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(In)visible Witnesses

Drawing on young people's media literacy skills to explore gendered representations of science, technology, engineering and mathematics

Jennifer Carr, Elizabeth Whitelegg, Richard Holliman,
Eileen Scanlon and Barbara Hodgson
The Open University, Milton Keynes

April 2009



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gendered representations of science, technology,
engineering and mathematics**

Jennifer Carr, Elizabeth Whitelegg, Richard Holliman, Eileen
Scanlon and Barbara Hodgson
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Report prepared for the UK Resource Centre for Women in
Science Engineering and Technology (UKRC)

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Executive Summary

For over 30 years there has been interest in how young people's, particularly girls', images of scientists, technologists, engineers and mathematicians (STEM) are constructed. Studies have examined how children's views of science and scientists develop as they grow up and why girls' (and boys') participation in school science declines with age. Key factors include a decline in many girls' self belief in their abilities in science, particularly the physical sciences, as they grow older. In addition many girls reject the stereotypically masculine image of science and scientists as one that they could adopt for themselves. The images of STEM that some girls (and some boys) are uncomfortable with are still pervasive and do not evolve from the educational environment alone. With this broader context in mind, the *(In)visible Witnesses* project looked beyond the school environment to investigate another potential sphere of influence on the development of children's and young peoples' understanding of the nature and value of STEM and the role it might play in their lives, that of the mass media, specifically children's television.

The project was conducted and reported in two phases. In phase 1 an analysis of content to investigate existing images of STEM on UK children's television was undertaken. This phase of the project informed the activities then carried out with children and young people. Underpinning the design of these activities was the premise that children and young people are not simply passive receivers of media messages, but active viewers and interpreters of media representations, and that this process of interpretation plays an important role in the ways in which children and young people actively construct their sense of self-concept and their identities.

In a series of activities designed to support children and young people in analysing short extracts from television programmes, the participants identified stereotypical images of STEM and STEM-related practitioners that had been used by the programme-makers, discussed what the reasons for using these stereotypes might be and what affect they might have on people's attitudes towards STEM. Developing from this, a set of activities was designed to engage with the 'creative' element of the children's and young people's media literacy skills. These activities included designing an episode of, and producing a story-board for, a STEM-related programme.

This constituted phase 1 of the project which is reported in Whitelegg, E. Holliman, R., Carr, J. Scanlon, E. and Hodgson, B. (2008). *(In)visible Witnesses: Investigating gendered representations of scientists, technologists, engineers and mathematicians on UK children's television*. Research Report Series for UKRC No. 5. UKRC: Bradford. Available at: <http://oro.open.ac.uk/10681> . (A condensed version of this first report giving a brief

description of the research methods, results and recommendations from this phase of the project is included as Appendix 1 at the end of this report.)

The second phase of the project (reported here) built on and extended the work of phase 1. In this phase the children and young people undertook their own content analysis of extracts from television series that we selected for them and contributed to further work on their perceptions of representations of STEM and STEM practitioners. The 'creative' activities using the participants' media literacy skills were extended in the second phase to engage the participants in planning a STEM-related television series, including companion websites and merchandising, and then 'pitching' their ideas to an (imagined) Executive Board of a television production company, which was looking to commission STEM-related programming. These activities demonstrated the children and young people's sophisticated media literacy skills when creating ideas for their own television series. Of particular note are the strategies they used to include STEM-related content, recognizing the potential for this type of programme to provide a source of learning, at the same time as making the programme fun and engaging to their imagined audiences.

Further details of the project, including two project reports on each phase of the project, can be accessed via the project website (www.open.ac.uk/invisible-witnesses). Both project reports conclude with recommendations that focus on the ways in which media literacy skills can be used to engage children and young people with representations of STEM in such way as to enable their insights to be used to inform the practice of policy-makers, broadcasters and educators.

Recommendations from Phase 2

1. This second phase of the project reinforces the earlier recommendation from the first phase that a complementary production study is commissioned to investigate how fictional representations of STEM in children's television programmes are produced.
2. As recommended by the first phase, greater emphasis should be placed on diverse, authentic representations of STEM in fictional children's television programming, and such an approach would promote pluralistic portrayals of STEM as it is currently enacted in a range of 'real-world' settings. In addition, science fiction programmes, with their focus on imagining future worlds and potential outcomes of current developments within STEM, would also be useful in this context.
3. The potential of multi-platform programming and companion programmes (such as *Doctor Who Confidential*), provides opportunities for 'real life' STEM professionals and the work that they do to be made more visible to children and young people. It is recommended that organisations whose role it is to promote careers within STEM, for example Sector Skills Councils, seek to work in partnership with broadcasters to look at how links can be made between the information they provide and relevant multi-platform broadcasting.
4. Programme makers should engage with children and young people to find out what sort of programmes about STEM they would like to watch, and we suggest that

development of the activities used in this research could provide programme-makers with a fruitful avenue through which to both engage this audience and make best use of its 'expertise' to inform their own practice.

5. Given further development and sufficient resources, the methodology employed here could be extended to produce a pack of teaching and learning resources that encourages children and young people's creativity in developing ideas for future STEM programmes. Such a pack could be used by teachers to facilitate reflection by children and young people on the portrayals of STEM that they witness on television and to develop students' media literacy skills within a STEM context so benefiting both areas of the curriculum.

1. Introduction

This report describes further work on the (In)visible Witnesses project and so continues the work described in the first report *(In)visible witnesses: Investigating gendered representations of scientists, technologists, engineers and mathematicians on UK children's television* (Whitelegg et. al, 2008). It should therefore be read alongside this earlier report where the background and rationale for the project as a whole is described as the detail of this is not repeated here.

The aims of the work described in the report, however, remain the same as those of the original study:

1. Study the (re)construction of gendered representations of science, technology, engineering and mathematics (STEM) on UK television, i.e. to investigate the continuing portrayal of established stereotypes of STEM and document the emergence of new images.
2. Investigate the extent to which these images might affect children and young people's perceptions of STEM.

During this project we have worked with three class-sized groups of children and young people. Our work with two of these groups was discussed in our earlier report¹, with the third being discussed in Section 4 of this report.

All of these participants completed a questionnaire that was designed to elicit pre-existing perceptions of STEM and to gather background data on television viewing patterns. In our previous report we discussed some preliminary findings from the questionnaire. In Section 2 of this report we build on that discussion, and address key issues arising from the analysis of the questionnaire across the whole cohort. In total, 59 participants completed the questionnaire. Of these 59, 30 were Key Stage 2 (KS2) pupils (17 female and 13 male) and 29 were Key Stage 3/4 (KS3/4) (18 female and 11 male). As noted in our previous report, although the numbers completing the questionnaire are relatively small, where possible we have sought to make comparisons with similar data collected from larger cohorts. We have also highlighted any issues that we believe have the potential to provide useful insights if explored in more depth in future projects. Indeed, the questionnaire data collected in the earlier stages of this project have already informed its development.

The questionnaire asked participants to identify three of their favourite television programmes and to try and recall, and describe, a television programme they had watched that was about science or included a scientist. In our earlier report we discuss the five most popular television programmes identified by the participants.² When the responses to this question are further analysed in terms of the gender of the respondents, only two

¹ See Whitelegg et. al., 2008, p.15 -34

² See Whitelegg et. al., 2008, p.18.

programmes feature within the favourite programmes for both boys and girls. These programmes were *The Simpsons* (Channel 4) and *Doctor Who* (BBC). The programme most commonly identified as either being about science or including a scientist (32% of the respondents who could recall a television programme) was the programme *Brainiac Science Abuse* (Sky TV)³. None of these three programmes had been transmitted during the original sampling periods for the earlier phase of this project⁴ and, as such, had not been included in our content analysis. In Section 3 of this report we will focus on these three programmes. As this phase of the research was time-limited, and not all of these series were being broadcast during the relevant time period, we viewed the series that were most recently released on DVD. We also included the 'companion' series *Dr Who Confidential* in our analysis as this was included as part of the *Doctor Who* DVDs.

Adopting a similar approach to that taken in the main study, we viewed the programmes in each of the series and identified STEM-related extracts using a set of pre-agreed operational definitions of STEM.⁵ In this study we produced narrative summaries of the extracts and conducted inductive coding to investigate emerging themes, e.g. the nature and value of STEM; the ways in which the identities of the STEM-related characters are constructed; and, the relationships between STEM-related and other characters. We discuss the methods used in more detail in Section 3.1.

In reporting on the analysis in Section 3.2 we have orientated our discussion towards the findings and recommendations made in our first report. In the earlier report we commented, for example, on the scope to present imagined, idealized images of STEM and STEM-related characters in fictional children's television. In the analysis we report on here we return to this theme in our discussions of the representation of STEM-related topics in *The Simpsons* and *Doctor Who* and of two key female characters, Lisa Simpson (*The Simpsons*) and Martha Jones (*Doctor Who*). Likewise, we recommended that greater emphasis is placed on *diverse, authentic* representations of STEM and STEM-related characters in children's programming. The analysis we report on here will discuss the potential for 'companion programmes', such as *Doctor Who Confidential*, to provide such representations, including real life STEM practitioners working in areas, such as the generation of special effects and Computer Generated Imagery (CGI), careers that young people may find particularly appealing. We will also reflect on the appeal of *Brainiac Science Abuse* for children and young people, and discuss ways in which this appeal might be used in a positive way.

