

Teaching aid for Teachers

Visual Communication Project-II

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Approval Sheet

The Visual Communication Project-2 entitled 'Authoring Tool for Teachers' by Utpala Wandhare is approved, in partial fulfillment of the requirements for the Master of Design degree in Visual Communication.

Signature

Date

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Chairman:

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1.0 Abstract

The technology is not an educational panacea, but it is an important facilitator of education. This is a strong rationale and the dominant argument for expanding the use of the technology in schools. The clear understanding of the role of technology in change and the implications of technology-mediated changes for education are the key to the success of any innovation in education. We need to take a look at traditional goals of education and formulate new definitions of learning consistent with the revolution in cognitive sciences. It is time we viewed the learning process as selective filtering of experience, co-ordination of information and construction of knowledge. To be able to do that is the biggest challenge of information and communication technologies to education. If we are convinced of this, then we shall be able to fashion a climate of values that encourages ordering and re-ordering of thoughts needed to comprehend the technology and strive for education to emerge from its disciplinary narrowness.

- <http://www.ncert.nic.in/itedu.htm>

Computers have revolutionized the way we live. From the very typical scientific applications for which it was developed, it has come to be a part of our daily life. In our offices in our homes and even in our schools. This medium has such tremendous abilities that need to be tapped effectively. How could this new medium made use effectively into our existing system of education?

2.0 Aim

The aim of the project is to look into a teacher's activities of teaching in a school and problems faced during the entire course of action of teaching and learning. Catering to all the problems that arise, developing a tool for teachers to help them in teaching in a better way with the help of computers.

Introducing computers in the schools, as an assisting tool for the teacher, with total understanding of where and how it can help, particularly in present classroom teaching scenario. Fully exploiting powers of the medium.

3.0 SCOPE

Understanding that in education, a machine cannot replace a guru or a teacher , but exploiting what a machine can do, it can help a teachers teaching with ease.

It does not aim at reviving the existing education system, but introducing computers where they can make a difference in the way teachers teach and students learn.

