Using electronic handwriting for online technical consultations and tutoring: case studies from mathematics

Maths & Computing
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The problem

\[\int_0^\infty \frac{\pi}{\sqrt{x^3}} \, dx\]

**Type**
\[\int_0^\infty \frac{\pi}{(x^3)^{1/2}} \, dx\]

**Latex**
\[\int_0^\infty \frac{\pi}{\sqrt{x^3}} \, dx\]
## What has been tried?

<table>
<thead>
<tr>
<th></th>
<th>Voice</th>
<th>Text</th>
<th>Images</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone</td>
<td>✓✓</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Tele-tutorials</td>
<td>✓✓</td>
<td>?</td>
<td>?</td>
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<tr>
<td>Audiographic tutorials</td>
<td>✓✓</td>
<td>✓✓</td>
<td>✓✓</td>
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<tr>
<td>Email</td>
<td>?</td>
<td>✓✓</td>
<td>?</td>
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<tr>
<td>Discussion groups (eg on WebCT)</td>
<td>X</td>
<td>✓✓</td>
<td>?</td>
</tr>
<tr>
<td>Chat</td>
<td>?</td>
<td>✓✓</td>
<td>?</td>
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</tbody>
</table>

- [ ] One to one;
- [ ] One to many
Electronic handwriting?

• What is it?

• What hardware do you need?
  – Tablet PC
  – Graphics Tablet
  – Mouse

• What software do you need?
How do you do it? (Chat)
What to expect!

- Abbreviations/acronyms
  - brb!!!!!, cya, lol, ok, btw, heh, oops, nite, cu

- Smilies ☺ :-(

- Strange names
  - DON'T EAT CHEESE BE4 NOON!!!
  - Work hard don’t give up, you will make it last
  - changing names linked to song titles

- Icons and emoticons

- Bad spelling; incorrect grammar
  - To compare the male and remale
  - Nah that is cool on them for now. Will keep plodding through this module. I'm sure I will be fine, am just struggling on this one becuase I don't grasp it as well as I do other stuff
Initial trial of online tutorials

- **S2 2005** – Failed WebCT chat and whiteboard
  - students asked for MSN Messenger in Foundation Maths

- **S3 2005** Data Analysis & Discrete Maths
  - Christine and Birgit

- **S1 2006** Foundation Maths
  - All team members

(funded through Department of Mathematics and Computing Teaching and Learning Improvement Grant)
Aims of the trial in S1 2006

• To effectively provide distance students with an innovative visual learning experience in mathematics that enhances the
  – Development of problem solving skills
  – Development of basic maths skills
  – Development of mathematical communication skills

• To enhance the student experience in mathematically based courses and develop a supportive community of learning.

• To provide staff with easy to use tools and methods for teaching mathematics to distance students
What did we try in Foundation Maths?

- Invited 240 students enrolled externally
- 52 replied, 41 participated at least once in trial
- Students completed questionnaire on entry and exit
- Informed about MSN Messenger and loading handwriting option
What did we try in Foundation Maths?

• Online problem solving and skill development - groups
  – 4 tutors with 5 groups in three entry points
  – Tue/Wed nights each week in S1, for one hour

• Online consultations – individuals
  – All external students invited, 1 tutor
  – 3 weeks before exams, available all day and 1 night each week
How did we do it?

- Chat groups (between 2 – 8 students)
- Each week designated problem solving or skill development
- Linked to web discussion group activities, replacing discussion contribution requirement
- Downloaded questions from Study Desk
- Asked to think about them before the session
- Surprise questions allowed
- Allowed to submit as part of ‘Workshop assessment’ (4%)
Starting off

Student A says:
yep I have it.

Student B says:
try and write a message yourself

Student B says:
beside under the send button is an pen with a line click that and write something

Student C writes:
my writing works!

Janet - Maths writes:

Student C says:
My writing thing works now as you can see

Student D writes:

I took it I have it
First attempts

Birgit says:
who of you can write?

Student 1 writes:
I can

Student 2 says:
not me

Student 3 writes:
I CAN, NOW

Student 4 says:
you showed me before and its not pretty but can be done

Student 6 writes:
YES SORT OF

Student 4 writes:

Birgit writes:

Student 5 writes:

Student 3 writes:

Birgit says:
can anyone see what Student 4, I and Student 5 have written? I can't
Socialising?

