WPIF PROJECT REPORT:

THE SEARCH FOR THE SCIENTIST'S SECRET

HOMERTON COLLEGE
UNIVERSITY OF CAMBRIDGE

Dr Paul Elliott, Admissions Tutor, Homerton College

With the support of the Trust, we have built one of the largest and most exciting educational games in the country. The project is in a constant state of development, but we have delivered the game to around 800 students to date, and have bookings for at least another 400 students before July. We are refining and reviewing the experience with each delivery, and will certainly be able to publish educational papers on the activity next year.

THE ESCAPE GAMES

Dr Elliott spent around six months of his sabbatical building new games and activities using the Newton Trust funding, which has been supplemented by funding from Homerton, together with a donation of medical models from a Homerton alumnus and a considerable quantity of boot-sale acquisitions. Dr Elliott readily concedes that he got "carried away", and that the activity is now far more diverse and exciting than originally envisioned: we now have separate escape "rooms" focusing on Thinking Skills, Biology, Earth Sciences, Mathematical Games, Evolution and Astrophysics (with a Chemistry game nearing completion). Each "room" now has its own distinctive physical element (such as an arcade machine, an anatomical display and a countdown case). The rooms can be used in different combinations for different target groups, and in total there are now over 100 distinct puzzles, each of which is embedded in a range of statues, games, and household objects. The "rooms" are summarised in Appendix 1.

DELIVERY

The activity was delivered to around 800 students at 14 events between June 2023 and March 2024 (see Table 1). The deliveries so far have been in two main forms: a "full" version in the Homerton Mary Allen Auditorium over the Summer, and a "portable version" in schools and other colleges (mainly over the Easter holidays); see Appendix 1. In all cases, students worked in groups of three or four, choosing which puzzles to solve. We have done this activity for age groups from Years 8 to 13 (but not Year 11 because of GCSEs). It was also delivered to students on the STEMSMART program residing at 5 colleges, and on a visit by the Elephant group. We have incorporated it into the PGCE training program, and trialed it with our own WP 1st years. We have some upcoming deliveries scheduled at the start of June, including in Hackney Town Hall (as part of our Homerton for Homerton Programme), and in two London schools. We haven't publicised the activity more widely yet, but hope to do so in June.

EVENT	DATE	STUD
Hom PGCE Teacher Training Day	8th June	29
Homerton Undergraduate trial	11th June	52
Selwyn Biology Summer School	5th July	31
Trinity visiting Elephant Group	12th July	70
Trinity Biological Summer School	15th Aug	59
STEM SMART (CATS, HOM and MU)	21st Aug	66
STEMS SMART (PE and CO)	22nd Aug	49
HOM Sustainability Conference, Yr 12	26th Aug	121
Kings Bridging programme	1st Sep	12
City academy Hackney, Yr 8	19th Mar	62
Cardinal Pole School, Lon, Yr 10	21st Mar	52
Cardinal Pole School, Lon, Yr 12	21st Mar	49
Stoke Newington School, Yr 10	25th Mar	73
Stoke Newington School, Yr 12	25th Mar	61
	TOTAL	786

Table 1. Deliveries to date

FEEDBACK

A summary of feedback from a subset of participants (and some teacher quotes) is found in Appendix 2. You can see that the activity was very well-received; of the students above the age of 14, around 95% agreed that it was fun, over 80% agreed that it was an unusual way of learning, over 70% agreed that they had gained understanding, and over 90% said that they would like to do an activity like this again. Students were slightly less positive about having gained knowledge, but that was never the intention of this activity. In terms of difficulty, around 50% of students above the age of 14 responded in a neutral manner, with the remainder roughly split between saying it was too hard or too easy; this would indicate that the activity is targeted broadly correctly for this group, given a range of ability. In addition, there were clear indications that students did not have enough time for the activity (although they did have 2+hours) and that they really valued working in groups. For 12-13 year-olds, the results were still very positive, but there was a drop in the positive indices by around 10-20% and an increased perception of difficulty and needing more time. Despite this, we are still pleased with the results for this younger age group, especially as there was no real form of academic selection for these students (unlike on most of the other programs that had pre-selected on academic excellence and Widening-Participation criteria).

