

E-TUTORIALS IN 3RD YEAR PHYSICS & ASTRONOMY COURSES: PERCEIVED VALUE AND IMPACT ON PERFORMANCE

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1 BACKGROUND

The Open University (OU) offers a distance learning program in Physics and Astronomy, among other subject areas, with a growing on-line teaching component. Individual study is supported by textbooks, multimedia material, and some face-to-face (F2F) tutorials in the course of the study year. Recently electronic tutorials (*eT*) have become a supplementary teaching component. The increasingly dispersed student population, funding pressure and mainly the wish to exploit the potential of widespread internet access have spurred intense activity in on-line delivered tuition. The novelty of the medium and the particular issues raised by the heavy usage of mathematical notation and graphics by *P&A* topics provide the main motivation behind the work presented here.

2 THE ASTRONOMY PILOT E-TUTORIAL

The *Energetic Universe (EU)* is a third level Astronomy course that examines advanced astrophysics topics relying heavily on current research, bringing together different threads of basic Physics and Astronomy knowledge which is rich in mathematics and graphs. It has traditionally been supported by F2F tutorials. E-tuition consists of multimedia material in DVD format. The introduction of an *eT* was intended to gauge reception of the idea and also the impact of attendance on course performance. An *eT* was designed and proposed to the whole class. About a tenth volunteered. The self-selected group of volunteers was split in two (participants and control) to eliminate bias. The *eT* was offered for a week after study block 3 (between the 3rd and 4th assessments), not to directly unfairly advantage those attending compared with the whole class. *eT* took a lateral view across key concepts encountered in different blocks. There was no intention to support the upcoming assessment or the exam. Comments were offered but no answers in order to promote student engagement with and synthesis of the contributions. The final grouping was based on participation: Active (10); Passive (11- 3 quit before end of course); Control (6 -6 quit). Student feedback was solicited via a questionnaire distributed after exam and before the final marks were communicated.

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2.1 Attendance's impact on performance

Perhaps expectedly, there was no significant variation in the assessment (TMA) or exam performance between the different groups. This is demonstrated in Figures 1 and 2. Any impact would have been surprising as the *eT* did not address any assessment topics and could not have resulted from indirect improved general understanding. Accordingly, the analysis of performance per individual exam question shows no effect.

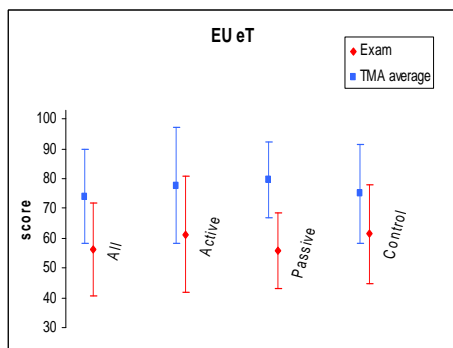


Figure 1 Comparative presentation of TMA and exam results for *eT* subgroups shown along with the whole class. No variation.

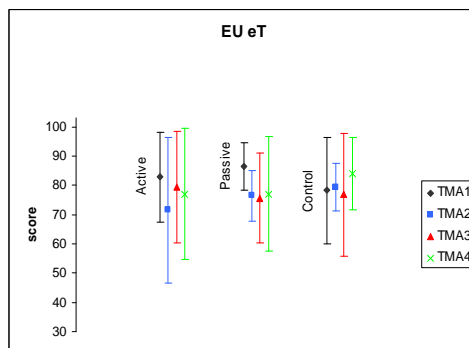


Figure 2 Comparative presentation of individual TMA scores for *eT* subgroups. No variation between groups. No variation in between TMA3 and TMA4 results (time of *eT*).

2.2 Analysis of questionnaire responses

A questionnaire aimed at exploring the student perspective on the *eT* was distributed after the course exam and before the results were communicated to the students. All active participants, along with a passive one, responded (11 in total). Despite our inability to draw any statistically meaningful conclusions from such a small sample size some valuable insight can be gained to inform future choices for *eT*'s.

As the main motivation for expressing interest in taking part in the *eT*, students quote a positive past experience with *eT*'s, the wish to take advantage of all support on offer and curiosity about a new method of support. Most of the responders engaged actively and several downloaded the material with the intention of using it for revision (some did).