Our analyses of these four series have, in turn, informed the design of the activities for the reception study, which is the third element of this report. In Section 4 we focus on how we built on and extended the methodological tools we developed in our earlier reception studies⁶. In Section 4.1 we will discuss the methods used in a study carried out with 22 young people (12 girls and 10 boys) aged 11-16 (KS3/4).

³ The second most commonly identified programme (13%) was *Whizz, Whizz, Bang, Bang* (CITV)

⁴ See Whitelegg et. al., 2008, p.5 -8

⁵ See Whitelegg et. al., 2008, p.7

⁶ See Whitelegg et. al., 2008, p.8 - 10.

A key premise that underpinned all of the audience reception studies carried out as part of the *(In)visible Witnesses* project is that children and young people are not simply passive receivers of media messages, but active viewers and interpreters of media representations. Indeed, we have argued that this process of interpretation plays an important role in the ways in which children and young people actively construct their sense of self-concept and their identities. The methods used within the studies, therefore, have been designed to engage with, and capitalise on, the participants' media literacy skills.

The Office for Communications (Ofcom) defines media literacy as 'the ability to access, understand and create communications in a variety of contexts' (2004, p. 2). In his review of the literature of research into children's media literacy skills, commissioned by Ofcom, Buckingham (2005) explains further what skills are implicated in each of these three elements of media literacy, and emphasises the relationship between them:

'Access' refers to the ability to locate media content that is appropriate to one's needs (and to avoid content that is not). ... 'Understand' refers to what users do when they have located content. ... 'Create' extends the notion of literacy from 'reading' to 'writing' in media, although it also entails abilities both to access technology and to understand media forms and conventions.' (p.6)

Discussing further the skills required for 'understanding' content, Buckingham focuses on 'the framework of four 'key concepts' embodied in most media education curricula: language, representation, industry and audience' (p.13). The concept of language includes, for example, an understanding of the technical conventions of programme making and ideas of genre and narrative. Understanding representation involves developing a range of skills from distinguishing between fact and fiction and assessing the degree of 'realism' within fiction, to understanding the ideological impact of programming (which includes the construction of positive/negative images and use and purpose of stereotyping). The concept of industry includes developing such skills as recognising the purpose of advertising and the possibility of bias and misrepresentation in factual programming. Understanding the notion of audience involves children and young people in developing skills to reflect on their own emotional responses to programming, but also the strategies deployed by programme-makers to create those responses. The first activity carried out by our participants was designed to encourage them to draw on these media literacy skills relating to 'understanding representation' in their analyses of short extracts from the four programmes discussed in the content analysis section of this report.

The second activity involved the participants working in small groups to plan a STEM-related television series and then 'pitch' their ideas to an (imagined) Executive Board of a television production company, which was looking to commission STEM-related programming. This activity builds on the 'story-boarding' activity carried out as part of the original study⁷, which had been identified by the participants as their favourite activity of the

⁷ See Whitelegg et. al., 2008, p.26 - 27

day. The activity is designed to engage with the 'creative' element of the participants' media literacy skills.

The third activity required the participants to draw once again on their analytical media literacy skills, in particular their understanding of the notion of audience, and reflect, in writing, on which of the television series they would recommend to be commissioned.

The final two activities involved the participants completing the Draw-A-Scientist test and an evaluation form.

In our earlier report we recommended that extending the activities carried out in the earlier audience reception study might be fruitful both in terms of providing broadcasters with information about the types of programmes that might appeal to children and young people and in developing resources that could be used in educational settings to facilitate reflection by children and young people on the images of STEM that they witness of television. In section 4.2 of this report we will orientate our discussion towards these two recommendations and highlight how these data illustrate what we believe to be the importance of these two recommendations in terms of encouraging children and young people to engage with STEM.

In the final section of this report we bring together the issues highlighted throughout and comment on how these findings enhance and extend the recommendations made in our original report.

2. Questionnaire

The questionnaire was designed to elicit pre-existing perceptions of STEM and to gather background data on television viewing patterns. In our previous report we discussed some preliminary findings based on data collected from participants in the first two of our audience reception studies, and key points can be found in the *Research Briefing* included as Appendix I of this report.

In this section we build on that discussion, and address key issues arising from the analysis of the questionnaire across the whole cohort. In total, 59 participants completed the questionnaire. Of these 59, 30 were Key Stage 2 (KS2) pupils (17 female and 13 male) and 29 were Key Stage 3/4 (KS3/4) (18 female and 11 male).

For a full question-by-question description of results, see Appendix II.

- **Some questions about you**

Fifteen participants (25%) said that they lived with a scientist or engineer (9 girls and 6 boys). Only 3 girls and 1 boy (2 girls and 1 boy were from the same family) said that these scientists or engineers were female (one was a teacher and the other a medical doctor). Twenty seven (46%) said they know a scientist or engineer. Of these, all the workers were male apart from 4, who were again teachers or doctors.

As noted by the earlier study⁸ when describing the work of the people they had identified as engineers, the younger children (KS2) focused on jobs that involved fixing machines (i.e. washing machines; cars; quad bikes; showers; tractors). The older participants, however, used terms such as 'design' and appeared to have a broader understanding of the types of work that engineers might do.

In the earlier study the participants had also been asked to imagine themselves as scientists or engineers and write about the kind of work they would do⁹. Of the participants that imagined themselves as engineers, 83% (all of these were KS2 pupils) described roles as vehicle mechanics or roles that involved fixing machines. Older participants, when imagining themselves as engineers, described roles that involved 'designing' rather than 'fixing' i.e. designing 'environmentally-friendly' houses, designing 'safer' buildings and designing 'greener, safer' aircraft.

Whilst it may not be surprising that the older participants have a more sophisticated understanding of the jobs that engineers might do, these age-related differences also

⁸ Whitelegg et al., 2008, p.16 - 18

⁹ Whitelegg et al., 2008, p.28 -32

highlight a potentially fruitful area for further investigation. As we have noted previously¹⁰ mechanical engineering is an important source of employment in the area where the younger participants live, which may help to explain why so many of these participants either lived with or knew someone they described as an engineer. When imagining themselves as engineers these younger participants once again appeared to draw on these 'real life' experiences, and it is interesting to note that a similar proportion of girls (39%) as boys (41%) imagined themselves in these roles.

Television programmes are one way in which young people gain knowledge about other peoples' life experiences. Fictional programmes, in particular, provide opportunities to create characters that can both engage young people by being 'like me' and provide narratives of life experiences that go beyond those that the young people witness in their immediate environments. We would suggest that further studies, carried out with the involvement of broadcasters, could explore the potential for development of programming that engages young people in this way. We would highlight, in particular, the potential for multi-platform programming to make links between fictional worlds and characters that engage young people and the 'real-life' opportunities that may be open to them. We will discuss this further in Section 3.2 of this report.

- **Scientists and engineers as people**

Taken as a whole, the participants' views on scientists and engineers as people could be viewed as positive:

Tidy, neat and orderly	66%
Intelligent, bright and clever	80%
Imaginative and full of ideas	72%
Hardworking	83%
Caring for others	61%
Has lots of friends	51%
Interesting and exciting	70%
Kind	60%

There were, however, some interesting age-related differences in the responses. The questions were presented in the form of two contrasting statements (for example: 'Untidy, sloppy' and 'tidy neat and orderly') at either end of a 5-point scale¹¹, with a response of 3 being interpreted as indicating a 'neutral' position. The KS3/4 participants indicated this neutral position more often than the younger KS2 participants across all responses, but significantly so in response to three of the statements:

- Caring for others/Selfish
- Doesn't have many friends/Has lots of friends
- Kind/Unkind

¹⁰ Whitelegg et al., 2008, p.16

¹¹ The questionnaire is Appendix IV to the original report.

So whilst the majority of all participants indicated the positive trait, figures for KS3/4 participants present a rather different picture:

Caring	45%	(KS2 77%)
Has lots of friends	28%	(KS2 73%)
Kind	28%	(KS2 83%)

It could, of course, be argued that older children are less willing to make broad generalisations in relation to what might be described as ‘personal’ traits rather than those that are ‘job-related’. However, relating these findings to those produced by the larger cross—cultural study *Science and Scientists* (SAS Study) (Sjoberg, 2000), which we drew on to compile this section of our questionnaire, raises interesting issues. All the participants in the SAS study were aged 13 or above, but participants were drawn from a number of developed and developing countries. In this study the researchers note that young people from developed countries seldom consider scientists to be kind or helpful, but that ‘this view prevails among children in developing countries’ (p.4). The researchers also make links between the responses to this particular element of the questionnaire and how the participants viewed science and its role in society. Drawing on the data from the questionnaire section ‘Science in Action’ and a version of the Draw-a-scientist activity that required participants to write a short explanation of their drawing (i.e. what the scientist is doing and what issues they may be working on), the researchers comment that responses from young people in developing countries suggest that:

Scientists are often seen to be brave and intelligent, they are seen as helping other people, curing the sick, improving the standard of life for everybody. They are also often seen as helping the poor and underprivileged, aspects that are never mentioned in responses from pupils in the West.
(p.72)

It would seem reasonable to assume that young people in developed countries have greater access to a broad range of representations of science and scientists than those young people living in developing countries, and yet the potential to promote this aspect of the role that science plays in society through these representations would not seem to be being exploited. With regards to young people imagining themselves as adults, ‘personal’ traits, such as being viewed by others as being kind and helpful rather than just as intelligent and hardworking, may be particularly significant. As such, further research to explore this issue, especially any gender implications, may prove fruitful.

