

GRAVITY

Southern Tour

PROJECT EVALUATION

Digital Learning Foundation

title :

Space 3D Explorer
GRAVITY 3D Show & Workshops
The Southern Tour

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The Project



Evaluation of the original PPARC/STFC funded pilot project was very positive. But, it was our first show for a secondary school audience and we weren't entirely happy with the level of audience interaction. Through group discussion, as part of the evaluation, we also discovered that pupils have a number of misconceptions about gravity and the way that it works. We felt that both of these matters needed to be dealt with before further use of the show.

With a primary school audience, you can ask a question and depend on getting a number of replies, we found this doesn't happen consistently in the secondary school. So, to address this problem we decided to integrate the use of a simple voting system into the show. This was not a simple matter, as it resulted in a complete restructuring and redevelopment of the show to allow the inclusion of the question sections. However, this rethink also allowed us to address the most prevalent misconception about gravity... that it is no longer present once you leave the surface of a planet. If you ask, "why do astronauts float about on the International Space Station?" Usually, more than 80% will say, it is because there is no gravity. Although some material from the original show does remain, most is new. But it was worth it, the resulting show, has a more logical progression through use of a series of simple virtual experiments that explain the basics of Newton's Theory of Gravitation. The show also covers gravity's role in the life of stars and the formation of the universe.

These changes in the 3D show naturally had an impact on the supporting workshops and these were also redesigned to be better integrated with the "Gravity" theme.

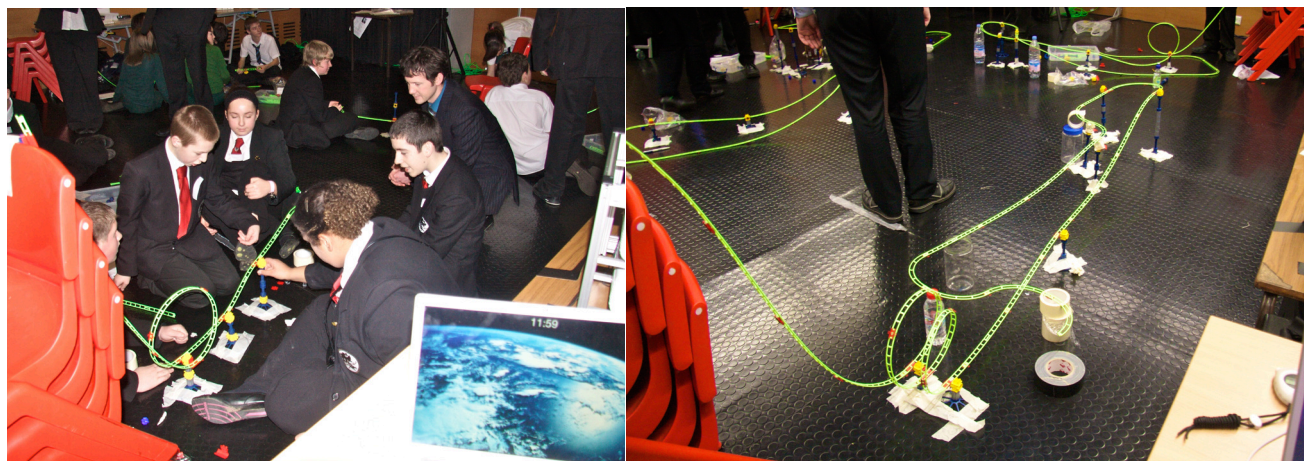
Gravity 3D Show

Gravity, is a travelling school show that is presented using Stereoscopic Projection, to create a memorable immersive 3D experience, that brings the "Wow" factor into the classroom to promote learning and understanding.

During the development of this show, we discovered that there are common misconceptions about gravity and the way it works. This 3D show tackles them through a series of virtual experiments, that explain the basics of Newton's theory of Gravitation, why satellites orbit the earth, why astronauts float about on the International Space Station and much, much more. Then we explore the formation of the universe and the part that Gravity, Dark Matter and Dark Energy have played. The Final part of the show looks at the Life and Death of Stars. Including, what will happen to our Sun and what happens if you fall into a black hole.

A voting system is used throughout the show to pose questions and capture responses.