They rated favorably the usefulness of an *eT* as a medium. Two would have preferred an extra *F2F* tutorial instead, if given the option, while most were happy with the *eT*. Everyone would sign up for an *eT* in their next Science course and recommend an *EU eT* to a fellow student. Virtually all would favour the introduction of a mixed *F2F/e-T* scheme, but many would like *eT* to be on top of what is currently offered.

Students appreciated the perspective of the unifying approach the *eT* took and found the material useful in revision. They valued the flexibility, extent and

accessibility of an eT , as well as the opportunity of checking answers. Significantly, the eT was viewed as providing equal access in comparison to $F2F$ that are offered locally. Among the negative aspects of the tutorial students quote the low number of active participants, the lack of human contact and the intimidating effect of others' contributions. Some would like more personal attention and encouragement, would prefer short and more focused questions followed with a full wrap-up (possibly complete answers). There was near unanimity on the whole endeavour being too time-consuming.

3 E-TUTORIALS ON ELECTROMAGNETISM

The $E\&M$ course ran a mixed scheme of tutorial support of $F2F$ tutorials, longer versions of these (day schools, DS) and 8 eT 's at a ratio of 2:1:1. Each one of the eT 's ran for a week and was administered by a different tutor. Out of the 381 students initially registered, 38 participated actively to one or more eT . None of the eT aimed at supporting any of the assessment material. Below, we present the attendance in the different forms of tutorial support and examine statistically some of the features of the student participation in eT .

3.1 Attendance

$F2F$ tutorials are offered in specific geographic areas and may require long travel. DS 's are designed to accommodate a larger geographical spread. As a result, the ensample of the 1st and 3rd $F2F$ as well as DS covered roughly three quarters of the student population (the 2nd $F2F$ was offered to only 27% of students), while eT 's imposed no access restrictions, in principle. $F2F$ tutorials tend to be more popular, though their popularity has been matched by that of the 1st eT (Fig. 3).

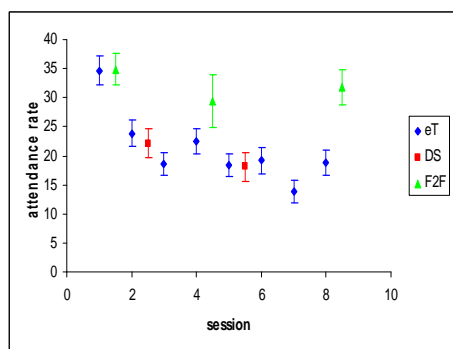


Figure 3 Attendance rates (as percentages) to different modes of tutorial support. See text for definitions. The horizontal axis corresponds to time progression within the course year.

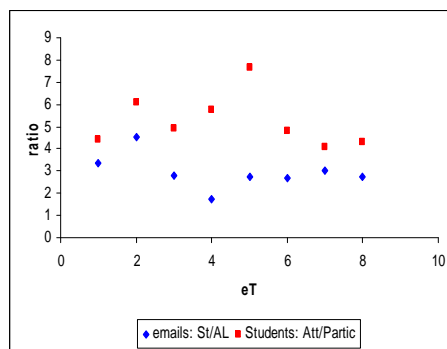


Figure 4 Ratio of postings by student/tutor. Also, ratio of attendees/ students posting.

In an attempt to quantify attendance, we present the ratio of student versus lead tutor (AL) postings, as well as the number of passive attendees for every

contributor in each *eT* (Fig 4). Every tutor email elicits 2-4 student postings on the average, while for every actively participating student there are 4-7 attending. Further, the retention rate (defined here as the ratio between the numbers of students reading the final over the initial tutor email) is weakly anti-correlated with the number of tutor messages (Figure 5). The readership of different types of e-mails is shown in Figure 6. Tutor postings with questions (<TQ>) and answers (<TA>) attachments are the most popular. Tutor comments as well as the closing messages are less read, while significant fellow student emails are read by a good fraction of students.

3.2 Impact on performance

The student population actively involved in *eT* performed better than the general population on the course. Nevertheless, there is no significant impact on assessment scores of students contributing to an *eT* when this is checked against their assessment performance after an *eT* they had not contributed to.

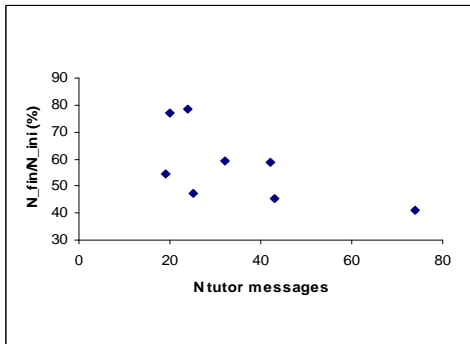


Figure 5 Retention rate defined as the percentage of students reading the final over the initial tutor message as a function of total tutor messages.