KEY PEDAGOGICAL INSIGHTS

1. EDUCATIONAL ACTIVITIES CAN BE DESIGNED FOR ALL AGE GROUPS

Escape rooms are well-known for being accessible to a wide range of ages, and the feedback indicates that the same applies to this educational activity. The "adventure game" educational scaffolding and competitive elements seemed to enthuse all ages alike. Adjustments had to be made to direct younger students to the easier puzzles first, but their overall performance was not significantly different to older students, even if slightly slower (results to be published).

2. AVOID DIGITAL ELEMENTS

As part of our bid, we developed a digital platform for monitoring results and getting feedback. However, after a few trials this was abandoned because it ruined the "hands-on" nature of the activity if students needed their phones. More practically, setting up students on wi-fi and accessing the platform was too time-consuming; we reverted to paper guidance and feedback.

3. INVOLVE TEACHERS

We started the project by using a team of undergraduate students to help deliver the activity. However, it soon became clear that this was not necessary; with a few pieces of simple guidance, the teachers/hosts of the students could get involved, and take on this role. We found that giving teachers the answers empowered them, and they would then enthusiastically guide their students through the puzzles (despite the fact that they had only just found out the answers themselves!). Teachers often have to accompany the students anyway, and, as a bonus, this saves a LOT of money.

4. STUDENTS NEED TO SIT DOWN

Typical escape rooms don't typically have seats, and in our early trials, we allowed students to move around a room full of puzzles, often with some guidance as to order. However, they would invariably start sitting on the floor and taking puzzles away. In the trials we solved this issue by initially bringing some puzzles to the students whilst seated at tables, and then allowing a sub-set to go to the displays before returning to their seats later-on.

5. FLEXIBILITY AND AGILITY ARE KEY TO SUCCESS

The activity has been built with a range of difficulties in puzzles, so that students that were struggling could have puzzles allocated to them that they could complete. In particular, the "Thinking Skills" activities were vital, as they can be solved by anyone, irrespective of their age or subject choice. After I wrote the proposal, a television program called the 1% club aired on British television, which describes these types of question as "the ultimate leveller".

6. COMPETITION NEEDS TO BE CAREFULLY MANAGED

The students can be fiercely competitive in these games. For this reason, we never announce a running scoreboard, and every success is rewarded. We have trialed a variety of prizes, ranging from sweets for right answers, to "tickets" that can be traded in for increasingly good prizes. The most successful technique seems to be giving clues to a mystery, where everyone always has a chance of getting the answer, but that chance increases as more puzzles are solved.

7. CONSUMABLE COSTS CAN BE SUBSTANTIAL

A lot of equipment breakages can occur (either by accident or on purpose), which are largely unavoidable, even with good-quality locks. These costs need to be factored into any delivery.

8. BRANDING AND PUBLICITY ARE IMPORTANT

We had a lot of trouble getting school and college "buy-in" to the early stages of this project, as nothing like this has been done before. However, as the activity builds a reputation (and we can show pictures and feedback), we are getting more and more interest. The next phase of the project will be reliant on publicity. We hope that the Trust will support us in this next phase, but even if not, we must thank the Trust for enabling us to think "big" and start our own adventure.

FINANCES

As the project developed, a lot more money was spent on equipment and printing than was originally envisioned, even though we built most rooms "from scratch" to generate novelty. Any surplus costs (£1601.75) have been covered by Homerton. It is also worth noting that budget did not include the costs of any rooms that were donated by either Homerton or other venues, or any transport. In addition to this budget, Homerton paid for coaches to bring students to the STEMSMART events, and also donated the college van for transport it to schools (the entire activity fits into 10 large suitcases). The staffing costs equated to those allocated, but it should be noted that cut costs, most event deliveries were conducted by Dr Elliott; we had not budgeted for costs of student transport and expenses.