Gravity Challenge Workshops



This full day event, is a science based digital media challenge, that includes a series of hands-on activities.

Working as teams of 4 or 5 students, they start with some simple experiments that help in understanding gravity and motion. Then, they try and build the fastest or most inventive roller coaster possible with the kit provided. During these activities, they are also using the DV camera as a timing and analysis tool to capture and playback slowly, to help understand what is actually happening. For many of the activities, they are asked to predict what they think will happen, compare this to what actually happened and then interpret their results.

In the Movie Challenge, they create movies to explain what they have learned, using the footage they have already captured along with new footage, voice over, titling, effects etc; The final movies are then introduced by each of the teams and shown in Final Presentation.

You will find more detailed information in the Challenge Workbook that can be downloaded here :

<http://dlfresources.pbwiki.com/Gravity-Workshops>

Numbers

The revised Gravity 3D show has now reached an audience of over 5,500 students, with around 1,200 students and staff taking part in the Gravity Southern Tour.

Pilot

The workshops were piloted during September in Lawthorn Primary School, Irvine, with P7 pupils and as a result North Ayrshire has now booked 16 days of the Gravity Challenge to be held in Ardrossan Academy and its cluster of 5 primary schools during June of this year. It is intended then to provide the challenge to all North Ayrshire schools next year.

The Southern Tour

To ensure the availability of DV cameras, computing facilities and support staff, City Learning Centres were targeted as potential venues and we had a very good response from our initial approach. However, the space requirements and the fact that it was a week long event proved difficult for some centres to accommodate within the timescale. In the end, four of the six weeks were either hosted or supported by a CLC. Of the remaining weeks, one was at Durham University and the other was split over two locations in North Wales, Ysgol y Moelwyn, Blaenau Ffestiniog and TechniumCast, Bangor University.

20 - 24 Oct 08 : Leeds West CLC

15 - 19 Dec 08 : University of Durham

12 - 16 Jan 09 : St Helens CLC/

26 -30 Jan 09 : Rawmarsh CLC / Magna

9 - 13 Feb 09 : Ysgol y Moelwyn, Blaenau Ffestiniog and TechniumCast, Bangor University, North Wales

23 - 27 Feb 09 : North Nottingham eLC

Travel, setup and staff training on the Monday, followed by four days of shows and workshops.

Evaluation

Three methods of evaluation were used during the project. The voting system results, evaluation forms filled out at the end of the event and discussion with both students and teachers.



Voting System

The voting pad used is very simple and robust as it has no screen, just raised buttons that can be used successfully in the dark environment of the 3D show. The benefits of the voting are very clear when it is use, the sound of the students "yes" when they get answers right and the moans when they get them wrong, are a good indication of the level of students involvement. Through the show we employ different types of questions:

- To raise awareness.
- Where we expect to get a wrong answer - because of a common misconception.
- To assess prior knowledge.

- d) To assess what has been learned.
- e) Evaluation of the experience.

It has been found that it is best to limit the number of choices to either 3 or 4.

The accuracy of the "did you enjoy the show" evaluation question, was raised by a few students making comments like "I voted the show as bad just for fun, I actually really enjoyed it." And " You shouldn't have four choices because 4) Bad, is below 1) Excellent and I pressed 4 by mistake!" It would be worthwhile at some point to carry out a comparative study of voting pads and evaluation forms to assess how the results differ.

Evaluation Sheets

In a departure from our normal mainly multi-choice evaluation sheets, we decided to have a number of questions that allowed individual comment. This enabled the responses captured to be more personal, but did make it a little more difficult to quantify the results. As usual, conferring between group members can result in copy-cat responses.

Each venue had its own particular challenges, for instance, lack of proper blackout, too small, too large without adequate heating, or unreliable computers/cameras are just some of the issues. In most cases, we were able to address these issues on the Monday during setup and training. But, the venue with lack of adequate heating and unreliable equipment, was more difficult to sort within the time and budget and therefore a few negative comments appear in the evaluation forms. However, even with these issues, the vast majority of pupils at this venue still enjoyed the event and gave it an Excellent or Good on the form.

Another issue was available time, and as it was dependant on the transport bringing the pupils, this could vary from day to day. The nature of the event did give a little flexibility, but often the result was that the media challenge was given less time than it really deserved and again this does feature as a comment on a few evaluation forms.

