

mmW @ the BA Festival of Science, York, September 2007

Evaluation report

1 Introduction

Millimetre-Waves: The vision for the future is a partnership between the Department of Physics at the University of St Andrews and FifeX. It is funded through the EPSRC's Partnerships for Public Engagement (PPE) awards scheme.

mmW ran a series of workshops as part of the Young Peoples' Programme at the BA Festival of Science on 11, 12 and 13 September.

The mmW stand and workshops took place in the Sports Tent, which was the site of all KS2 and 3 activities and was extremely hot and noisy.

Each workshop comprised 4 interactive activities and the stand. Visitors to the Festival were able to view the stand at time when workshops were not taking place

2 Evaluation methods

An evaluator was present on Wednesday 12 and Thursday 13 September. She observed the following workshops:

Wednesday

- 1 x KS2 session (16 students – 9 Y x 5 and 7 x Y6)
- 3 x KS3 sessions (37 students – 36 x Y7 and 1 Home Educated)

Thursday

- 1 x KS4 session (20 students - Y10)
- 1 x KS2 special needs (12 students)

The KS2 and KS3 sessions on the Wednesday lasted 45 minutes and students completed a selection of the workshop activities and no worksheets. Because of time constraints on the schools the Primary level questionnaire was used in all these sessions. All 53 KS2 and 3 students completed the primary questionnaire.

The KS4 session lasted 90 minutes and all the students completed every workshop activity including the worksheets. The 20 KS4 students completed the secondary questionnaire as did one KS3 home educated student who had taken part in a workshop on Tuesday 11 September.

10 teachers/ home educators completed the Teachers questionnaire. Seven visitors to the exhibition also completed exhibit feedback questionnaires.

At the KS4 session, the BA also handed out feedback questionnaires.

3 Observations

The five presenters were extremely enthusiastic and professional. They coped very well with the extremely noisy and hot conditions in the sports tent. They demonstrated that they were able to adapt the activities to the unhelpful environment and also to engage with students from a wide range of ages and educational abilities.

The presence of a member of the team from FifeX removed much of the

Students attending sessions later in the day were visibly tired in the hot temperature. Despite this most of them remained engaged and interested throughout.

Several teachers and visitors to the stand commented that the content would be very suitable to take to schools but that in order to do this; the physical set-up may need to be made more portable/transferable.

A number of students returned to the stand at lunchtime and were overheard telling their friends how good and interesting it was.

The stand (with the exception of that of a major International Government-backed project) was the most professional-looking in the sports tent area. The branded polo shirts added to the professional image.

The KS4 students seemed unsure what to do with worksheets i.e. hand them in or take them away. They also found them difficult to complete when stood up.

Radars in a room technology sometimes froze or broke down. It also seemed to rely on the presence of one presenter (Dav).

Feedback questionnaires were only handed out when the evaluator was present. The rulers were very popular and proved to be a good incentive to complete the questionnaires.

4 Questionnaire Responses

4.1 Teacher Questionnaires

The questionnaires were completed by the following:

- 1 x special needs
- 3 x home educators
- 4 x secondary teachers
- 2 x primary teachers

Every teacher rated the whole workshop and individual elements as good or very good. Their reasons included:

“Very clearly explained”

“Presenters engage with children and are enthusiastic about the subject”

“Highly informative. Clever and helpful analogies. V.good equipment/demonstrations”

“Activities were interactive and fun”.

“It’s a very good idea to include children in the activities session. The boys clearly enjoyed the activities.”

“Sometimes the use of language both scientific and everyday was going above their heads.”

“Pitched at a level that was accessible but also challenging.”

“Overall it was very good. Sometimes the presenters used jargon, which the students did not understand.”

Six teachers rated the workshop as ‘very interesting’ and six as ‘very interactive. Seven said it was ‘very educational’ and five rated it ‘very fun’.

Reasons for these ratings included:

“Good explanations. Accessible to children.”

“Complex concepts, well explained.”

“Lots of interactive. Very clear displays. Enthusiastic and clear explanations. Large variety of demonstrations.”

“Plenty of real-life applications.”