- **Science in action**

Two-thirds of all the participants felt that science was ‘interesting and exciting’; ‘useful and important for everyday life’; and was about ‘doing experiments’. Slightly less than half (47%) felt that science was personally important and 34% said it was something they would like to do when they left school. A gender analysis of this data reveals that 88% boys and 63% girls thought science was ‘interesting and exciting’; slightly more boys than girls felt it was

'important for everyday life', and that they would like to be involved in science when they left school.

Age-related differences are again significant in relation to science being something that the participants want to be involved with when they leave school. There is a slight increase in the proportion of boys' positive responses at KS3/4 when compared to KS2, but whilst 41% of KS2 girls gave a positive response, only 22% of KS3/4 did so. In this regard the responses would seem to be in line with other studies that have found that girls' interest in school science declines with age. More girls (54%) than boys (38%), however, responded that science was 'important to me,' and the proportion of positive responses from girls increased from 47% at KS2 to 61% at KS3/4. This last finding is contrary to other research (e.g. Murphy and Whitelegg, 2006), and it might be fruitful for any further studies to explore if young people envisage science in any particular context when thinking about whether or not it is 'important for me'.

- **Things I like to learn about**

Responses to this question could be viewed as encouraging in that none of the topics (37 in total) elicited a completely negative response from the participants, and the topics that were of interest to more than half of the respondents were wide-ranging. There are, however, some significant gender differences in the lists of topics that over 50% of the participants indicated that they would like to know more about (see p.81 of Appendix II).

The importance of these differences in interests in terms of designing the school science curriculum has been discussed in other research, but the role that television can play in children's informal learning is also relevant here. Television programmes, and programme-related websites, have the potential to not only provide additional learning in relation to topics already of interest to young people, but to generate interest in new topics. In terms of encouraging girls' participation in STEM, it might be fruitful to explore how programme genres or characters that appeal to girls might play a particular role here, and we will discuss this issue further in Section 3.2 of this report.

- **Learning about science and scientists**

In responding to the question about the most enjoyable thing they had done in a science lesson, the majority of participants identified 'hand-on' activities and experiments. Only four participants (two from KS2 and 2 from KS3/4) identified learning about specific topics rather than carrying out activities. Many of the experiments and activities identified involved what might be described as 'eye-catching' science e.g. explosions, mixing chemicals and burning objects.

As discussed in the introduction to this report, when the participants were asked to recall a television programme that contained science, the most commonly identified programme

was *Brainiac Science Abuse*. This programme focuses on showing the kind of ‘eye-catching’ science that the children seem to enjoy in their science lessons, albeit on a rather larger scale! Given that this type of programming seems to engage children and young people¹² it is perhaps particularly important that programme-makers consider the impact that these programmes have on viewers’ perceptions of science in a broader context. In Section 3.2 of this report, we will discuss this issue further, addressing specifically the issue of the representation of women in *Brainiac Science Abuse*.

There were age-related differences in the participants’ responses to naming a famous scientist and describing what the scientist was famous for. Only 5 (17%) of the KS2 participants named a famous scientist, whilst only one KS3/4 participant didn’t name a famous scientist. The two scientists identified by KS2 participants were Einstein and Newton, and these were also the two scientists most commonly named by KS3/4 participants (50% named Einstein with 17% naming Newton). Only one female scientist was named (Marie Curie), and only one participant identified a contemporary scientist (Stephen Hawking)¹³. Again, this would seem to be an area where informal learning through television has the potential to extend children and young peoples’ knowledge beyond their learning in the science classroom.

- **Important for your future job**

The top six most highly rated qualities (in descending order) were to:

- have an exciting job
- develop knowledge and skills
- get a secure job
- use my talents or abilities
- make my own decisions
- help other people.

More than twice as many boys (92%) than girls (43%) indicated that having more time with their families was important for them. This response may reflect the perceptions about work/life balance and gender roles that the participants have already developed i.e. girls may not feel that spending *more* time with their families is important if they already perceive caring roles within the family to be gendered. It does raise a more general issue with regards to representations of scientists, and other SET professionals, as being focused on their work, possibly to the detriment of other relationships. Further research could usefully explore whether children’s and young people’s concerns in relation to work/life balance means that certain images of scientists are equally alienating to both boys and girls, and therefore represent less than positive images in terms of career choice.

¹² The second most mentioned programme was *Whizz, Whizz, Bang, Bang*, which has a similar format to *Brainiac Science Abuse*.

¹³ Stephen Hawking was not mentioned by name but the participant wrote ‘The man in the wheelchair with a voice box – not sure, all I know is that he is very clever’.

Other gender-related differences included:

- 'to make and invent new things' - 63% of the boys chose this, compared to 43% of the girls;
- 'to control other people' – 33% of the boys, 9% of the girls;
- 'become famous' – 42% boys, 23% girls;
- 'have more time for hobbies' – 67% boys, 43% girls;
- 'have an easy and simple job – 42% boys, 14% girls.

- **Questions about watching television**

In the first two sections we asked the participants to tell us about their favourite television programmes and any programme they could recall that was about science or that contained a scientist. The responses to these two sections have already been discussed briefly in the introduction.

Of the top five favourite programmes listed by all participants, two are soap operas, *Hollyoaks* (Channel 4) and *Eastenders* (BBC1). The popularity of these programmes, however, is divided in terms of gender. *Hollyoaks* was named by 10 participants, 8 of these were girls, and *Eastenders* was named by 6 participants, 5 of these were girls. Studies of this genre have highlighted the gendered pattern of viewing (see, for example, Geraghty, 1991). As such, it could be argued that this genre of programme has the potential to present young girls with positive images of STEM and STEM-related careers. This might be achieved through storylines within the programme itself, but might also be achieved through companion series and multi-platform programming. *Hollyoaks*, for example, has a companion programme (*Hollyoaks in the City*) that follows the lives of two characters that have moved away from the community represented in the main programme. Alternatively, companion websites provide opportunities to develop additional storylines in a variety of formats (For example written diaries/weblogs or comic strips) that focus on the experiences of characters when they are in environments not featured in the main programme (for example at work, school or university).

Only four programmes were named by more than 2 boys as their favourite programmes (*The Simpsons*; *Doctor Who*; *Futurama*; and, *Top Gear*). All of these programmes contain STEM-related content and characters. With the exception of *The Simpsons*, however, none of these programmes were named by the participants when asked to recall a programme that was about science or that contained a scientist. Within the context of the questionnaire the majority of the participants interpreted the notion of a programme being about science or containing a scientist in a very narrow way. Only two other fictional programmes were mentioned. These programmes were *House* (Channel 5) and *Silent Witness* (BBC1). A significant proportion of the participants did not respond to this question at all (50% of all KS2 participants and 20% of all KS3/4 participants). When asked to make connections between TV programmes and STEM-related content in a different activity, one that involved the participants looking at images from TV programmes and discussing whether or not they

contained STEM, the participants were able to make links between STEM and a variety of different types of programmes.¹⁴

In our previous report¹⁵ we make the point that much of the STEM content that we found in our samples of children's television programmes was 'hidden', for example, within fictional programming and animated cartoons. We also suggested that this indicated that STEM is a significant cultural resource that is drawn on by programme makers. We would suggest that developing more sophisticated media literacy skills can play a role in enabling children and young people to 'unpack' that hidden content and, as such, these skills may have an important part to play in engaging young people in these areas.

The remaining questions in this section focused on how often the participants watched television, where they watched television and any rules there were within their homes in relation to watching television. Over 50% of the participants watched television everyday, with the remaining watching on most days (41%) or a few days a week (8%). The lounge is the room in which the majority of the participants watch television (81%) and only 12% of the participants watch television in their own bedroom. The majority of the participants (82%) stated that they had some restrictions placed on their television either in terms of what they can watch or when they could watch it.

¹⁴ Whitelegg et. al., 2008, p22 - 27

¹⁵ Whitelegg et. al., 2008, p.34

3. Content Analysis

This section discusses the results of content analysis carried out on three television series that were identified in the analysis of the questionnaire data collected in Phase 2 of this study as being the favourite programmes for both boys and girls (*The Simpsons* (Channel 4) and *Doctor Who* (BBC)) and the programme most commonly identified as either being about science or including a scientist (*Brainiac Science Abuse* (Sky TV)). None of these three programmes had been transmitted during the original sampling periods for this earlier phase of this project and, as such, had not been included in our earlier content analysis. As this phase of the research was time-limited, and not all of these series were being broadcast during the relevant time period, we viewed the series that were most recently released on DVD. We also included the ‘companion’ series *Dr Who Confidential* in our analysis as this was included as part of the *Doctor Who* DVDs.

An overview of each of the series discussed in this section can be found in Appendix III.

3.1 Methodology

The process for analysis of these data was similar to that used in the earlier study¹⁶, in that all of the episodes of each of the series were viewed and episodes that contained STEM-related content were then selected for further analysis. As a result of this process all episodes of *Doctor Who*, *Doctor Who Confidential* and *Brainiac Science Abuse* were included in the further analysis, and 6 episodes (out of a total of 25 episodes) of *The Simpsons* were also included.

Due to the constraints of this phase of the project, it was not possible to produce fully annotated verbatim transcripts of these episodes and, as such, we did not carry out an in-depth quantitative analysis of speaking actors¹⁷. We were, however, able to access transcripts for the episodes of *Doctor Who* and *The Simpsons* via websites compiled by fans of the programmes.¹⁸ These transcripts were checked for accuracy and amended if necessary. Where there were no transcripts available, a narrative summary was written, with only relevant speech being transcribed verbatim.