Due to time constraints it was not always possible to have evaluation forms filled out and for this reason, none were used for the first week in Leeds.

Further Information.

The workbooks and information to replicate the experiments and the roller coaster challenge are available on our wiki here :

<http://dlfresources.pbwiki.com/Gravity-Workshops>

You can also find additional photographs of the events here :

<http://tiny.cc/DKxEh>

or <http://gallery.me.com/phil.lavery#100114&bgscolor=black&view=carouseljs&sel=0>

Conclusion.

Discussion with both students and teachers confirmed that the basic concept of the event was correct. In fact a number of the schools and CLC's are now considering adopting parts if not all of the Gravity Challenge for continued use. As mentioned above we have also been booked for a further 16 days of events by North Ayrshire.

As always, there are a number of minor things that one would want to change, and the main one, would be the development of a digital workbook that could work on multi-media enabled mobile device like the iPod Touch or laptop, as this would allow supporting multimedia to be presented, and embed the "just in time" learning approach of other parts of the event.

In conclusion, I believe the event was a great success and am hopeful that it will continue to be developed and presented over the coming years.

Phil Lavery. 30 March 09



Some Comments

Pupils: What did you like best and why?

I enjoyed building the roller coaster because it gave everyone a chance to get involved and share thoughts and ideas.

O.H, St Augustine High.

Making the rollercoaster - different to science that I've done.

A.J, Brinsworth,

The rollercoaster challenge because it made us think and it was fun to work out the best way of doing things.

J.C, De Lasalle

Rollercoaster – It was really fun and I was very excited when ours worked

L.E, Maltby Comp,

Rollercoaster because it was fun and it brought us closer together working as a team

A.S, Fernwood,

Rollercoaster because it was fun and good. And you learnt more stuff because it is interactive

N.H, Maltby Community School,

I liked the 3D gravity show because it was very realistic and interesting

A.T, St Augustines

The 3D show - it was something different and I learnt lots of new stuff

J.H, Rawmarsh Comp,

Pupils: List some of the things you have learned today.

I have learnt how to edit films on iMovie and I have learnt a lot about space dwarfs, stars, gravity and space.

A.T, St Augustines

Gravity can be found in space, stars are made of hot gas.

A.S, Fernwood,

That white dwarfs are dead stars, if you go into a black hole you get spagettified, and heavy and light things fall at the same speed.

L.E, Maltby Comp,

How to work with people that I don't usually talk to

N.H, Maltby Community School

Staff: General

The level of independent learning going on was tremendous
A.N. Newton le Willons

Staff : What did you like best and why?

3D show – visual impact of movement and interactive questioning
M.Y.G, Newton le Willons

I really enjoyed the 3D show as it was informative but most importantly interactive so it gave regular feedback to pupils
E.F, St Helens

Experiments, as they were short and pupils had to think
D.J.D, St Cuthberts

Rollercoaster allowed development of students ideas and discussion.
A.M, Sutton High

Rollercoaster building made the children think & work out problems themselves
C.L, De Lasalle,

The team aspect, especially the rollercoaster challenge – engaging, enjoyable & got the teams thinking & communicating
A.N, Brinsworth

Evaluation Report

Dr Moyra Campbell



Feedback from pupils participating in the program was collected during the 3D show by individual hand held voting pads and also at the end of the event by questionnaires.

Voting Pads

All of the pupils in the audience for the 3D show were given a voting pad. The voting aimed for a number of objectives:

- To keep pupils engaged in the show
- To point out common misconceptions
- To assess what they knew and what they had learnt
- To evaluate the experience

The responses were captured digitally, collated and analysed. A total of 987 responses were collected.