Both primary teachers stated that the content was a little advanced for their age groups.

Every teacher identified something that their students had learned from the workshop. The learning points included:

About Infra Red to see different temperatures

Understanding of waves and properties

Understanding characteristics of different waves

Basic understanding of waves and applications

They were able to link whole EM spectrum together as a quick overview - it brings together knowledge and previous ideas

They have a better understanding of resolution (some good practical activities) and an understanding of the uses of this technology.

The Doppler effect and the use of radar amongst other things

Different wavelengths and how they work in life

Different wavelengths and uses of them

Every teacher agreed that workshops were an effective way of stimulating interest in science and engineering. Among the reasons given were:

Because not too long and the children had to do things and take part.

Children accept the way things are - they need to be challenged to think and understand.

Applications of science are a good source of stimulating interest.

We are finding out that class visits are talked about and remembered far more readily than routine lessons. They DO stimulate.

Anything hands on really engages the children. They learn first hand and remember and take things further later.

Encourages an interest in experimentation/exploration.

Any hands-on experience is good.

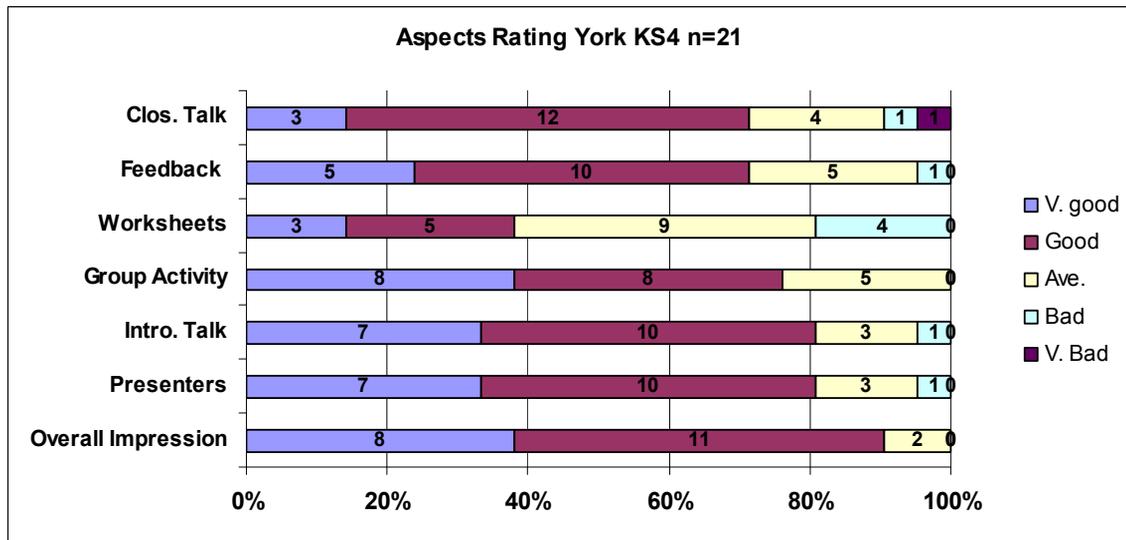
Only one teacher said they would not continue to discuss in lessons the issues raised by the workshop because they were not relevant in the subject he taught.

The hands on activities were rated as the most successful elements of the workshops and the talks the least successful. However in all cases this was attributed to the poor acoustics and high levels of background noise in the venue. All suggestions for improvement and comments related to choosing a different, more suitable venue.

4.2 KS4 Student Questionnaires

The questionnaires were completed by 11 females and 10 males. 19 were aged 14, one aged 12 and one aged 15. They were generally positive about the workshop. The student who was 12 was being home educated, all the others were in Year 10.

'Very good' or 'good' was the most popular rating for the workshop overall. (see graph over leaf). The individual who rated the closing talk very bad said it was because they could not hear it. Those who rated the worksheets as average or bad said it was because they were boring or difficult to complete standing-up.



Most students felt that the workshop was very interesting and very educational (see activity rating graph below). Respondents were less certain about whether the exhibit was fun or interactive, although the results are positive overall.