In addition to the actual episodes that had been originally shown on television, each DVD contains a number of additional features including, in the case of *Doctor Who* and *The Simpsons*, commentaries¹⁹ made by members of the cast and crew and programme producers, writers and directors. Each of the relevant commentaries was listened to and notes made on any discussions that related to issues such as the motivations for portraying

¹⁶ Whitelegg et. al., 2008, p.4 - 8

¹⁷ Whitelegg et. al., 2008, p.8

¹⁸ For *The Simpsons* see <http://www.snpp.com/> and for *Doctor Who* see <http://who-transcripts.atspace.com>

¹⁹ The programme-makers involved discuss the programme whilst they watch it. The viewer can then view the episode whilst listening to these commentaries in place of the normal audio track.

a character in a certain way or choosing a particular storyline. The narrative summaries, notes and transcripts were then analysed using NVivo 8 computer-assisted qualitative data analysis software (CAQDAS). As discussed in the introduction to this report, our analysis focused on themes relevant to the project as a whole e.g. the nature and value of STEM; the ways in which the identities of the STEM-related characters are constructed; and, the relationships between STEM-related and other characters.

3.2 Results and interpretations

Appendix IV provides an overview of the main themes that emerged during the analysis of these data, and many of these themes are explored in more depth in Section 4 of the report, when we discuss the participants' analysis of extracts from each of the television series. As outlined in the introduction to this report, in the section that follows we will focus on the ways in which this content analysis relates to two recommendations made in the previous report, and discuss:

- The scope to present imagined, idealised images of STEM and STEM-related characters in fictional children's television
- The need for a greater emphasis to be placed on diverse, authentic representations of STEM and STEM-related characters in children's programming.

3.2.1 Issues and debates

One of the themes that emerged from the analysis of the two fictional series related to the ways in which these programmes engaged with STEM-related issues and debates. These included, amongst others, issues relating to 'frontier science', for example human genetics and DNA; and recurring debates about the foundations and status of knowledge, including the tensions generated between arguments underpinned by religion and those underpinned by science.

In an episode of *The Simpsons (Lisa the Skeptic)*, Lisa starts a campaign against the development of a shopping complex on a site of where fossils have been found in the past. The developers agree to allow an archaeological survey to take place before they continue with the development. During the dig Lisa uncovers a skeleton of what appears to be a person with wings:

Millhouse [male child]:	What is it Lisa?
Lisa	It looks like a human skeleton, but these other bones almost look like wings.
Ned [adult male: devout Christian]	You mean like an angel?
Lisa	Well obviously that is impossible...
Moe [adult male]	Yeah, Lisa's right. It is an angel!
Lisa	But it can't be an angel

Moe

No? Well if you're so sure what it ain't, how about telling us what it am!

The majority of the Springfield residents get caught up in the idea that this is the skeleton of an angel, with Lisa alone looking for an alternative explanation. One of the ways in which she attempts to do this is to take a sample of the skeleton to Stephen Jay Gould, who 'guest stars' as himself in this episode, for analysis. Much of the humour within this episode is focused on the actions of those people who believe the skeleton is an angel. We see, for example, a group of Springfield residents watching Lisa being interviewed on the (fictional) TV programme 'Smartline'. When the programme finishes Moe comments "Science, what's science ever done for us?" Moe then uses a voice-activated remote control to turn the television off. Moe is also seen being injured whilst taking part in a riot, during which Springfield residents destroy the town's scientific institutions. Moe says "I'm paralysed, I just hope medical science can cure me!" One of the 'scientific institutions' that the rioters set on fire is the Christian Science reading room.

On the other hand, the reputation of science and scientists also provides a source of humour. When Lisa takes the sample to Stephen Jay Gould, she tells him that she can't afford to pay for the work she wants him to carry out. The scientist responds "I didn't become a scientist for financial gain. What ever little money you have will be just fine." The next day Gould arrives to tell Lisa, and the rest of the Springfield community, the results of his tests and has to admit to the results being "inconclusive". Later in the programme, when 'the angel' is revealed as a publicity stunt contrived by the developers of the shopping complex, Lisa asks Gould why his tests didn't prove 'the angel' was a fake. Gould admits that he actually had not had time to carry out any tests.

In one scene, when Lisa is put on trial after she has attempted to destroy 'the angel', the 'science vs religion' theme of the programme is made explicit. At the beginning of the trial the Judge Snyder announces:

"Lisa Simpson, you are charged with the destruction of an historic curiosity. A misdemeanour. By the larger sum, this trial will settle the age old question of Science vs Religion. Let the opening statements commence"

In issuing his judgement at the end of the trial, Snyder says:

"I find the defendant not guilty. As for Science vs Religion, I am issuing a restraining order. Science should stay 500 yards from religion at all times."

Although much of the humour within this episode is relatively overt, overall there appears to be an attempt to deal with the tensions between science and religion in a fairly nuanced manner. The over-arching narrative represents, potentially, a quite complex combination of plot and story²⁰, with the humour working on 'different levels' depending on the viewers'

²⁰ Within many forms of narrative analysis the distinction is made between 'plot', the information that is presented directly to the viewer, and 'story', the inferences and assumptions that the viewer may

understanding of the central debate. It could be argued that children and young people are perhaps the least likely to have a well-developed understanding of this debate, and indeed we will return to this issue further in Section 4 when discussing the participants' analysis of an extract from this episode. As we have discussed previously²¹, however, certain images from episodes of popular programmes have considerable longevity in the minds of children and young people, and episodes from series such as *The Simpsons*, which are repeated on television regularly, may have an ongoing, and developing, influence on viewers' perceptions of STEM-related issues.

In another episode of *The Simpsons* (*Lisa the Simpson*) there was another example of the 'Religion vs Science' debate. In this episode it is not the main focus of the plot, which focuses on Lisa's concerns that all of the Simpson family, as she writes in her diary, "go through a process of dumbening²²". Lisa becomes concerned when she can not think of the answer to a 'brainteaser' that is printed on the back of a food container. All of her friends work out the answer, but even after a night of working at the problem, Lisa still doesn't have the answer. Having spent all night working on the problem, Lisa has forgotten to complete her homework project. She tries to produce something at the last minute in the lesson. On viewing the results Miss Hoover, her teacher, says "This is terrible at best. I'm surprised at you Lisa!" Lisa discusses the problem with her mother, who tells her not to worry. Abe, Lisa's grandfather, overhears the conversation and tells Lisa that 'dumbening' happens to all the Simpson family – "Oh, your dad used to be as smart as a monkey! But then his mind started getting lazy and now he's as dumb as a chimp."

Lisa decides she needs to find out more about the possibility that her intelligence, and subsequently her lack of it, might be linked to the defective 'Simpson gene'. She goes to see Dr Hibbert, who shows her a short film called 'In the kitchen with DNA', which he says will answer all her questions. In the film we see Troy McClure, a television presenter, wearing chef's hat labelled 'God' talking to a small boy who asks "Mr McClure, what is DNA?" McClure responds that "DNA is God's recipe for making you". He then proceeds to demonstrate the process saying "take a dash of dad and a pinch of mom then we bake in the oven for nine months." The small boy then asks McClure what DNA stands for, and McClure cannot answer. Lisa's response is to ask if there is anyway in which she can change her DNA. Being told there isn't, she says "Maybe I should just give up now, and settle into a mindless happy stupor".

We then see Lisa sitting with Homer and Bart watching television and eating snacks. Whilst watching the television she daydreams about her future. The images conjured up by the daydream make Lisa decide to make the most of her last days before her mind "melts into a soft, Simpsony sludge". She fills her time with visits to an art gallery and playing her

(or may not) make when trying to interpret the plot. (For further discussion see, for example, Gillespie, 2006)

²¹ Whitelegg, et al, 2008, p.26

²² Lisa uses the word 'dumbening' because she can't think of an appropriate term for becoming less intelligent than you were before – and she takes this as evidence that she really is dumbening!

saxophone at the local jazz club. Being interviewed on a television news programme Lisa announces, “For reasons beyond my control, I will soon become vapid, sluggish and slow-witted. So before that happens, I want to share some things that have really meant a lot to me” She finishes by saying “Beauty is all around, not just in the parlours and pageants. You can find it in the swirl of galaxies or the swirl in the centre of sunflower”.

Lisa’s parents are so worried by her behaviour that Homer traces “every Simpson living in the tri-city area” and asks them to visit Springfield. At first, when Homer asks each of the male relatives what they are doing with their lives, Lisa’s worst fears seem to be confirmed. At that point Dr Simpson, who is female, explains to Lisa that the defective Simpson gene only affects the Y chromosome, and all her female relatives are high-achieving, successful women.

Genetics and DNA are also a main theme in the plot of three episodes of the *Doctor Who* series. *Daleks in Manhattan* and *Evolution of the Daleks*²³ are set in New York in 1930, with the city in the grips of the Great Depression. The Doctor and Martha become involved with what the newspapers are calling ‘The Hooverville²⁴ Mystery’, where men who had been recruited as temporary labourers to work on the building of the Empire State Building keep disappearing. The Doctor and Martha discover that the Daleks have been kidnapping the men. The Daleks then carry out “intelligence scans” on the men, with those of low intelligence being taken to become slave workers and those of high intelligence being taken to the “transgenic laboratory” to be used in “The Final Experiment”. The so-called final experiment involves creating hybrid Daleks who are part human – or, as one of the Daleks puts it “a Dalek in human form”. The leader of the Daleks, Dalek Sec, has taken part in a trial experiment, and he is now part-human. When questioned by The Doctor as to what it feels like to be part-human, Dalek Sec says that he now feels “everything we wanted from mankind, which is ambition, hatred, aggression and war. Such a genius for war!”