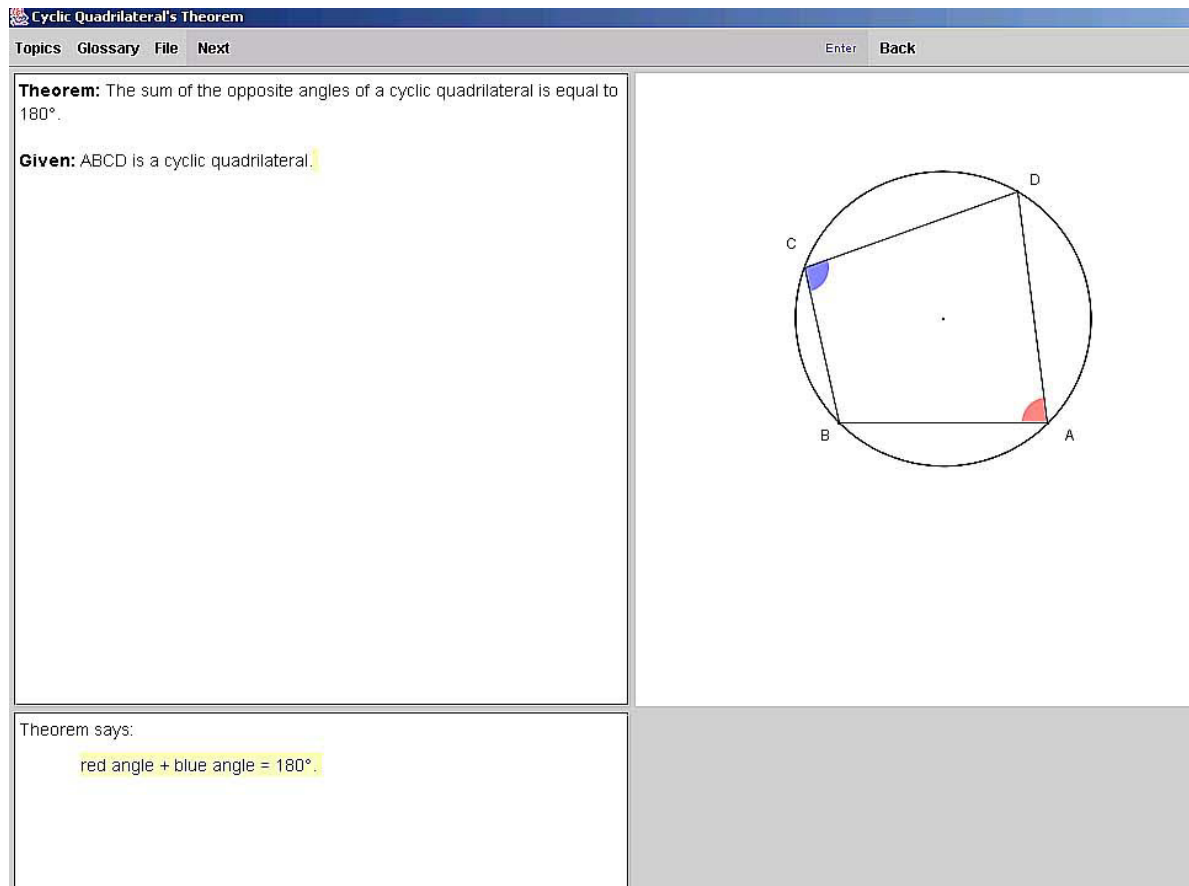
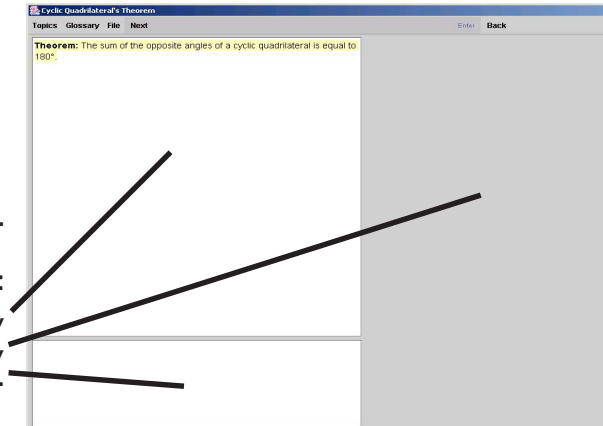
The entire procedure of teaching and learning was concentrated on classroom scenario, i Maharashtra State board, class 10th, prototyped (for geometry).

Conceptualize a tool that helps teacher to teach in the present flow of classroom teaching, as the present system is, textbook based, less interactive.

4.0 Data Collection

Screen shots of the interface to prove a theorem.

The screen divide in three parts:
place for figure,
place for steps,
the important information.



4.1 The Shikav Project

The project idea got triggered by an ongoing project in the computer science department of IIT Bombay. The project named 'Shikav' carried out by Prof. Ranade, looks into the area of teaching by using computers. The project consist of geometry concepts, science concepts etc, converted into computer applications. The application allows student to learn the concept step by step, with the help of dynamic figure. By interacting with the figure by changing variables. The teacher can use the application to make her own visual display of any problem or theorem by imputinng the data in a specified language.

One can procced step by step by clicking 'NEXT'.

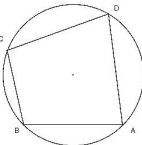
The variables of the figure can be changed by dragging the elements.

Cyclic Quadrilateral's Theorem

Topics Glossary File Next

Theorem: The sum of the opposite angles of a cyclic quadrilateral is equal to 180° .

Given: ABCD is a cyclic quadrilateral



Cyclic Quadrilateral's Theorem

Topics

Glossary

File

Next

Enter

Back

Theorem: The sum of the opposite angles of a cyclic quadrilateral is equal to 180° .

Given: ABCD is a cyclic quadrilateral.

To prove that: $m\angle A + m\angle C = 180^\circ$
and $m\angle B + m\angle D = 180^\circ$

Proof: Angle $\angle BAD$ is an inscribed angle of arc BAD.
Arc BCD is an intercepted arc of angle $\angle BAD$.