APPENDIX 1: THE ESCAPE GAMES

1. Types of Delivery

The “Full” Escape Game at Homerton College in Summer 2023

The “Portable” Escape Game at Cardinal Pole School in Spring 2024

1.A. THE THINKING SKILLS ROOM

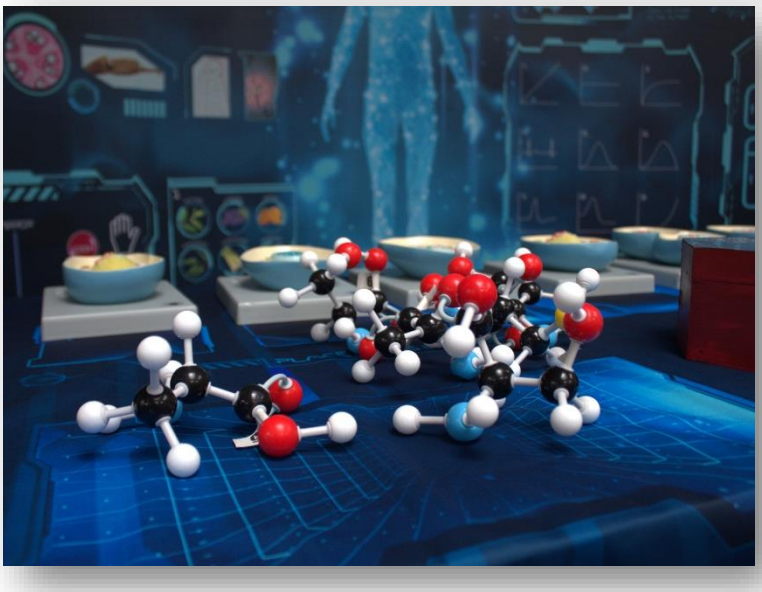
The Thinking Skills room contains puzzles that test student's abilities in general thinking skills from a number of different perspectives. It is the room that requires the least scientific knowledge, and so the puzzles are particularly useful for children and for adults (who may have forgotten their GCSE science).

Students will tackle puzzles on perception, algebra, code-breaking, ratios, number patterns, deductive reasoning, Boolean logic, lateral thinking, paradoxes, geometric thinking and spatial reasoning.

The puzzles are all housed in every-day objects ranging from telephones to walking-sticks to artificial wine-bottles (no wine included). This room is the most discipline-free and is used in all runs of the escape game, hence why it now contains around 30 puzzles.

1.B. THE BIOLOGY ROOM

The Biology room is the most complex room, and is packed with anatomical models and equipment to investigate. The questions have been designed based upon interview questions that Dr Paul Elliott has used over the last 15 years, and they require students to apply their understanding of biology to new questions and situations. This room requires a degree of GCSE knowledge, which makes it the most reflective of science interviews, but this limits it's use a little.



1.C. THE GEOLOGY ROOM

The Geology room is one of the most difficult rooms, but also the most-hands-on. Students are confronted by a range of crystals and fossils, and must solve problems relating to these using the info-graphics on the backdrop to guide them. This activity requires student to assimilate information and apply it to new situations. The activity can be run in the Sedgwick Museum as the infographics contain the same information as some of the museum exhibits.

1.D. THE MATHEMATICAL GAMES ROOM

The Maths games room contains a series of fiendish mathematical puzzles hidden inside popular games such as Connect-4, Chess, Roulette, Jigsaws, Yahtzee, Sodoku, Scrabble and even a full-size adapted arcade machine!

These puzzles are largely based on Cambridge interview questions, and they require skills in pattern- spotting, logic, estimation, and number manipulation. Six of the puzzles have been adapted from actual Cambridge interview questions, making this the most deceptively hard room.

After solving each puzzle, students are rewarded with coins which they can put into the arcade machine, causing it to open and reveal a hidden compartment.

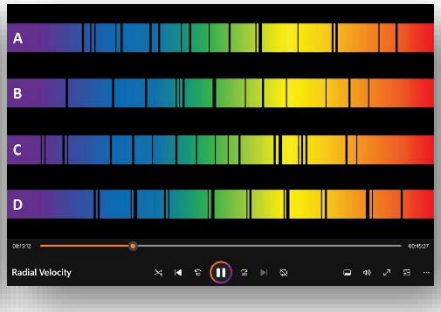
1.E. THE EVOLUTION ROOM

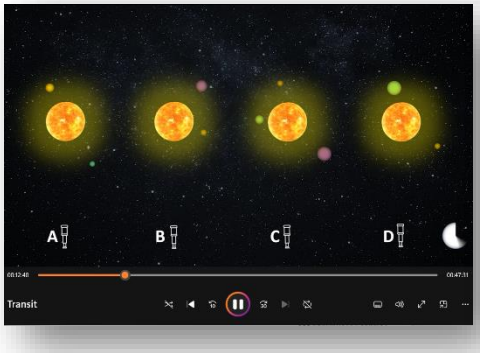
The Evolution room features a range of animal statues, each of which has coded lock-box attached. From a series of clues on the table, students must identify the correct statue and then find an associated animal (and it's code) on the tablecloth beneath. This requires an ability to synthesise different sources of information.

