Computer Assisted Instruction:
Applications in Science Education

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What is CAI ?

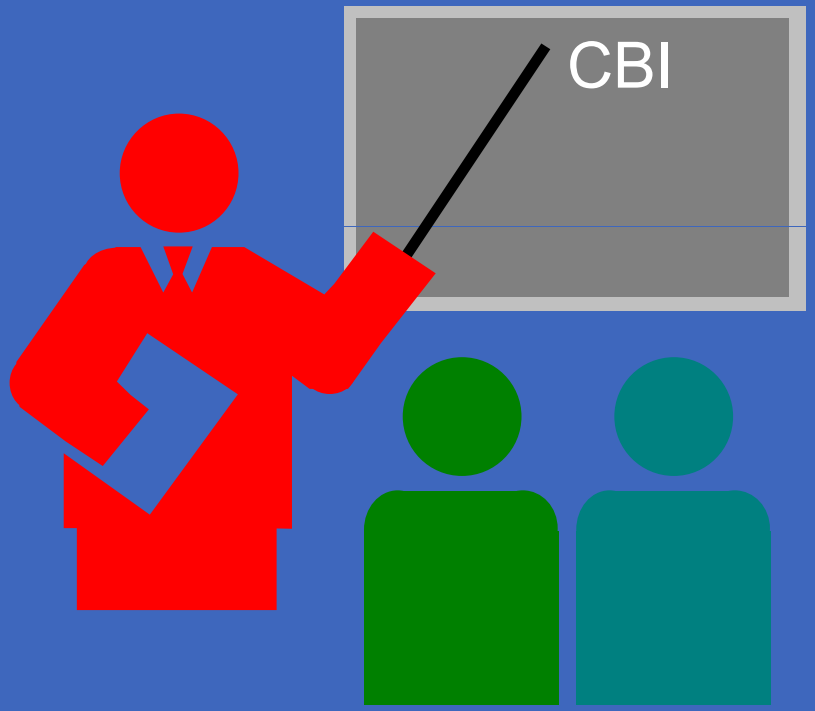
- A self-learning technique, usually offline/online, involving interaction of the student with programmed instructional materials.
- Computer-assisted instruction (CAI) is an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place.
- CAI uses a combination of text, graphics, sound and video in enhancing the learning process.
- CAI refers to the use of the computer as a tool to facilitate and improve instruction. CAI programs use tutorials, drill and practice, simulation, and problem solving approaches to present topics and they test the student's understanding.

School districts are turning to advances in computers to…

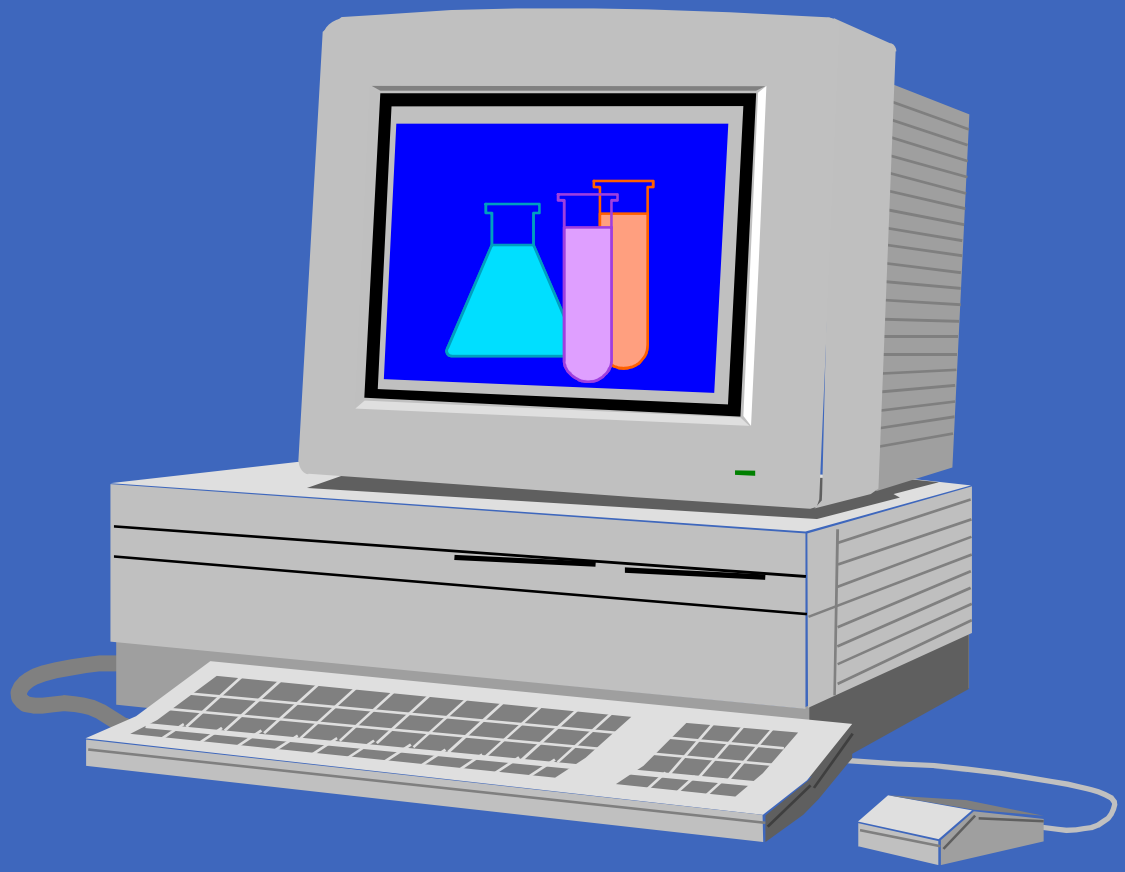
- Reduce administrative burden;
- Compensate for poor teacher content knowledge (especially in districts that report difficulty recruiting and retaining teachers, particularly in math and science);
- Allow more individualized student attention; students can progress at own pace.

