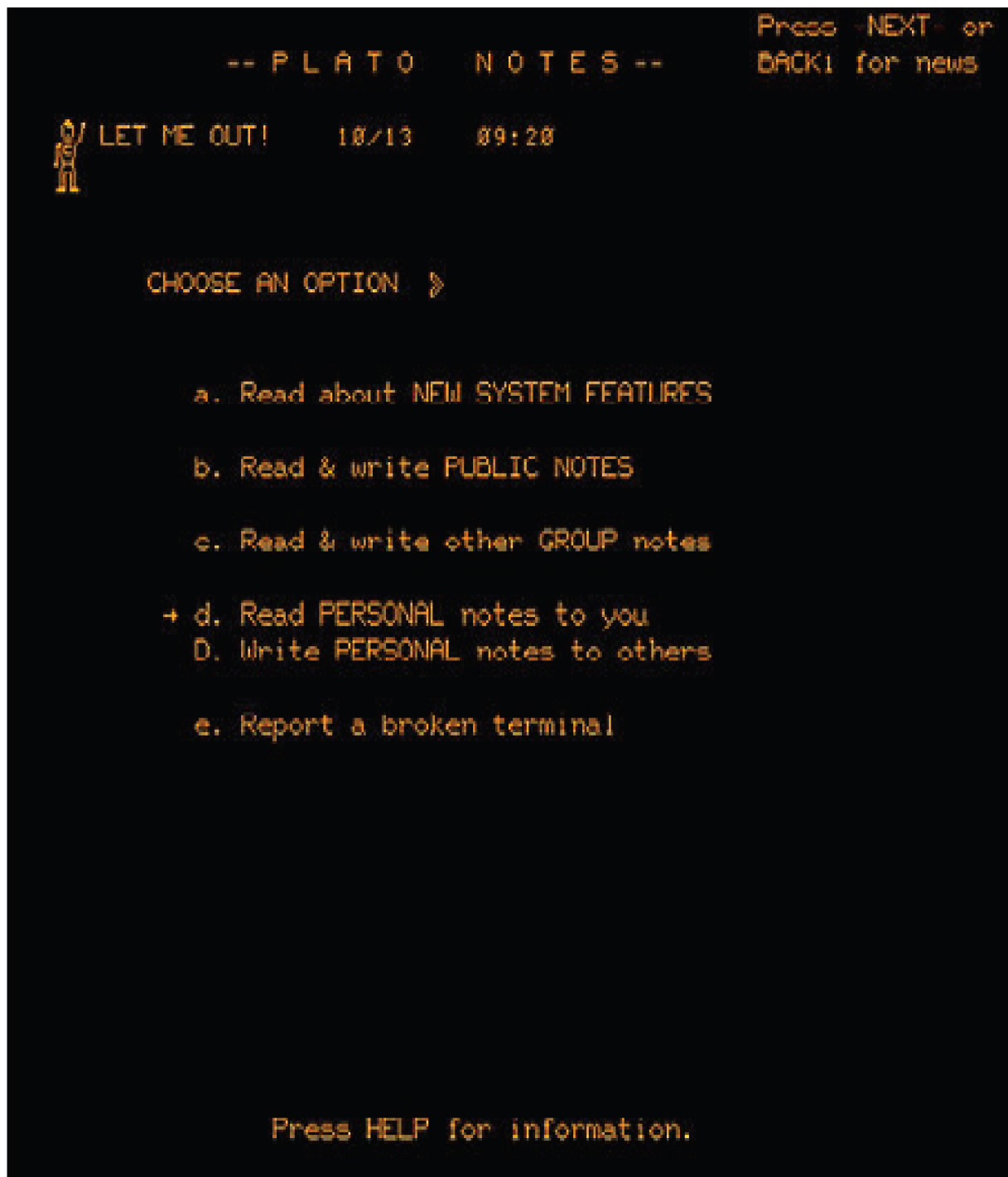
The reason why this title is discussed separately from the others is that it is about the lowest age level. It is observed that there is a dilemma in using computer in preschool education. While there are supporters thinking that computer use in preschool education is positive in terms of social skills, cognitive and problem-solving skills, creativity, language development literacy skills, motor and hand-eye coordination and motivation, there are supporters of the view that computers are not belong to preschool classes. According to this view, computers deprive children of activities made with hands and sensory experiences.

