

The problem with maths for science is not just the maths !

> Is it fair to ask a student to take the reciprocal and use some elbow grease ?

> When does $(8) = -8$?

> If $t_{\text{STAT}} = -3.2$ and $t_{\text{CRIT}} = 2.36$, is the inequality $t_{\text{STAT}} < -t_{\text{CRIT}}$ true ?

> Who could find anything wrong with:

$pH = -\log([H^+])$ e.g. $pH = 8.0$ when $[H^+] = 1.0 \times 10^{-8} \text{ mol L}^{-1}$?

> Why is $\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$ is a *mean* average for many students ?

Why is it so difficult to integrate external learning resources into our own teaching?

Identify some key aspects of the problem

Consider mechanisms to facilitate:

integration of external learning resources,
local use/production of context-based
'study guides' for student navigation

Consider possible ways forward through cooperation

Diversity, diversity, diversity

Maths for a range of different courses:

- Bioscience and biomedical programmes

- Forensic sciences

- Environmental sciences and health

Very different ability levels

- Mature students, some of whom have very weak maths

- GCSE mathematics Grade C (over 2 years previously)

- Recent A-level maths

Variety of required learning preferences

- Self-study

- Traditional lecture

- Classroom environment

Managing student learning

Teaching – delivery of subject content:

- Traditional lectures

- Printed materials

- Video lectures

Resources for student learning:

- Tutorials, seminars

- On-line resources for self-study

- Peer learning sessions

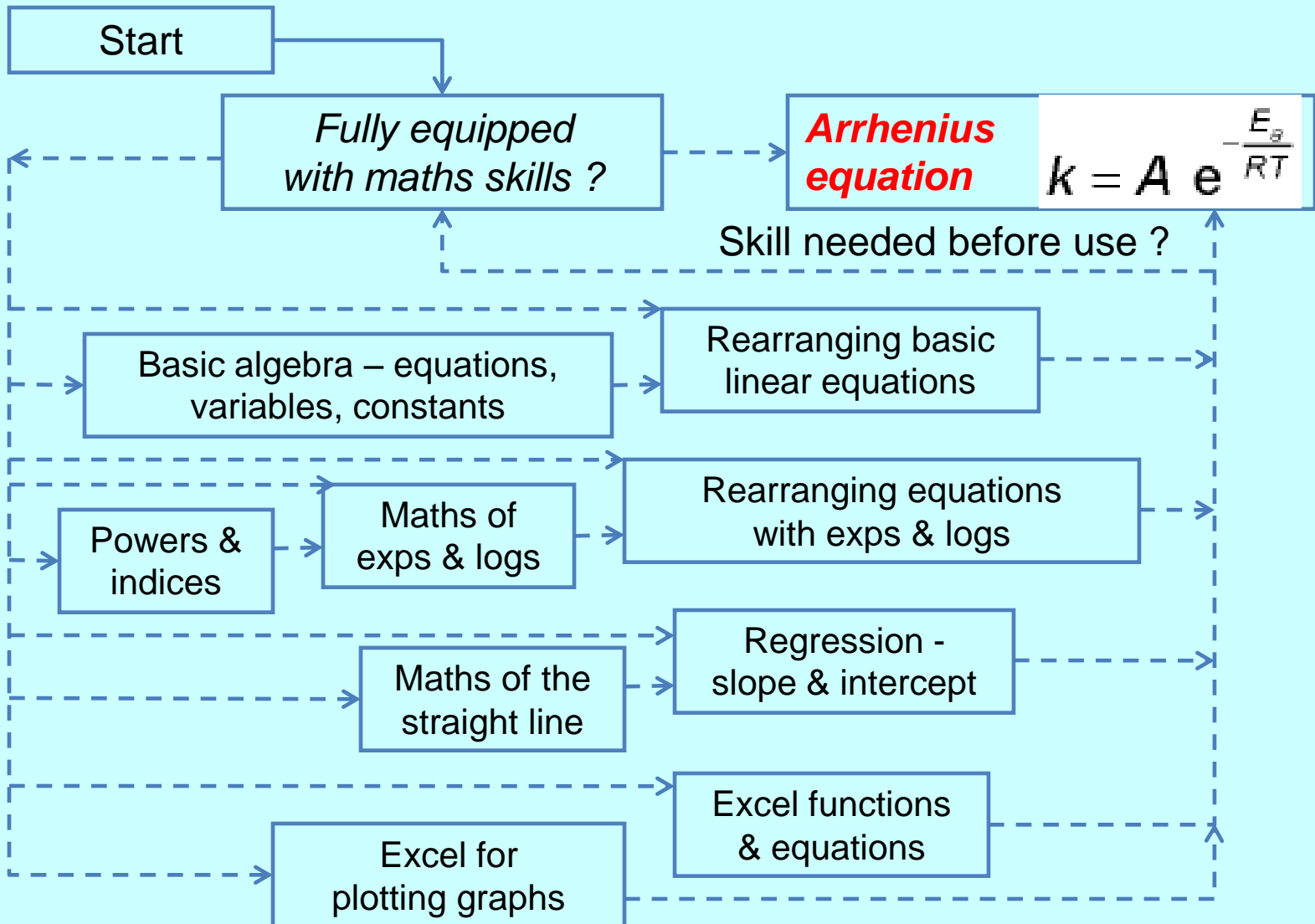
Study guidance:

- Course design

- Suitable resources and assessment

- Support for sub-groups / individual students

Example: Linearizing exponential equations



Managing a typical cohort of students - issues

Depth of understanding required. For example:

Rule of thumb – just accept that $\ln(Ae^x) = \ln(A) + x$

Limited understanding of logs using bases 10 and e

Deeper understanding of logs to *any* base, $\log_b x$

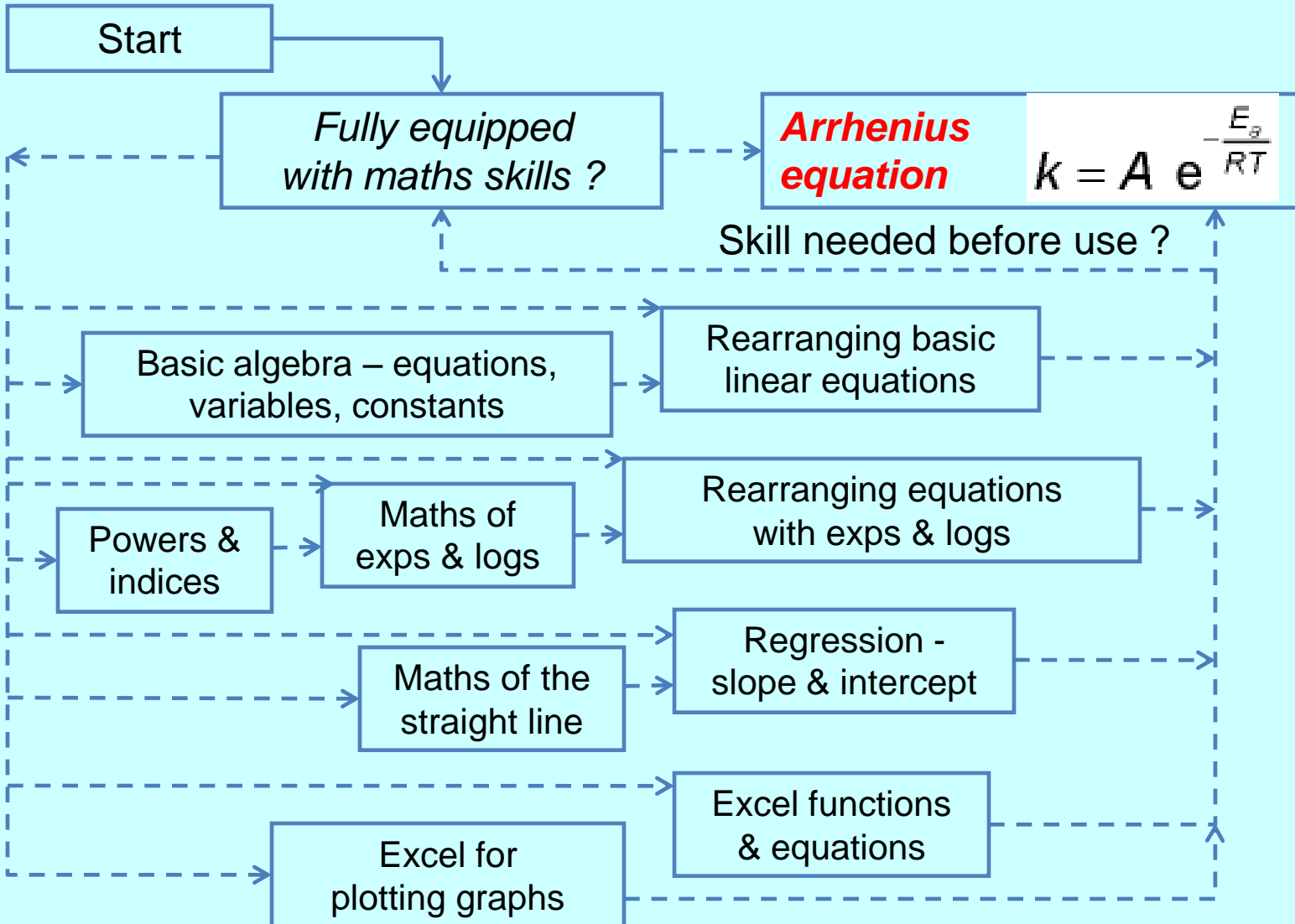
Timing:

Some skills must be understood before the ‘context’

Can any skill be developed together with the ‘context’?

How does the timing fit with other demands on the maths ?

Example: Linearizing exponential equations



On-line context-based Study Guides

Set out detailed objectives and/or pose a problem

- data analysis, case study (<http://calcscience.uwe.ac.uk/w2/sp/study.htm>), topic, module
- relevant to local needs

A 'dialogue' asking the student to consider whether he/she has the specific abilities to reach the objectives

- including self assessment + video feedback

Detailed links to appropriate learning resources

Worked video answers including use of relevant software

Transportable and adaptable for:

- downloading into local website / VLE
- editing for use in specific local context

Describe problem / topic / skill / concept	What common problems do students encounter In understanding or carrying out the work?	Comments

Development of resources in UWE

Printed materials > text book > 2nd Edition

Essential Mathematics and Statistics for Science, 2nd Ed
G Currell & A A Dowman, Wiley-Blackwell, 2009

Dedicated website for all questions and assessments

www.wiley.com/go/currellmaths2

Use of software for data analysis

Diagnostic testing, self-assessment tests

Dissemination of techniques – ‘Chemistry For Our Future’

Series of Organic Chemistry videos:

funded by the Royal Society of Chemistry

at the transition level between school and university

recorded and produced by Dr Dilys Thornton

<http://science.uwe.ac.uk/ls/orgchem/>

Skills Training Workshop:

Recording and editing screen-capture videos

Video production

Producing on-line self-assessment questions

<http://calcscience.uwe.ac.uk/CFOFWorkshop/CFOFWorkshop.htm>

Possible way forward – similarities with ACOL project

Development of Study Guides:

- Based around modules, topics, case studies, skills
- Links to existing materials + new learning elements
- Self assessment to guide student study

Develop a wide variety of context-based learning elements:

- Use expertise of teaching professionals**
- Provide help and/or training in the local production of on-line materials**

Website:

- Provides the 'home' for locally produced materials
- Dynamic evolution - student usage and feedback provides the final quality control

	Yes	Possibly	No
These materials would be useful for my students			
Colleagues in my university/college would also be interested in these materials			
I would like to share ideas on the content and style of new study guides			
I would like to share my own experiences with the production of similar materials			
I would like to learn the techniques of producing screen-capture videos			
I would like to learn the techniques of producing on-line self-assessment questions			
I would like to learn the techniques of re-editing existing screen-capture videos			
I would like to be kept informed of any new developments in this area			

With thanks to:

Dr Dilys Thornton

University of the West of England

Royal Society of Chemistry