Computer Based Instruction

- What is it?
- Forms of computer assisted instruction
- Advantages and limitations
- Research
- Integration
- Evaluation



Computer Based Instruction



Computer Based Instruction

- Computer based instruction (CBI) is defined as the use of the computer in the delivery of instruction.
- Other similar terms include: computer based training (CBT), computer assisted instruction (CAI), and computer assisted learning (CAL).

Computer Based Instruction

- CBI is the oldest form of computer use in education; when most people think of computer applications in education, they think of CBI first.

- **Innovative methods – (situational)**
  - Quick learning
  - More learning
  - Longer retention

CAI programmes

- Drill and Practice
- Simulation
- Instructional game
- Tutorial
- Discovery
- Problem solving

Common Categories of CBI

- Drill and Practice
- Tutorial
- Simulation
- Instructional Game
- Problem-Solving
- Other

Drill and Practice

- Exercises designed to increase fluency in a new skill or body of knowledge or to refresh an existing skill or body of knowledge.
- This approach assumes that the learners have previously been introduced to the content.

Drill and Practice

- Traditionally associated with basic skills in topics such as:
  - Science
  - Mathematics
- Good programs provide user control, give feedback and reinforcement, and help learners master skills.

Drill and Practice

- Good for basic skills/knowledge where rapid student response is desired.
- Usually best to use in a series of brief sessions.
- Mainly intended for use by individuals.
- Should be geared to a level appropriate for the students.

Tutorial

- A form of CBI in which the computer assumes the role of a tutor -- introducing content, providing practice, and assessing learning.
- Tutorials are used to introduce new content to learners in much the same manner that a human teacher might.

Tutorial

- Because tutorials present content to students, they can be used in any area of the curriculum for:
  - remediation when learners lack necessary background knowledge.
  - enrichment when learners wish to go beyond the basics.
  - introduction of content to all learners (freeing the instructor to do other things).

Tutorial

- Good for verbal and conceptual learning.
- May require significant investment of students' time.
- Can be effectively used by individuals or groups of 2-3 students.
- Should be followed by opportunities for student application of knowledge.

Simulation

- A form of CBI that provides a simplified representation of a real situation, phenomenon, or process.
- Provides the opportunity for students to apply knowledge in a realistic format but without the time, expense, or risk associated with the real thing.

Simulation

- One of the best ways to use CBI in the sciences and other subject areas; simulation makes good use of what the computer does well.
- Simulations can mimic physical objects or phenomena, processes, procedures, and situations.

Simulation

- Best used for application of knowledge, problem solving, and thinking skills.
- Time involvement may be brief or extended depending on the simulation.
- Good for small groups of students, although can be used by individuals.
- Often requires guidance and follow-up for effective use.

Instructional Game

- Usually another type of CBI (e.g., drill and practice or simulation) modified to include gaming elements.
- Generally features
  - an end goal and rules of play.
  - sensory appeal.
  - motivational elements (e.g., competition, cooperation, challenge, fantasy).