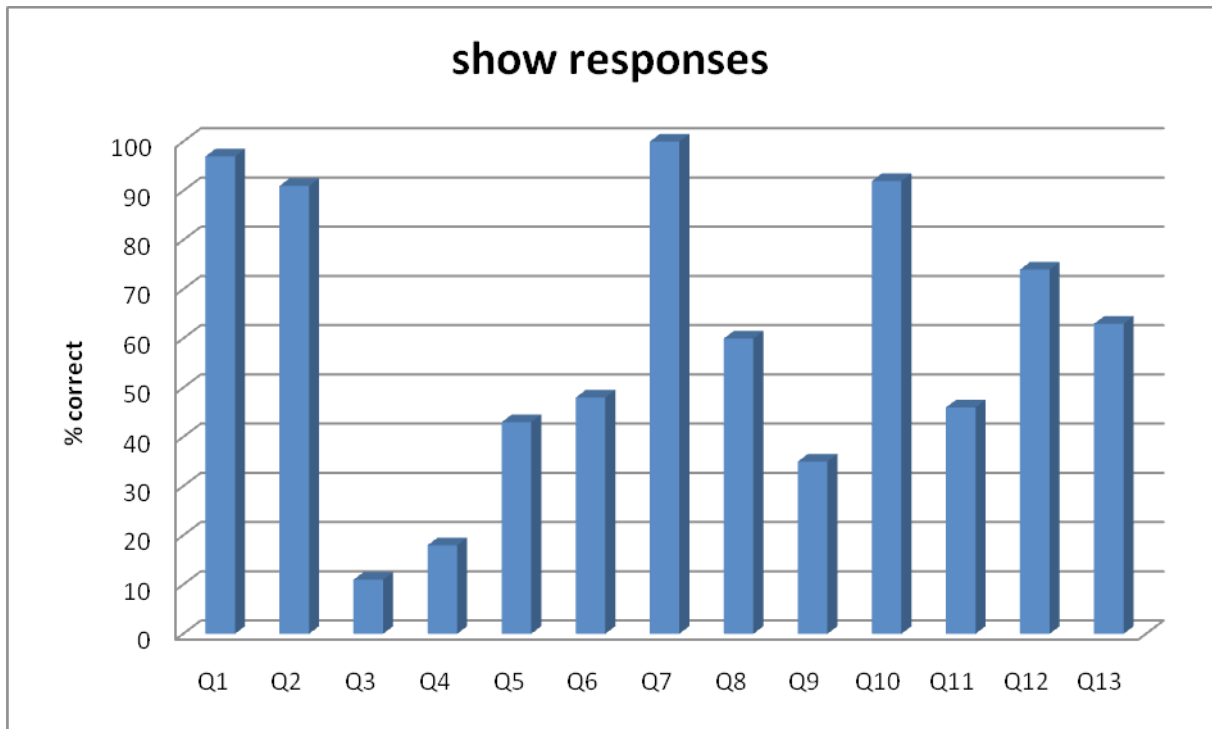


Figure 1. The correct responses are expressed as a percentage of the total votes for that question. A list of all the questions and possible answers can be found in the supplements.

Learning Outcomes

Q11 -13 assess what pupils had learnt during the day. Q11 asks about the fate of the sun which 46% answer correctly while 63 % had learned that Eistein had found gravity to be equivalent to acceleration. Of particular note are the learning outcomes related to gravity above the earth's surface. Nearly everyone(91%) knew that an apple dropped at arm's length would fall to earth (Q2). However, only 11% realised that an apple dropped at the height of the International space station (ISS) would also fall to earth (Q3). When shown a movie of astronauts on the ISS floating about only 18% said this was because they were falling (Q4). These answers reveal common misconceptions about the force of gravity outwith the earth. By the end of the show 74% (Q12) correctly said that the statement that 'there is no gravity in space' was false showing a significant number of pupils had grasped this counter-intuitive concept.