Questioned further by The Doctor about the experiment, Dalek Sec explains that the Dalek race is near extinction, with only four Daleks still alive. They have tried to ‘grow’ Dalek embryos, but none have survived. Their solution now is to take human-beings and preserve them “near death” with their “minds wiped ready to be filled with new ideas”. Dalek Sec then explains, “I am the genetic template. My altered DNA is to be administered to each human body. A strong enough blast of gamma radiation can splice the Dalek and human genetic codes and wake each body from sleep”. The final part of the plan is to use the tower at the top of the Empire State Building, which has been built using Dalekanium²⁵, to channel the energy from a solar flare to create the “blast of gamma radiation”. The Doctor, of course,

²³ The Daleks are organisms from a planet called Skaro. Their bodies are integrated into a protective metal casing, which both allows them to move around and to use the weapons that are a part of the metal casing.

²⁴ ‘Hooverville’ was the popular name given to the settlements, made up of shelters built from whatever materials could be found by people who had lost their jobs and homes, which had developed in many major US cities at this time.

²⁵ Dalekanium is the metal material that the Dalek casings are made from.

manages to stop the experiment and destroy all but one of the Daleks, who escapes by carrying out “an emergency temporal shift”.

During his encounters with the Dalek Sek, The Doctor has several exchanges with the Dalek about what it means to be human, rejecting Dalek Sek’s assertion that “ambition, hatred, aggression and war” are the motions that human-beings feel most strongly. The notion of what it means to be human also plays a part in the other episode of *Doctor Who* that involves a plot that focuses on genetic engineering.

In *The Lazarus Experiment* The Doctor takes Martha back to her home in the present time. Although Martha originally agreed to travel with The Doctor for ‘just one trip’, she has now been on two trips – one into a different time and one to a different planet – and it is time for her to return to her previous life. As The Doctor and Martha are saying goodbye to each other, The Doctor hears a television news report during which a Professor Lazarus announces “Tonight I will demonstrate a device. With a push of a single button, I will change what it means to be human”. Hearing the announcement, The Doctor decides he needs to find out more. The Doctor and Martha attend the event, a launch party, invited by Martha’s sister Tish who happens to work for Professor Lazarus. On arriving at the party The Doctor asks Tish “Do you know what the professor is going to be doing tonight? That looks like it might be a sonic microfield manipulator.” Tish responds, to Martha, “He’s a science geek. I should have known.” When Tish leaves to meet other guests The Doctor asks Martha “Science geek? What does that mean?” Martha responds “That you’re obsessively enthusiastic about it”. Interpreting the description as a compliment, The Doctor says “Oh, that’s nice.”

Professor Lazarus, who is an elderly man, has invented a machine, which he refers to as a genetic manipulation device. He steps into the machine and a few minutes later he emerges looking much younger and announces “Ladies and gentlemen, I am Richard Lazarus. I am 76 years old and I am reborn!” During his ‘rebirth’, however, a problem has occurred with the device and, as a result of the genetic manipulation, Lazarus turns into a large insect-like monster.

We used an extract from this particular episode in the reception study, and in Section 4 we will discuss the participants’ interpretations of the narrative and its links between genetic engineering and ‘what it means to be human’. What we want to highlight at this point is the narrative links between these three episodes. Whilst the plots of these episodes could really only be sustained within the fantasy settings of science fiction, the representations of science as ‘problem-creator’ that they draw on reflect elements of ‘real life’ stories both past and present.

The idea that only those humans of high-intelligence could be used to create the new race of Daleks has obvious eugenic overtones. With this in mind, the setting of New York in 1930 would not seem inappropriate as membership of the American Eugenics Society, founded

in 1926, reached its highest levels in the 1930s. The notion of a superior race, the Dalek in human form, being brought about through “the Final Experiment” evokes images of the Nazi Party’s ‘Final Solution’, which was to take place during the Second World War a decade later. In *The Lazarus Experiment* we see gene ‘manipulation’ being put to use for other than medical reasons. Surveys of public attitudes into the uses of gene therapy (see, for example, Wellcome Trust, 2005) highlight that distinctions are made by the public between medical and non-medical uses of gene therapy. Non-medical uses receive much lower levels of approval than medical uses, and participants register much lower levels of trust in science and scientists in relation to these uses.

In the context of young people’s formal education, there is an increasing emphasis on the idea that pupils should engage with the role and impact that STEM-related issues have on people’s everyday lives. This is reflected not only in the specifications for teaching STEM-related subjects, but in the development of new curricula where these issues are the primary focus of study. For example, the subject specification for the new ‘Science in Society’ GCE states that the prime intention that underpins the curriculum is to ‘develop the knowledge and skills that learners need in order to grapple with issues related to the science and technology that they meet now and will meet in their adult and working lives’ (AQA, 2008, p.2). Whilst science fiction programmes and animated sitcoms are unlikely to be the primary sources of information it is envisaged that the young people will draw on in order to ‘grapple’ with these issues, we would argue that drawing on young people’s media literacy skills to explore the representations that the young people already engage with and enjoy could provide a useful starting point from which to explore controversial issues and the debates that surround them. Other concerns may be that it is through these types of programmes that children and young people get distorted and inaccurate information about these controversial issues and debates, but it could be argued that it would be more effective to address these possible misconceptions rather than ignore them.

3.2.2 Martha Jones and Lisa Simpson

When discussing their recent research into the gender stereotypes of scientist characters in television programmes popular among middle school-aged (12 –14 years-old) children in the US, Steinke et. al. (2008) suggest that “presenting positive televised images of women scientists may be a particularly effective strategy for providing role models to promote girls’ interest in science, particularly when direct interaction with human role models is not possible” (p.5). They argue that it is particularly important that researchers explore the possible impact of characters that appear in a range of programme genres, and not those whose main focus is science education. They point out that analysing programmes that are popular with young people is more likely to provide insights into the ways in which images influence attitudes towards both science and the appeal of a career as a scientist. As such, their research project explores characters from dramas, cartoons and situation comedies, as well as science education programmes.

In this section we want to focus on two STEM-related characters from the fictional programmes included in our analysis, Martha Jones and Lisa Simpson. Although other female STEM-related characters do appear in both series, we want to use these two characters to illustrate the point made in our previous report²⁶ concerning the potential for fictional programmes to present positive role models that young people might readily identify with.

In some ways the characters of Martha and Lisa are quite different. Lisa is represented as being different from many of her peers. As a 'child genius' her talents are considered to be 'extraordinary' rather than inviting the viewer to identify with a character that is 'like me'. Martha, on the other hand, is represented as being a comparatively 'normal' young woman. In the first few scenes of the episode where we meet Martha for the first time she is walking down the street on her way to work, chatting on her mobile phone and organising a 21st birthday party in the local pub for her brother. We then see her at work with her colleagues, sharing the ordeal of carrying out 'rounds' with a senior consultant. When it is Martha's turn to diagnose a patient, rather than excelling at the task her suggestion of "stomach cramps" elicits a derisory response from the consultant – "That is a symptom, not a diagnosis. And you rather failed basic techniques by not consulting first with the patient's chart." It is Martha's responses to the extraordinary situations that she later finds herself in, rather than her everyday life, that marks Martha out as different from the rest of her colleagues. Even at this point some of her reactions are very 'normal', and she becomes the first ever character on *Doctor Who* to be heard swearing when she looks out of the window to find that the hospital has been transported to the moon!²⁷

Despite the differences between the characters, the themes that emerged from our analysis do highlight some commonalities, and we would suggest that these themes illustrate the potential for characters to not only engage young people, but to provide positive role models.

Rather than being represented as characters that lack interpersonal skills, both characters are portrayed as playing a central role within their families' relationships. Discussing the character of Lisa when contributing to a commentary for the *Lisa the Skeptic* episode one of the writers on the series, David X. Cohen, says "Lisa always seems to me to be the heart of the family". Although Lisa sometimes appears to be exasperated by the behaviour of members of her family, especially with Homer and Bart, she also often acts as mediator between members of the family when there are arguments or disputes. As mentioned in our

²⁶ Whitelegg, et al, 2008

²⁷ Martha says "We're on the moon. We're on the bloody moon!" Discussing his decision on an episode of *Doctor Who Confidential*, the writer Russell T. Davies says that he felt it would be the kind of reaction that you would expect in that sort of situation. Having seen a Harry Potter film where one of the young characters says "bloody hell", and the audience's response was one of laughter rather than shock, Davies says that he felt that the use of this swear word in a family show was possibly acceptable where it hadn't been before.

previous report²⁸ when participants in the reception study discussed Lisa's personality she was described as "sweet and nice-natured"; "eager to please"; and, "caring".

Being interviewed on *Doctor Who Confidential*, Russell T. Davies describes the opening scenes of the episode where we first meet Martha. He says "we do see Martha as, she's sort of peace-maker within her family, because it is a family in crisis". Martha's parents are divorced and her father wants to bring his new girlfriend to his son's 21st birthday party:

Martha [phone rings]	You're up early! What's happening?
Tish [Martha's sister]	It's a nightmare, because Dad won't listen, and I'm telling you, Mum is going mental. Swear to God, Martha, this is epic. You've got to get in there and stop him.
Martha	How do I do that?
Tish	Tell him he can't bring her!
Martha [her phone rings again]	Hold on, that's Leo. I'll call you back.
Leo [Martha's brother]	Martha, If Mum and Dad start to kick off, tell them I don't even want a party. I didn't even ask for one. They can always give me the money instead.
Martha	Yeah, but why do I have to tell them? Why can't you? [Her phone rings] Hold on, that's Mum. I'll call you back.
Francine [Martha's mother]	I don't mind your father making a fool of himself in private, but this is Leo's 21st, everyone is going to be there, and the entire family is going to look ridiculous.
Martha	Mum, it's a party, I can't stop Dad from bringing his girlfriend. [Her phone rings] Hold on, that's Dad, I'll call you back.
Clive [Martha's father]	Martha? Now, tell your mother, Leo is my son, and I'm paying for half that party. I'm entitled to bring who I like.
Martha	I know, but think what it's going to look like for Mum, if you're standing there with Annalise.