Instructional Game

- Examples of this type of CBI are found throughout education. Usually, they are aimed at younger learners such as those in the elementary grades.
- Games can substitute for worksheets and exercises, as a reward, or, in some cases, to foster cooperation.

Problem Solving

- CBI program that is designed to foster thinking or problem solving skills, but does not fit into one of the other categories.
- Usually focuses on a specific type of problem solving and provides practice on a number or variety of problems.

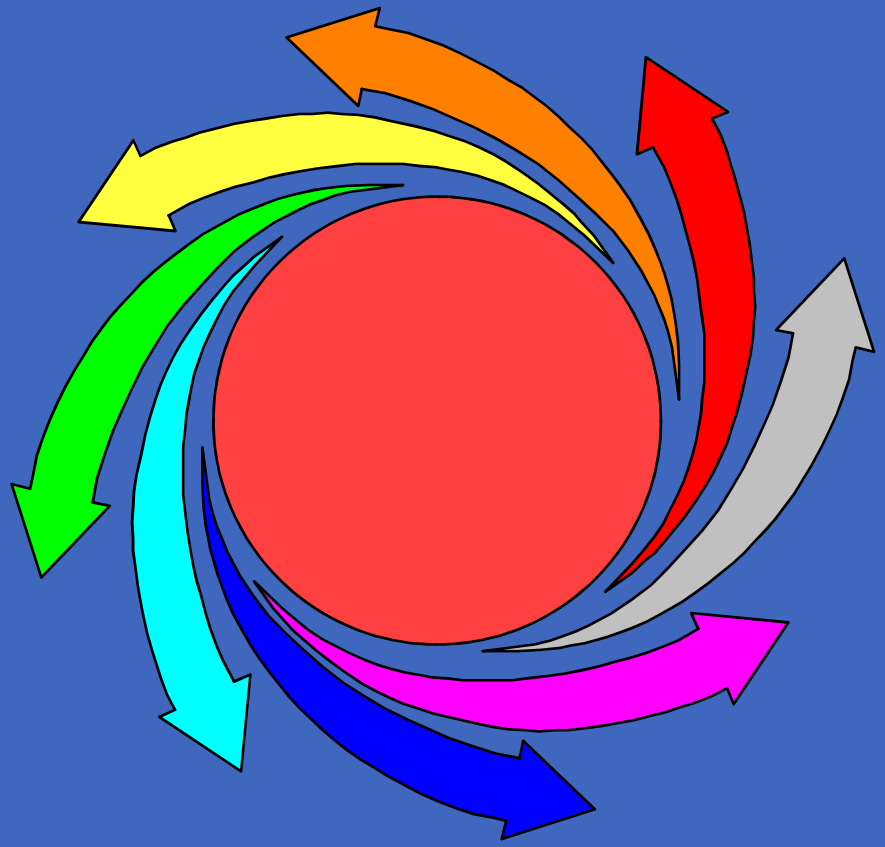
Problem Solving

- Problem solving applications sometimes focus on specific topics areas (e.g., mathematics, science) and sometimes they are designed to promote general problem-solving abilities (e.g., pattern recognition, prediction).

Other

- Many applications, particularly those that have been developed in recent years, are not easily classified into one of the preceding categories.

Advantages and Limitations of CBI



Advantages of CAI

- one-to-one interaction
- great motivator
- freedom to experiment with different options
- instantaneous response/immediate feedback to the answers elicited
- Self pacing - allow students to proceed at their own pace
- Privacy helps the shy and slow learner to learn
- multimedia helps to understand difficult concepts through multi sensory approach
- self directed learning – students can decide when, where, and what to learn

Advantages of CBI

- Interactive.
- Provides immediate feedback.
- Infinitely patient.
- Motivates learners.
- Provides consistency in presentation.
- Can adjust difficulty to level of learner.

Advantages of CBI

- Able to branch to provide appropriate content presentation to the learner.
- Can present concepts or processes dynamically and using multiple forms of representation.
- Can maintain records of student performance.
- Frees the instructor to do other things.

Limitations of CAI

- A poor substitute for actual experience
- Software limitations
- Restricted Text displays
- Learning becomes too mechanical
- Hardware limitations

Limitations of CBI

- Equipment and software can be costly.
- Development takes time and money.
- Not all learning outcomes are well addressed by CBI.
- Unsophisticated applications may not make good use of the computer.
- Simple CBI has limited modalities (but multimedia is changing that).

The End