A Journey in the History of Computer Assisted Learning

The beginning of the digital era dates back to 1623, Wilhelm Schickard's calculating machine. There are some cornerstones in the history of computer development; in 1679 Gottfried Leibniz with 1 and 0's, in 1810 Joseph-Maire Jacquard with punched cards, in 1830 Charles Babbage with analytical engine, 1941 Konrad Zuse with Z3 and in 1945 John Mauchley and Presper Eckert with ENIAC. The idea of computer-assisted education appeared first at the end of the 1950s. Considering that mechanical teaching machines as a start, computer assisted education have reached today since the 1950's. These effects were observed in North America, some parts of Western Europe and the Soviet Union. In 1953, designed by Gordon Pask to perform a single education task, SAKI (Solartron Adaptive Keyboard Instructor) is one of the first examples. Another example is a computer-controlled teaching machine known as Mentor, which was designed by the Thompson, Ramo, Woolridge Corporation. Mentor was able to teach in different subjects.

Most authorities trace CAE back to Skinner, 1954, who defined the learning as behavioral changes. Programmed instruction has appeared as an extension of this theory. Programmed instruction is the basis of computer-assisted education and it is an individual and self-learning technique. In programmed instruction, learning materials are presented from a machine or computer. This presentation can be considered as the advancement of paragraphs in series on separate screens. The advancement, like turning the page, happens with the student's approval of passing to the next screen. There are two basic models: linear and branching. Small steps, active engagement, immediate correction, proceed at student's own pace, correct answers are the basic principles of it.

When Skinner developed the teaching machine in the 1950s, he did not have the idea of computer system but in the same years IBM converted Skinner's behaviorism into IBM Model 650 computer. The first steps of the feedback appeared in computer assisted education system. In 1961, IBM experimented another computer assisted instruction study with IBM Model 7010. The Authoring language called the Coursewriter was developed in 1964. IBM went on developing such products with researchers such as Atkinson and Suppes at Stanford University. IBM 1500, developed by the Division of Instructional Systems Development in 18 months, was one these products. Then, IBM 1500 appeared with new versions with additional features such as CRT screen, qwerty keyboard, light pen; visual projector, student stations (expanded to 32 students in time), audio adaptor, hub, authoring languages (Coursewrite II, APL, MAT).



Picture 1: PLATO Screenshot (1975)

Reference: <http://www.computerhistory.org/revolution/the-web/20/377/2154>



Picture 2: PLATO V

Reference: <http://en.wikipedia.org/wiki/File:Platovterm1981.jpg>

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It is considered that the first version of the first well-known systems in this field, PLATO, completed by Donald L. Bitzer, reached approximately 1000 terminals worldwide. PLATO system was developed in Illinois University in 1960 and served for 40 years to the students. In the first version, PLATO was connected to the TV. In the second version, it gave the first signs of socializing in the digital environment by providing the time-share between two students. PLATO III (1963-66) was able to accommodate up to 20 terminals. Flexibility in education was ensured with the first authoring language TUTOR in PLATO III, so people without computer programming skills had the chance to develop computer assisted education materials. By the 1970s, online chat and bulletin board was available long before the Internet and a 720-hour course content was developed with PLATO in those years.

Picture 1 and 2 are the examples of the different versions of PLATO. When the last product of PLATO was closed in 2006, it had some features such as forum, message board, online testing, e-mail, chat rooms, symbolic languages, instant messaging, remote desktop sharing and multi-player games.

Seymour Papert is a scientist who believes that it is important for children to discuss with and talk to him. According to him, the interaction between the facts they learned at the course and their own ideas are also important. At this point, they can utilize computers. With these thoughts in 1967, Papert and his colleagues developed a computer system called "Turtle" in Massachusetts Institute of Technology Artificial Intelligence Labs. LOGO, the adaptation of Lisp artificial intelligence programming language, is used in Turtle. In Picture 3 and 4, the Papert's Turtle is shown. LOGO has a simple language that can be learned from a very young age. Also, LOGO allows for the solution of many complex geometry problems. Students are able to move the Turtle with commands of forward, backward, left and right by using the computer. Papert says that they received the best compliance results with 12 year olds. "Floor Turtle" was moved to screen in time and it was used in teaching diverse age groups in different areas. Although it has been a long time, studies based on the LOGO principle still continue.



