COMPUTER ASSISTED BIOLOGY EDUCATION

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ÖZET

Bilgisayarların insan hayatına yaygın olarak girmeleri 1980'li yıllara rastlamaktadır. Bugün hemen hemen her alanda bilgisayarların kullanımına şahit olmaktayız. Özellikle 1985'den sonra bilgisayar eğitimde de yaygın olarak kullanılmaya başlamıştır. İlk başlarda daha çok okulların genel işlerinde kullanımın yanında yavaş yavaş derslere yönelik yazılımların artmasıyla bir çok dersde kullanılmaya başlanmıştır. Bugün okullardaki bilgisayar kullanımından temel olarak üç amaç hedeflenmektedir; (1) bilgisayarları kullanabilmek ve kullanım alanlarıyla ilgili bilgiye sahip olmak (2) bilgisayar okur-yazarı olmak ve (3) derslere destek amacıyla kullanabilmek. Bilgisayar destekli biyoloji eğitimiyle ilgili örneklerden bazıları ise simülasyonlar, bilgisayarlı ölçüm araçları, animasyonlar ve bunların hepsini bir arada bulunduran multi-media(çoklu ortam) yazılımlarıdır. Bu yazılımlardan birçoğu bugün öğrencilerimizin biyoloji konularını kendi kendilerine öğrenip sınayabilecekleri şekilde hazırlanmış ve öğrencilerle öğretmenlerimizin kullanımına sunulmuştur. Bu yazılımlarla öğrenci ve öğretmenlerimizin bilgisayar kullanım yeteneklerini gelişebilmekte ve öğrencilerimizin biyoloji öğrenimi hızlanabilmektedir.

INTRODUCTION

After introducing computer usage in education around 1980s, in the all levels of schools educators around the world are realizing the importance and benefit of computers in education. Some schools regularly

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use computers in education, others are actively contemplating their use, and still others are just beginning to learn about them. Professional biologists need to learn enough about educational computing that will permit sound decision-making regarding the use of computers in a particular situation.

Nowadays, educational computing is the fastest growing area of education in the United States from the primary grades through the university and beyond to lifelong continuing education. The other example is that the number and variety of applications of computers in science education have grown at an ever-increasing speed since the introduction of the microcomputer in 1976. It is becoming commonplace for students to have their own computers and most science departments have microcomputer for student use. There has been a tremendous growth in the number of computer programs available for instructional purposes.

To describe the status of computers in biology education and to consider the aspects of the form an international perspective, we need to address some questions.

What is the Computer Revolution?

When large computers began to appear in the 1960s, they had clear value in areas such as banking and airline reservation systems but were largely ignored by educators, today, more powerful computers, the appearance and spread of the totally new microcomputer, and a growing diversity of uses and users are causing a true computer revolution throughout the world.

The computer revolution includes more than just computers in the narrow sense, particularly in the future. It also includes many electronic media such as telecommunications, videodisks, and television as a two-way communications device. (Crovello, 1987).

Main purpose of invited computers was to use some important places, such as military services or some government agencies. However,

after discovered personal computers, the computers spread to all areas like bank system, agriculture, education, and so on. Despite the growth of computer using too many areas, the computers entered the education and finally science and biology education at the end of 1985's. Especially, nowadays, in the world almost in everywhere, many people can use computers for different purposes, such as internet, computer games, and simple office works.

What Are Computer Systems?

First of all, we need to define what are the computer systems. A computer system usually has three essential components: hardware, software, and people. First one is the hardware that is the machine itself, along with such peripheral parts like the printer or drivers. Software means that it is written to tell the computer hardware what to do. For educational purpose, the all parts should be suitable each other because if we ignore some parts of the computer system, we cannot use effectively for our purpose. Therefore, the most important thing is to choose correct computer in education. For example, it could be different the needs of departments of the engineering and education. In computer-assisted education, there are two most important groups who are instructors and learners. In decisions made about computers in education one must simultaneously consider the specifics of all three components of the computer system. The costs of the wrong decisions have been so big that instructors and students sometimes cannot use the system very productively.

What do Computers mean in Education?

Computers in education' is a general term meant to cover all elements of educational computing. It has three major components: awareness, computer literacy and computer-assisted education.

Computer awareness' is an appreciation of how computers affect us in our everyday lives, both individually and as a member of society. Such

examples can be listed as the following; grocery store checkout scanner, computerized brain scans, traffic signal controls, and computer-based economic and weather forecasting are specific examples.

