

An aerial photograph of a vast desert landscape featuring rolling sand dunes. The dunes are characterized by fine, rhythmic ripples that create a textured, undulating surface. The lighting is soft, casting gentle shadows that emphasize the contours of the sand. In the lower right corner, a small crab is visible, its legs and shell partially buried in the sand, adding a sense of scale and life to the otherwise desolate scene.

# **The STAR Project**

*(Student Transition and Retention)*

## **Professional Skills Tutoring System**

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## SUMMARY

The School of Applied Sciences in Wolverhampton University runs a professional skills tutoring system, which is interlinked to a number of taught modules such as “Techniques in Biosciences”. The students are divided into groups of about ten and assigned a tutor. The module starts during induction week and contains some diagnostic testing, introductions to basic techniques and the encouragement of individual learning skills. The professional skills are further developed in the second semester using links with other modules.

This system provides for continuity of support for students and the motivation which assessment brings to student work within a modular system.

**Keywords:** student retention, student attrition, tutoring, induction

## INTRODUCTION

With increasingly larger university class sizes, containing students from a wide range of social and academic backgrounds there is even greater need for small group tutorial classes. Small group tutorials can play a significant role in helping students cope with the transition into the higher education environment. In these classes students can get to know their tutor groups socially and also get additional academic help. The tutorials are a good student support system and help weaker students identify areas where they may potentially have problems early in their studies.

## RELEVANCE TO THE STAR GUIDELINES

At its outset the STAR project researched, produced and published a set of guidelines based on the causes of student attrition and which pointed the way towards possible good practice. The STAR guidelines relevant to this case study are 2.3, 2.4, 2.5 and 3.2.

- 2.3 Induction activities should support the development of those independent study habits suitable for Higher Education
- 2.4 Induction events should provide the foundations for social interactions between students and the development of communities of practice.
- 2.5 Induction activities should promote the development of good communication between staff and students.
- 3.2 The course and its delivery should assist students’ transition from their previous educational experience to studying at tertiary level as well as

addressing the different needs arising from the subject backgrounds of the student cohort.

Cook, *et al.* 2005

## HISTORY OF THE PRACTICE

A dedicated study skills module was first run in 2003/04. It grew out of a skills tutorial system that was not incorporated into a module. The implementation of the original skills tutorial system was a direct result of criticism during a QAA inspection in relation to student progression and achievement.

Among many otherwise complimentary comments, the reviewers noted:

*An analysis of the most recent HND entry cohort indicates that 43 per cent of the entrants left the University without gaining at least the level of qualification for which they had registered (this excludes the students who did not obtain an HND because they had transferred to a degree course); the corresponding figure for the most recent B.Sc. entry cohort was 26 per cent. Furthermore, the failure rate in examinations for many modules in year two is high, requiring a significant number of resits. The reviewers acknowledge that the Division's access policy will result in lower completion rates; that its student profile is such that it will inevitably suffer more than the average from financial pressures; and that some of the students left with a sub-degree or diploma qualification. Nevertheless, they believe that these issues give cause for concern.*

QAA 1999

## THE PRACTICE

The School of Applied Sciences in Wolverhampton has developed a Professional Skills Tutoring System and an outline is attached as Appendix 1. Although not a free standing module the system utilises elements in taught modules, one such being “*Techniques in Biosciences*”. The module description is as follows:

*This module covers many of the basic laboratory, safety, IT and study skills which all practically-based scientists should need for successful completion of programmes in Biosciences. In addition to a selection of subject based techniques, encountered on other modules, it guides you through techniques of basic numeracy, use of word processing/spreadsheet/data manipulation software in common use throughout the University, and key information-gathering & library skills. The module also covers generic and personal study skills. Towards the end of the module you will be introduced to the first phase of an Integrated Career & Personal Development Learning Programme which will permeate your studies and is specifically designed to improve your eventual “readiness for the world of work”.*

This 15-credit module runs in semester one starting in the induction week. The development of basic scientific skills forms part of the module. In particular, it includes a number of diagnostic tests so that the ability of the students in a number of different areas can be assessed (see appendix 2 for an example). These are in IT

skills, basic scientific numeracy and literacy. The teaching methodology is to use these tests as vehicles for encouraging the informal contacts that form part of the Professional Skills Tutorial System. This is accomplished by using the professional skills tutor as initial assessor for these skills areas. The assessment is designed to be diagnostic. Areas of weakness highlighted by the student assessment can then be addressed by one-to-one tutorials with the professional skills tutor. The number of sessions that are required will vary from student to student with some students needing no more than a reassurance that all is well with the identified skills whilst others who may need more help. An area which commonly requires more support is the use of logarithms.