Picture 3. Seymour Papert's LOGO Turtle
Reference: <http://museum.mit.edu/nom150/entries/1158>



Picture 4. Kids Studying with LOGO Turtle
Reference: <http://el.media.mit.edu/logo-foundation/logo/turtle.html>

One of the important systems in computer-assisted education is TICCIT (Time-shared Interactive Computer-controlled Information Television) which is designed in 1977 (METAGEM, 1991). TICCIT was developed with the cooperation of Brigham Young University and Mitre Corporation. The software of TICCIT was developed at the university and the theory of instruction strategies was developed by David Merrill. This theory consisted of the components of the strategy and this theory has been the basis of theory-based computer assisted instruction.

It can be seen that the studies of CAE started in the 1960s in European countries such as United Kingdom and Germany and they became widespread in Europe in the 1980s. Upon looking to the east, we can see that the studies of CAE started in Russia, as mentioned before, in the 1950s, in countries like Egypt and Jordan in the 1980s, in China and Japan in the 1980s.

Computer Assisted Education in Turkey

The computer use for educational purposes and its survival have occurred with a series of firsts in Turkey. These are as follows:

- The establishment of the first computer in Turkish Republic Highways in October 1960.

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- The evaluation of the exams conducted by the Ministry of Education in the 1960s.
- The computer use for the first time in universities in 1964 at İstanbul Technical University and then at İstanbul University.
- The beginning of computer engineering and computer programming education in 1967.
- All the processes from the preparation of questions of university entrance exam to the evaluation of them began to be carried out by Student Selection and Placement Center in 1977.
- The opening of the computer division at Ankara Bahçelievler Vocational High School in the 1978-1979 academic year.
- The use of computer and IT terms in "the IT Glossary", prepared by Prof.Dr. Aydın KÖKSAL, in 1981.
- The formation of "Secondary School Computer Education Specialized Commission" in the Ministry of Education in 1984 (the first attempt to use computers in education)
- With the proposal of "Secondary School Computer Education Specialized Commission", it was planned to teach elective "computer course" in the computer labs established in 100 pilot secondary schools in the 1985-1986 academic year.
- The execution of the computer lesson for high school seniors' 3-hour courses per week.
- The computer lesson was "elective" in secondary and high school and it was "required" in Vocational High School for Girls and Electrical Electronics Division of Industrial Vocational High Schools in the 1987-1988 academic year.
- The development of TÜBİTAK Education Microcomputer which was a prototype compatible with IBM PC-XT in Ankara Electronics Research and Development Institute in 1987.
- 37 in-service training provided by the Ministry of National Education within the Computer Assisted Education Project between 1985 and 1989.
- The National Education Project was signed between the Ministry of National Education and the World Bank in March, 1990.
- The opening of the Department of Computer Education and Instructional Technologies within the Faculties of Education.
- The development of computer course curriculum in primary education in 2006.
- The beginning of elective "Information Technology" course from 1st to 8th grades in primary school programs (within the studies of development educational programs by the Ministry of Education, the Board of Education and Discipline).
- Discussing the requirement of "Information Technology" course in 2010 and what kind of a lesson it should be? Elective or required?
- With Fatih Project, scheduled to be implemented in the near future, the objectives –Information and communication technologies must be one of the main devices in educational process and students and teachers will use these technologies effectively- emphasized in Information Society Strategy which is prepared by State Planning Organization are desired to reach. To be able to reach these objectives, requirements are as follows;
 - ✓ completion of the infrastructure of information and communication technology in formal and non-normal education institutions.
 - ✓ teaching students to use information and communication technologies in these places.
 - ✓ the development of education programs assisted by information and communication technology.It is being planned to install laptop, interactive LCD Panel Board and internet network infrastructure in classes of preschool, primary school and high school in order to appeal to more senses in the process of teaching by using Information Technology devices effectively. In order to ensure the efficient use of IT equipment installed in classrooms in the process of learning teaching, it is being planned to provide in-service training for teachers. In the meantime, the creation of educational e-content is being studied to adapt educational programs to IT-assisted education.

CAE SOFTWARE

Computer assisted education system strategies are tutorials, practices, simulations, problem solving, process software and Socratic inquiry. Some of these will be discussed briefly.

