



Objectives

Children should learn:

- to relate individual statistical techniques to a wider problem;
- to think analytically about a statistical problem;
- to apply a variety of techniques to solve a problem.

Context

This resource provides a structure for considering and investigating world records in athletics. It involves students handling data in order to answer questions or investigate a hypothesis.

Points to note:

The presentation requires Microsoft PowerPoint version 2002 or above. You may download the free PowerPoint viewer from our website if you have an earlier version. This presentation contains 36 slides.

How far? How fast? How high?

For athletes the ultimate prize is to win an important competition (like the Olympic final) **and** break the world record at the same time!

What do you think the current world record is for . . .

- the longest triple jump?
- the fastest 100m sprint?
- the highest high jump?



Objectives

Children should learn:

- the context of the problem
- to consider the magnitude of different records

Activities

The three questions on the slide are also on the pupil worksheet. The answers are revealed on the next 3 screens. Students should answer for males and females separately. Lower ability groups could investigate the records using the internet at this stage to become more familiar with the data that is available.

Points to note:

When addressing both Men's and Women's records – it might lead into a discussion of differences between world records according to gender. Later this can be used to form a hypothesis.

How far? How fast? How high?

The *current* world record for men's **triple jump** is 18.29 m. . .



Jonathan Edwards (UK)



Inessa Kravets (Ukraine)



. . . and for **women** it's 14.41 m.

What number of cars, laid end-to-end, would have the same distance as either record?

Objectives

Children should learn:

- about the magnitude of world records
- to use physical representations to estimate distances

Activities

Discussion point on slide

Points to note:

Approximately equivalent to 5 and 6 cars respectively – for interested students this could lead to a discussion of different lengths of car and how you account for this (roughly speaking, take an 'average' length car).

How far? How fast? How high?

The *current* world record for men's **high jump** is 245cm. . .



Stefka Kostadinova (Bulgaria)



Javier Sotomayor (Cuba)

. . . and for women's **high jump** — 209cm.

What objects of the same height should these record holders be able to jump over?

Objectives

Children should learn:

- about the magnitude of world records
- to use physical representations to estimate distances

Activities

Discussion point is suggested on slide

209cm – approximately the height of a doorway or a shed

245cm – approximately the height of the ceiling or a home staircase

Points to note:

How far? How fast? How high?

The world record for men's **100m sprint** has been broken a few times during the last 10 years.

Asafa Powell (Jamaica)



It is currently 9.77s.



Griffith Joyner (USA)

For the last 20 years the women's record has been 10.49s. This has lasted almost 20 years.

How soon do you think it will be before either record gets broken?

Objectives

Children should learn:

- about the magnitude of world records
- to use physical representations to estimate distances

Activities

Discussion point is suggested on the slide.

Is it more likely the men's record will be broken (since it's been broken more recently) or the women's (since it's not been broken for a while)?

Points to note:

Drugs have had a part to play in a number of records in particular sprint competitions; this could too lead on to an extension at the end of the first investigation - how often do athletes test positive for drugs?

Plan	Collect	Process	Discuss
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Investigating World Records

Lots of data has been collected over the years on world records in athletics. Some of the information goes back as far as the 1880's!

Before we start looking through the records, we can think about either a **hypothesis** or **questions** we wish to investigate.

[Hypothesis](#) [Questions](#)

Objectives

Children should learn:

- that data can be accessed in different ways;
- to ask questions about presented information;
- to form hypotheses.

Activities

Points to note:

Clicking on either button will lead on to different routes through the rest of the PowerPoint presentation. This allows you select routes for classes of different abilities.

The default path follows the Hypothesis route.

Plan



Collect

Process

Discuss

What is a hypothesis?

You might have noticed something and thought to yourself 'that always happens' – it makes sense, you believe it and you're fairly sure it is always true.

For example

I think that the women's world records are always slower or shorter than the men's records.

When you *believe* in something but don't yet have lots of evidence, it is called a **hypothesis**.

Objectives

Children should learn:

- to form and investigate hypotheses.
- how hypothesis writing fits into problem solving
- to make and justify predictions relating to data

Activities

Discussion of points on slide

Points to note:

Plan	Collect	Process	Discuss
<h2 data-bbox="304 315 890 360">Explaining our thoughts</h2> <p data-bbox="300 389 1270 461">Usually when we write a hypothesis, we give reasons why we think it might be true.</p> <p data-bbox="300 501 504 535">For example:</p> <p data-bbox="300 575 1294 685">I think that men's world records are broken more often than women's...because men are more competitive than women and because they compete more often.</p> <p data-bbox="300 725 1246 797">It's difficult to prove a hypothesis is <i>always</i> true or false but investigating it can help us see what the evidence suggests.</p>			

Objectives

Children should learn:

- to form and investigate hypotheses.
- how hypothesis writing fits into problem solving
- to make and justify predictions relating to data
- that we usually provide some sort of justification when writing a hypothesis

Activities

Pupils could practice writing hypotheses

Points to note:

Plan	Collect	Process	Discuss
<p data-bbox="304 311 959 360">Some example hypotheses</p> <p data-bbox="298 389 1222 423">Men's world records are broken more often than women's.</p> <p data-bbox="298 463 1299 499">Improvements in men's records have gotten smaller over time.</p> <p data-bbox="298 537 1185 573">Women's records are always slower/shorter than men's.</p> <p data-bbox="298 611 1201 647">100m and 200m records are improving at the same rate.</p>			

Objectives

Children should learn:

- to form and investigate hypotheses.
- how hypothesis writing fits into problem solving
- to make and justify predictions relating to data


Activities

Pupils can select one of the hypotheses to investigate or come up with their own.

Points to note:


These example hypotheses can be edited and replaced with your own suggestions.


Plan	Collect	Process	Discuss
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Sources of Data

The International Association of Athletics Federations (www.IAAF.org) has records for all official timings recorded each year.