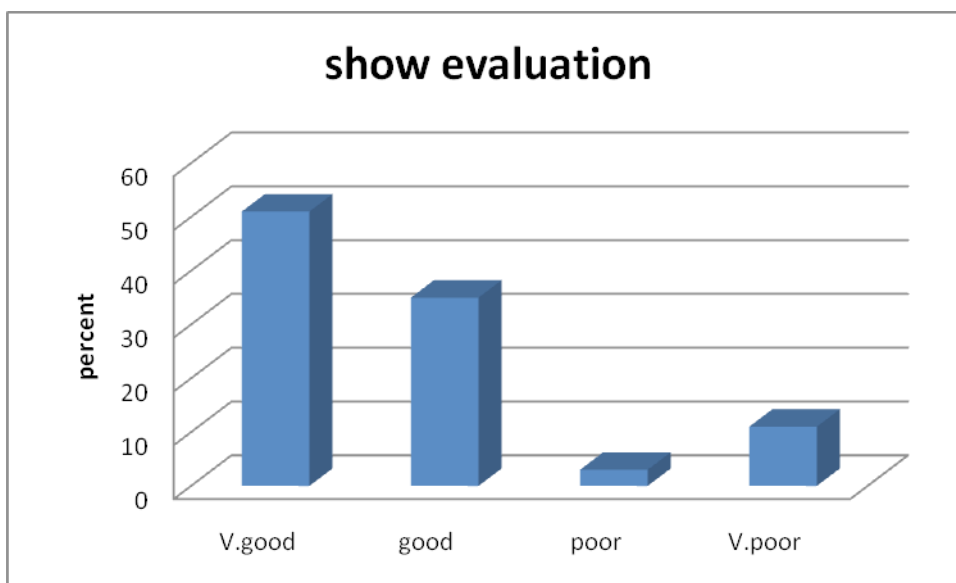


Figure 2. Evaluation of 3D show using voting systems. Summary of results of 874 votes.

3D Show Evaluation with voting pads

51% of audience voted show to be very good and 35% voted good giving a total of 86% giving a positive score, in excess of our target value of 75%.

Evaluation of Questionnaires : Pupils' ratings

Below is table and graph of evaluated questionnaires (208 in total) from the attending pupils. The score is expressed as a percentage of the respondents. Table 1.

Table 1	Pupils			
	excellent	good	OK	bad
overall	44.9	44.4	10.6	0
3D show	45.5	37.3	16.6	0.5
expts	24	57	16.3	2.4
RC	63.4	27.8	6.2	2.4
movie	30.7	42.9	23.4	2.9

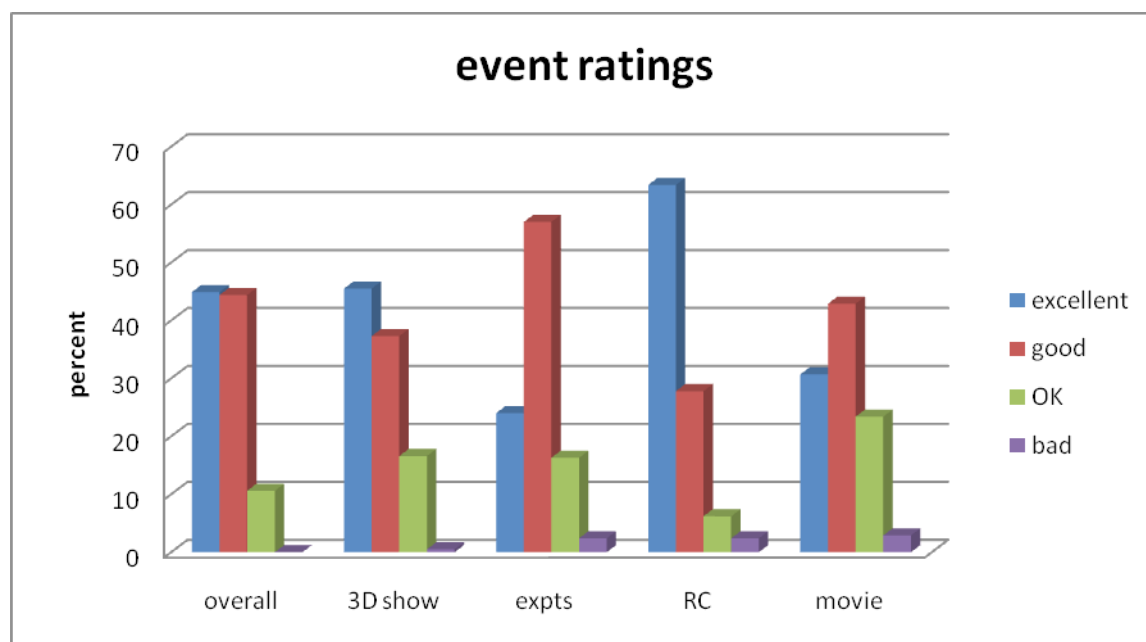


Figure 3. Overall ratings from the events as indicated on questionnaires by the pupils. Pooled results as a percent of total respondents(208).

