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First years enjoying physics? (The Undergraduate Physics Olympics)

Abstract

The Undergraduate Physics Olympics (UPO) was run for the first time in the second semester of the 2005/06 academic year. The aim of the event was to enhance the first year experience by organising teams of freshers to compete for prizes on a set of practical physics challenges. Over the course of an afternoon each team of 4 had to race against the clock to design and build a boat, set up and use their own code, and demonstrate linear acceleration in the park outside. Communication between students was encouraged by awarding points for bonus questions demonstrating good team spirit as they prepared for their first laboratory sessions together. The event also enabled students to be introduced to the departmental laboratories, and to the staff and more senior students in an informal environment, at an early stage in the year.

A full evaluation of the first event was carried out by a final year project student in order to perfect the format for use during a more appropriate time slot during Freshers' Week. The second event in September 2006/07 was also well received, with many of the previous year's participants volunteering to help run the event. Statistical and anecdotal evidence both indicate the UPO is an enhancement of the first year experience, helping to build peer support groups, vital as the first year intake steadily increases.

Background

In the 2005/06 academic year, lecturers and tutors observed that this particular cohort was very focused on results, to the extent that they allowed themselves little time for communication of ideas and reading around the subject. This was compounded by the current design of the first year programme, with little opportunity for teamwork and no laboratory work until the second semester.

I applied for funding from the HEFCE Teaching Quality Enhancement Funding (TQEF) to implement some simple, but immediate intervention. The start of the second semester allowed for available timeslots at a time when students are under less pressure from coursework deadlines and exams, and offered maximum impact potential.

The aim was to design an event which would provide opportunities for first year students to:

- improve communication between students.
- work in a team from early on in the course.
- interact with more senior students and staff members in an informal environment.
- get some practical physics experience early on in the course.
- perform some simple 'fun' experiments.

The Solution

A potential solution already existed in the form of the very successful Physics Olympics, developed in the 1990s by Dr Dominic Dickson as an outreach event in the University of Liverpool and since syndicated around the world. The format of this event is a competition involving teams of 4 completing physics 'challenges' to a time limit with a quiz running in parallel. As this had been tried and tested on A-Level students there was equipment for many possible challenges available at an appropriate level. In addition several senior undergraduates agreed to share their experience of demonstrating and judging this event.

The Undergraduate Physics Olympics

The adaptation of this format for our first year undergraduates was a simple matter, though the time limitation may be obvious from the unoriginal choice of title. During the 3 hour afternoon slot, the students were divided into teams according to whom they associated with in lectures, in order to give them the opportunity to work with new peers.

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They were then expected to complete each of the 4 challenges, the quiz, and some bonus questions before team photos and a prize giving ceremony. The event was hosted in a large laboratory with music of the students' choice played at background level.

The challenges involved simple materials and had to be completed, including judging, within 25 minutes. The students were provided with 1 sheet of A4 paper for information, setting out the task, listing the set of materials, and the judging criteria in the clearest format possible.

Bonus Round

As a bonus round I approached teams randomly, after they had had some time together, and asked them each to name another member of the team. Less than 50% of teams could all name another team member, but asking inspired some good spirits and friendly interaction as teams watched their friends in other teams at a loss.

Prize Giving

The competitive element stimulated a lot of interest and a short prize-giving was held after the final session. This was a very light-hearted affair with a slideshow of photos of the

whole event running in the background. A brief summary of successes and anomalies was given, and the winning team of each event was called forward to draw random prizes (£4-6) from a large box. In the prizes we aimed for variety with only 2 or 3 of each type, so interest was high throughout as each student figured out what their prize was or did. The overall winners, who incidentally had not won any single event, got prizes worth ~£10 each. Finally all involved drew a random memento (£1-2) from another box to reinforce the positive attitudes towards their learning experience.



Figure 1: What frame of boat will support the most marbles?

The Challenges

The most popular challenges:

Make a craft to float as many marbles as possible from any of 2 sheets of light card, 4 sheets of plastic, 8 straws, some tape and staples. The record was ~2kg of marbles!

Given a dozen bricks of wood of different densities (all bricks looked the same) build the longest extension possible from the edge of the table ~0.6m!

The less popular pair:

Lift as many staples into a plastic cup making contact with the staples only with the equipment provided, 2 large nails, a length of wire and 2 AA batteries ~145!

Obtain the period of a lighthouse based in a separate room using only a stopwatch of fixed location in the main laboratory, with no direct line of sight available.

An online shop aptly named 'I Want One Of

Those' (www.iwoot.com) was very helpful: everything was delivered the morning after the order at no extra cost. The prizes were all gadgets with some physics or least scientific aspect. The preferred prizes tended to be suitable for throwing (Frisbees, throwing discs, phlat balls, zylos), or objects that make a noise (the more irritating the better). The lower price range ranged from pocket kites to gummy lenses for camera phones to puzzles to carry around on a keyring.

