To collect and analyse useful qualitative data on mathematical difficulties as experienced by students in a Mathematics Support Centre – A challenge?

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UCD School of Mathematical Sciences

Scoil na nEolaiochtai Matamaitice UCD

Outline of talk

1. UCD Maths Support Centre
2. Our Research Project - Sept 2013
3. A Pilot Study - Feb 2014
4. Data collection - Sept 2014
5. Preliminary analysis of data - Jan 2015

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The Maths Support Centre (MSC)

- UCD MSC opened February 2004
- Student level
- Student programmes
- Increasing numbers

Electronic Records

- Database Recording
- 25,000 entries since 2009
- Accessed by the lecturer

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Aim of our research

Identifying university students' mathematical "trouble-spots" and developing effective supports: an analysis of Maths Support Centre Data.

Some examples from 25,000 entries

- *“Trigonometry, Vectors”*
- *"Changing units, scientific notation”*
- *“Limits”*

Initial list of codes

V/Basic algebra	{a}
Factorising	{f}
Indices	{i}
Inequalities	{in}
Logs	{l}
Rules of signs	{s}
Trigonometry	{t}
Resultant of Sim eqns	{se}
Sets	{sets}
Unit vector	{uv}
Converting units	{cu}
Basic Statistics	{stat}
Basic Probability	{p}

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Informing Tutors

Meeting MSC tutors

mid January 2014

Examples given to tutors

One student did not know

$$x/2 = \frac{1}{2}x \qquad \{a\}$$

Another student believed

$$x/2 = x^{-2} \qquad \{a\}, \{i\}$$

Student asked why $\sin x$, $\cos x$, $\tan x$ changed sign as x goes from 0 to 2π {t}

To improve data

Example A: A Student had a problem with limits and continuity and also a problem factoring out the "h" and expanding in a question on first principles. {a},{s},{f}

Example B: A Problem simplifying an expression (common denominator.)

$$P = 220 - n\left(\frac{200}{n+1}\right) \qquad \{a\},\{fr\}$$

Consequential Improvements

Extra category entries

LaTeXentries for mathematical expressions

Carbon copy A4 notebooks

Pilot study data entries

1. Student was finding the critical points of $\ln(\cos x)$. But did not know that if $\frac{a}{b} = 0$ then a must be zero and b not zero. {a},{fr},{cp}

2. How to find a condition that ensures that a 2 x 2 matrix has two equal eigen values. Student needed to know that $b^2 - 4ac = 0$. {a},{m}

3. Solving the indefinite integral $\int e^{\sin(x)+c} \sin 2x dx$ using basic algebra to simplify $e^{\sin(x)+c} = e^{\sin x} e^{c}$. {a},{int}

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Final preparation

- Meeting with tutors
  - Collection dates
  - Change in coding

Change to more explicit coding

	Orig Codes	New codes
V/Basic algebra	{a}	{alg}
Basic Statistics	{stat}	{stat}
Basic Probability	{p}	{prob}
Changing units	{cu}	{chunits}
Co-ordinate geometry (St line, Circle etc)	{cog}	{cogeom}
Critical points	{cp}	{crit}
Differentiation (application and rules)	{d}	{diff}
Factorising (also surds)	{f}	{fact}
Fractions (incl. ratio)	{fr}	{frac}
Functions (linear, quad and cubic, Solving f(x) = 0	{fun}	{fun}
Graphs (sketch'g and read'g data from graphs, tables)	{g}	{g}
Indices	{i}	{ind}
Inequalities	{in}	{ineq}
Integration	{int}	{int}
Logs	{l}	{log}

