# Space Confidential

## Planetarium Show Production in the Hands of High School Students

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At the end of June 2008, Eve Reed and Louise Payne, two fourteen and fifteen year-old students from the South of England were flown to Chicago to present their own ten-minute planetarium presentation the IPS conference delegates at the Adler Planetarium. The girls were winners of a Global Immersion competition that had lasted more than three-months and had produced a fulldome show in hope of presenting their work at the conference Ð every aspect of the show; the script, the flight, the content and the concept was entirely their work.

### The Concept

The Space Confidential project concept originated in October 2007. It was during the Triple Conjunction conference in Wheeling, West Virginia, that informal discussions about the state-of-the-art of three seemingly disconnected fields led us to explore what might happen at the intersection of: (1) discoveries of extrasolar planets, (2) planetarium show production capabilities and potential of planetarium software in immersive settings, and (3) the science education revolution that gives students an active role in their learning experiences. What would it look like to combine the newest results, technology, software and techniques from each of these areas?

What if a group of people were brought together to look at the following points from both academic and commercial perspectives?

- Has such a project process aided understanding and awareness of the given topic?
- Is there any evidence to suggest that interactive modeling and immersive environments can (and have) facilitated a learning process?
- Is there really any scope to allow for audience involvement, control and manipulation of fulldome media?

The idea quickly evolved into a more detailed project proposal, with many questions being raised. What we report on here is the result of bringing together fulldome, science education insights, a compelling but unresolved science question, a competition, planetarium software, and a group of youngsters that had no experience in designing, storyboarding or recording a real-time spaceflight presentation.

### The Science Rationale:

*How common are planetary systems "like our own" around Sun-like stars in our galaxy?*

The answer to this question depends on what is meant by "like our own." Our Solar System has two gas giant planets, two "ice giants", several terrestrial planets, as well as two "rubble piles" of failed planets all surrounded by a cold cloud of comets. We are just starting to take the Galactic census of each of these types of objects.

There are now over 300 exoplanets known (http://exoplanet.eu/) spanning a range of masses from close to the mass of Earth, to larger than Jupiter. Dusty debris, from colliding rocks and similar to dust generated in our own warm asteroid and cold Kuiper Belt may be very common, while gas-giants like Jupiter and Saturn appear around only 10-15 % of stars like the Sun. Astronomers announced this month that "super-Earths" (planets a few times the mass of Earth) could be as common as to surround 30 % of Sun-like stars. The next step will be to understand which of these attributes is important in creating an environment suitable for life, and how common habitable planets might be in our Galaxy.

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## The Commercial Rationale:

The twelve to nineteen year old demographic within the Planetarium sector is typically difficult to tap into. Government education requirements are more demanding than ever, and youngsters are expecting more from their visitor experiences. The sharp rise of the "iPod® and Xbox®" culture has raised the bar for technology – kids now expect high-resolution, loud, fast and extravagant entertainment on a regular basis.

The industry is responding to this with ever more innovative ways of communicating science. Yet it appears that content being produced and distributed in the marketplace is unappealing to this mass population segment. To make domes sustainable, we need to produce fulldome movies that entice audiences of all ages – making sure that they leave with a memorable and moving message, one of educational value that also has a tangible, emotional effect on the individual.

## The Team

The people involved in this project represent a wide range of expertise, interests and goals:

### Science Education

- Jane Braisher (Curriculum Projects Coordinator at Cams Hill School) Jane offered several hours of practical coaching and mentorship, supporting the students involved in the competition throughout the series of extra-curricular workshops and meetings.
- Matthew Newberry (Joint Director of the Cams Hill Science Consortium - a partnership involving teachers at thirty-three schools across the South of England conducting action research into Science Education for children age 4 to 19) Matthew has a strong background in and passion for science, education and new (and especially interactive) learning tools which initiated his involvement and that of the Cams Hill School students in this project.
- Professor John Gilbert (Prof Emeritus of Science Education at the University of Reading, England) A Joint Director of the Cams Hill Science Consortium.
- Audra Baleisis (Science Education Specialist, Flandrau Science Center) Audra has experience designing planetarium experiences that take advantage of the revolution in science education techniques and research about how people learn.
- INTECH Science Centre and Planetarium. The INTECH charity is based in the South of England. Set-up to encourage and promote science, math and engineering among young people, the organization has a specific interest in using their facility to further educate and enlighten young people in the field of science and astronomy. INTECH is also home to the UK's newest and largest digital Planetarium.