Martha's family, and her relationships with them, are part of the narrative that runs throughout the series. The time travel element of the *Doctor Who* narrative means that Martha is able to be shown having adventures across time and space, and then returning to her home or calling her family on the phone within a normal time-frame.

Martha and Francine argue frequently about Martha's relationship with The Doctor, who Francine assumes to be Martha's boyfriend. Other topics that cause arguments are Martha not replying to her phone messages, not going around to the family home for meals and 'answering back' when her Francine is trying to talk – "when did you get so rude? I'll tell you

²⁸ Whitelegg et. al., 2008, p.25

when. Ever since you met that man!” Despite the arguments, it is to her mother that Martha turns for comfort when put in a situation where she really believes her life is at risk.

Similarly, in *Lisa the Skeptic* although we see Lisa asserting her own independence by, for example, negotiating with the developers, appearing on television to argue her case and taking a sample of the skeleton for testing, she also finds she needs her mother’s support. Towards the end of the episode there is a moment when even Lisa comes to believe that the skeleton might be that of an angel and that the residents of Springfield might be about to witness the end of the world. Immediately after it is revealed that the whole incident is a marketing ploy Marge, Lisa’s mother, says to Lisa “Well I guess you were right honey, but you have to admit that when the angel started to talk you were squeezing my hand pretty hard”. Lisa responds “Well it was just so loud....but thanks for squeezing back.”

In short, however fantastic and ‘unreal’ the experiences of Martha and Lisa might be, their characters are always situated within a set of family relationships that most viewers would recognise as being fairly commonplace. Martha’s and Lisa’s desire for independence and adventure, whilst at the same time finding their family relationships both a source of annoyance and of comfort or support, might be a narrative that is of particular appeal to young people. When one of the aspects that underpins this sought-after independence is the characters’ involvement with STEM, there is the potential for these characters’ stories to not only engage children and young people in a broader sense but, in doing so, to provide aspirational narratives that seem achievable and desirable.

Although ‘grown-ups’ may not always agree with Lisa’s stance on certain issues they seldom seem to question her knowledge and understanding of STEM, and it is this knowledge and understanding that provides Lisa with a distinctive status both within her family and the community at large. In *Doctor Who*, The Doctor is usually the character who is seen solving the various problems and disasters that occur during the adventures, but on several occasions in this series, Martha has to take control of a situation and, indeed, save The Doctor.

Discussing an episode when The Doctor has been possessed by an alien being (42), Freema Agyeman, the actor who plays Martha, says “There is a shift in the relationship when she just has to take control. He (The Doctor) is genuinely scared. She’s never heard him say he’s scared. And I don’t imagine he’s said it very often”. Martha is seen using a ‘stasis chamber’ to freeze The Doctor and, in the process, kill the alien:

THE DOCTOR	It’s burning me up. I can’t control it. If you don’t get rid of it, I could kill you. I could kill you all. I’m scared! I’m so scared!
MARTHA	Just... stay calm. You saved me, now I return the favour. Just... just believe in me.
THE DOCTOR	It’s bloody killing me! Then what’ll happen?!
MARTHA	That’s enough! I’ve got you!

In a two-episode storyline (*Human Nature* and *The Family of Blood*) The Doctor has to turn himself into a human-being, using a device called a “Chameleon Arch to re-write my biology”, in order to prevent aliens tracing him and taking charge of “Time Lord Technology”. Part of the process of becoming a human-being involves The Doctor losing his memory and, as Russell T. Davies puts it, “Martha is left facing the monsters alone. The whole story wouldn’t work if the Doctor didn’t trust Martha”.

In the series finale, a three-part story (*Utopia*, *The Sound of Drums* and *Last of the Time Lords*), The Doctor is imprisoned by The Master²⁹ With The Doctor unable to do anything to prevent The Master from conquering the Earth and then launch a universe-wide war. It is left to Martha to save not only The Doctor, but the rest of the human race.

As we have already mentioned, Martha does leave The Doctor at the end of this series in order to return to her medical studies. However, Martha subsequently appears in the companion series *Torchwood*. In this appearance Martha has finished her medical training and is working for the Unified Intelligence Taskforce (UNIT), an organisation that also appears in story-lines of *Doctor Who*, as a medical officer and expert on alien life-forms. Even more recently, the character of Martha has reappeared in several episodes of the most recent series of *Doctor Who*. As such the audience has been able to follow Martha’s career and watch her gain in both expertise and confidence. Again, although the STEM-related activities that Martha Jones is involved in could only really be sustained within science fiction scenarios, the potential exists from broadcasters to make links between this fictional character and ‘real-life’ STEM practitioners. We discuss this potential in the section that follows.

3.2.3 Doctor Who Confidential and Brainiac Science Abuse

The documentary series *Doctor Who Confidential* provides the audience with insights into the characters and storylines involved in each episode of main series. The programme also shows what is involved in the technical production of the series, including the generation of CGI and the use of special effects. Much of the technical production involves STEM-related activities, and the professionals who are involved in these activities often appear on the series discussing the detail of the work that they do. In the versions of the series³⁰ that we analysed, only one of these professionals was a woman³¹, and she is glimpsed only briefly as part of a wider shot of people working on CGI for the series. The lack of women, or at least of women being represented as experts in this context, may well be a reflection of the

²⁹ The character of The Master first appeared in *Doctor Who* in 1971. Like The Doctor, The Master is a Time Lord, but his ambition is to “control the universe” and he is a personal enemy of The Doctor.

³⁰ We viewed the ‘cut-down’ 15 minute versions that were included on the DVDs

³¹ We note, however, that women were shown as being involved in the programme in other professional roles. Julie Gardner (Head of Drama, BBC Wales) and Jane Tranter (Head of BBC Fiction) are seen discussing the appeal of *Doctor Who*. Other women who appeared in *Doctor Who Confidential* included a producer, a production manager and a writer.

under-representation of women working in these particular sectors of the audio visual industries³². We would like to suggest, however, that a series that has such a high level of popularity as *Doctor Who* does provide broadcasters with particular opportunities to play a part in engaging with a broad range of young people in an effort to address this under-representation. The multi-platform nature of the series may be useful in this regard.

The appeal of programmes like *Doctor Who Confidential* is that they provide the audience with a 'behind the scenes' view of the main programme. In the case of *Doctor Who*, this 'behind the scenes' view is also provided by the commentaries that actors and production staff make to accompany the programmes. As well as being provided as 'additional features' on the DVDs, these commentaries can be downloaded from the programme's website. The website also contains extracts from *Doctor Who Confidential* and additional 'exclusive' clips of interviews with actors and production staff talking about their involvement with the programme. What these additions to the main programme do not provide, however, is any information on how to become even more involved 'behind the scenes'. That is to say, they do not give details of how a young person might progress to work within the sector and how this might be linked to the subjects they are studying at school. Providing this kind of information would not necessarily involve the programme-makers themselves in having to generate this type of content. Skillset, the Sector Skills Council for the audio visual industries, already provides suitable content on their website (see, for example, their guides to the media industries called 'Access all areas' http://www.skillset.org/careers/jobs/sector_overviews). Providing links from the programme websites to relevant information might encourage young people to start making these connections.

Brainiac Science Abuse is also characterised by the lack of female engagement in STEM-related activities. Although there were three female brainiacs shown in the episodes we viewed, the majority of brainiacs were male. Even when the women were shown taking part, the roles that they played in the experiments could be viewed as reinforcing certain gender stereotypes. Richard Hammond introduces the extract *What's the fastest way to make toast?* by saying "We like a man's breakfast and we like it on a grand scale. Science makes a man hungry and a hungry man needs toast – lot's of it³³". We then see one of the female brainiacs preparing toast by hanging bread on a rotary clothes line and 'cooking' it with a flame-thrower. Likewise, in the extract *The lazy man's guide to making a kebab*, we see the male brainiacs preparing to cause an explosion inside "one delicious jumbo doner (kebab)" whilst two female brainiacs prepare the salad to go with the kebab.

³² For details other 2006 employment census carried out by the Sector Skills Council Skillset, see: http://www.skillset.org/uploads/pdf/asset_9920.pdf?6

³³ The use of gender-specific language occurs at several points in the extracts we viewed. For example, Richard Hammond refers to the amount of 'man-hours' taken to build Thrust SSC, the fastest vehicle on land. He also comments that such a vehicle would be "out of the reach of the ordinary man".