Other skills are then covered in modules that operate in the second semester modules. These include statistical methods, which is linked to the genetics curriculum of a cell biology and genetics module. The professional skills tutor is also responsible for overseeing the student's personal development plan (PDP). In this way areas of weakness and strength identified through these modules form part of the student's individual action plan and will be integrated into the PDP.

The aims of the "*Techniques in Biosciences*" module are integral to this approach and emphasise the development of subject specific skills:

- To introduce a variety of commonly used techniques, experimental, analytical and observational, together with generic communication skills
- To encourage a responsible and safe approach to work in the laboratory
- To become familiar with basic IT software in common use within the University
- To foster an attitude of self responsibility and motivation and to acquire personal effectiveness qualities of use to potential employers

Three to four academic staff supported by 3 demonstrators who hold temporary appointments as academic staff teach the "*Techniques in Biosciences*" module. The demonstrators are Wolverhampton graduates and therefore know the school and the systems in operation and also, being relatively young, provide an informal interface with students and the students feel more able to express any concerns. Where possible the tutorials are taken by experienced academics supported by demonstrators. Pressure from other activities currently means that some tutorials have to be taken by less experienced staff.

The subject areas covered include:

- Health and safety – safe working practices
- Interpreting data
- Design of bioscience experiments
- Presentation skills
- Self assessment

The key skills covered are communication, problem solving, improving own learning and performance and information technology. Assessment is directly related to the learning outcomes of the module.

Within this module many of the practically based classes or workshops are conducted with groups of 25 students. However, the sessions that are linked to the Professional Skills Tutoring system normally consist of about 10 students with a single member of staff (or less commonly a demonstrator). The student group is selected to give a representative cross-section of backgrounds. This is done by including students studying for a variety of awards including the HND sub-degree award and Honours degrees.

There are 6 scheduled meetings included in the Professional Skills Tutoring system, 3 in each semester with each one-hour session timetabled by the tutor. These professional skills sessions may take only a short time with a group of able students but are supplemented with one-to-one tutorials where problems are encountered. This mix of small group teaching and one to one tutorials means that an allowance of 50 hours is given for the tutoring process.

## RESOURCE IMPLICATIONS

The tutorial system is labour intensive in terms of time and the tutors get 50 hours contact time per professional skills tutorial group.

*“It is quite labour intensive but a big part of it is about developing a relationship with the students so that they can trust you so that they will come to you when they have a problem. We tend to withdraw from this after the first semester so it is important to get the students up and running and to be able to identify at an early stage those that may have problems.”*

Professional Skills Tutor

The second semester further enhances the skills of the student. The details are given in Appendix 1. The purpose of the second semester activities is to promote the student as an individual learner able to diagnose weaknesses and develop strategies for coping without the tutor’s help.

### **Staff and student opinions**

There has been an overall improvement in student retention and progression in the School of Applied Sciences and this has been linked to both the continuity and support provided by the professional skills tutoring system and the development of a new re-assessment policy within the university. Overall progression rates from first to second year rose from the mid eighty percent to well over 90 percent for the first two years of implementation of these policies.

The staff noted that the professional skills tutorial system also

*“allows them (the students) to build informal networks.”*

Student opinion indicates an understanding and appreciation of the help that the tutorial system provides.

