Online Team Investigations in Science (OTIS) – Work in progress

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OTIS

Team investigations in Open University physical science modules

OU – Part-time, distance learning students

Astronomy / Planetary Science

S382 – PIRATE robotic telescope

S382 – SDSS telescope data

S818 – Mars rover simulation

Features

Advanced undergraduate / taught postgraduate

Team working projects

Use synchronous as well as asynchronous communication tools

Varied models of assessment

Why this study?

Anecdotally, these team working investigations seem to be enjoyable and effective.

We want a more scholarly analysis so we can understand these teaching activities in depth.

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Cooperative learning in STEM subjects

Why adopt cooperative learning? (small groups working towards a common goal)

In face-to-face context, has long been recognised (e.g. Springer, Stanne and Donovan, 1999) as leading to improved student outcomes (in terms of assessment) in STEM subject areas.

Cooperative learning mirrors the collaborative working approaches used in STEM research and employment.

Challenges to cooperative learning in the distance learning environment

- Interactions through CMC
- Accessibility issues related to types of CMC adopted
- Student availability
- Student attitudes to cooperative learning

But there is interest in CMC as a way of delivering authentic learning (e.g. Amory, 2014).

Themes in understanding online cooperative learning

Online cooperative learning

Examples of cooperative working in the online environment at the OU: computing (Minocha and Thomas, 2007), psychology (Robinson, 2013), ICT (Donelan and Kear, 2018)

The mode of communication is clearly a very important factor, but it is far from being the whole story.

- Pedagogic design
- Student engagement and ownership of task
- Peer-learning
- Role of assessment
- Group dynamics
- Gender differences in participation

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S382 – PIRATE robotic telescope

Level-3 module ‘Astrophysics’

Astronomical observation and data reduction addresses practical skills development.

Rationale for team approach:

- efficient use of facilities
- project tasks can be sub-divided between a group
- peer-learning

Task: To make new observations of a candidate variable star over a sufficient length of time that the nature of the variability can be determined.

Duration: 9 study weeks

Group size: 6 to 10 students

Assessment:
50% on a group report (written as a wiki)
50% on individual progress report (compiled weekly)

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S382 – SDSS research database

Level-3 module ‘Astrophysics’

Astronomical data analysis addresses practical skills development. (Trend in astronomy is for increased use of automated surveys.)

Rationale for team approach:

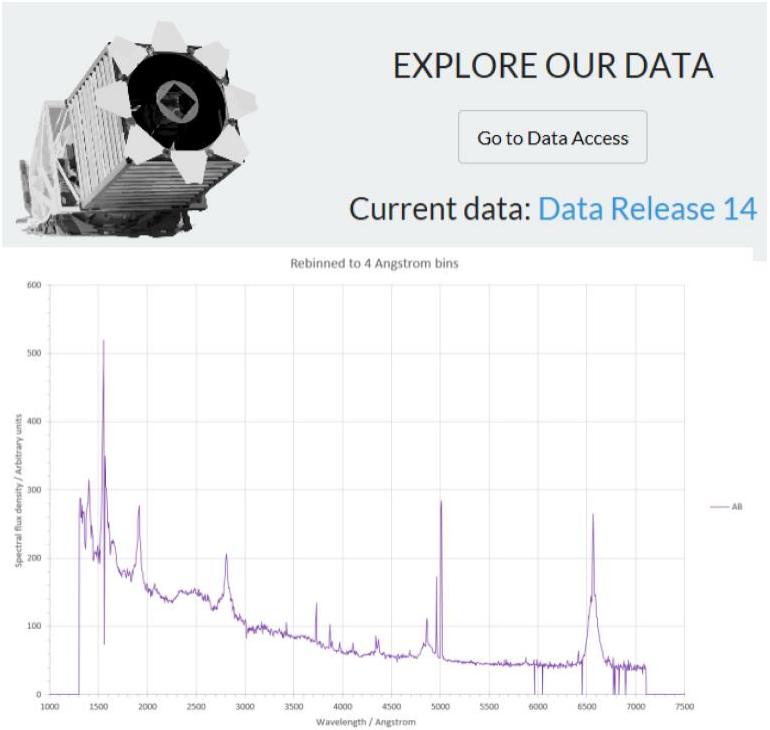
- project tasks can be sub-divided between a group
- peer-learning

Task: The Sloan Digital Sky Survey contains optical spectra of many quasars. Students are asked to create a composite spectrum (extending into the ultraviolet) of quasars and assess whether this composite can be considered representative of quasars in general.