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Tutorials

Tutorials, which can be described as tutor software, are programs to teach a particular subject or concept and they are the most common type of CAE software.

Practice Software

Practice software is the program developed to reinforce previously taught subjects or concepts. It is used in definitions, history facts, the solution of math programs, scientific principles or concepts, language teaching and so on.

Simulation

The simulation is the tendency to imitate a real or imaginary environment or system. In general, it serves to the purposes of education, science and entertainment. It is needed due to the cost, unavailability, danger or time. Simulations must be compatible with the student's previous knowledge and experience.

Micro-worlds

A micro-world is a small but complete version of a certain part of a certain area of interest. Individuals do not work but "live" in Micro-world. It is like learning the language by living in the country where it is spoken as a native language instead of attending a language course. Micro-worlds can be in real life and it can also be created artificially. Besides LOGO, Geometer's Sketchpad and Interactive Physic are the examples of commonly known micro-worlds. Micro-worlds are different from simulations in two ways. The first one is that the micro-world represents the student with the presentation of a simple micro-area, thus the student discovers the micro-world on his own. The second one is that micro-worlds match the student's cognitive and sensory status; in other words, the student already knows what to do with the micro-world.

Virtual Reality

Virtual Reality is a system offering an impressive and interactive computer experience in 3D in the real time. Another definition is that it is a high-level interactive computer simulation changing or increasing the feedback for the user's movement by sensing the user's position. Nintendo Wii, one of the today's popular applications, is an example for this system.

Other Components to Use in Computer Assisted Education Software

In this title, Educational Computer Games and illustrations will be discussed.

Educational Computer Games

Educational Computer Games provide effective and efficient computer assisted instruction to the students of all ages. The main objective of computers for educational purposes facilitate the player's learning by using high level thinking skills in line with the characteristics of game play without using only the hidden practice activities. Games are based on the competition. There is a specific goal and games have rules. They want players to cope with difficulties. Students have right to make choices. They are also fantastic.

Illustrations

Illustrations should be able to appeal to the eye. They should draw attention; motivate the student; be a part of the presentation and be explanatory. Physical properties, such as color, pixel depth, degree of reflecting the size and the fact, are very important in preparing the illustrations.

The Use of Computer-Based Devices in Education

In this title, the expression, "the use of computer based devices in education" is preferred rather than the expression "the use of computer in education". The underlying reason is that there are major changes in the studying and learning strategies of today's students. It is possible to come across a child on the bus studying with a speech record or video of his friend, teacher or an expert on his

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smart phone. Video games, word processors, spreadsheet tools, statistical tools, etc. have already become obsolete.

Digital Textbooks: When these books first appeared, paper-based content was converted to digital format and they were used as a “support material” for students to help learning and teaching of discovery, construction, implementation and sharing of knowledge. Today, digital textbooks have many supportive features such as note taking, reminder messages, writing and highlighting tools, chat and discussion boards, navigation tools (e.g. bookmark, page search/scroll and course selection) screen capture capabilities, textbook display options and search tools. These textbooks support also multimedia like interactive games, video, audio, animation and 3D screenings. Students can write a textbook using these features. In short, they support students to learn at their own pace and at suitable time for them by accessing the course content at home or school in line with their own interests and abilities.

Handheld Devices: Today’s computer assisted education is moved from computers to handheld devices. Personal Digital Assistants, PDA, mobile phones, smart phones, mp3 players and tablet computers that are slightly larger than the palm are examples of these devices. These devices can fit into the palm but they do not contain only audio, image, video playback, individual and group communication with the help of small speakers or headphones by exporting the voice and voice recording but also note-taking, calculation, map, weather forecast, address book, word processing, spreadsheets, etc.

A Geographic information system, GIS, is one of the widely used information and communication technologies in education. It is a computer-based system used for storage, re-finding, processing, analysis, presentation, creation, interpretation, and visualization of geographic or spatial data. This system is also used to learn/teach geography and solves the problems of geographical issues. Geography teachers can easily use these systems in their classes. It is estimated that these systems were used first by Rober Tinker. In addition, the first GIS software for educational purposes is thought to be AEGIS. With the use of GIS, The ways of students’ acquisition and interpretation of geographic information may change.