### Immersive theater industry

- Global Immersion. With more than ten years experience in the field of fulldome and immersive technology integration, Global Immersion has a particular interest in audience demands, thoughts and opinions. The team also has a long-term goal of exploring innovative ways to communicate science education and to build a network of educational partners - this was one of the key initiation factors of the project concept.

### Exo-planet Research

- Dr. Michael Meyer (Astronomy Professor, University of Arizona) Dr. Meyer has extensive research experience in star and planet formation, and infrared studies of planetary debris disks around other stars.

## The Process:

### Student participant profile:

Our target group was the entire school year of two hundred and ten (14/15 year old) students from Cams Hill School in Fareham, England. Older and younger students would be sitting external exams at the time of the competition final and there was a concern over commitment and workload.

After introducing the competition to the various Science Clubs and targeting the individual Science classes during lesson times, surprisingly, just twenty-one students volunteered to take part in the project. The group of students were what the UK schooling system refers to as "GAT's" – Gifted, Able and Talented. GAT are typically characterized as self-starters, quick to learn, intuitive and able to work to deadlines. Those students who chose not to participate gave a number of reasons including practical reasons such as being involved in another school event running at the same time, or a lack of confidence in their own abilities, typically referring to their ability to present to a large audience at an International Conference should they win the first prize.

## The Brief

The brief instructed students to pair up and produce a ten-minute presentation using Uniview™, seeking to answer the question posed above (about the frequency of planetary systems "like our own") by Dr. Meyer. Students had to produce a "learning diary" that documented their process of show research and production. Two months after project launch, each of the pairs would give their presentations to an audience of friends, family and staff at the INTECH Planetarium in the competition finals. The winning pair would be flown to Chicago for an all-expenses paid trip and would give their presentation to an audience in the Adler Planetarium for the IPS conference.

Conditions of entry included:
- Any/all scientific content had to be self-taught
- Compulsory, regular entries in 'learning diaries'
- A minimum of two hours per week (outside of school hours) committed to the project
- A valid passport!

The project launch involved a 'hands-on' software session for the students and oversaw the installation of a site-wide license of Uniview (from SCISS AB of Sweden). Following a demonstration of the features and tools of the software, students were expectedly eager to learn the visualization platform interface – although they were provided with user manuals and instructions, the level of tuition required was minimal.

## Facilitating the Creation Process

Initially the students were confused about how to 'best' approach to the task. The competition brief was specifically designed to be very open-ended and to challenge the GAT students to be creative. As traditional school based projects/challenges tend to be much more structured with directives for presentation, we suspect that some of the students felt uncomfortable with the concept that there was no simple correct approach, or even a series of answers for the tasks that had been set. In giving students free reign with their presentations they were left to think, research, learn and structure without third party assistance, something that most had never been required to do before.

To initiate planning and the creative process, students were asked to consider:

- How are 'common' and 'rare' defined?
- What exactly is our 'planetary system'?
- What are extrasolar planet discovery trends from the past decade?
- Who is your audience?
- Should you be storyboarding before you begin your flight?
- A good presentation does not necessarily mean listing the facts – sometimes it is best to focus on just one idea or theory

The students received regular tuition/support in the form of after-school workshops. The challenges offered by this Space Confidential Competition required the students to have a far greater understanding of astronomy than that which they were learning from their GCSE courses at this stage. Jane Braisher and Matthew Newberry

worked not only to facilitate the students gaining access to materials, (to enhance and develop their knowledge and understanding) but also to coach and support their IT, presentation and public speaking skills. This allowed pairs to practice and produce presentations in Uniview, and also to quiz representatives from Global Immersion on the format of the competition.

### Drawing the competition to a close

The Space Confidential final was held on May 15th 2008 at INTECH Planetarium, with the six student teams. The grading criteria for the presentations fell into four categories: (1) creativity (2) accuracy and scope of scientific content (3) originality of concept, and (4) presentation skills. Presentations were not assessed on the level of competency (or features used) with Uniview.