Computer literacy is the ability of a particular person to perform a particular fax via computer, which may not require knowledge of a programming language, for example, professors or students may write programs to simulate exponential or logistic population growth, use word-processing packages to prepare term papers. Additionally, a regular person is able to understand some of the computer terminology, such as; hard disk, RAM, byte, pixels, etc.

Finally, computer-assisted education is the use of computers to teach or learn a subject other than computing. Computers in a general biology laboratory for a frog dissection, simulations for anatomy class can be some examples of computer-assisted biology education (Tabin and Fraser, 1987).

How and When Can Computers be Used in Biology Education?

Today's biology teachers use computers in many ways as the following: literature retrieval, data retrieval, data accumulation, on-line control of experiments, statistical analysis, graphic summarization, simulation and modeling, decision-making, drill and practice, tutorials, test generation and administration, course management and word processing (Crovello, 1985). The list is growing breadth and depth every year. For example, in 1984 and 1985 the major thrust for many biologists in the United States was the introduction of computers into the teaching laboratory for automated data accumulation in student experiments. Students don't always have to use computers directly. The teacher can use a computer to create illustrations for lecture or laboratory, or to create short bibliography of relevant articles from a much larger literature data bank.

Computers are not only used effectively in the laboratory but also many biology assignments are completed on a student's own time. In such cases the major problem is how to make the relevant programs available when students want to use them. A common solution is to put some computers in a common location such as the library, and to put the programs on extra cost, since library staff can minimize its physical abuse or theft.

Finally, some biologists use computers during lectures to demonstrate dynamic phenomena more easily and completely. Depending on class size, this can be done with the computer screen alone, with additional television-type monitors placed around the room, or with a large-screen projection system linked to the computer. Some biologists have begun to use the computers as an electronic blackboard, particularly when such projection systems are available, in this case, the teacher might record on the computer before the lecture anything that otherwise would've to be written on the blackboard during the lecture (Novak and Gowin, 1984)

Why Are Computers Used in Biology Education?

Computers are used for certain reasons mentioned in the above ways because educators believe that computers will enhance learning in the all situations. In the following paragraphs, let's find more specific reasons why we need to use computers in education.

Computers can allow us to teach what we already teach, but better, maybe defined as teaching more easily, or in greater depth, etc. For example, we are able to pool results of genetics crosses by several different sets of students. The computer quickly calculates not just the normal goodness-of chi square statistics but also the valuable heterogeneity chi-square. This allows us to determine if significant variation has occurred from the results of one laboratory exercise to the other. Other examples include increased ease and depth of learning about such dynamic phenomena as protein synthesis, predator-prey

relationships, or the evaluation of effects of different insect or weed control strategies.

Computers can increase students' interest in the subject matter. In this sense computers are gimmicks of sorts, but there is nothing wrong with such use if it indeed heightens interest. From education theory we know that students can learn more than cognitive area like biology if they've a positive attitude towards the subject. If computers can contribute to this, so be it. To paraphrase, computers can create an enhanced learning context that can contribute to students' growth. One reason why many students like computers is that they realize the greatly expanded mental power that is under their control.

Using computers in education often increases the need for creativity. For example, in a simulation program that models world food production, students can be asked to explore possible solutions to the world food problem that would be both fair and long-term. They must be creative in choosing even their possible solutions, since so many exist and not even a computer can explore them all.

Computers can decrease boring tasks associated with even simple exercises. The genetics example described earlier is one example. Another occurs in teaching ecology where it is valuable to generate several large, random or clumped samples to represent the distribution of individual weeds in an agricultural field. The computer can do this faster and more reliably than students might do by drawing different colored chips from a bowl. More importantly, students can use the time saved to think more deeply about how to analyze the results and to determine what they mean. Naturally, computers can also decrease some of a teacher' boring tasks (Crovello, 1985, Friedler, Merin, and Tamir, 1992)

Computers allow students to learn at their own paces, and also according to their own diurnal rhythms. To paraphrase, computers can have longer office hours than teachers. Moreover, it is less possible that

the computer will become irritated and lose its patience not like teachers if a student does not understand a concept quickly.

Computers permit a high level of individualized instruction since each student must interact with a computer directly and continuously while using it. This contrasts to lecture situations with one professor and many students. A paradox emerges from this last statement: the allegedly impersonal machine, the computer, may provide a more personal education. Also, computer usage may provide a better education to a heterogeneous group of students.