Learning Theories and CAE

As shown in Figure 2, there are three components of computer-assisted education: software, hardware and pedagogical infrastructure. The third dimension affects the students’ mental connection to the subject and especially the development of computer assisted learning materials. Therefore, theoretical approach is of key importance in CAE.

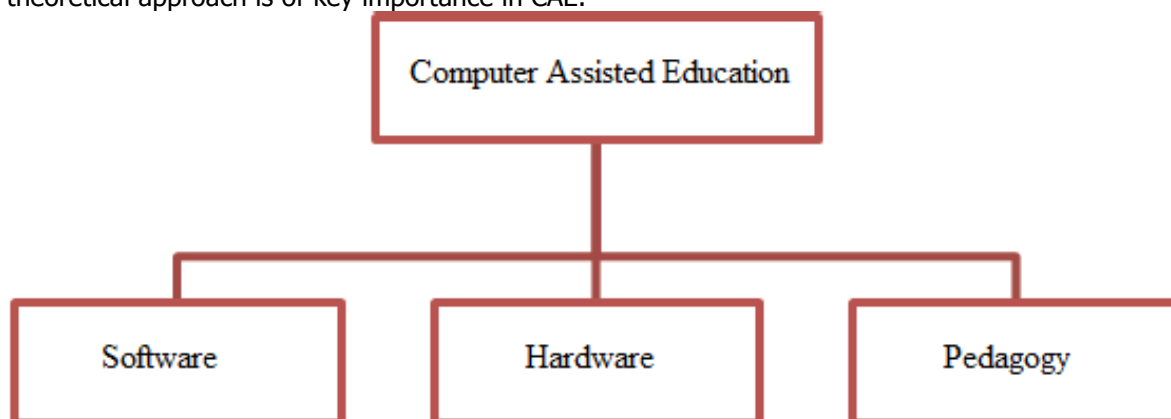


Figure 2: Components of Computer Assisted Education

Behaviorism and CAE

Technology-based primary curriculum is, as mentioned before, behaviorism oriented programmed instruction. These programs are task-based and they operate the principle of stimulus-response of

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behaviorism. In this approach, feedback is naturally important. However, beyond the existence of feedback, its quality is also important. Except for reporting to the student whether his answer is right or wrong, it should be informative, timely and descriptive. Today, adaptive hypermedia environments can serve this purpose. Behaviorist computer assisted learning environments can be successful especially in low-skilled learners but more flexible structures may be required for students with higher-level skills. Behaviorist CAE can be used for the teaching of factual information such as the capital of Turkey is Ankara.

Cognitivism and CAE

Changes in thoughts about teaching and learning in time have begun to show itself in CAE in the transition process from behaviorism to cognitivism. When the Internet first began to become widespread, the effects of cognitivism were felt. Tutorials, games and simulations can be considered as an example of learning methods.

When the computer assisted education is mentioned, multi-media learning often comes to mind and when multimedia learning is mentioned, Mayer comes to mind. Mayer revealed seven principles in the design of learning environments according to the theory of multimedia learning:

Number	Principle	Students in their learning environments	When compared to	Learn better
1	Multi-media	-	presenting only words	presenting words and pictures together
2	Spatial Contiguity	corresponding words and pictures on a page or screen	far from each other	close to each other
3	Temporal Contiguity	corresponding words and pictures	presenting successively	presenting simultaneously
4	Coherence	extraneous words, pictures and sounds	-	Not existing
5	Modality	On the screen	Presenting animation onscreen and text together	Presenting animation and narration together
6	Redundancy	On the screen	Presenting animation, narration and onscreen text together	Presenting animation and narration together
7	Individual Differences	Design effects are stronger for	High knowledge learners and low spatial learners	Low-knowledge learners and high spatial learners

Carefully designed multimedia having interaction components provides visibility in learning. The user:

- a- "sees" the action, whenever he makes a choice
- b- gets immediate feedback for the action he choose.
- c- gets timely and understandable information about the results of the action.

There are five types of multimedia interaction: dialogue, control, manipulation, search and navigation. The dialogue is that the student asks questions and receives answers or answers the questions and

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gets feedback about his answer on multimedia. Control can be explained as the student's decision on the learning pace or order. Manipulation is the student's control over the presentation. In other words, it is the changing parameters such as moving, enlarging, reducing the objects on the screen. The existence of facilities similar to the search options on the internet can be described as the interaction of multimedia search. Navigation can be expressed as making selection from a variety of sources like clicking on a menu item.