In July 2008 Sky Television announced that the current series of *Brainiac Science Abuse* would be the last. As we have already mentioned, however, other programmes that follow a similar format were also named by participants in the study and given that so many of the participants that took part in the study named programmes that followed this format as the science programme that they could remember having seen on television, it is worth considering the appeal of such a programme for young people. When we discussed the participants' responses to the question about what they enjoyed doing in science classes, we highlighted the way in which many of the activities focused on science that was 'eye-catching'. These types of programmes do provide that sort of 'eye-catching' STEM-related activity, and it could be argued that they work to dispel a possible representation of STEM as 'boring'. In the extracts from *Brainiac Science Abuse* that we watched, there were attempts to explain the science behind spectacle. How much of this information is taken in by an audience, who are perhaps at that point in time focused on spectacle, would possibly be the subject of a further study. Likewise, strategies that could be used to provide additional information for the viewer, such as more detail of scientific principles that are being illustrated within the 'experiments' or the real-world uses of the science, would improve the potential of these types of programmes to engage young people in STEM. Once again, the solution might be provided by companion websites or other forms of multi-platform programming.

In the next section of this report we look at the series that were designed by the young people that took part in this stage of the project, and we discuss the emphasis that they put on not 'dumbing down' the STEM-related content of their series and the alternative strategies they considered in order to combine the humorous and educational aspects of their programmes. It may well be that the solution to developing STEM-related programming that both informs and entertains lies in asking the young people themselves to think about how this might best be achieved.

4. Reception study

In this section we discuss the reception study activities carried out with 22 young people (12 girls and 10 boys) aged 11-16 (KS3/4).

4.1 Methodology

The participants were invited to be involved via contacts already established during the previous studies or through OU networks (an open invitation was made to staff in the Faculties of Science; Maths, Computing and Technology; Education and Language Studies and Social Sciences to involve their children in the study). The participants all received information leaflets about the study beforehand, and both the participants and their parents were asked to sign consent forms in accordance with ethical procedures, which had been agreed beforehand with the University's Human Participation and Materials Ethics Committee.

The participants in this study were all volunteers who gave up their own time during the school holidays to participate in the project, so the activities were conducted on the OU campus outside a classroom environment. This setting enabled more in-depth focussed work outside the constraints of the school day, and made planning the event much simpler and within our own control. Eight participants had been involved in the previous reception study for the project, whilst fourteen had not participated before.

Table 1 below provides an overview of the day's activities:

Table 1: Overview of activities

Activity	Description
1	Analysing short extracts. Small group activity Participants watched and discussed short extracts from TV programmes as per worksheet (for details of all worksheets see Appendix III). Participants then presented their findings to the whole group.
2.1	Developing a television series. Small group activity. Participants planned an overview of their television series as per worksheet and then pitched their ideas to the whole group.
2.2	Developing a television series. Small group activity. Participants planned one episode of the series in detail and then pitched their ideas to the whole group.
2.3	Developing a television series. Small group activity. Participants planned series associated websites and merchandising and then pitched their ideas to the whole group.

- 3 Reflective writing. Full group activity, self-completed as individuals. Participants asked to imagine themselves as members of the Executive Board of the potential funders of the television series and write a letter of recommendation for one of the series (not their own).
- 4 Draw-a-scientist activity. Full group activity, self-completed as individuals.
- 5 Evaluation. Individual participant reflection on the activities in Stages 1 to 5.

For the first two activities of the day, the participants were divided into small groups of 5-6 per group, comprising one single sex girls' group, a single sex boys' group, and 2 mixed gender groups. Table 2 below provides details of the composition of these groups.

Table 2: Composition of groups

Name of Production Company³⁴	Gender	Age (girls)	Age (boys)
SERLA	All female	2 aged 14 3 aged 13	
pH4 Production	All male		1 aged 16 1 aged 15 3 aged 13
Vision Productions	Mixed	1 aged 15 1 aged 13 1 aged 11	1 aged 16 2 aged 11
Test Tube Babies	Mixed	3 aged 15 1 aged 11	1 aged 13 1 aged 12

The first activity (see Appendix V) of the day was designed to engage with media literacy skills of 'understanding', in particular analytical skills relating to language, representation and audience. Working in small groups, participants watched a short extract (approx. 10 minutes) from a television programme. These extracts had been chosen by the research team because they contained either stereotypical or counter-stereotypical representations of STEM or STEM practitioners and/or men and women. In the Ofcom review, Buckingham (2005) points out that:

³⁴ The groups were asked to choose a name for their production company as part of Activity 2 (see p.23). As the composition of the groups remained the same throughout all the group activities, the name of the production company is used as the group identifier throughout this report.

‘Despite considerable debate about the dangers of stereotyping and well-established evidence of systematic biases in the representation of different social groups, there has been relatively little research about how children make sense of such representations.’ (p.16)

This activity required the participants to not only try and identify stereotypes within the extracts but, through presentations to the group as a whole, explain their reasons for identifying these particular representations as stereotypical. Other aspects of the activity required the participants to summarise the narrative of the extract (language) and identify the strategies used by the programme-makers to make the programme appealing to children and young people (audience).

In our earlier study the storyboard activity (Activity 2), which was designed to encourage the participants to engage with creative aspects of media literacy, formed a part of the day’s activities whereas this time it was the major activity for the day, with the young people spending approximately 3 hours on this. Figure 1 below outlines the scenario that was given to the participants in order to provide a context for the activity as a whole. The activity consisted of three stages (see Appendix VI), and within each of these stages the participants are required to draw on the ‘understanding’ element of their media literacy skills in order to contribute to the groups’ ‘creative’ project.

Figure 1: Scenario for Activity 2

The legendary television producer, Ms Big Bucks, has decided that she wants to make a television series that promotes science, technology, engineering and mathematics (STEM) to young audiences.

Your group own and run a television production company. Your company have been given the opportunity to ‘pitch’ your ideas for such a television series to her.

Working in your groups you need to follow the brief provided for you below by Ms Big Bucks’ television production company. The brief outlines the different stages of the bidding process. After you have completed each stage of the project, you will present your ideas to the Executive Board of the television company.

The other members of all the other groups will be acting as the Executive Board during your presentation, and you will play the same role when other groups give their presentations.

At the end of the whole process you will be asked to write a recommendation to Ms Big Bucks, suggesting which programme she should fund and why. So remember to take notes during the presentations!

Your first task is to think of a name for your production company, and then start work on Stage 1 of the pitch.

As outlined in Figure 1 above, for activity 3 the participants were asked to write a letter recommending one of the proposed series for funding, and stating the reasons for their recommendation. For this activity the participants switched from working in small groups to working individually. The reason for this change in format was to encourage participants to reflect on the presentations that they had seen and write about their personal opinions, rather than having to come to a group consensus.

All the group discussions were recorded on digital audio recorders and presentations to the whole group were also recorded on a digital video recorder. All these recordings were analysed using Transana³⁵ CAQDAS, which is designed specifically to support the inductive coding of audio and video data. All resources used by the participants during their presentations, for example scripts and illustrations or key points recorded on flip-chart paper, were also retained and used to augment the analysis of the recorded data. In order to enable easy cross-coding from the discussions and presentations from activities 1 and 2 to the letters of recommendations written by the participants for activity 3, recordings were made of the letters, and these recordings were then imported into Transana. (Appendix VII contains a brief overview of the organisational structure used within the Transana software)

There were two elements to the coding of the data in Transana. Firstly, a series of keyword groups were established in advance of the inductive coding, and these keyword groups related to the central issues explored in this project including:

- *Representations of gender*
 - stereotypes
 - counter-stereotypes
 - signifiers
 - links to STEM
- *Representations of STEM*
 - nature and role of science
 - nature and role of technology
 - nature and role of engineering
 - nature and role of mathematics
 - signifiers
- *Access*
 - programme scheduling
 - multi-platform
 - interactivity
- *Understanding*
 - language
 - representation
 - industry
 - audience

³⁵ Transana (<http://www.transana.org>) is Open Source software developed and supported by the Wisconsin Center for Education Research.

Secondly, a more extensive set of codes was generated through inductive analyses, which were cross-referenced to the keyword groups where appropriate.

In our previous studies the participants had completed the 'Draw-a-Scientist' activity as the first activity of the day. As such, some young people who had participated in the earlier study had already completed the 'Draw-a-Scientist' (DAS) activity in the earlier phase, so may have been expected to be aware of stereotypical portrayals of scientists and sensitised to the issue of gender. We decided, therefore, to repeat the DAS activity at the end of the day with all the participants to see if different kinds of images were drawn. This strategy is similar to other research (for example Steinke et. al., 2007; Losh et. al. 2008) that seeks to explore the possible role that interventions designed to develop media literacy skills might have in altering gendered perceptions of STEM practitioners. The results of the DAS activity were analysed both according to the Chambers (1985) protocol and the additional signifiers we had used in the earlier studies³⁶.

Finally, we asked participants to complete an evaluation of the day's activities.

4.2 Results and interpretations

The results of the reception study are split into five sub-sections: analysing short extracts; designing and pitching a television series; writing a letter of recommendation; 'Draw-A-Scientist' and the evaluation activity.

4.2.1 Analysing Short Extracts

In order to contextualise our discussion of the participants' responses to this activity, we begin this section with overviews of each of the extracts watched by the groups.

Overview of the extracts

Doctor Who
Series 3
Episode: '42'
Watched by SERLA

In response to a distress signal, The Doctor and Martha land the TARDIS on a spaceship. The female captain of the spaceship, McDonnell, explains that the engines have cut out and left the ship on a crash course with a local star. A nearby monitor announces that the projected time until impact is 42 minutes, hence the title of the episode. The episode is 42 minutes long, and so the story is told in 'real time'. Martha and a male member of the crew, Riley, set off to try to gain access to the control room so that the auxiliary engines can be used to steer the ship away from the star. The series of doors leading to the control room

³⁶ See Whitelegg et. al., 2008, p.9 -10.

have been sealed automatically as part of the spaceship's emergency procedures, and they can only be opened if the correct passwords are entered. The passwords are answers to a series of randomly-generated 'pub quiz' type questions. Meanwhile the Doctor and other members of the crew go to the main engine room, to try to fix the systems. The Doctor finds that all the engine-related machinery has been destroyed, and comments that someone "knew what they were doing", inferring that these weren't random acts of vandalism.