Reasons given for these ratings included:

The activities were interactive which made them enjoyable

There was lots of info to take in, in such a small amount of time

Could have slowed the talking down

I learnt a lot and most activities involved something interesting

The activities were the best part and anything that wasn't clear in the introduction was easier to understand in the activity

It was very educational but it wasn't very fun

There was lots of information but at times the language was too advanced

I enjoyed it

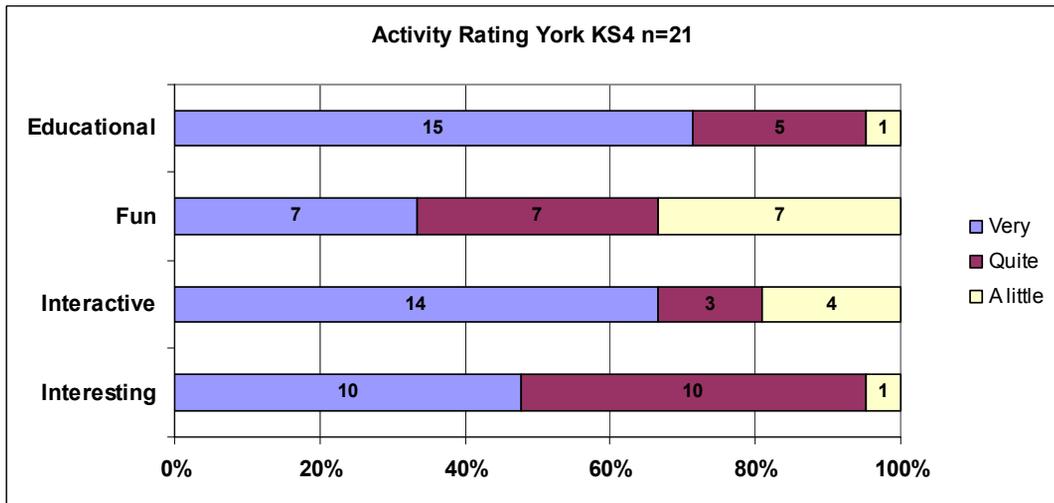
You got the feeling you were rushed

I learned a lot and it was interesting

I thought it was very good

It is quite hard to take in all the info.

It is the people just saying stuff and not explaining



A majority of respondents (80%) said they not sure if they would continue to discuss the issues raised by the work shop. 10% said yes and 10% no.

38% said the workshop had made them more interested in science and 62% reported no change in their attitude, which may be because they were already interested. Their teacher said they were the top set and all had chosen to study triple science.

A number of different learning points were identified. They included:

What RADAR stands for

There are many forms of vision

About pixels

Doppler

mm wave lengths can be useful

About wavelength and how it affects vision

About the Doppler effect and RADAR and more about pixels

That different waves have different frequencies

About radar, mm, doppler

How imaging and radar work

That mm waves are useful

About infrared and how it is used

What a millimetre wave is

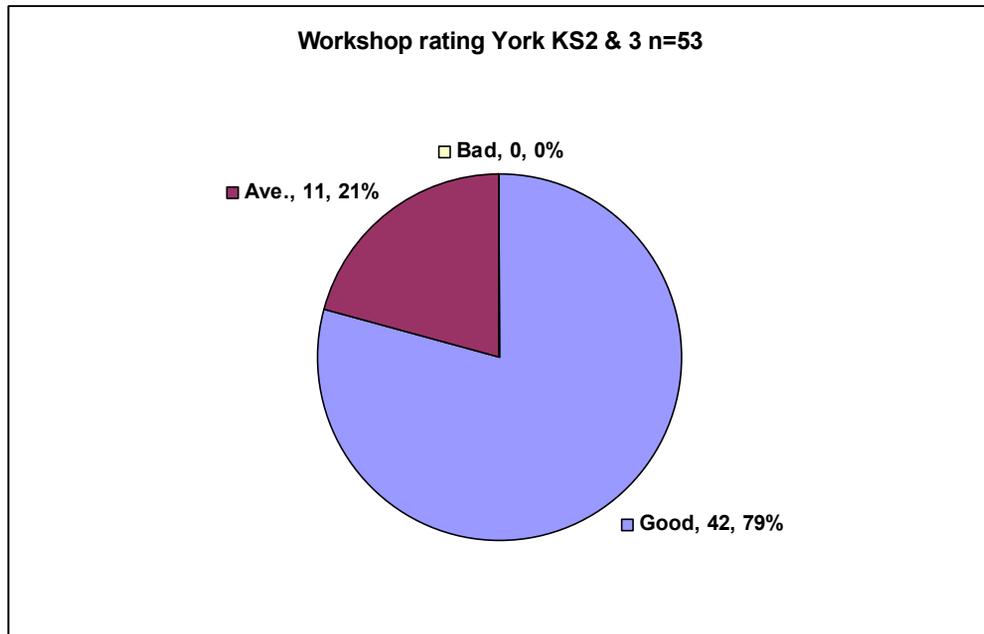
About wavelength and resolution. I already knew about radar