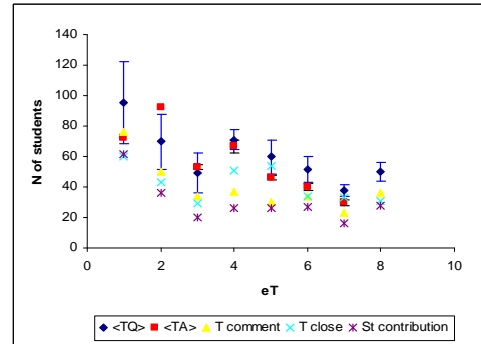


Figure 6 Readership of different types of postings. Tutor questions and posted answers attract most hits; tutor comments or closing email fewer. Student postings are read by good fraction of students.

4 CONCLUSIONS AND FUTURE WORK

As our analysis has shown, it is not possible to identify any impact of attending an *eT* on the scores in either assignment or exam. This should not come as a surprise as no *eT*'s were designed to specifically support either, as is often the case with *F2F* support. This, of course, has an impact on the attractiveness of an *eT* in the first place. Exam revision *eT*s have been offered and proved popular. There has been no analysis, to our knowledge, of *F2F* tutorial attendees' performance.

As the comparative analysis of the different modes of tutorial support on *E&M* has shown, *eT*'s are as popular as *DS* and the initial one attracted a student fraction similar to that of *F2F*'s (Figure 3). This highlights the crucial importance of the first session –though a trend of diminishing attendance in the course of the year is well established [1]. It is quite plausible that not only those students who

contribute benefit from the provision of *eTs*, as is the case for *F2F* sessions too. The fact that there are 4 to 7 times as many students lurking compared to contributors (Figure 4) is therefore encouraging. *F2F* tuition experience suggests that the different ways of attending a session do not preclude reaping the benefits of tutorial support.

It does seem quite hard work to elicit student contributions. The average fraction of student to tutor postings is between 2 and 4 (Figure 4). The amount and quality of content contributions varies widely (here are lumped together one liners along with messages with attachments); still though, students seem to anticipate personalised care.

The number of tutor postings, nevertheless, does not improve “retention”, as shown in Figure 5. Attachments and catchy titles boost readership (Figure 6). Response to a questionnaire distributed to *E&M* students [2] and returned by 21% of active students, indicates as a major reason for non-participation to *eTs* the demand placed on their time. This is corroborated by the questionnaire response of the *EU* students and the preferential focus of study time on compulsory tasks. Further, students found *eTs* less helpful or interesting than *F2F* and *DS* and were met with difficulty when it came to using maths in a predominantly text based environment. On the other hand, the easy accessibility, the wealth of material and variety of delivery methods are attributes of the medium that should be capitalized on.

Profiling of *E&M* contributors [3] points to students in age brackets with fewer personal commitments and higher education educational level. This profiling is now being extended to *eT* attendees too in order to identify the group characteristics and better address their needs with the intention of converting these to contributors.

It is however more important to recognize the features that would make an *eT* a more effective form of student support and in particular address the issues raised by the participants. There are clear issues on the scheduling and scope of an *eT*. Time spent on an *eT* is not explicitly scheduled in the study calendar nor is the purpose of each *eT* necessarily spelled out. It is worth noting that when the students were invited to shape the content and form of an *eT* they refrained from playing a part [3]. As the *EU* questionnaire responses showed, a positive experience with an *eT* favorably predisposes students to attend future ones.

This study suggests that *eT*'s that would be purpose-designed, timed, short and focused (e.g. address skills and run over 2 evenings), widely advertised and provide some replacement for human contact (e.g., a webcam accompanied by figures, images) could have better attendance. Care must be given to encourage timid contributors as well as attendees. This requires a higher time investment on the part of the host tutor. The time spent on the *eT* has to be defined to prevent over-investment in one part of the course which increases the likelihood of poor performance, frustration or simply suppresses any future intentions to attend *eT*'s.

REFERENCES

- [1] Papathanassiou, H 2007 S283 End of Year report, Open University
- [2] Freake, S 2007 internal π CETL report
- [3] Papathanassiou, H and Freake, S 2007 internal π CETL report