*“Excellent, I find the tutorials and my personal tutor brilliant as my progress is constantly assessed and I am given the chance to rectify my mistakes and*

*brush up on my skills, as there is always somewhere to go for help if my tutor cannot, they point to someone that can”*

*“The skills module is really good because it’s showing me how to do different skills and apply them to other modules. And also this is helping me develop new skills which are completely different to ones I learnt at the college.”*

First year students

Students seem to like the flexibility of the Professional Skills element with one commenting

*“good because you can work through at your own pace but staff are on hand to help if needed.”*

There was a diverse range of students interviewed and while some students suggested that there was some repetition of ‘A’ level, others disagreed. Some recognised that the tutorial system was:

*“useful as a grounding to fill in any gaps of the course”.*

with others noting that although they had covered much of the material in the tutorials they thought that they would be useful for others and as a revision for themselves.

The only criticism other than having covered some of the topics already at ‘A’ level was in relation to the group size.

*“Not enough time with tutors due to large groups”*

Overall the student opinion is positive. Although some have covered the information prior to coming to university they see the benefits of everyone having an equal experience of the skills needed for the rest of the course.

## **CONCLUSION**

In its initial survey of bioscience departments, the STAR project found that staff cited a tutorial system as the single most effective practice for student retention. Small group teaching offers an effective bridge between the school experience and that experienced in the large groups common at University. Small group teaching however, often needs to be integrated into modules since students can perceive unassessed, freestanding tutorial schemes as not being compulsory. The tutorial system described here is integrated into a modular scheme and contributes to the assessment of those modules and thus provides a supported and assessed development of skills. The institutional value placed on it both in terms of the staff time devoted to it and the marks assigned to it convey the importance of skills development to students.

## CONTEXT

<b>Institutional context</b>	<ul style="list-style-type: none"> <li>• 12612 undergraduates</li> <li>• 5211 part-time undergraduates</li> <li>• 794 staff</li> <li>• University agenda includes widening participation</li> </ul>
<b>Departmental context</b>	<ul style="list-style-type: none"> <li>• 120 Bioscience undergraduate students</li> <li>• 45 % male 55 % female</li> <li>• 19 Academic staff</li> <li>• 10-20% mature students via access course</li> <li>• 2/3rds students live in West Midlands and majority live at home</li> </ul>

## REFERENCES

Cook, A., Rushton, B.S., McCormick, S.M. and Southall, D.W. (2005). *Guidelines for the management of student transition*. University of Ulster, Coleraine. Also at [http://www.ulster.ac.uk/star/resources/star\\_guidelines.pdf](http://www.ulster.ac.uk/star/resources/star_guidelines.pdf) (Accessed 15-09-05).

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## FURTHER INFORMATION

STAR Case Study: A Module in "Study in Higher Education"

<http://www.flinders.edu.au/teach/teach/firstindex.htm> - Strategies to teach first year students.

<http://www.support4learning.com/education/study.htm> - Resources for education / revision, Study skills.

<http://www.studygs.net/> - Study Guides and Strategies.

<http://www.vark-learn.com> - A Guide to Learning Strategies.

## APPENDIX 1

<i>Professional Skills Tutorial System 2002 / 2003</i>			
<b>Meeting / Date</b>	<b>Activities &amp; Outputs</b>		<b>Key Skills</b>
Induction Week	<b>30/9 – 4/10</b>	<b>Icebreaker</b>	<b>Social Gathering</b>
<b>Tutorial No. 1</b> <b>Mid-Late OCT</b>	<p>Prior to tutorial, as part of AB1001 intensive week WWW exercise, tutees will have established e-mail contact via Biosciences intranet and provided a Personal Portrayal ProFile (electronic version). Tutors will have been given a copy of their tutee's ILP completed during welcome week. Discussion takes place on tutor &amp; tutee specialisms. Essay from IT Word on AB1001 should have been received, marked (graded pass/fail only) and feedback sheet(s) discussed. Tutees informed about key skill assistance sources, feedback diaries and given a list of 2<sup>nd</sup> discursive essay topics for selection. Initial thoughts on planning and run through of assessment criteria.</p> <p><b>Work for Tutorial 2</b> – AB1001 Units &amp; Measurement Exercise to be completed and handed in to skills tutor by agreed deadline. Selection of extended essay topic confirmed via e-mail. Complete feedback diary page.</p>		<p><b>Communication</b></p> <p><b>Use of Information Technology</b></p> <p><b>Application of Number</b></p>