<ul style="list-style-type: none"> Home News Calendar & Results World Rankings <li style="border: 1px solid red;">Statistics Records Top Lists Standards IAAF Magazine New Studies in Athletics The Sport of Athletics 	<h3>IAAF Records</h3> <p>This section incorporates all of the Official Records and World Best Performances recognised by the IAAF for each of the various competition categories and age groups.</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">MEN</th> <th style="width: 20%;"></th> <th style="text-align: right; border-bottom: 1px solid black;">WOMEN</th> </tr> </thead> <tbody> <tr> <td style="border-bottom: 1px solid black;">100 Metres</td> <td></td> <td style="text-align: right; border-bottom: 1px solid black;">100 Metres</td> </tr> <tr> <td style="border-bottom: 1px solid black;">200 Metres</td> <td></td> <td style="text-align: right; border-bottom: 1px solid black;">200 Metres</td> </tr> <tr> <td style="border-bottom: 1px solid black;">400 Metres</td> <td></td> <td style="text-align: right; border-bottom: 1px solid black;">400 Metres</td> </tr> <tr> <td style="border-bottom: 1px solid black;">800 Metres</td> <td></td> <td style="text-align: right; border-bottom: 1px solid black;">800 Metres</td> </tr> <tr> <td style="border-bottom: 1px solid black;">1000 Metres</td> <td></td> <td style="text-align: right; border-bottom: 1px solid black;">1000 Metres</td> </tr> <tr> <td style="border-bottom: 1px solid black;">1500 Metres</td> <td></td> <td style="text-align: right; border-bottom: 1px solid black;">1500 Metres</td> </tr> <tr> <td style="border-bottom: 1px solid black;">One Mile</td> <td></td> <td style="text-align: right; border-bottom: 1px solid black;">One Mile</td> </tr> </tbody> </table> <div style="text-align: center; margin-top: 10px;"> <p>List of 30+ events</p>  </div>	MEN		WOMEN	100 Metres		100 Metres	200 Metres		200 Metres	400 Metres		400 Metres	800 Metres		800 Metres	1000 Metres		1000 Metres	1500 Metres		1500 Metres	One Mile		One Mile
MEN		WOMEN																							
100 Metres		100 Metres																							
200 Metres		200 Metres																							
400 Metres		400 Metres																							
800 Metres		800 Metres																							
1000 Metres		1000 Metres																							
1500 Metres		1500 Metres																							
One Mile		One Mile																							

Objectives

Children should learn:

- where they can get data from to investigate their hypotheses
- that data can be obtained from primary and secondary sources.



Activities

Demonstration of how to obtain relevant data from the IAAF's webpage. In this particular case how to find records for men and women.

Points to note:

The hyperlink on this page will take you through to the IAAF's homepage.

Plan	Collect	Process	Discuss
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How far? How fast? How high?

Which athletic event(s) are you going to investigate?

What data will you collect?

↓			

How far back should you go?

Objectives

Children should learn:

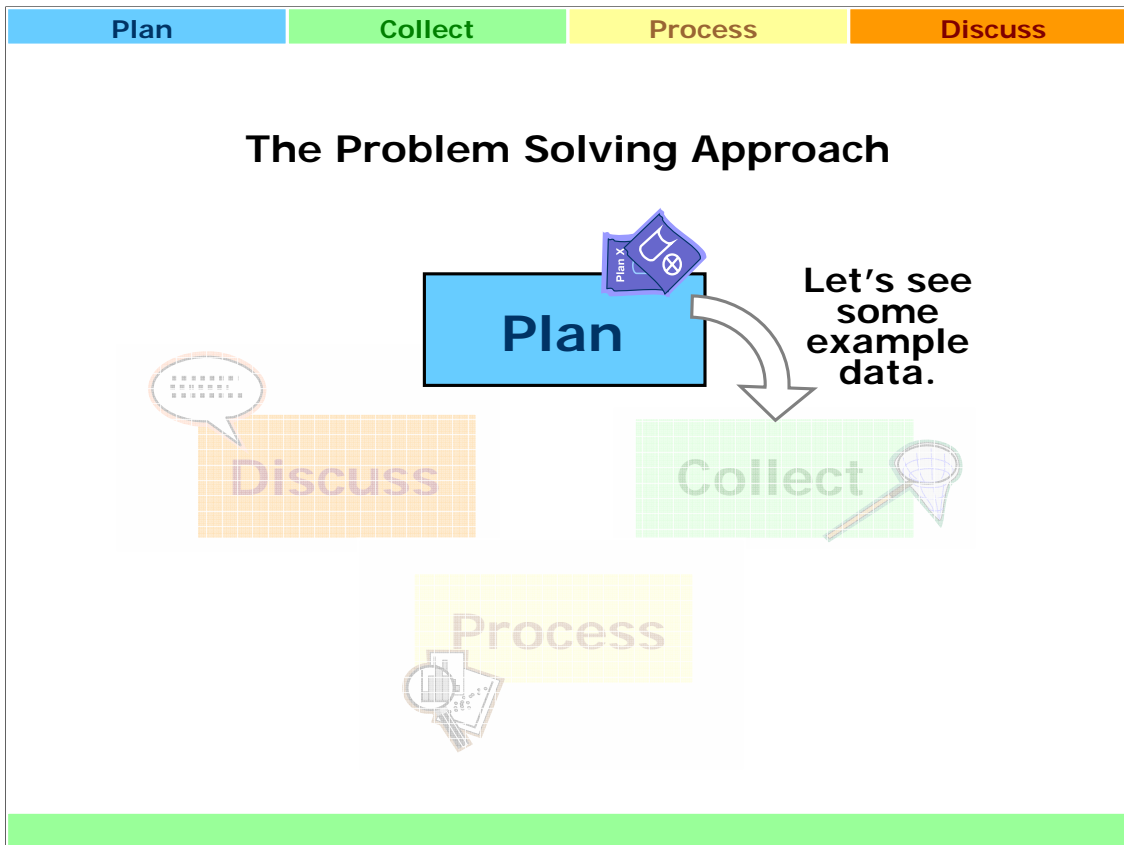
- to plan what data they will need to address their question
- to think about where they can get relevant data from
- that sometimes it is sensible to collect additional information that may help in later in the enquiry.

Activities

Discussion: What data is needed to investigate the pupils' questions?
How are we going to record the data?

Points to note:

This is an opportunity for students to plan **how** they will collect the data, think of an appropriate way of recording the data and discuss measurement.



Objectives

Children should learn:

- where the current task fits within the 'problem solving approach'
- to review prior work.

Points to note:

Now we have **planned** our work, we need to **collect** some data that will help us answer the problem.



How far? How fast? How high?

Hypothesis

"Around the world I think that Women's 100m records are always slower than men's. I also think that they will differ by about 1 second in each area."

Data

Area Records				Area Records			
Area	Performance	Wind	Athlete	Area	Performance	Wind	Athlete
AFRICA	9.85	1.7	Olusoji A. Fasuba	AFRICA	10.90	1.4	Glory Alozie
ASIA	10.00	1.9	Koji Ito	ASIA	10.79	0	Xuemei Li
EUROPE	9.86	0.6	Francis Obikwelu	EUROPE	10.73	2	Christine Arron
NORTH,CENTRAL AMERICA&C.	9.77	1.6	Asafa Powell	NORTH,CENTRAL AMERICA&C.	10.49	0	Florence Griffith-Joyner
OCEANIA	9.93	1.8	Patrick Johnson	OCEANIA	11.12	A 1.9	Melinda Gainsford-Taylor
SOUTH AMERICA	10.00	A 1.6	Robson Caetano da Silva	SOUTH AMERICA	11.17	A 1.3	Lucimar Aparecida de Moura

Objectives

Children should learn:

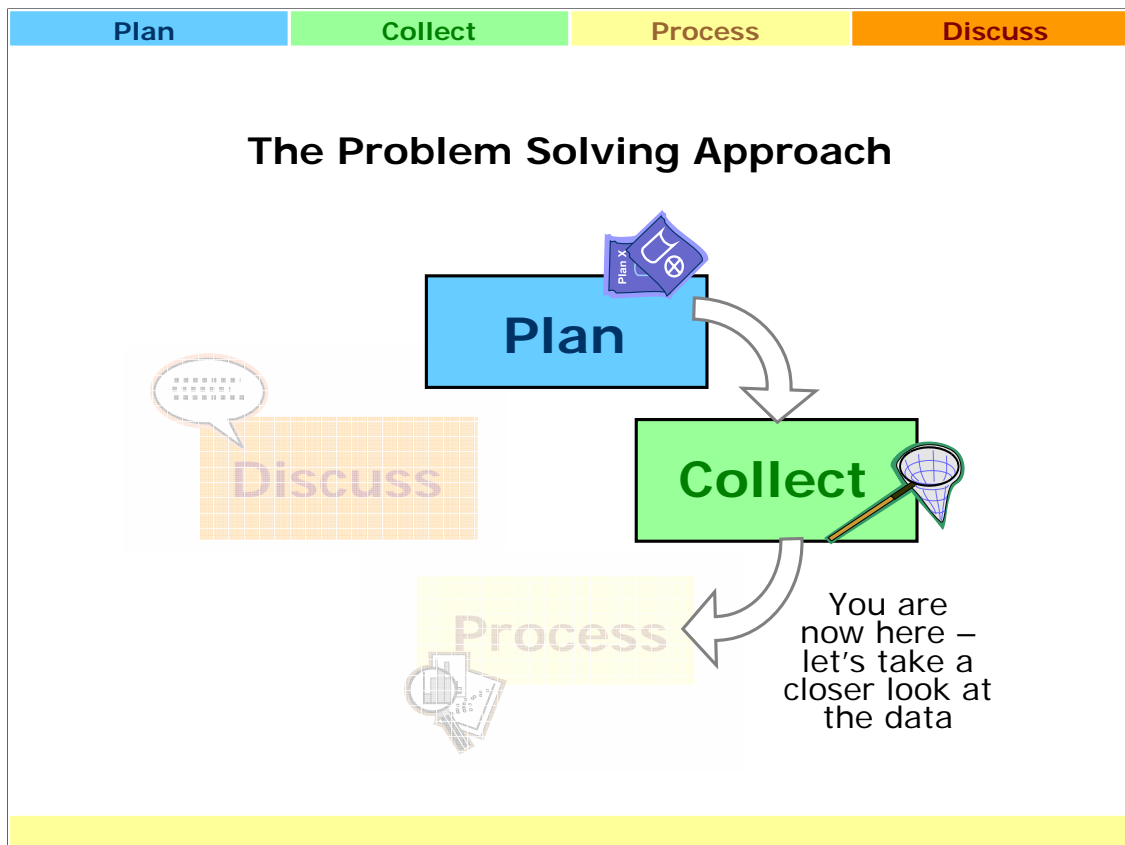
- how to investigate a hypothesis using data
- to think about the data collected and the best way to process them;

Activities

Pupils could be asked what they would need to do with the data to support the presented hypothesis.

Points to note:

A suggestion of the processing that could be done with this data is shown on the next couple of slides.



Objectives


Children should learn:

- where the current task fits within the 'problem solving approach'
- to review prior work.

Points to note:

Now we have **collected** our data, we need to **process** it. We need to get it into a form that is easier to manage by drawing some graphs and charts and doing some calculations.

Plan
Collect
Discuss



Process

How far? How fast? How high?

Area Records			
Area	Performance	Wind	Athlete
AFRICA	9.85	1.7	Olusoji A. Fasuba
ASIA	10.00	1.9	Koji Ito
EUROPE	9.86	0.6	Francis Obikwelu
NORTH,CENTRAL AMERICA&C.	9.77	1.6	Asafa Powell
OCEANIA	9.93	1.8	Patrick Johnson
SOUTH AMERICA	10.00	A 1.6	Robson Caetano da Silva

Area Records			
Area	Performance	Wind	Athlete
AFRICA	10.90	1.4	Glory Alozie
ASIA	10.79	0	Xuemei Li
EUROPE	10.73	2	Christine Arron
NORTH,CENTRAL AMERICA&C.	10.49	0	Florence Griffith-Joyner
OCEANIA	11.12	A 1.9	Melinda Gainsford-Taylor
SOUTH AMERICA	11.17	A 1.3	Lucimar Aparecida de Moura

To test the hypothesis, we need to compare each pair of records:

Africa 1.05s slower

Asia 0.79s slower

Europe 0.87s slower

N.America 0.72s slower

Oceania 1.19s slower

S.America 1.17s slower

Mean 0.97s slower

Objectives

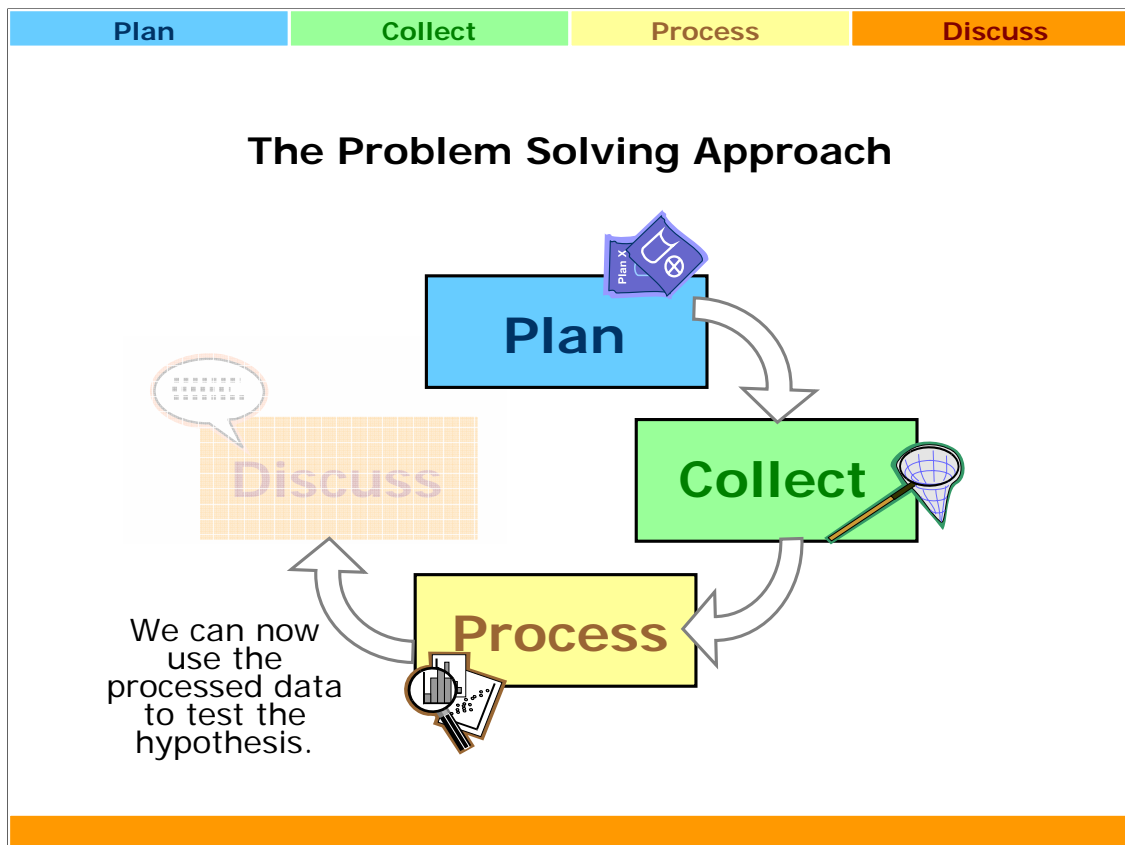
Children should learn:

- to think about the data collected and the best way to process them;
- how to explore data to investigate a hypothesis

Activities

Pupils could be asked to calculate each of the differences before they are revealed. The calculation of the mean could be used in the same way.

Points to note:



Objectives

Children should learn:

- where the current task fits within the 'problem solving approach'
- to review prior work.

Points to note:

Now we have **processed** the information by drawing charts and doing calculations, we need to **discuss** what our results show us and how they help us consider the problem.

How far? How fast? How high?

Hypothesis

Around the world I think that Women's 100m records are always slower than men's. I also think that they will differ by about 1 second in each area.

		All slower	
Africa	1.05s	N.America	0.72s
Asia	0.79s	Oceania	1.19s
Europe	0.87s	S.America	1.17s
		Mean	0.97s

Do all of the results support the hypothesis?

Is the hypothesis correct? Or are there exceptions?

Have we collected enough data to prove the hypothesis?

Objectives

Children should learn:

- to evaluate, reflect on and discuss results

Activities

Does the hypothesis seem true?

Are there any exceptions?

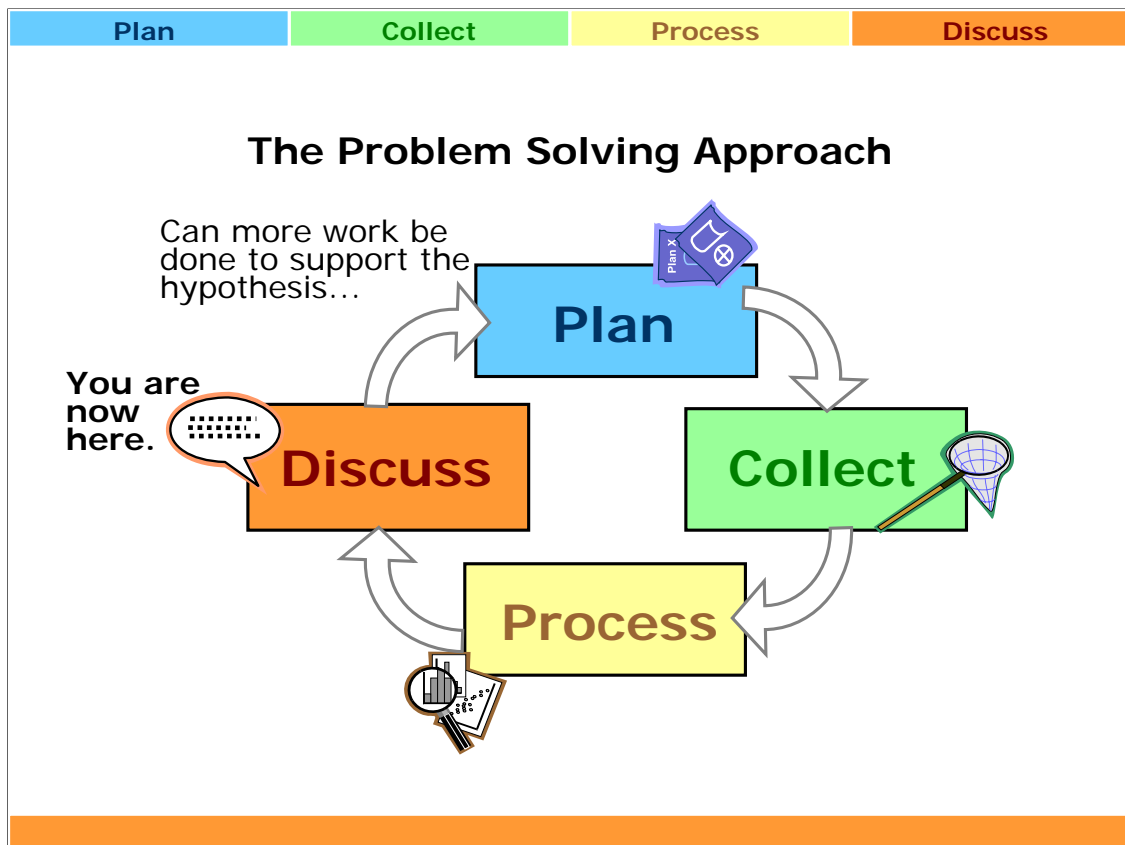
Why women closer to men in N.America but further apart in S.America? (Access to training and competitions for men/women...)

Is this enough data to truly prove the hypothesis?

Could we expand the number of areas from 'continents' to individual countries?

Would it still be true?

Points to note:



Objectives

Children should learn:

- where the current task fits within the 'problem solving approach'
- To review prior work.

Points to note:

At the end of the work having **discussed** our findings we could now start the whole cycle again.

Plan	Collect	Process	Discuss
 <h2 data-bbox="300 315 1054 360">How far? How fast? How high?</h2> <p data-bbox="300 396 1283 465">Try and come up with your own Hypothesis or you could test one of the following.</p> <p data-bbox="300 506 1182 539">Women's records are always slower/shorter than men's.</p> <p data-bbox="300 580 1246 649">The USA has the more world records holders than any other country.</p> <p data-bbox="300 689 1219 723">Men's world records are broken more often than women's.</p> <p data-bbox="300 763 1294 797">Improvements in men's records have gotten smaller over time.</p> <p data-bbox="300 837 1198 871">100m and 200m records are improving at the same rate.</p>			