The respondents' most favourite part of the workshop was 'Cops and Doppler'. Their least favourite was 'Seeing through Stuff', which several respondents said was difficult to hear and others reported as not having enough for them to do.

4.3 KS2 and KS3 Student Questionnaires

43 males and 10 females completed the questionnaire. 34 were aged 11, 10 aged 10, 8 aged 9 and 1 aged 12. 36 students were in Year 7, 9 in Year 5, 7 in Year 6 and 1 (aged 10) was home educated.

The students were positive about the workshop with most rating it as good.



Among the general reasons given for this rating were 'it was interesting' or 'enjoyable'. Specific reasons included:

It was interesting to see what you can do with mm waves

It was interesting but we spent too long on each activity and the one I didn't do looked like the best

It was a good workshop but I wish I had more time to see things

It was a good set out and explained to us very well

*It was interesting because I had never heard of mm-waves
I never knew that you could see the lava through cloud*

I thought it was great how millimetre waves can see through more things than other technology and it was good fun learning it

It was well organised and easy to understand with good examples

Brilliant. State of the art. Some of this stuff could be put to brilliant use

It was good fun and they showed us lots about mm waves

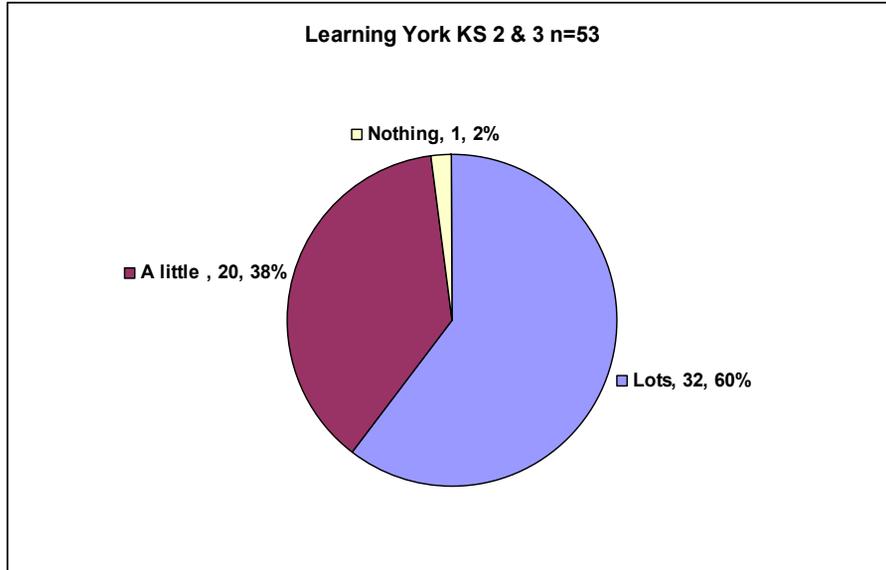
It was hard to understand - I would do it again definitely.

It was great how they showed everything in different ways

It was great they showed us everything in a way that was hard to get bored. Fantastic.

58% of students said the workshop had made them more interested in science/engineering. None said it had made them less interested.

60% said they had learnt lots and 38% said a little. The one student who said nothing displayed some behavioural difficulties.