Data Collection

- Daily tutor entry checks
- Additions to tutor entries

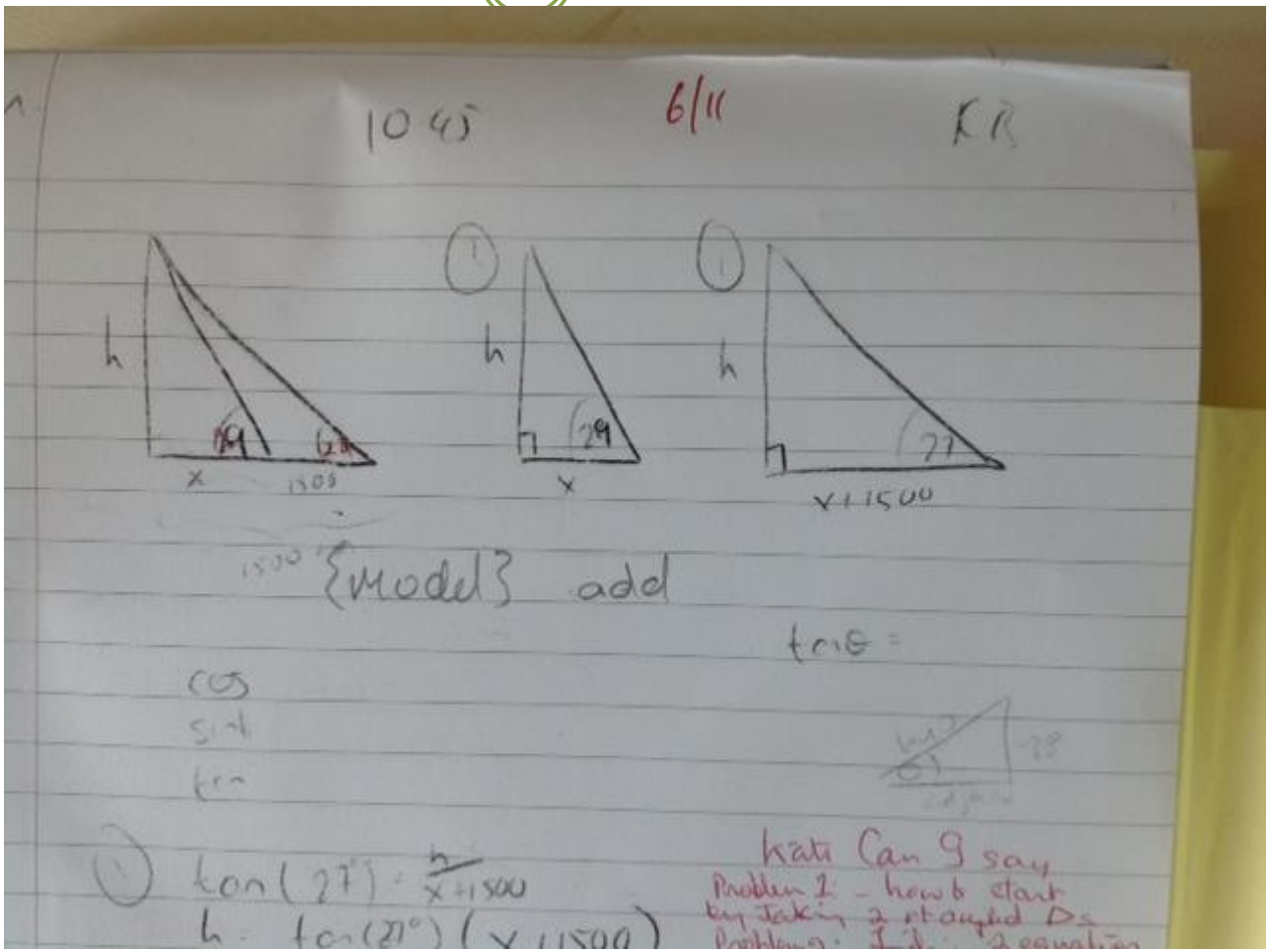
Tutor entry in database

Surveyors are looking at a clifftop. They look up at angle 24 deg and move 1500m closer and are at 29 deg to the top. Find height.

Used method of calling the unknown length x and dividing into two triangles and making two sim equations and solving for x (if needed) and height.

{trig},{frac},{fact},{alg}

An example in tutor notebook



Query to tutor

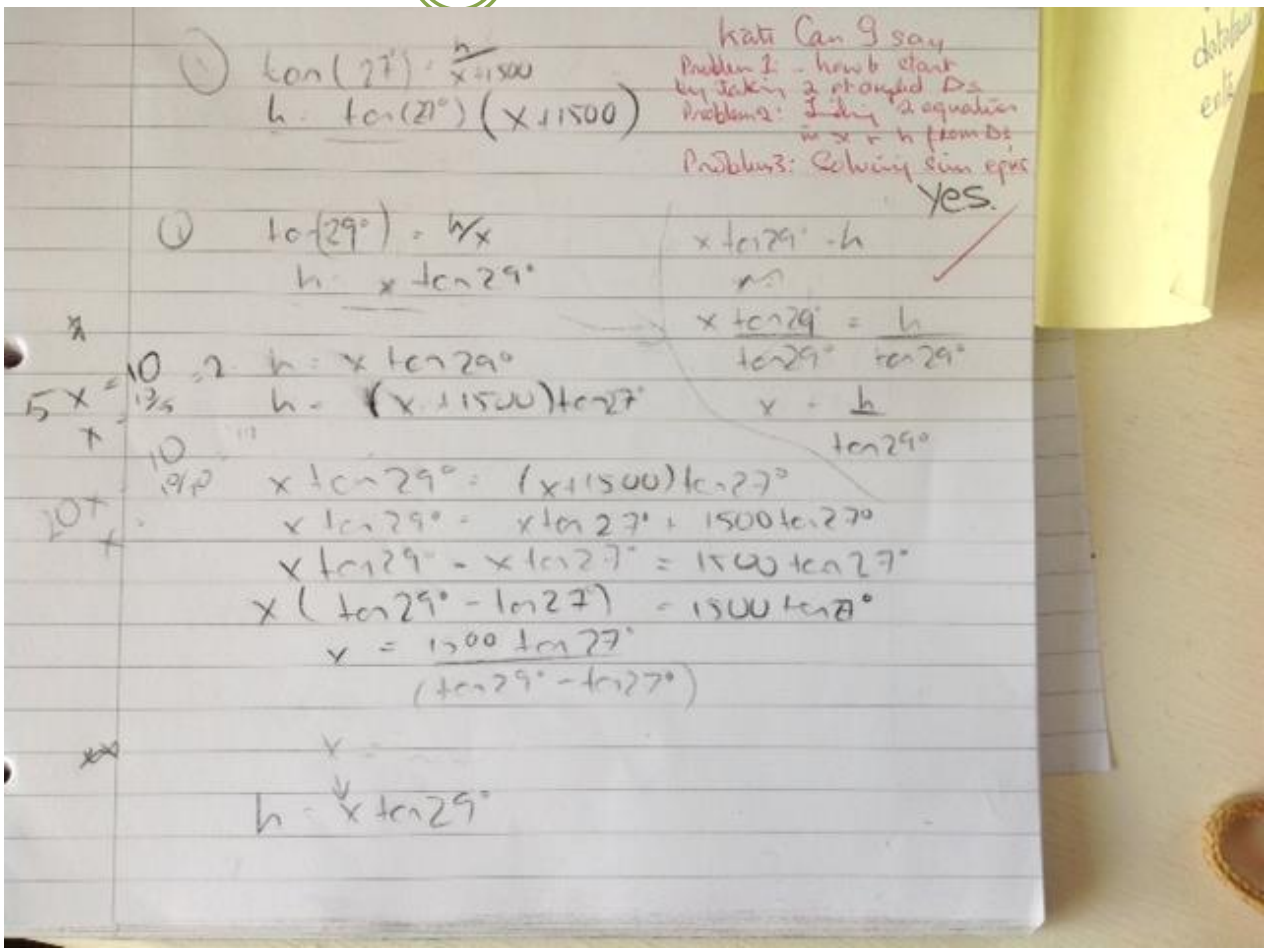
Were these the mathematical trouble-spots for the student?