After involving of heavy usage of computers in education including biology, some of the teachers and educators have begun to wonder that if one-day computers can replace the position of a teacher, what will happen to the teachers, although there are a lot of advantages of computers assisted education for every one. The answer of this question has two sides that one is that the control of a teacher will be decreasing in the classroom and the other is that any kind of education can take place without teacher or human presence. Finally, as it is said "computer assisted biology education", it does not mean fully computerized education: and also, computers will be a part of education while human soul always is a part of education (Yeudit, Dori, and Yochim, 1992).

Some Conclusions And Implications Related To Computer Assisted Education In Biology

According to results of one research by Friedler, Merin, and Tamir (1992), it has been found some important results, below listed the order of importance.

1. It is possible to teach new biological topics using computerized simulations.

2.   Learning via computer involves heavy demands on the student who has to learn simultaneously new topics and a new medium.

3.   It cannot be assumed that since students were born in the " computer era" they can work with the computer. They need to be taught how to do so.

4.   Some students exhibit a high level of anxiety toward the computer. They should receive special instruction to overcome their fears.

5.   The computer provides the opportunity to adjust different levels of activities to different students and allows each of them to work at his/her work at his/her own place.

6.   Application of inquiry skills during the work with computerized simulation depends on the problem presented to the students and their previous experience with the software and with inquiry mode of learning. Therefore, the student workbook should develop inquiry skills by guiding the students from easy problems to "open" problems.

7.   Easy-to-use computer software should be developed with a simple way to save, load, and print files. Our aim should be that each student would have the computer and the printer available while working at the laboratory. This will allow the student to move easily from " doing " the experiment to running data on the computer and to have the printed data immediately available for analysis.

8.   Teachers should participate in preparation programs that will allow them to integrate the computer as a natural and efficient tool in their teaching, thereby overcoming their anxiety toward computers.

9.   Different criteria should be considered while using computerized materials as assessments tools.

10.   Integrating computers into the classroom will help to broaden and deepen the students' knowledge as well as to expose students' difficulties in conceptualization. Learning via another medium might help to decrease situations such as we encountered where students say, " this is the biology of the laboratory. I know the term ' independent variable' from the classroom, but it is not the same in the laboratory."

For biology classes, the need of computer is unarguable. In the history of human being, every new invention brings some benefits but also some dangers or problems. On the other hand, some problems or suspicions could not prevent to new techniques for the sake of human being. Today, instead of conventional methods in biology classroom, biology teachers and students enjoy the usage of computers to assist to them. Main benefits can be summarized as the following; a) Simulations for many biology experiments in labs make students easily control variables and see the results on the monitor and b) Frog dissection can be remembered by people when they hear the word of biology. Lately many animal rights associations protest the use of animals in labs, medical experiments. However, with help of computer animations and simulations, these types of frog dissection can be done via computer.

Contributions To The Science Education

Many researchers have made decisions about computer-assisted education how it contributes to the science education and improves it. Some of them listed below were indicated by several scholars (Hofstein, Ben-zvi, and Carmeli, 1990; Tabin and Fraser, 1987). "

1. A diversity of teaching methods and strategies and a range of learning goals;

2. Sensitivity to individual students' needs, abilities, and cognitive levels;

3. An expertise in his/her domain, with a knowledge base that can be described and presented clearly as focused on concepts and concept maps. A concept map is defined as " a schematic device for representing a set of concept meanings embedded in a framework of prepositions" (Novak and Govin, 1984)

4. An ability to maintain a comfortable pace for the majority of the class;

5. An ability to lead discussions and ask questions at a high cognitive level."

These are some kind of benefits for science education or biology education in college level, even if in other levels such as primary and secondary school biology education.

DISCUSSION

As seen in the paper, computer usage has been increased very rapidly and amazingly and also education has been affected by the computer development since it was introduced to education. For example, ten years ago, the number of Internet sites was 10 but today more than 10 millions. Thus, many computers can be seen in universities, colleges, shortly in everywhere. However, some problems have emerged how schools should choose the best software and hardware for the educational purposes. Some schools can purchase expensive computers but sometimes money can be spent to wrong directions or aimless. Therefore, before buying the computer systems, school administrations or teachers should be very awake what kind of software and hardware are the best for their purposes. Indeed, the computer assisted biology education helps students to learn some concepts or notions quickly but it has never been replaced with the teacher's role, it helps only.

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