Respondents listed a number of general learning points about mm waves and waves in general. Some more specific comments included:

About waves being able to travel through fog

That you can see through things with machines

How mm waves can see through things

How police catch people speeding

That waves don't pass through everything but only some things.

I learnt about infrared cameras

mm waves can pass through "stuff"

Infrared can't see through clouds

How sound changes - Doppler

I learnt how people see through things

About the more pixels there are, the clearer the picture

All the uses of infrared

How mm waves can see through even wood

How mm waves can detect things and map them out

That you need lots of pixels to see things properly

mm waves can be seen through lots more than infrared

I learnt about infrared a bit more, before I hardly knew anything about it

I learnt about millimetre waves and their uses

The difference between UV rays, mm waves and thermal imaging

That you can see through things without an X-Ray

The respondents other comments were all positive. They included:

I thought it was all very well explained

Keep doing this workshop!

I really enjoyed it

I hope we get to come again

It was BRILL!

It couldn't have been better

4.4 Exhibit Questionnaires

Six out of 7 visitors who completed questionnaires felt that the stand was very interesting. Five rated it as very educational. Respondents were less certain about whether the exhibit was fun or interactive, although the results are positive overall.

Visitor comments about the stand included:

Good displays pitched at right levels of complexity

Seeing excellent research being put to practical use

Strong application of basic research to societal applications

Important for security

The end uses of this research are important to everyone in society

Respondents chose a number of different parts of the exhibit as their most favourite:

The radar in the room Easy concept to get hold of, fun to experiment with.

The explanations

Medical imaging and sat radar - the latter is my research field

Video demonstration of 'see-through' capability

Interpretation by the scientists

Only two visitors said they had a 'least favourite' aspect of the exhibit. One mentioned the security aspects because they were not interested and another mentioned the lack of a handout.

Some of the responses to the questions 'What, if anything, did you learn from the exhibit?' included:

Current capabilities of hardware and something of software

CMB, Doppler effect

Use of radar in volcano monitoring

Applications of mmwaves are so wide ranging

Importance of thermal imaging, mm waves

Lots about the uses

Most visitors to the BA Festival are likely to have positive attitudes towards science. Even so, one of the respondents said they were now more enthusiastic.

Questionnaire respondents were asked whether they were likely to continue to discuss any of the issues raised by the exhibit. 4 out of 7 said yes, only one person said no and the remainder were not sure.

Respondents' general comments were positive and supportive. They included:

Need leaflets as reminders of demonstrations

Keep doing it

Keep it up! Good luck!

Take it into science centres

This is bound to be an important technique. I hope the UK invests enough to benefit.

5 Conclusions and recommendations

The Festival was a very successful first outing for the workshop, which was very well received by students and teachers/educators alike. The presenters were able to adapt the content to a range of different age groups and varied educational abilities. The wide range of activities helped to maintain audience interest.

The following recommendations are made based on the learning from the Festival.

1. Careful consideration needs to be given to the venue for the workshop. It would work well in a classroom setting.
2. Presenters need to be wary of using jargon even in everyday language. They should also take not to speak too quickly.
3. The 'Seeing through Stuff' activity needs further development. It needs to be made more interactive.
4. The worksheets could be developed to broaden their appeal and impact.
Audience members were unclear as to whether they should be handed in or taken away. If the intention is to promote further learning then the sheets are likely to be taken away, when references for additional information (e.g. websites) would be a useful addition. If there is insufficient time to write out answers or the sheets have to be completed standing-up then multiple choice questions be more suitable.
5. A handout for teachers or interested visitors with some links would be a useful development that would help learning to continue after the workshop. Teachers would also like copies of the worksheets so they can refer to them in lessons.
6. The Radar in a room technology needs some refinement to make it robust enough to cope with workshop/exhibition conditions and to allow other presenters to use and explain it.
7. Ensure that things like balloons are included in the Exhibition Pack so that the workshop can be simplified if needed i.e. IR demonstrations used more extensively.
8. Presenters use feedback questionnaires even when an evaluator is not present. This will ensure the most representative feedback possible is obtained.