$\therefore m\angle BAD = \frac{1}{2} m(\text{arc BCD})$ (1) [\(inscribed angle theorem\)](#)

Similarly, Arc BAD is an intercepted arc of angle $\angle BCD$.

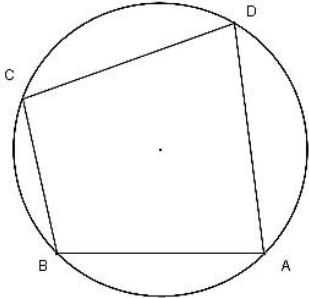
$\therefore m\angle BCD = \frac{1}{2} m(\text{arc BAD})$ (2) (inscribed angle theorem)

$\therefore$ From 1 and 2 we have

$m\angle BAD + m\angle BCD = \frac{1}{2} [m(\text{arc BCD}) + m(\text{arc BAD})]$
 $= \frac{1}{2} \times 360^\circ$ (Arc BCD + Arc BAD = complete circle)
 $= 180^\circ$

i.e. $m\angle A + m\angle C = 180^\circ$

Similarly we can prove that $m\angle B + m\angle D = 180^\circ$



$\angle BCD + \angle BAD = 97.5 + 82.5 = 180$
 $\angle ABC + \angle ADC = 102.5 + 77.5 = 180$

Done!

The teacher can use to add her own proofs by typing in another mode.

4.2 Computers and Teaching

Understanding the Shikav project I started my work with trying to find out what else are the activities carried out by the teacher during the entire course of teaching and whether computers can help in those activities.

I visited schools, mostly having Maharashtra state board. They were mostly private schools, as government schools, did not have computer facilities.

Around 10-12 schools were visited and 20-25 teachers interviewed for understanding teaching and its practical aspects.

The schools visited:

Bishop cotton,
Centre Point,
St. Joseph,
Bhartiya Vidya Bhavan,
Dherankanya,
Mount Carmel,
St. John,
St. Francis,
Campus School,
Kendriya Vidyalaya,
Gopalkrishna,
Godrej School.

Teachers interviewed:

High school
-Economics teacher,
-Zoology teacher,
Higher- middle school
-Physics teachers,
-Algebra teachers,
-Geometry teachers,
-Biology teachers,
-History teacher,
-English teacher.
-Computer tutors.
Middle school,
-Mathematics teachers,
-Science teachers,
-Craft teacher,
-Computer tutor.

10-15 classes were attended to obtain contextual data regarding teaching and learning.

Classes attended:

Sthandard	Classes in no.
11th std.Economics	1
10th std.Geometry	5
9th std. Geometry	4
9th std. Physics	2
7th std. Science	3
6th std. Maths	2

All the information gathered by interviews and contextual data helped in finding about:

- 1) **Teaching**
- 2) **Computers.**

4.2.1 About Teaching

Teaching and learning in schools:

Different methods of teaching in classroom:

Most effective way of teaching in a classroom:

Computer as an assistance in teaching and learning:

4.2.1.1 Teaching and learning in schools

1.Teaching concepts:

Following the text book process

Modifying the text book methods with some interesting illustrations

Totally interactive, teacher making an entire story out of a concept.

2.Solving exercises:

Give home-work and solve in class-room

Solving on the black-board

Finding answers for a question

Orally solving

Interactive solving of exercise while teachers solves on black-board

3.Self learning:

In repetitive learning, of concepts

Practicing, etc.

4.2.1.2 Methods of Classroom teaching

Give homework and solve the same in class

Solving the problems in class, solving entirely on board, and the students simultaneously writing.

Explaining concepts

Explaining definitions (construction of sentences)

Explaining using real life experiment to explain concepts

Gives Examples of real life to explain the same

Telling a story related to that concept

No books while learning, like in a laboratory.

Explaining a concept, not by definition, but relating to real life application.