The winning pair was selected based upon the accuracy and standard of the presentation content as well as the level of creativity of both the show, and their supporting material (which wasn't even a pre-requisite of the project!). Winning students Eve Reed and Louise Payne produced a number of supporting presentations including a scrapbook, a presentation board, a 'Bebo' Planetarium page and a lengthy Learning Diary – copies of all of this material, in addition to the other students documentation can be found on the Space Confidential section of the Global Immersion website.

### The Big Presentation Day: IPS, Adler Planetarium, Chicago

Somewhat jetlagged, Eve and Louise gave their ten-minute presentation to three audiences in the Adler Planetarium on Sunday 30th June. Surprisingly enough, neither girls experienced any nerves (quite a shock in comparison to their sleepless nights around the time of the competition finals!). Their show was a huge success – albeit an experimental study, the process demonstrated that it was more than possible to provide the tools and means to younger generations, and finish with a show that would not necessarily be worthy for sale or distribution, but would undoubtedly provide the show's producers, the students, with an invaluable interactive learning experience.

### Findings & Conclusions

The student pairs approached their task in a number of different ways. Some groups chose to play with Uniview for weeks, record a flight, and then write a script. Other groups chose to spend hours researching the people involved, the IPS conference and astronomy, then storyboard and brainstorm to produce a dramatic presentation. One commonality of the students' experiences seemed to be the choice to work with a partner who was a long-time friend, with whom they felt comfortable.

We encountered a number of hurdles during the course of the project:

- Nerves – Five pairs of students withdrew themselves from the competition before the final had taken place. This resulted in the cancellation of the semi-final, and all remaining six pairs being put through to the final.
- Commitment issues – It is common for GAT students to have many demands on their time and to be involved in a variety of extra curricular clubs and activities. As such, the students had a number of other commitments which conflicted with some of the workshops. This resulted in some students obtaining more practice and support than others.
- Although the learning diaries provided insight into some groups' creation process (as may have been expected with students of this age group) not all participants kept regular entries, choosing instead to fill them in at the end of the two months. This prevented the learning diary from being a full and comprehensive record of their progress. Another potentially fruitful approach to gauge learning progress was to ask students to write down their thoughts about the science question they were posed. When the winning team did this (without using any newly learned vocabulary) after the competition, their answers

demonstrated the ability to build an argument to explain whether they believed Earth-like planets were common or rare. Having the participants do this before the project began would have allowed us a comparison between their reasoning on this topic pre- and post-project
- The students were competitive and looked for ways to earn bonus points toward winning. They had difficulty comprehending that there was no right or wrong way to complete the task. We believe this reflects back to the learning processes that they have been used to for so long.
- None of the students had ever visited a planetarium. We realized however, that this was not necessarily a bad thing – there were no external influences or childhood memories affecting their choice of flight path, their script, the sound or the manner in which they approached the task.

Our questions for this project were: (1) whether the student-designed planetarium presentation process aided understanding and awareness of the given topic, (2) what evidence we could gather to suggest to support this, and (3) was it feasible for teenagers to learn about the given subject during the process and produce a fulldome planetarium presentation that would inspire other teenagers?

As with the science question we posed to the students, answering these questions will require us to first define our terms more specifically. How do we define learning? What is evidence for learning? What unanticipated but valuable experiences did students have? This exploratory project allowed us to better understand these fundamental questions so that we can design future projects to address the larger questions.

The exciting advances in our search for other worlds around other stars provide a perfect subject to engage students in learning not just about science results, but about the process of science itself. As planetarium content developers and teachers know, there is no better way to learn something than when you must teach it to others.

This project has opened the door to a whole wealth of opportunities. Whilst striking up a modernistic and enthusiastic relationship with a number of educational establishments (schools and consortiums), a great deal of valuable information on the content production process has been obtained.

Eve and Louise gave their Space Confidential planetarium presentation in their newly renovated school hall in October this year – there was no dome, just a five-foot projection screen and an audience of 260 family, friends and teachers. The show was just as effective as with the audience of the Adler Planetarium four months previously – demonstrating that with the right tools and skill-sets, projects such as this can be initiated and completed successfully; leading on to a wealth of new ideas and concepts…

"*Much education today is monumentally ineffective. All too often we are giving young people cut flowers when we should be teaching them to grow their own plants*"
John W. Gardner