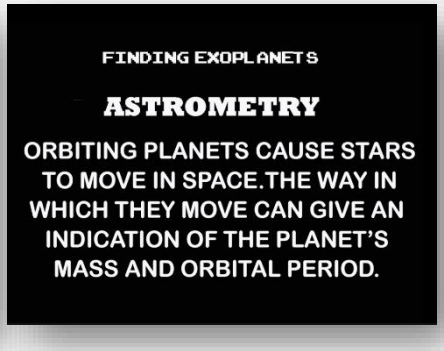
The questions are all based upon the book "A Zoologists guide to the Galaxy" by Dr Erik Kirshenbaum who kindly helped in the development of this activity. In answering the questions, students will gain an understanding of some of the key characteristics that we may find in "animal" life on other planets.

This activity can also be run in the Museum of Zoology (the tablecloth numbers are the same as museum exhibits), or in school gardens (the statues can be hidden outside).

1.F. THE EXOPLANET ROOM







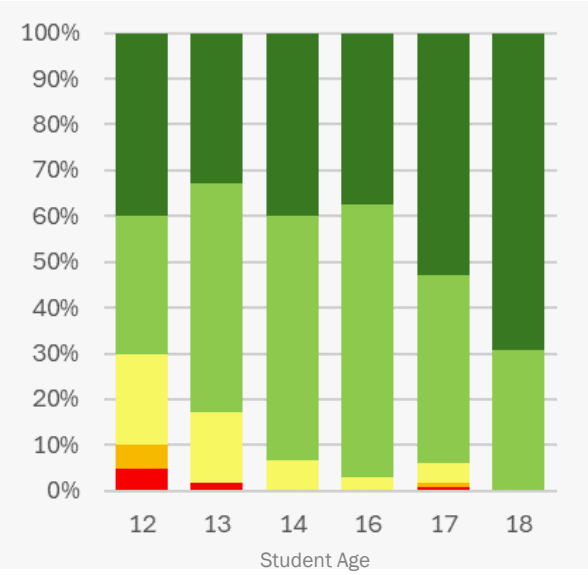
The Exoplanet room contains a number of fiendish puzzles based upon Earth's scientific search for exoplanets. Students will learn about Astrometry, Radial Velocity, The Transit Method, Doppler shift, Gravity Lensing, and Atmospheric Analysis of distant planets, before answering some applied questions about these physical processes.

The game contains 5x LCD screens housed within a "Research station" (a tent). They must solve problems under time-pressure to diffuse a countdown clock.

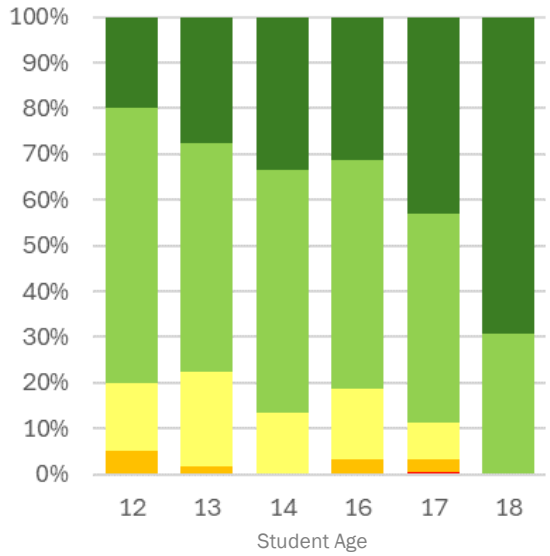
Note: This was the last game room to be completed, and so there are limited pictures of it "in action"