Asking where is it used in real life

Making a story out of that, then bringing back to topic

Writing some values in board

Teaching concepts simultaneously with textbook words, making a story,

Illustrating on board, and giving a similar example.

No stepwise but explaining one thing using all possible method

Weaving a story.

Question answers writing in notebook understanding in textbook

Reading out question

Asking to construct sentence.

Converting the sentence

Referring that answer in textbook

Reading the matter by student

Asking to construct sentence

Correcting the sentence

Dictating some parts

Or otherwise marking in textbook point wise.

Explaining concept of textbook

Plain explaining

No story or Example to explain

Explaining what is in textbook

Conducting the related example in text book

One way

Solving the entire exercise orally, writing (scribbling on board)

Explaining each and every step and it went wrong

Going back and forth, like if the step told by students is wrong, then explaining

Drawing on board the figure and explaining on that or using that.

Then again starting with actual writing. Here writing is stepwise.

4.2.1.3 The most effective way in classroom teaching.

No books while learning, like in lab.

Explaining a concept, not by definition, but relating to real life application.

Asking where is it used in real life

Making a story out of that, and then bringing back to topic

Writing some values in board

Teaching concepts simultaneously with textbook words, making a story, illustrating on board, giving similar example.

No stepwise but explaining one thing using all possible method, weaving a story.

Here the entire concept is taught in the form of story.

Students are made to think, associate with live application.

Here the abstract teaching of textbooks is followed by a live application.

Students are asked to make connections, and made to think.

Interactive and no writing or copying.

4.2.1.4 Computer as an assistance

- While teaching in class,
- Home-work before teaching,
- Home-work after teaching,
- Self learning,
- Practicing.

4.2.2 About computers: In schools for teaching

1. **M**ost of the finding was that now the need of computer education has been well understood and almost all schools have introduced computers in some way or the other, but the ratio of computers to students is considerably low.
2. **S**chools have one computer room with on an average 30-40 computers and a class of 40-50 students use it. They have on an average one period per week. The position of computer in school at this time also is not more than a machine to print. So, teachers use computers in schools to make time- tables, mark sheets etc. It is seen as better option of a typewriter.
3. **A**mong the finding it was observed that schools introduce computer in primary school teaching students things like paint, draw etc. Middle school they teach about basics and some software like power-point, word etc. At higher school level they teach about programming languages.

4. **T**here are schools that have not only introduced computer related education but also encourage students to do some assignments using computers, like making posters, charts, reports etc.
5. **T**he most promising finding among all was that now teachers have started using computer as a tool to teach.
6. **CD's:**
Teachers have started feeling the need of using computer in schools. They are constantly looking for material that is available in other books on in educational CD's that will help them to teach. The main aim is to find out such related data that explains the textbook concept more easily and effectively. For this they are constantly looking for visually explanatory concepts. There are CD's available which are focused on mainstream educational system of schools like CBSE board, etc. They are again not so popular as the format of the CD's is text based with some animations of few topics.

7. **T**eachers view point about available CD's:
Teachers say that these CD's are as good as teaching from the textbook.
8. **P**ower point presentation:
They are in process of actually converting all textbooks into power-point presentation. They have started by doing it chapter by chapter. The criteria that they have, is to make concepts easy to understand by introducing visuals and related real life applications.
Using web to download images, finding out for educational CD's to use to teach in classroom, preparing power-point presentations. Downloading from web takes time in searching, compiling etc. available educational CD's, do not gel into the classroom teaching as they don't have information which needs to explain using the current text book format. Using them also means doing extra work of searching for correct CD and then compiling etc.

4.2.3 Analysis:

1. There have been enormous research and theories related to education and teaching. My concern was to approach the entire act of teaching and learning from the teachers point of view, where the targeted system was Maharashtra State Board.
2. With the limited computer infrastructure in schools, the computer teaching is limited to higher secondary. Although it makes more sense to introduce it at a younger class/stage.
3. The most important issue in higher schools is of time. In the limited time the concepts have to be taught.
4. Basics of geometry has to be explored from std 7th where the subject gets introduced.