Objectives

Children should learn

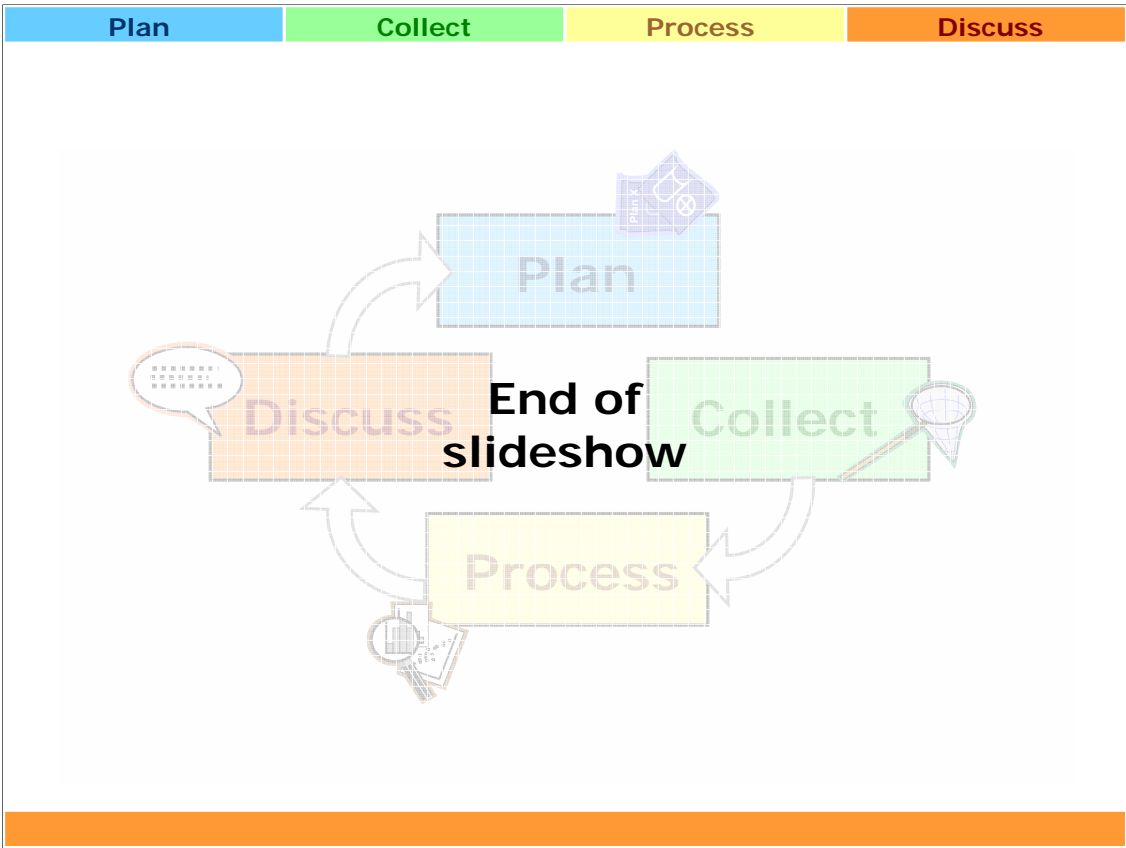
- to relate their investigation back to the original problem;
- to make and justify predictions relating to data
- to plan what data they will need to address their question;

Activities

Pupils use the worksheet to right down their own hypotheses.

Points to note:

These example hypothesis can be edited to include your own suggestions.



Plan



Collect

Process

Discuss

Example Questions

I'm interested in the 100m sprint and these questions:

When was the last time the World Record was broken?

How often has the World Record been broken over the last 10 years?

How much faster does the World Record become (on average) each year?

What will the World Record be in 10 years time?

What is the fastest a human could run the 100m?

Objectives

Children should learn:


- that the several questions can be posed and answered during one investigation.

Activities

Discussion of the questions. Who and why might be interested in them?

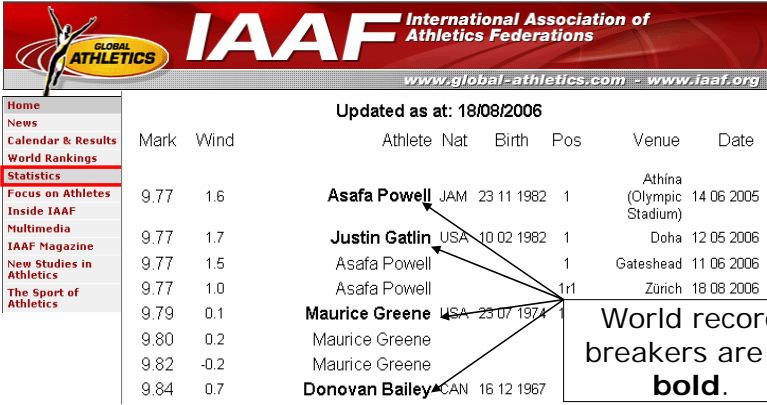
Points to note:

Plan
Collect
Process
Discuss



Sources of Data

The International Association of Athletics Federations has records for all official timings recorded each year. These can be found at www.IAAF.org.



Updated as at: 18/08/2006

	Mark	Wind	Athlete	Nat	Birth	Pos	Venue	Date
	9.77	1.6	Asafa Powell	JAM	23 11 1982	1	Athina (Olympic Stadium)	14 06 2005
	9.77	1.7	Justin Gatlin	USA	10 02 1982	1	Doha	12 05 2006
	9.77	1.5	Asafa Powell			1	Gateshead	11 06 2006
	9.77	1.0	Asafa Powell			1st	Zürich	18 08 2006
	9.79	0.1	Maurice Greene	USA	25 07 1974			
	9.80	0.2	Maurice Greene					
	9.82	-0.2	Maurice Greene					
	9.84	0.7	Donovan Bailey	CAN	16 12 1967			

World record breakers are in **bold**.

Objectives

Children should learn:

- where they can get data from to investigate their hypothesis
- that data can be obtained from primary and secondary sources.

Activities

Demonstration of how to obtain relevant data from the IAAF's webpage. In this particular case how to find prior world record holders.

Points to note:



Other suitable internet sources include:

<http://www.alltime-athletics.com/>

<http://trackfield.brinkster.net/Logon.asp>

http://www.geocities.com/raindog_bigtime/

Plan	Collect	Process	Discuss
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How far? How fast? How high?

Which athletic event(s) are you going to investigate?

What data will you collect?

How many samples will you collect?
In other words how far back or how many of the prior records?

Objectives

Children should learn:

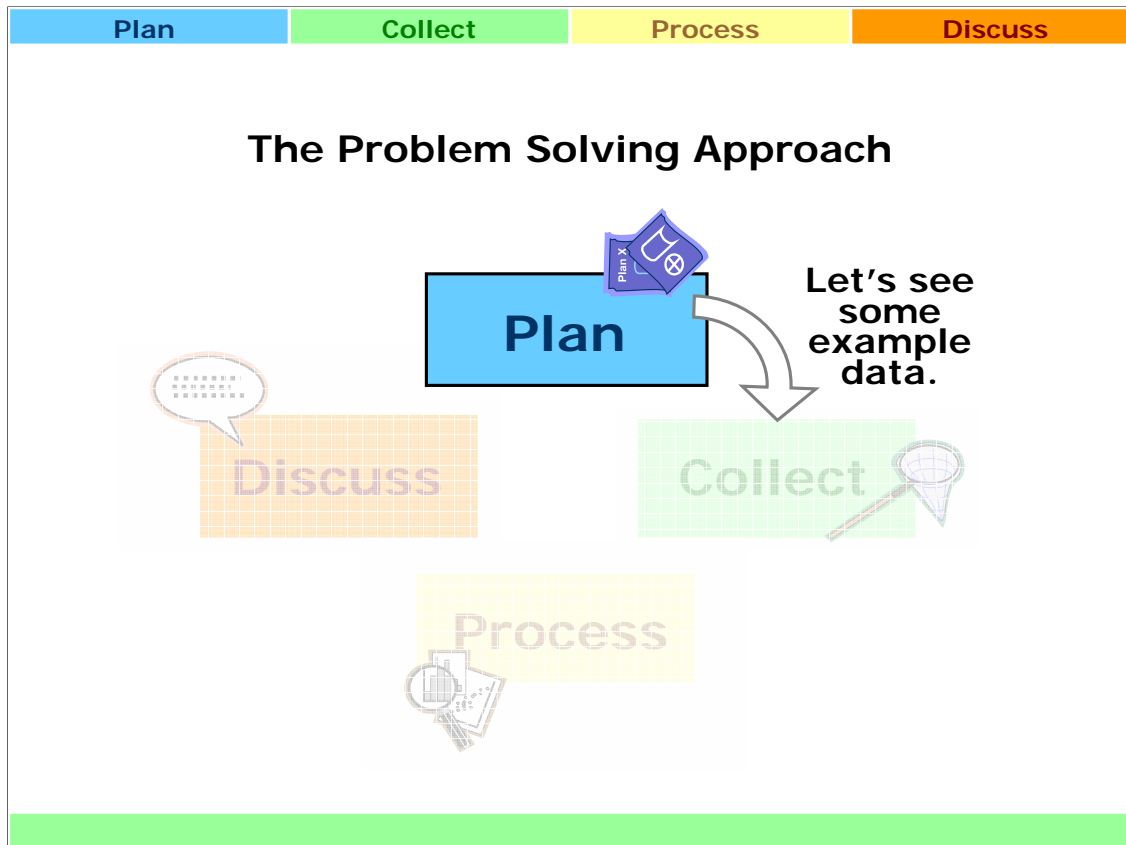
- to plan what data they will need to address their question;
- to think about where they can get relevant data from;
- to consider sample size and data collection methods;
- that sometimes it is sensible to collect additional information that may help in later in the enquiry.

Activities

Discussion: What data is needed to investigate the pupils' questions?
 What is the best way to collect the data?
 Efficiency? Sampling?
 How are we going to record the data?

Points to note:

This is an opportunity for students to plan **how** they will collect the data, think of an appropriate way of recording the data and discuss measurement.




Objectives

Children should learn:

- where their current task fits within the 'problem solving approach'
- to review their prior work.

Points to note:

Now we have **planned** our work, we need to **collect** some data that will help us answer the problem.

Plan		Collect 		Process		Discuss	
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How far? How fast? How high?

Year	Men's record (s)	Year	Women's record (s)
1932	10.38	1952	11.72
1948	10.34	1952	11.65
1958	10.29	1960	11.41
1960	10.25	1964	11.23
1964	10.06	1968	11.21
1968	10.03	1968	11.12
1968	10.02	Let's start by looking at (processing) the men's 100m sprint records.	
1968	9.95		
1983	9.93		
1987	9.92		
1988	9.90		
1988	9.86		
1991	9.85		
1994	9.84		
1996	9.79		
2005	9.77		

Objectives

Children should learn:

- to think about the data collected and the best way to process them;
- to ask questions about presented data.

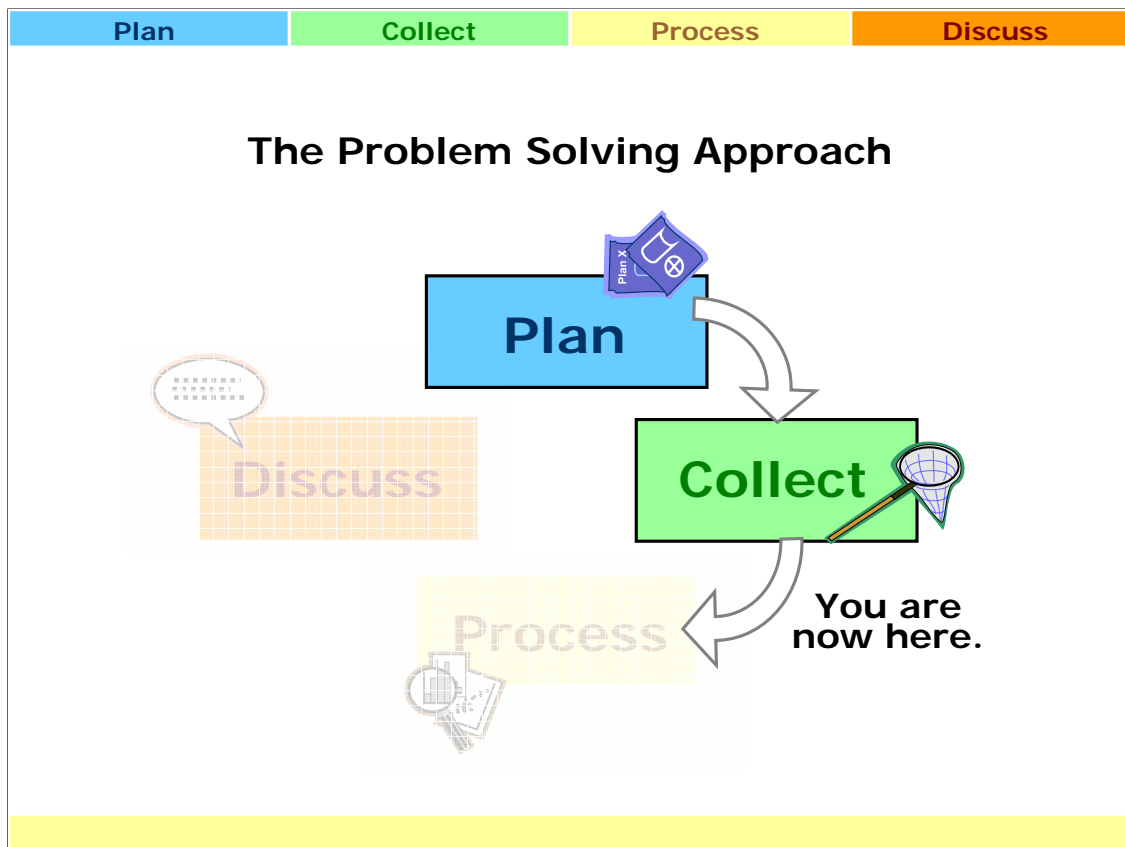
Activities

This screen shows some example data – the following screens deal with the processing of the (men's) data.

You could still allow a quick discussion about the differences they can see between the two sets of data.

- What differences or similarities can they see?
- Do records drop by the same amount each time?
- How often has either record been broken in the last 10 years?