Participants were asked to mark overall in addition to individual sections; 3D show, experiments, roller coaster challenge and movie challenge. 89% of respondents found the overall event to be excellent or good. Further evidence for overall success was given by the fact that 94% of respondents polled for more similar events.

Favourite Items

The roller coaster challenge was a clear favourite with 63% finding it to be excellent and a further 28% good. The 3D show was also popular with 45% voting it as excellent and 37% good.

These results were borne out by asking pupils what they liked best. The results show below found 64% of respondents preferred the roller coaster challenge claiming it to be fun, inventive and promoting team work. 24% liked the show because they learned a lot and enjoyed the 3D effect.

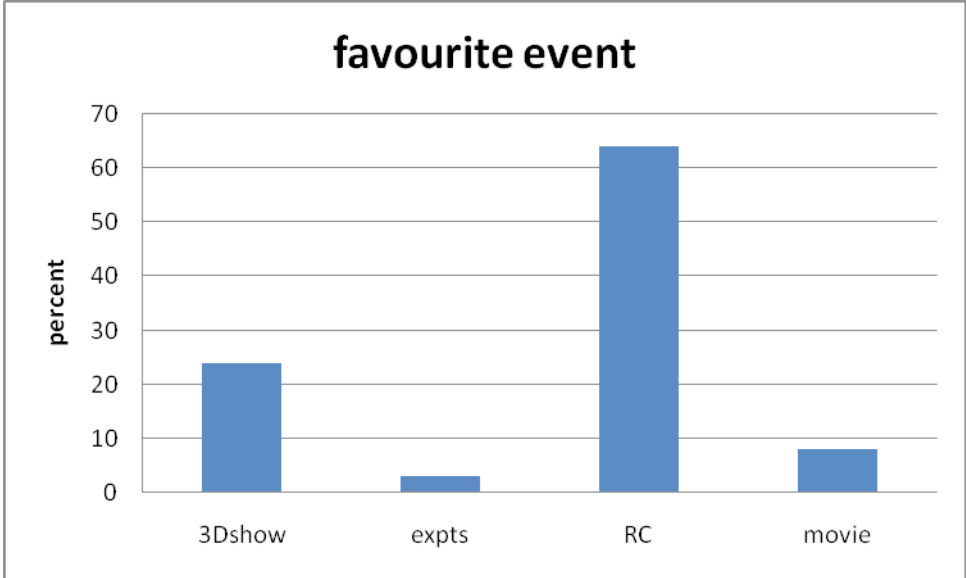


Figure 4. Pupils were asked what part of the day’s event they preferred. Percentage results from 188 respondents.

Teachers’ ratings

teachers ratings	%	22 responses		
	excellent	good	OK	bad
overall	85	15	0	0
show	73	27	0	0
expts	52	47	5	0
RC	91	9	0	0
movie	57	38	5	0

Figure5. Ratings as assessed by teachers attending the event (22 respondents).

All of the events were very highly rated by the teachers with 85% rating the overall experience as excellent. They found the show to be highly informative and the roller coaster event to promote teamwork and gave the pupils hands-on experience. 100% of teachers indicated that they would attend other similar events.

Problems and suggested improvements.

Pupils were asked what in day's event they did not enjoy. Results are shown in table 2.

nothing	3D show	experiments	R. coaster	movie
150	7	5	0	1

Table 2

Pupils were asked for suggestions for improvements

3D show	Expts.	RC	movie	facilities	lack of time
6	0	0	0	29	14

Table 3

The above results showed that the majority of participants had no complaints. While many had found the 3D show to be a favourite it was not popular with a few. The most common complaint was that it was too long. The movie challenge also came in for criticism because there was not enough time to complete it, or because the computing facilities were unreliable. Some of the venues were criticised because they were cold or lack of refreshments.

Summary

Evaluation by questionnaires and voting pads showed that the vast majority of respondents enjoyed the event with 89% rating the overall experience as excellent or good. Use of the voting system allows a much more detailed analysis of audiences level of understanding and reveals the value of the 3D show as a learning experience.

The big success of the event was the roller coaster challenge with 64% of pupils citing it as their favourite because it was fun, instructive and promoted team work.

Although the questionnaires revealed a few minor problems, the event would appear to have been a great success and met its targets.