APPENDIX 2: STUDENT FEEDBACK

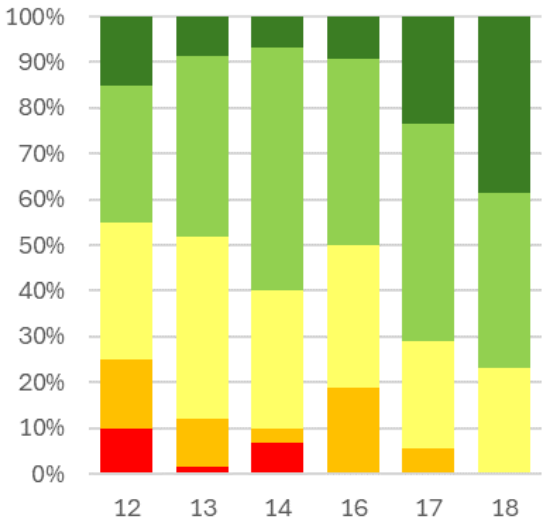
The feedback presented below comes from 371 individuals who participated in the escape game activity. This data *does not* include those groups for which feedback was trialed online, or some of our later groups, for which we are still awaiting the results. This feedback was collected through anonymous paper surveys, and students were asked 8 questions, The results are presented as percentages who agree or disagree with certain statements, sorted by age.



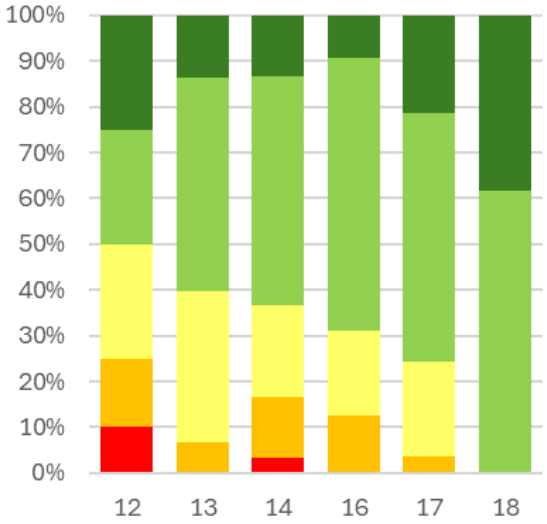
A. "I ENJOYED THIS ACTIVITY"



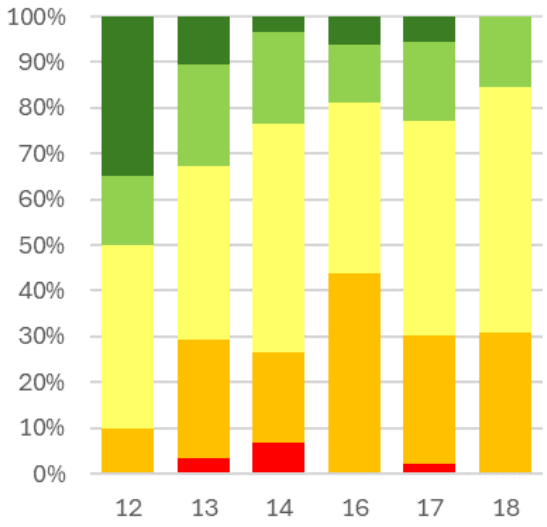
B. "THE ACTIVITY WAS AN UNUSUAL WAY OF LEARNING"



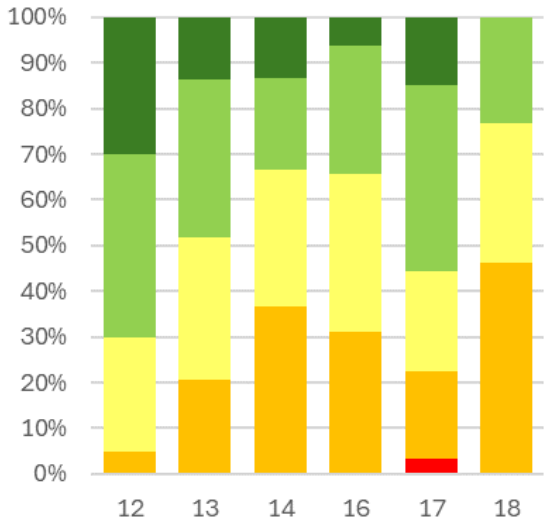
C. "I GAINED KNOWLEDGE"