Points to note:



Objectives


Children should learn:

- where their current task fits within the 'problem solving approach'
- to review their prior work.

Points to note:


Now we have **collected** our data, we need to **process** it. We need to get it into a form that is easier to manage by drawing some graphs and charts and doing some calculations.

Plan	Collect	Process	Discuss
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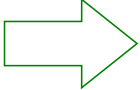


How far? How fast? How high?

Now that we have collected suitable data, a graph would help to see how the world record has changed over time.



We will plot world record time on the **y-axis**



We will plot year on the **x-axis**

Objectives

Children should learn:

- to think about variables and appropriate methods for displaying data;
- that graphs and charts can be used to gain additional information.

Activities

Pupils could be asked to suggest the axis to be used before information is revealed.

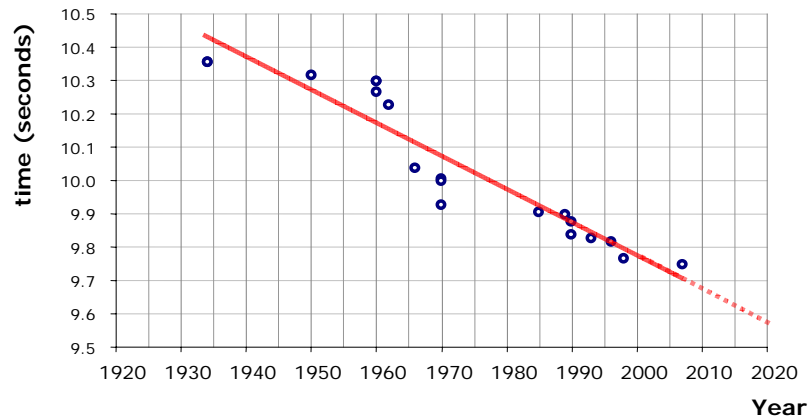
What are the suitable max/min values to use on either axis?

Points to note:



How far? How fast? How high?

100m Sprint : Men's World Record times



Could we predict the likely world record in 10yrs time?

Objectives

Children should learn:

- to think about variables and appropriate methods for displaying data;
- that graphs and charts can be used to gain additional information.

Activities

We are looking at the trend in world records - what trend can be seen? Are the points regularly spaced?

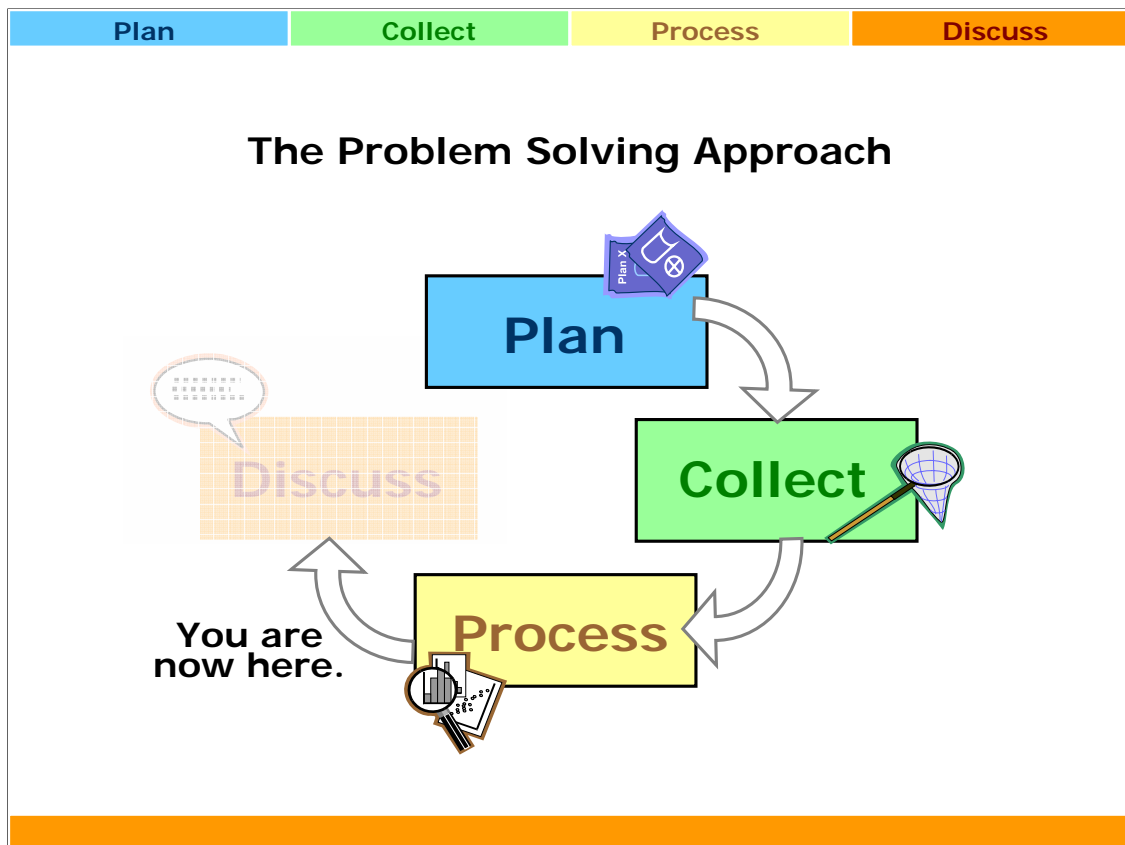
In which year(s) was the world record broken more than once? (Were these Olympic years?)

When we add the line of best fit to show the general trend how well does it fit the points?

Ask the pupils to draw their own lines and continue them to 2020, where do they expect the record to be in ten years time?

Points to note:

Should a pupil point out that a curve is more suitable - since the record cannot indefinitely drop down toward zero - this is dealt with in the next section.



Objectives

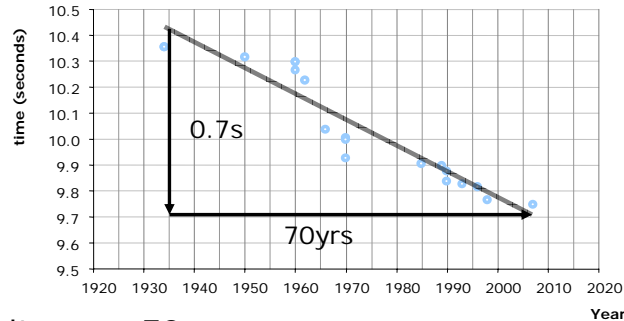
Children should learn:

- where their current task fits within the 'problem solving approach'
- to review their prior work.

Points to note:

Now we have **processed** the information by drawing charts and doing calculations, we need to **discuss** what our results show us and how they help us consider the problem.

How far? How fast? How high?



These results span 70 years.

Over this period the world record has dropped by about 0.7 seconds.

How much of a drop would you expect over the next 10 years?

