

SCIENTIFIC TRAINING BY ASSIGNMENT FOR RESEARCH STUDENTS (STARS)

Project supervisors know only too well the perennial problems and mistakes that arise in many undergraduate research projects. These problems often include the following: poor project management, inability to clearly identify hypotheses, poorly designed experiments with no controls and/or inadequate replication, poor or inappropriate graphical and tabular presentation of data, incorrect, incomplete and inconsistent use of citations, etc.

The Scientific Training by Assignment for Research Students (STARS) project is an interactive web-based learning resource (<http://www.ucc.ie/research/stars/>) that aims to develop the ability of research students to plan, design and execute research through experiential learning. An explicit aim of STARS is to provide training in research skills for undergraduate students who would be expected to undertake a final year research project (ideally, it is intended that students will have used the STARS learning resource before beginning their final year research projects). Because of the generic nature of the research skills being targeted by STARS, this resource may also be appropriate for postgraduate research students, particularly those in their first year.

An overview of the specific research skills that are targeted by STARS include:

- » project management (planning, scheduling, goal-setting, time-management, and effective communication between student and supervisor(s))

- » the ability to conduct a literature review
- » the ability to generate and test hypotheses
- » the ability to design data collection protocols with appropriate sampling methodologies
- » data analysis and interpretive skills
- » report writing skills
- » data presentation skills (oral, poster, graphical, written)
- » the ability to analyse, synthesise, and critically evaluate different types of information.

CONTENT

The STARS website consists of three main sections: 'Useful Tips', 'Short Activities' and 'Case Studies.' The 'Useful Tips' section provides advice and guidance on issues such as the *viva*, common problems in seminar presentations, and advice on producing effective posters. It also provides information and links to selected education websites with high quality information relating to a range of relevant research skills.

The 'Short Activities' section identifies some specific research skills and provides short assignments relating to each. These assignments have been designed to typically contain intentional errors that the students are expected to identify (and subsequently rectify). These assignments cover a wide range of

research skills, such as experimental design, referencing, scientific writing, and data presentation. For example, resources in the section on 'Referencing' (<http://www.ucc.ie/research/stars/referencing.html>) begin by requiring students to proofread the format of a list references to identify the associated referencing format; the more demanding assignments relating to referencing require students to detect the improper use of references in text, coupled with formatting inconsistencies in the associated list of references. As with most of the assignments in the STARS resource, students can view a version that indicates all of the corrections, thus enabling them to gain immediate feedback relating to their proficiency of a particular skill. 'Open-ended' questions are also provided in the 'Short Activities' section to encourage the student to reflect further on the appropriate use(s) of a particular research skill.

Assignments in the 'Case Studies' section then require students to implement and integrate a variety of skills that have been developed in the 'Short Activities' section using realistic scientific research examples. The dominant type of assignment here is a 'case study', the equivalent of a short research report (3–4 pages long). These have been written to include a wide variety of intentional errors, for example, in data presentation, report structure, experimental design and data analysis. As an assignment, students read the report and evaluate it by producing the equivalent of a referee's report. A critique is provided alongside each case study that identifies the

errors in the research report, and students are expected to compare their evaluation with that of the critique. This approach provides immediate feedback to the students on their ability to critically evaluate scientific research. Other assignments within the 'Case Studies' section provide students with the raw data from a research report, and require them to analyse, graph or tabulate the data in a more appropriate manner. Again, open-ended questions are provided within this section to encourage students to further integrate skills and develop their critical thinking skills.

IMPLEMENTATION

If students are to be expected to fully engage with the STARS learning resource, its use should be integrated into the learning outcomes and assessment of a relevant module at an appropriate stage in the degree programme. In this way, STARS can be used to promote problem-based learning in the classroom, for example, by structured class discussions, and problem-solving in small groups. 'Learning by doing' can be 'learning by doing together'!

Dr John Finn
Teagasc, Johnstown Castle, Ireland
jfinn@johnstown.teagasc.ie

Dr Anne Crook
Teaching Enhancement Officer
University of Reading
a.crook@ucc.ie