5. The focussed area found out was 10th standard geometry as is based on abstract concepts. Understanding concepts takes a backseat due to limited time.
6. The basics of geometry is a vast topic to be researched and studied.
7. Considering that the student knows about basics one can talk of 10th std geometry to the student in 10th standard without going into concepts of lower class.

4.2.4 Inference

1. **T**he initial part of the study focused about educational facts relating to schools and teaching with new media.
2. **S**econd stage focussed on finding a niche in the existing school teaching curriculum keeping in mind the limited infrastructure (with respect to computer)
3. **I**ntroducing a teaching tool that would help teacher.
 - Explaining rather than writing.
 - Make teaching more interactive: in terms of
 - Telling a story**, which animates,
 - Explaining the same concept in abstract** ,
 - with visual animation
 - answering on the spot questions using data retrieval system
 - Making concepts understandable by strategy games.**

4.3 Geometry

4.3.1 Introduction

The greece the babylonians and egyptians all contributed to to the development of geometry. But Euclid is the onewho systematized geometry, set it up as a collection of definitions, postulates and theorems, all logically followong one another. All geometrical courses follow te trail blaisedby Euclid.

The very word geometry points to its practical origins: it means "measurement of earth". A greek named Eratosthenes, among others , used it (and its realtive, trigonometry which means "measurement of triangles") to find the circumference of the earth. (This was crucial for map making, and it's even relevent today, with all our satallites!.)

People of all sorts use geomtry Architects, Engineers, even Artists. But the greatest value of geometry has nothing to with what technical application people use it for. What Euclid did 2300 years ago was revelutionary because it got got people thinking logically and reasoning things out.

Euclid set the stage for science, for careful examination of the world, of cause an effect.. And when student study geometry, it sets the stage for some of those students to head into sciences and technical fields that require careful thought.

4.3.2 In schools

Sum up of teachers interview about teaching and learning geometry

Teachers agreed on geometry to be an area of most importance as the geometry is based on abstract concepts.

According to teachers abstract concepts means those which lack real application, as which on some level happens in other subjects.

Arithmetic is also based on abstract concept but, it mostly involves formulas, and students understand or are able to grasp formulas easily.

While in geometry the subject is very abstract and all the exercise are based on abstract problem solving.

The dilemma is that even if teachers wish to teach it giving real live example or applications it becomes very time consuming and is practically absent in the present teaching scenario.

The entire course of teaching is based on concepts explanation and then solving exercises.

The entire concentration shifts to solving exercise or writing or copying rather than understanding.

The entire year course is divided in time. At given specified time teacher has to complete the course.

Teachers get a year's timetable, with when to complete how many chapters, as exams have to be also incorporated in the given time of entire year.

Some chapters need more time, as it becomes difficult for students to internalize the concept or understand. The problem arises is that teachers reschedule the timetable accordingly and teach. But still the time is so much limited that finishing it somehow becomes the main focus.

The solutions teachers have found out is to make student repeat until he understands, and for student also it becomes the aim to understand by repeating.

So the main focus is to complete the course and make them repeat until understood, as final exams have problems that are given from existing ones in textbook.

According to teachers the most difficult topic in terms of abstract concepts is chords and tangents.

Observations and problem areas based on the teachers interview and contextual data.

4.3.3 Classroom Observations

Teachers

- Solving the exercises on the board.
- Teacher explains what she has written and writes what she explains.
- Teacher has to control the class also and check whether students are paying attention or not.
- Time is the biggest constraint for teacher to explain concepts.
- When concepts like congruency is to be proved, teacher explains everything related to congruency.
- Teacher explains proofs with the help of a figure drawn on the board, as a visual element becomes insufficient to explain the entire proof,

Students

- The solution comes directly from teachers side.
- Students at the same time cannot write and hear, as teachers pace of teaching is fast.
- They can't leave writing half way as they need to complete to refer for exams.
- There is interaction in classroom, but all don't participate.
- And so to concentrate on writing as black-board shall be rubbed off.