Duration: 9 study weeks (5 weeks in team working)

Group size: 6 to 10 students

Assessment:
50% on a group report (written as a wiki)
50% on individual progress report (compiled weekly)



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S818 Mars rover simulation

Taught postgraduate module in space science

The Mars rover mission simulation develops skills in online team-working that are needed for space operations.

Rationale for team approach:

- Space mission operations require a team approach to ensure science goals are met based on analysis of science/engineering data and subject to engineering constraints.
- Peer learning
- Self-reflection on performance in team

Task: Explore a simulated Martian environment to search for geological signatures of the presence of water in the past. Rover has cameras and (simulated) analytical instruments.

Duration: 1 study week

Group size: 10-15 students

Assessment:
Self-reflection exercise

Methods and data

Two approaches:

- Synoptic analysis of online communications (forums, wiki)
- in-depth interviews with a sample of students

The synoptic approach should allow us to analyse trends of behaviour and identify factors and themes that require deeper study.

The interviews will probe student perceptions and will allow in-depth questioning: this will be especially useful for eliciting views that students are unlikely to share in the team setting.

Cohorts in study – student numbers

S382-2016: 72 (PIRATE), 92 (SDSS)

S382-2017: 47 (PIRATE), 93 (SDSS)

S818-2017: 51

S818-2018: about 50

We will characterise the cohorts by gender balance, previous educational qualifications.

We will also use posting data to characterise the degree of activity taking place in project forums.

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Synoptic data

Accessible sources of data:

- Forum discussions (all modules)
- Report wikis (S382 only)

The forum data will be analysed qualitatively by theme.

Preliminary inspection of data suggests that this is useful for drawing out information related to

- student engagement
- group dynamics (forming, sustaining)
- peer learning

Example (preliminary inspection) – shows a lot of activity related to peer acknowledgement and team self-organisation

Nodes

Name	Sources	References
Acknowledging others	1	100
Apologies (for absence, non-participation	1	6
Clarification	1	1
Collaborative writing (wiki)	1	26
Encouraging others	1	3
Facilitation	1	13
Group self-description	1	1
Help offered	1	3
Initial attitudes	1	1
Late-joining or re-joining	1	2
Leading the group to make decisions	1	9
Managing the forum	1	3
Off-topic sharing	1	21
Peer learning	1	4
Reflection on project	1	2
Role selection	1	27
Soliciting group feedback	1	4
Student self-description	1	5
Student summaries	1	13
Technical issues (design)	1	4
Time management	1	2
Tutor intervention - at student request	1	8
Tutor intervention - not requested	1	7
Tutor summaries	1	1
Validation	1	1

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Structured conversations

With a small sample (six students) from each project: (sample selection to be representative where possible)

In-depth discussion to explore all themes, but in particular to draw out information that is not usually disclosed online.

Example questions/prompts

- Were there aspects of the way in which the activity was structured that were problematic or could be improved? [*Pedagogic design*]
- Can you tell me how you felt about the assessment task (or tasks) that related to this activity?
  [*Assessment strategies*]
- Overall, how would you describe the experience of working on a group project?
  [*Student engagement, general*]
- Do you think it is important for students to engage in this type of group activity?
  [*Student engagement*].

Analysis

Qualitative thematic analysis of transcripts

Concluding comments

A deeper understanding of team working investigations is important for the development of similar teaching tasks in STEM disciplines.

The findings of the study may feed into the professional practice of staff that are planning, designing or running similar activities.

This study should be of interest to the wider HE community in terms of its analysis of student engagement, and application to employability in an increasingly online world.

> *“Thanks Chris and to everyone else who's been so active this last week getting the wiki finished on time. The final report is just amazing! Incredible to read what we've acheived as a group over the last 10 weeks.”*

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