Conversation 1
Student 1 says:
so what do we all do fro a job im a
surveyor

Student 2 says:
work at an enigeener firm

Student 1 says:
kool

Student 3 says:
elec engineering cadet in mining

Student 4 says:
cadet civil drafter

Conversation 2
Student 1 says:
yes i am. how are you sine the Blues won

Student 1 says:
*since

Linda G says:
Hummmmm

Linda G says:
i am not one eyed - so i think the blues
did a good job!

Linda G says:
but if it wasnt for that 20 mins (sigh)

Student says:
nah i think the Blues did crappy just the
Maroons were worse. i was nearly a qld
supporter by the end of it.
Problem solving – the aim

Student 1 says:
Yeah - we are supposed to work out if female times for the 100m will ever match/pass males times for the 100m

Student 2 says:
the aim would be to determine whether female athletes will ever reach or surpass their male counterparts

Student 3 says:
I believed the aim was to apply your knowledge of linear functions and simultaneous equations to determine the exact point of intersection (if there is one) where female athletes surpass the male athletes for a better time in the 100m run

Student 1 says:
Student 3 - I would have thought that might be more of the methodology?

Student 1 says:
I think Student 3’s is right, but if you go straight for the methodology, sometimes you may exclude other simple methods to answer the objective

Student 3 says:
oh ok, so just not so detailed...
Janet - Maths says:
 knowing something about isosceles triangles might help...do you know anything about them?

Student 1 says:
 the two angles opposite are equal?

Student 2 says:
 it mentions that each of the four area can be divided into two triangles the centre points are all 90 degrees
Problem solving

Student 1 says:
45

Student 2 says:
A = D? t/f the same equation as for D?

Student 2 says:
But looking at the picture DC seems shorter than AC.
Janet - Maths says:
try this one
Janet - Maths writes:

Student D writes:

\[ y = \sqrt{3x^2 - 2} \]
\[ y^2 = \frac{3x^2 - 2}{5} \]

Student A writes:

\[ 5y = \sqrt{3x^2 - 2} \]
Student D writes: \[ x = \pm \sqrt{(y^2 + 2) \over 3} \]

Janet - Maths says:
excellent....make usre the saure root covers the 3 on the bottom too...(I know it is hard with the mouse)

Student D says:
yes it is.

Student E says:
brb

Student C says:
I don't understand why we put the + - in front of the square root.

Student B says:
because you have to allow for the fact that we don't know if the y value will be either positive or negative

Student D says:
Because the y number could be a positive or negative number
Janet - Maths says:
Have a go at these two
Student B writes:

\[ 6^2 = 36 \quad \rightarrow \]

\[ 5^3 = 125 \quad \rightarrow \]

Janet - Maths says:
great
Student C writes:

\[ \log_6 36 = 2 \quad \log_5 125 = 3 \]

Janet - Maths writes:

\[ 6^2 = 36 \quad \rightarrow \quad \log_6 36 = 2 \]
Consultations

handout
Student comments

I think it went well, like you said some confusion to start with but now that we are set up it should go smoothly next week. It is much easier than the other discussion

I have found this tonight to be of great help especially with your handwriting, I feel like i am in a classroom looking up at a chalkboard

It was my first time using this program, and I found it fairly easy to operate, I definitely give it the thumbs up! It would also make studying chemistry a lot easier, with all the formulas and such. Wish I had it years ago!

Thankyou for you help this evening Birgit, my brain is starting to hurt, so I'll pass on another question, I learnt a lot tonight particularly with regard to talking about maths problems, thankyou for your time
Analysis of survey - prelim

- **Valued the interaction**
  - Real-time responses rather than asynchronous discussions on WebCT: “no post and wait a day to get a response”
  - “helped me gain confidence in seeking assistance if needed”
  - “you were not the only one stuck with certain concepts”
  - Prior to the tutorials they felt isolated: “sense of being in a class”

- **Motivation**
  - Felt motivated and kept on track

- **Presence of lecturer**
  - “conversation tends to stay on topic and less time is wasted”

- **Handwriting:**
  - “most helpful in problems that involved diagrams and angles”
  - Would prefer a “pen mouse”, handwriting readable though
  - Tutes would have been difficult without handwriting

- **Size of groups**
  - Participants about 3-6, maximum 10 students
What we thought

• Very rewarding
• Thanked by students after every session
• Time consuming (student/staff ratio)
• Built a learning community, and we were part of it
Future directions

• Offer at designated consultation times
• Complement phone conversation
• Used in lectures, recorded for later student access
• Now also being trialed in
  – The Learning Centre
  – PALS sessions
• E-ink can be easily included in emails
Thanks. Bye bye.