General

- Explaining concepts through problems, help in solving any problem.
Its interactive, question answer.
- The initial concept is understood orally first.
- First figure is important, then steps are written.
- Here how to write, in what sequence is given very much importance than explaining.

4.3.4 Problem areas in classroom teaching

Teachers

- Teacher has to constantly turn back while writing to keep the students in control.
- Entire concentration is to write and finish the exercise due to limited time
- Figures have to be repeatedly drawn on black-board by teacher.
- Drawing with coloured chalk does not make so much of difference.
- Putting information in one figure is very messy and confusing,
- Very fast, no relation to what explained.
- Students can't pay attention. There is nothing to look at or interact.
- Teacher is writing. No visual clue other than in textbook.
- No explanation of why this construction happened or does not.

Students

- The interaction is very less as the entire concentration of the students is on writing.
- Students getting distracted is a big problem.
- Black board has to be wiped off, hence no reference.
- Catching up with each other is extremely difficult.

4.4 Some of the comments obtained during data collection:

1. Prof. Kirti Trivedi

-IDC IIT Bombay

Understanding is more important than writing.

2. Dr. Vivek Monterio

-Founder of Navnirmiti

Learning about basics of geometry would mean to start from the very beginning, which in itself needs lot of time. The subject has to be understood from standard 7th, to know about basics.

At 10th standard level, concentration must be more on the concepts in 10th standard textbook, and make the learning more interesting.

Dealing with 10th standard has its own problems and should be an initiative to solve them.

The tool should be more of a data bank with pre- designed concepts.

Teachers should a role of director, telling which topics found difficult, then telling the entire sequence to be made into an application.

3. Prof. Ranade

- CSE Dept. IIT Bombay

Its very important to look at what teachers are finding difficult to explain, or which are those topics which students find difficult to understand.

There needs to be a study done in finding out such difficult topics to be able to convert into computer applications.

Teaching becomes effective with the use of dynamic screens and visuals.

Computer is a powerful tool and should be used in education.

4.Prof. Sohoni

- CSE Dept. IIT Bombay

The tool goes beyond the present flow of teaching, creates more interest the way teacher teaches and students learn in present Maharashtra State Board system.

Live application concept is very important.

5. Prof. Joshi

-Mathematics Dept. IITBombay.

There is a need to change or introduce some concepts so that concepts do not come as a surprise at later stage.

For example: Real concept of tangent comes in later chapter in 10th standard, but that concept should be taught right at the beginning of tangents.

6.Dr. Fatima

- Ph.d. Mathematics

Each and every concept has a real application and that is how geometry came into being. So it becomes very important to apply abstract concepts in real life, so that a student can easily relate to.

4.5 Existing CD's:

Navneet - class 10th geometry, Maharashtra State Board

The entire data is text bok based, focuses more on the practice and exam aspect.
There are quiz which one can use, to know where one stands.

NIT

A tool that tries to simulate as exactly as it happens
like using scale compass or making construction.

It becomes more combersum to use commands which are difficult to use.

Maya softwares

The interface is bad in the sense of the entire Cd is text based. The entire book
has been just copied , and make no sense.

Other Cd's that are avialable in the market are:

Mastermind,

S.Chand,

SRD

4.6 The Real situation -

***Time** is the biggest constraint.
Obtaining **good marks** are at top priority, for students teachers and everyone.*

For these two reasons the only way the teaching happens is through ways in which all the kinds of problems in exercises are well understood. This takes place by repeatedly doing the problem till understood. Understanding concept or all such issues gets a backseat, but completing the course is the main aim. And when time comes to complete what has been taught, exams are on head. When there is no time to explain concepts, they are enforced and reinforced by the only solution REPEAT.

For this only reason solving exercises is very important activity. It happens by writing step-by-step called two-column format.

So writing steps and that too fast, with the speed of the teacher and while understanding is the only way learning happens

All this happens in the classroom, teacher writing on a blackboard, very insufficient for both writing and explaining as a medium to write on. First of all writing and understanding, doesn't mean teacher should write. It should be understood that students need to write, as they have to understand the '2 column format' not the teacher. Only activity is explaining that she should perform.