Objectives

Children should learn:

- to think about variables and appropriate methods for displaying data.;
- that graphs and charts can be used to gain additional information;

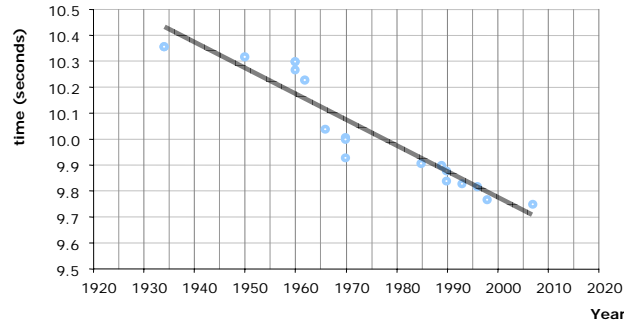
Activities

This screen is used to continue to work with the line-of-best-fit.

Points to note:

Possible chance to discuss numerical calculation of gradients.

How far? How fast? How high?



If this line of best fit is true, in 200 years time it predicts a world record of 7.8s. Does this sound realistic?

Sketch the trend you expect the world record to have over a long time period.

Objectives

Children should learn:

- to think about variables and appropriate methods for displaying data;
- that graphs and charts can be used to gain additional information.

Activities


This screen is used to continue to work with the line-of-best-fit and reveal that it is unlikely to be a straight line but a curve with a lower limit.

Points to note:

Possible chance to discuss numerical calculation of gradients.

Pupils could use the internet to look at the fastest suggested 100m at

<http://condellpark.com/kd/sprintlogistic.htm>

Plan	Collect	Process	Discuss
			
How far? How fast? How high?			
Plot these years and times.	Year	Women's record (s)	
	1952	11.72	
	1952	11.65	
Has there been a regular trend over the last 50 years?	1960	11.41	
	1964	11.23	
	1968	11.21	
	1968	11.12	
	1972	11.08	
What do you predict the world record will be in 10years time?	1973	11.07	
	1976	11.04	
	1976	11.01	
	1977	10.88	
	1980	10.87	
How do these records compare with the men's?	1983	10.81	
	1983	10.79	
	1984	10.76	
	1988	10.49	

Objectives

Children should learn:

- to think about variables and appropriate methods for displaying data;
- that graphs and charts can be used to gain additional information.

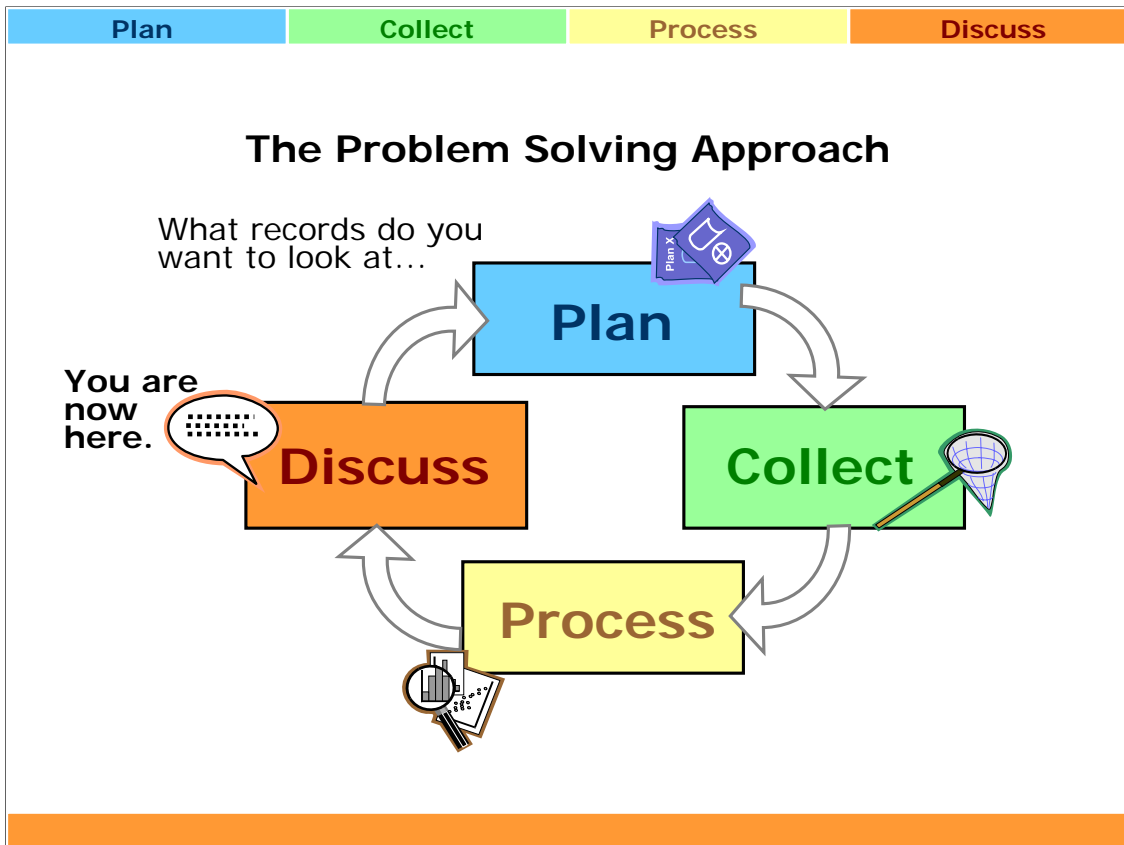
Activities

Pupils plot the equivalent dataset for Women and analyse the data in same way as they have been shown for Men's records.

A useful comparison they could be asked to make would be the average drop in time per decade (Men = -0.1s/dec and Women = -0.3s/dec)

This should prepare them to explore their own choice of event.

Points to note:



Objectives

Children should learn:

- where the current task fits within the 'problem solving approach'
- To review prior work.

Points to note:

This screen is used throughout the lesson at the key transition points to remind the group where they are in the cycle.

At the end of the work, having discussed our findings we could now start the whole cycle again.

Plan	Collect	Process	Discuss
<p data-bbox="304 203 568 293">Plan </p> <h2 data-bbox="300 315 1054 360">How far? How fast? How high?</h2> <p data-bbox="300 398 1023 434">What field or track event will you investigate?</p> <p data-bbox="300 465 943 501">What trend do you think you might find?</p> <p data-bbox="300 533 1302 613">By how much does the world record improve, on average, each year?</p> <p data-bbox="300 645 970 680">What do you think the world record will be</p> <ul data-bbox="357 685 1182 763" style="list-style-type: none">• this time next year?• by the next Olympics (Beijing 2008, London 2012) <p data-bbox="300 792 1214 860">Are men's records being broken as frequently as women's records?</p>			

Objectives

Children should learn:

- to form and investigate questions about real data.
- how plan writing fits into problem solving
- to make and justify predictions relating to real data

Activities

Pupils can select their own event to investigate and make predictions based on the questions given above.

Points to note:

These example questions help give a structure on which hypotheses can be formed. These questions can be edited and replaced with your own suggestions