<p><b>Tutorial No. 4</b></p> <p>Mid January- <b>Early Feb</b></p>	<p>Return extended essay with completed front sheet feedback form. Summarise collective strengths and weaknesses of essay writing/IT skills. Return SWOT analysis with appropriate commentary.</p> <p><b>Work for Tutorial 5</b> – complete statistical exercise (as part of AB1000) by set deadline. Up-date skills feedback diaries.</p>	<p><b>Improving own learning &amp; performance</b></p> <p><b>Application of Number</b></p>
<p><b>Tutorial No. 5</b></p> <p><b>Late March</b></p>	<p><b>GROUP TUTORIAL</b></p> <p>Review success or otherwise AB1000 statistics.</p> <p>Package – discuss any feedback comments.</p> <p>Plan activities and tasks for group poster exercise.</p> <p>Topic to be based upon students' choice of best-extended essay submitted by the group.</p> <p><b>Work for Tutorial 6</b> – complete group poster work and up-date feedback diaries.</p>	<p><b>Application of Number</b></p> <p><b>Communication</b></p>
<p><b>Tutorial No. 6</b></p> <p><b>Early May</b></p>	<p>Tutors to conduct process review of poster group work and tutees to provide a group critique of poster presentation.</p> <p>Group assessment of all posters according to the specified pre-disclosed assessment criteria.</p> <p>Tutors/tutees to complete individual structured student reports as part of Progress Files developments.</p>	<p><b>Communication</b></p> <p><b>Teamwork</b></p> <p><b>Improving own learning &amp; performance</b></p>

## APPENDIX 2



## AB1001: Techniques in Science

## UNITS AND MEASUREMENT

The booklet that accompanies this work sheet covers the SI and Non -SI units that you are likely to meet in science. This work sheet is designed to give you experience working in various units and converting between them. There is a mixture of very easy through to not very hard calculations that you are likely to use on the course. The "maths" involved is nothing more complicated than simple "sums" and proportions. Those of you that have studied maths and the sciences to GCSE or GCE O-level will find little to trouble you and should finish well within the time. Those who feel less secure with calculations may take a little longer but there is plenty of time for you to reach the pass mark. You may use the booklet and you will not be penalised for asking the staff for help if you get stuck.

You are to attempt ALL the problems on the work sheet and have them marked BEFORE you leave the session. There are a total of 80 marks attainable and to pass this session you must get AT LEAST 56 correct.

The first FIVE questions are designed to test your general mathematical ability and are to be performed **WITHOUT A CALCULATOR**. The questions are similar to those used on foundation level science modules of the Open University. These are specifically designed for students with very little formal mathematical background.

1) Solve the following equations (6 marks)

a)  $2 \times (-5) =$  .....

b)  $(-3) \times (-2) =$  .....

c)  $\frac{4}{(-2)} =$  .....

d)  $\frac{(-8)}{(-4)} =$  .....

e)  $10 - (-5) =$  .....

f)  $(-10) - (-5) =$  .....

- 2) Express the following numbers in scientific notation (4 marks)
- a) 24328 .....
- b) 3000000 .....
- c) 0.000003 .....
- d) 1.0 .....
- 3) Express the following scientific notations in ordinary numerical form (5 marks)
- a)  $5.5 \times 10^4$  .....
- b)  $5.5 \times 10^{-4}$  .....
- c)  $10^3$  .....
- d)  $1E^{+3}$  .....
- e)  $1E-2$  .....
- 4) Solve the following problems and express your answers in scientific notation (3 marks)
- a)  $(2 \times 10^5) \times (4 \times 10^{-3}) =$  .....
- b)  $\frac{(4 \times 10^6)}{(2 \times 10^{-3})} =$  .....
- c)  $\frac{0.005 \times (2 \times 10^6)}{50} =$  .....
- 5) Given that  $\log_{10}$  of 2 = 0.301 and that  $\log_{10}$  of 8 = 0.903 what are the values of the following? (3 marks)
- a)  $\log_{10}$  of 16 = .....
- b)  $\log_{10}$  of 4 = .....
- c)  $\log_{10}$  of  $\frac{1}{4}$  = .....