Everything here is explained through figure. But in this activity of writing and explaining figure loses significance. The figure, which is the most important visual, becomes the most insignificant one.

In the figure itself it is very important to understand what is given and what is proved.

These two things drive any student to think of path. But the mere lack of it makes it impossible to even imagine that it can help in such considerable way.

While the teacher writes step by step, she explains concept, which come across, but they are all verbally told. No clue as to what is she referring to etc.

Understanding

***Time** is the biggest constraint.
Obtaining **good marks** are at top priority, for students teachers and everyone.*

The above two facts hamper learning so much that while solving ,all the answer come from teacher.

Student are told , and made to understand, but why to apply the particular path chosen is not explained.

Result is that they understand the steps, but never figure out why steps are followed in the manner they are.

While in a rush to write or copy the '2 column format' ultimately understanding is also left out, postponed that student check it at home, which happens rarely.

Learning

If answers are not prompted but made to think as to how to solve, shall make students attack any given problem strategically.

In this process of understanding to decide on a strategy to solve a given problem the students look for key words.

If the students are made to actually measure, compare in figure itself, they can figure out how to crack the problem.

4.7 Analysis:

1. There have been enormous research and theories related to education and teaching. My concern was to approach the entire act of teaching and learning from the teachers point of view, where the targeted system was Maharashtra State Board.
2. With the limited computer infrastructure in schools, the computer teaching is limited to higher secondary. Although it makes more sense to introduce it at a younger class/stage.
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3. **I**ntroducing a teaching tool that would help teacher.
 - Explaining rather than writing.
 - Make teaching more interactive: in terms of
 - Telling a story**, live application, which animates
 - Explaining the same concept in abstract** or book format.
 - with visual animation
 - answering on the spot questions using data retrieval system
 - adding by typing on the spot in the premade format
 - which animates as a visual
 - Making concepts understand by strategy games.**

5.0 Last presentation:

5.1 The tool-

Contents:

Teaching mode used by a teacher in classrom

Abstract teaching

Premade solved exercises,
theorems in textbook using basic
elements as line circle point etc.

*This mode helps teachers in explaining ,
students to understand
and helps them to write also.*

Teaching with live appplication

premade solved exercises and theorems in textbook
converted into live aplications using different charaters etc. Like snake
playground etc.

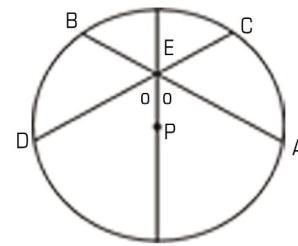
Teaching using a game.

students to plan strategy to prove

.. tool

dynamic visuals in the form of animation, can be modified on the spot,
linked information retrieval-multilevel interactivity,
choosing multiple paths while solving a proof,
editing or modifying,
applicable to variety of teaching methods,
making problems into stories by using different characters.
screen manipulation of diagrams and figure .. better interactivity.

Prototyping problem no.25, from 10th standard Geometry, chapter no.3, Chords and Tangents.



In the fig. P is the centre of a circle. E is a point on a diameter. Two chords AB and CD intersect the diameter in E such that $\angle AEP = \angle CEP$. Show that $AB = CD$.

Solution:

Proof:

1. $\angle AEP \cong \angle CEP$ Given
2. Draw seg PM $\perp$ AB, seg PN $\perp$ DC. Construction
3. Seg PM $\perp$ chord CD Construction
4. Seg PN $\perp$ chord AB Construction
5. In $\triangle PME$ and $\triangle PNE$ $\angle MEP \cong \angle NEP$ Given
6. $\angle EMP \cong \angle ENP$ 90 degree
7. Seg EP $\cong$ Seg EP Self congruency
8. $\triangle EPM \cong \triangle EPN$ S A A Test
9. Seg PM $\cong$ Seg PN C. S. C. T.
10. Chord AB $\cong$ Chord CD chords equidistant from centre are congruent.

8.0 References:

Navneet guide book

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Vedic mathematics

Envisioning Information

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