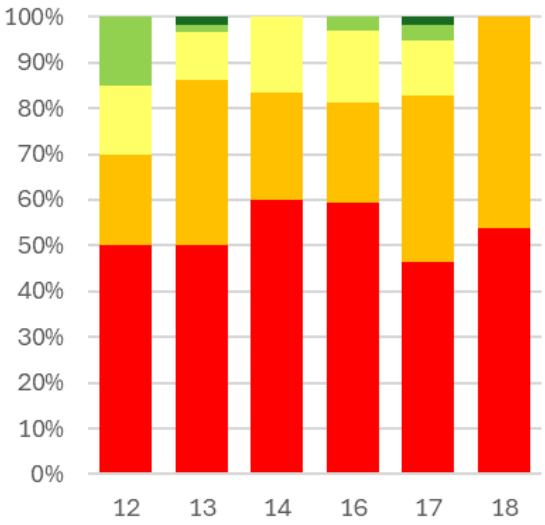
D. "I GAINED UNDERSTANDING"



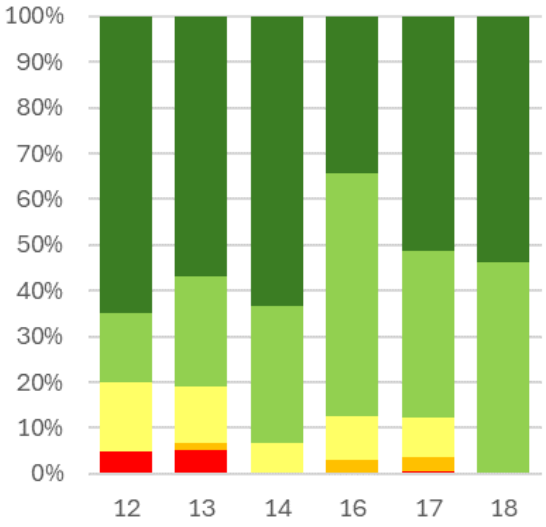
E. "THE PUZZLES WERE TOO DIFFICULT"



F. "WE NEEDED MORE TIME"



G. "I WOULD HAVE PREFERRED TO DO THIS ON MY OWN"



H. "I WOULD LIKE TO DO AN ACTIVITY LIKE THIS AGAIN"

APPENDIX 2: TEACHER FEEDBACK

"I just wanted to express my heartfelt gratitude for organising the escape room event for our students. It was an incredible experience that allowed students to bond, solve puzzles, and have a great time together. Your efforts in creating an inclusive and supportive learning environment are truly commendable."

Leefiya Begum, Deputy head of Sixth form
Stoke Newington School, Hackney

"I really enjoyed it as well, very impressive to be able to provide such a large, visually engaging and well thought out activity on the road! Feedback from students that I've spoken to has been overwhelmingly positive, and it would be great to have you back again (or come to you) in the future."

Tom Read, Head of Sixth Form
Cardinal Pole School, Hackney

"Enabling high achieving students to be self-paced means they can impress themselves; some work pretty fast but are kept busy. In a large group they support each other and think aloud. It is self-directed, discussive, and although they'll likely never do the same thing if studying a Cambridge, the skills involved represent learning here in a completely unique way."

Amber Silk, Outreach Coordinator
Trinity College, Cambridge

"The Escape Room was a fantastic part of our participants' STEM SMART residential experience this year. On one level, if offered an extremely well put-together social activity that made their first evening together welcoming and enjoyable. At the same time, what Paul delivered was also a broad range of activities that encouraged problem solving and thinking skills, and gave a very accessible insight into interview questions and topics – all of which were valuable to young people considering STEM subjects at Cambridge. I hope, very much, that we will be able to send more groups to benefit from this resource again in future."

Matt Diston, Head of Access and Recruitment
Murray Edwards College, Cambridge

"I HAVE NEVER SEEN YEAR 8'S WORK SO HARD FOR THIS LONG"

Physics Teacher, Anon