- 6) Complete the following table using items from the list provided.(7 marks)

Prefix	Symbol	Multiple
centi	c	$10^{-2}$
deci		
femto		$10^{-15}$
kilo		
mega		
micro		
milli		
nano		
pico	p	

$10^6$ ,  $10^3$ ,  $10^{-1}$ ,  $10^{-3}$ ,  $10^{-6}$ ,  $10^{-9}$ ,  $10^{-12}$ , f, n, m,  $\mu$ , d, k, M.

- 7) Express the following in grams (8 marks)

1.0 tonne ..... 1.0 mg .....

1.0  $\mu$  g ..... 0.5 mg .....

1.0 g ..... 0.5 kg .....

1.0 kg ..... 0.5 tonne .....

- 8) The image of a bacterial cell observed with an electron microscope is 90 mm in length. If the magnification of the electron microscope is  $6 \times 10^4$ , what is the length of the original bacterial cell? (One correct answer)

a..... 540 mm                      d..... 1.5  $\mu$  m  
 b..... 6.6 mm                      e..... 540  $\mu$  m  
 c..... 1.5 mm

- 9) The relative molecular mass (RMM) of  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  is 246.5. How many grams of  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  will there be in 450 ml of a 1 molar solution? (One correct answer)

a..... 123.25                      d..... 110.93  
 b..... 0.12325                      f..... 120.50  
 c..... 0.01109                      g..... 0.1205



- 15) Physiological saline solution contains 0.85% by weight of salt in water. How many grams of salt would be contained in the following volumes of solution? (5 marks)

100 cm<sup>3</sup> ..... 10 litres .....

1 dm<sup>3</sup> ..... 10000 μ l .....

10 ml .....

- 16) A 20% solution of sodium iodide (NaI) contains 20 g of NaI per 100 ml of solution. Which of the following are also 20% solutions of NaI? (Five correct answers)

a. .... 20 g in 100 cm<sup>3</sup>                      f. .... 20 g in 10 ml

b. .... 2000g in 1 dm<sup>3</sup>                      g. .... 2 g in 1 ml

c. .... 0.2 g in 1 ml                      h. .... 200 g in 1 dm<sup>3</sup>

d. .... 200 mg in 1 ml                      i. .... 2000 mg in 1 dm<sup>3</sup>

e. .... 0.2 μ g in 1 ml                      j. .... 2000 mg in 10 cm<sup>3</sup>

- 17) Calculate the molarity (moles per litre) of a 20% (weight per volume) solution of sodium iodide. The RMM of NaI = 149.89 (1 mark)

..... moles per litre

- 18) If the solution in the previous question was diluted five times (1 vol of solution added to 4 vol of solvent), what would be the concentration of NaI in % and in molarity? (2 marks)

.....%

..... moles per litre.

- 19) The RMM for tartaric acid is 150.09. How many grams would be required to make one litre of the following solutions. (6 marks)

25% ..... 0.75 molar .....

250 μ molar ..... 1.0 molar.

750 mmolar ..... 1.0 mmolar .....

- 20) Microbial cells in a liquid suspension can be counted directly using a specially ruled microscope slide. The formula for converting the number of cells seen on the slide to the number of cells per ml of suspension is  $N \times 4 \times 10^6$  where N is the average number of cells seen in a given area of the slide. **Use your calculator** to determine the number of cells per ml of suspension when N is equal to 50.

Write your answer here .....

The correct answer is  $2 \times 10^8$  cells per ml. If you get  $2 \times 10^9$  cells per ml it is likely that you are using your calculator incorrectly. If so ask for assistance, as you will get the next question wrong if you make the same mistake.

(1 mark)

- 21) One gram ( 1 ml) of beefburger was homogenised in 9 ml of sterile water. 0.1 ml of this homogenate was added to 99.9 ml of fresh sterile water to give Sample A. 100  $\mu$  l of Sample A was spread onto an agar plate which was incubated for 18 hours at 37°C. After incubation there were 55 colonies on the agar plate. Assuming that each colony grew from 1 viable cell in Sample A calculate the number of viable bacteria per gram of beef burger. Show all your working.

(5 marks)