1: How to start by taking two right angled triangles

2: Finding 2 equations in x and h from triangles

3: Solving simultaneous equations

Same page from notebook



Extending the data entry

[NC:
Tutor said student did not know how to start by taking two rt. angled triangles.

Could not find two equations in h and had a problem solving the sim. equat'ns.

Tan 27 = h/(x+1500) and Tan 29 = h/x .

Tutor wrote 5x=10; x=10/5. and 20x =10; x= 10/20 in explanation while solving the sim. eqns. NC]

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1. UCD Maths Support Centre
2. Addressing the research question - a major problem
3. Initial data – a pilot study – Feb 2014
4. Data collection – Sept 2014
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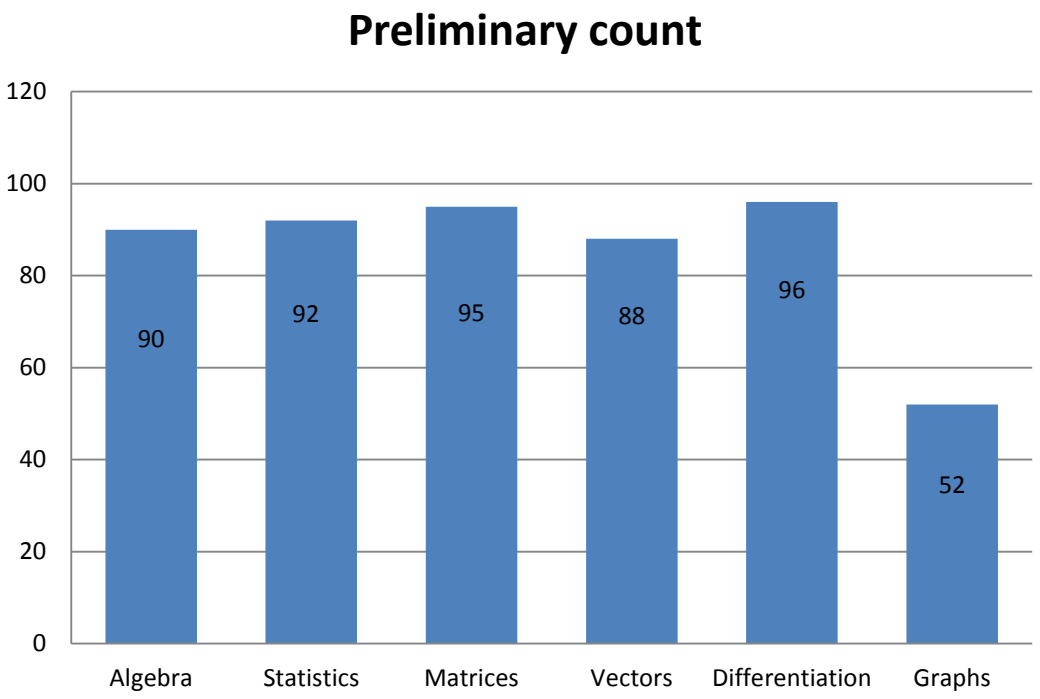
Preliminary analysis of data

Total number of student visits over eight weeks - 2012

Extracting information under the various codes.

Third validation of the coding.

Preliminary count of problem areas



Thank you.

Any questions?

For further information please contact
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