Intelligent Tutoring Systems are also considered in cognitive CAE environments. Skinner's opinion of "there is no need to point out the student's mistakes in linear programs" has affected CAE in a negative way. The criticisms to the Behaviorist CAE were its weaknesses in feedback and failure in individualization. Therefore, Intelligent Tutoring Systems seem to be a solution to these complaints. It is possible to define Intelligent Tutoring Systems as the pedagogical software that knows to whom, what and how to teach. It includes four elements: student model, teacher, subject area, expert and user interface. SCHOLAR, SOPHIE, GUIDON are some examples of well known ITS. Brown developed an experimental mechanism named SOPHIE based on the Pask's conversation theory. This mechanism can be regarded as an interpretation of Pressey's teaching mechanism, which takes individual differences into consideration.

Constructivism and CAE

As is known, there is a fact and the individual tries to reach it according to the objectivist- (behaviorist and cognitivist) based approaches. However, in constructivism, the individual reaches to the truth through his own experiences. Database Management Systems, simulations and virtual reality can guide individuals to find their own truths.

LOGO was developed in order to support constructivist-learning environments named "micro-worlds". Papert hoped children to learn by self-correcting in the natural learning process. This idea, in fact, reflects the constructivist principle of constructing the knowledge himself. In constructivism, learning with the LOGO turtle is a typical example of discovery learning. Micro-worlds can be used to create self-managed learning environments.

In Social Constructivist Approach, it is very important for students to benefit from feedbacks in constructing their own knowledge. We can define this situation by talking about the child's learning process of his mother tongue. In the process of learning a language, a child is approved and corrected by speakers using that language better. Those speakers learn something about the language from the child, too. Skinner also expresses another analogy about the subject. Scientists need to share their studies through articles, proceedings, workshops, etc. so that their studies are checked and approved by other scientists. Social Constructivist Approach reflects in today's computer assisted learning environments with e-chat. Students get the chance to access the feedback of their truths and errors from their peers, teaching staff and experts in connection with social constructivism.

Constructivist computer-based education applications such as based on the situation, situated cognition, coupled teaching, problem-based learning, cooperative learning, distributed cognition and open-ended learning environments can be carried out with the opportunities provided by medias like blogs, wikis, social bookmarking, social communities and virtual worlds.

Future and CAE

What awaits us in the field of CAE in the future? Children from preschool age will be able to transfer the world into the screens of their devices at school. Students will experience "Alice in Wonderland" in multi-user virtual environment interfaces. It is expected that experiences of students, who can access to computer from anywhere at any time, will deepen with the "augmentedreality interfaces".

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SUMMARY

- ✓ Computer controlled education is the management of teaching-learning processes on computer.
- ✓ Computer based education is the use of computer as an instructional source.
- ✓ Computer assisted learning can be expressed as the use of the computer as a complementary system in education.
- ✓ In order to qualify the materials presented in a computer environment for educational purposes must include learning materials and activities which are including a- learning objectives, b- teaching strategies (properties necessary for the selection and ranking of activities and events in the learning environment), c- student assessment and/or feedback.
- ✓ Multimedia is a computer-assisted, interactive presentation including at least two of text, audio, static or active images and animations.
- ✓ Considering that the information presented in a group of texts is a node, hypertext is the connections of these nodes linked to each other.
- ✓ With the installation of multimedia features such as graphics, audio, video to the plain text by the developing technologies, hypertext has become hypermedia.
- ✓ The idea of computer assisted education appeared first at the end of the 1950s.
- ✓ Programmed instruction is the basis of computer assisted education and it is an individual and self-learning technique.
- ✓ The use of computer for educational purposes in Turkey started with the evaluation of the exams conducted by the Ministry of Education in the 1960s.
- ✓ Tutorials which can be described as tutor software are programs to teach a particular subject or concept.
- ✓ Practice software is the program developed to reinforce previously taught subjects or concepts.
- ✓ The simulation is the tendency to imitate a real or imaginary environment or system.
- ✓ A micro-world is a small but complete version of a certain part of a certain area of interest.
- ✓ Virtual Reality is a system offering an impressive and interactive computer experience in 3D in the real time.

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