Evaluation and Improvement

The inaugural UPO was also run as a pilot to a new idea for Freshers' Week for the academic year 2006/07: therefore obtaining student opinion was very important on a somewhat hurriedly organised event. A final year project student in the Science Communication Unit, Mark Twigg, had the task of

independently evaluating the UPO. He employed several methods to find out what the participants in the UPO thought of the event (see note 1).

Qualitative Analysis

He attended the UPO to observe but did not participate. In his conclusions he refers to notes made at the time. "The groups seemed to interact very well with each other and began talking very quickly." "The groups all seemed to be having fun whilst taking part and soon built up a repertoire with the demonstrators as well."

Quantitative Analysis

At a later date structured questionnaires were distributed for quantitative analysis.

Over 92% said 'yes' to the questions:

Was the UPO enjoyable?

Are you comfortable approaching people you met during UPO?

Was it easier to talk to demonstrators & staff?

While the response 'yes' was unanimous to the question: Is it important to be able to work as a team?



Figure 2: The 3 nationalities of Team West make an electromagnet together

The evaluation found that the event achieved its aims, and would be worth running again but during Freshers' Week followed by a social event. There was also substantial anecdotal evidence of improvement throughout the semester (see note 2). Perhaps the best indication of the pilot's success was that more than half the students who had participated presented themselves to help with running the UPO the following Freshers' Week.

UPO Freshers' Week 2006/07

As originally planned the UPO was rolled out full scale for Freshers' Week 2006/07. The format was little altered with only the minor changes suggested by the previous students. The students were treated to a buffet lunch, then teams were

"The students seemed to be quite competitive and all really seemed to want to win each event."

He held some brief discussion groups immediately afterward and found two constantly repeated comments:

"it is difficult to get to know anybody new after the first few weeks of term."

"being able to work in a team is very important."

In the week after the event semi-structured questionnaires were given to the students with a very high response rate. The main questions asked them if they had enjoyed the event and had thought it was well structured. The most common replies included: "Enjoyed challenge/problem solving/meeting new people/fun/competitive/variety/limited-time a good element".

selected at random, though each group was allowed to pick their own team name.

The challenges which had initiated the least amount of teamwork (according to the evaluation) were dropped in favour of an outdoor event requiring students to move a metre stick a set distance (~30m) employing linear acceleration, and developing a code to pass a message successfully using only a drink can.

The quiz was revamped to include many specifically local questions, such as street names outside the Physics Department, incidents from recent news stories about physics and science, and naming the Minister for Science and Technology.

Improvement of small details helped smooth the running of events such as colour coding of paperwork for each section. The prize-giving was held immediately afterwards, which meant some very hard work by the judges to bring everything together, but it also meant that no one knew the winning team until the end. The students then invited the Freshers to an informal social event (i.e. the student bar), and the following day the Physics Society organised a fun social event outdoors. Approximately half way through the first semester all photos were put up on a student notice board, and the students reminisced.

willing to help with the event, but as the challenges are all designed by students, I fear there will be a projectile challenge involved somehow!

In the longer term, if another Physics Department ran a similar type of event, I would consider hosting an event with teams from more than one university, but set a more scientifically rigorous problem for students to work on, to encourage the more adept students.



Figure 3: Group photo after completing 4 events, bonus events and quiz in 3 hours

Discussion & Conclusions

The first UPO attracted ~60 students as it was run over more than one session and those scheduled for the later session had worked out that it was not compulsory. Therefore the students who turned up tended to be the more sociable outgoing students. The Freshers' Week 06/07 event was slightly hampered by a university event scheduled for the same time for some of our students which meant ~40 students participated.

In preparation for the Freshers' Week 2007/08 the new students will receive a brochure containing their schedule for the whole week. The UPO has been allocated 4 hours, and will begin with team selection, some icebreakers, followed by a buffet lunch and the main event, this time expecting ~90 students in one day. Staff are invited to the whole afternoon, though I would particularly like a staff team to enter at least one event. Again I have an over abundance of volunteers

Notes:

1. *Investigation and Evaluation of the Undergraduate Physics Olympics* by M. Twigg. This is a final year thesis by a science communication student.
2. The laboratory sessions containing a majority of students who had participated in the UPO noticeably differed from the other sessions, as students tended to discuss experiments between themselves, approaching demonstrators only with meaning-based questions rather than the usual equipment-based ones. Also the tutorial attendance improved of those who had participated, and in general the year group were more willing to ask questions in large-lecture situations especially of those staff who had been present at the event.