At this point there is a message via the ship's intercom from another male crew member, Ashton, saying that Korwin, McDonnell's husband, is having some sort of seizure and that McDonnell should come to the ship's medical centre immediately. McDonnell and the Doctor run up to the ship's medical centre where they find Korwin lying with his eyes closed, screaming in agony, and shouting "It's burning me!" Korwin is being restrained by Ashton, a male crew member, and Abi, the ship's female medic. Ashton tells McDonnell that he saw Korwin sabotaging the spaceship. The Doctor sedates Korwin and instructs Abi to test Korwin to find out what is wrong with him - "carry out a bioscan and tissue profile of the metabolic detail". Abi responds that she is already doing this and The Doctor comments "oh, you're good". The Doctor and McDonnell return to the engine room and resume trying to fix the systems.

While updating the Doctor, via the intercom, on the tests she has been running on Korwin, Abi is attacked by Korwin. We see Korwin walking towards Abi with his eyes closed and he says 'burn with me'. He then opens his eyes and we see two streams of intense light come from his eyes. The Doctor runs to Abi's aid telling everyone else to keep working on the engine. McDonnell and another male member of the crew, Scannell, ignore his command and follow him. On reaching the medical centre they find that Abi has been 'vaporised'. The Doctor describes this as "endothermic vaporisation". He looks at the results of the tests carried out by Abi, noting that "body temperature is 100 degrees" and that "oxygen has been replaced by hydrogen". Then ponders aloud on what the cause might be "parasite? mutagenic virus?". He asks McDonnell if the ship has landed anywhere or docked with another ship recently, and McDonnell states that they have not. McDonnell is at first unwilling to believe that Korwin could be responsible for sabotaging the ship and killing Abi, but then relents and alerts the rest of the crew to avoid him.

Throughout these events, Martha and Riley continue to open the security doors by answering the questions, with the help of the Doctor. In order to answer one question, Martha has to use her mobile phone, which the Doctor has modified enabling it to be used to call anywhere in time and space, to ring her mother and ask her to search for the information on the Internet.

Doctor Who Confidential
Series 3
Episode: 'Monsters Inc'
Watched by Test Tube Babies

The programme is linked to the episode of Doctor Who called 'The Lazarus Experiment'. Professor Richard Lazarus is a scientist who has invented a 'genetic manipulation device'. He demonstrates the device at a cocktail party by using it to make himself 40 years younger, stating that his purpose is to "change what it means to be human". The demonstration goes wrong and Lazarus is turned into a 'monster'. The extract itself has a number of overlapping themes.

There are clips of interviews with some of the cast and crew of Doctor Who where they respond to the question 'What is a monster?' David Tennant, the actor who plays The Doctor states that The Doctor never refers to 'monsters', but uses the term 'creatures' reasoning that "the broader implication (of the term monster) is evil, kind of something to be feared, and I think, as ever, it's more interesting if you think of each creature on its merits". Russell T. Davies, the series writer, also comments that the Doctor would never use the term 'monster' and talks about the topic in more general terms saying " You've got to be careful that to be alien isn't to be bad. That isn't something that we want the programme to say"

The director, producer and writer discuss the work of Millennium FX, the company that provides all the special effects and prosthetic make-up for Doctor Who. We then see images of people, including a woman, working at the Millennium FX studios. A male Computer Graphics supervisor describes the process of creating the creature that Lazarus mutates into in this episode.

Cast and crew members discuss two scenes in this episode that involve 'stunts'. The first is when the creature appears and attacks the guests at the cocktail party. As the creature is created using Computer Graphics Imagery (CGI), the crew need to find ways of making one table collapse as if a creature has jumped on it and other tables hit members of the cast as if they were thrown by the creature. A stunt performer replaces one of the main actors in this scene. The actor says "having a stunt man is great because, somebody else gets smashed in the face and you collect his man-points afterwards". The second stunt features a scene where The Doctor is escaping from Lazarus's lab, which is on fire and about to explode. David Tennant is to perform this stunt himself. We see the male stunt co-ordinator planning and testing the stunt. When being interviewed about the stunt, David Tennant comments "there's this whole thing about actors doing their own stunts, and if you don't do your own stunts you're in some way, I don't know, wanting in manliness. But the truth of the matter is I wouldn't be allowed to do it unless it was completely safe".

Brainiac Science Abuse
Series 1
Watched by PH4 Productions

This extract comprised four clips, each covering a different 'experiment'.

- Walking on Custard

Introducing this clip Richard Hammond, series presenter, says "humans can't walk on water because they have to obey the laws of physics". He explains that people are too heavy to be supported by surface tension and are not buoyant enough to float. Jon Tickle, co-presenter, is seen jumping into a swimming pool and sinking. When he rises again to the surface Jon Tickle says "But I can walk on custard!"

We then see the pool being emptied of water and filled with custard. The custard is being made on "an industrial scale" using concrete mixers. Jon Tickle explains that custard is a "non-Newtonian liquid" in that it sometimes it has properties like a liquid and sometimes it has properties like a solid. He explains that he will walk very quickly and will be "impacting" very hard on the custard, and that this pressure should ensure that the custard is solid and, therefore, he won't sink. He also explains that the custard must be of a type made with cornflour. He then walks across the custard, whilst the Brainiacs look on and cheer. Richard Hammond then says that in order to "prove your theory" Jon Tickle should stand still, "according to your theory I'd expect you to sink if you stand still". Jon Tickle stops walking and begins to sink.

- Racetrack

The Brainiacs test out a number of objects – skates, skateboard and office chair - that they have modified so that they are propelled by CO₂ from a fire extinguisher.

One male Brainiac, wearing a safety helmet and knee and elbow pads, tests the devices and another male Brainiac, holding a clipboard and stop-watch, records the time it takes for either the Brainiac to lose control of the 'vehicle' or the CO₂ to run out. He then measures and records the distance travelled.

Richard Hammond explains that because the office chair is heavier than the skates and skate-board they will use two fire extinguishers to 'power' it. He describes this as being "twin cylinder".

The skate-board goes further than the skates, but not as quickly.

The office chair goes both "further and faster".

- Peter Logan's Exploding Paste

The clip starts with Peter Logan announcing "I am Peter Logan and this is my exploding paste". We are told that the paste is safe when it is wet, but becomes "unstable" when it is dry. The exploding paste is made from iodine crystals and one other "secret ingredient". Logan is seen painting it on the handle of a toilet flush. We see, via a hidden camera, a

male Brainiac come into the toilet and use it. He then touches the handle in order to flush it, and there is a small 'explosion'.

Richard Hammond tells us that "Peter invented the paste at school, but to date the only use he has found for it is practical jokes"

- The Electric Fence

Richard Hammond explains the purpose of this kind of electric fence – "to keep cattle in and foxes out". We see a single male Brainiac touch the fence and get an electric shock. The Brainiac appears to be in a great deal of pain. Richard Hammond explains that when the Brainiac touches fence "it completes a circuit from the fence to the Brainiac, through his body down to ground, through ground to earth stakes, from the earth stakes to the unit".

The Brainiac then stands on polystyrene tiles and touches the fence. Richard Hammond explains that the tiles act as insulation and therefore the Brainiac does not get a shock.

Richard Hammond then indicates a flashing light on the unit, and explains that when the light is on there is a charge running through the fence. He hypothesises that if the Brainiac can make sure that his feet are not touching the ground when the charge is in the fence, he won't get a shock. Hammond tells the Brainiac that he will tell him when the light is on and the Brainiac should jump in the air. We see the Brainiac attempting to time his jumps so that he is in the air when the charge is in the fence, but he is not successful and receives several shocks. Richard Hammond says "we need to work on that theory a bit!"

Richard Hammond then says "what can be better than shocking a Brainiac? Shocking a whole load of them!" Five Brainiacs, one of whom is a woman, then hold hands and one of them touches the fence. The first three Brainiacs feel the electric shock. The Brainiacs then change their order in the line. Richard Hammond suggests that the Brainiac who was furthest away from the fence, but still felt the shock, may have "unique insulating properties". This Brainiac is stood at the end of the line, but the next 'experiment' demonstrates that he doesn't have insulating properties.

All the Brainiacs except the one at the far end of the line are then told to stand on polystyrene tiles. Richard Hammond, speaking quietly to the audience, says that the Brainiacs think that because the charge has never travelled to the end of the line, insulating the other four Brainiacs should mean that no-one gets a shock. The Brainiacs hold hands and one of them touches the electric fence. All the Brainiacs receive a shock. Richard Hammond explains that the charge has travelled down the whole line "looking for earth and shocking everyone long the way"

All the Brainiacs then stand on polystyrene tiles and none of them receive a shock. Richard Hammond says "well done" and walks towards the Brainiac at the far end of the line, extends his hand as if to shake hands with the Brainiac. The Brainiac responds by stepping

forward off the polystyrene tiles, and all the Brainiacs receive a shock. Richard Hammond says, directing his comment to the audience, "Some people never learn".

The Simpsons
Series 9
Episode: Lisa the Skeptic
Watched by Vision Productions.

A new shopping mall in Springfield is being built on an area where a large number of fossils were found. Lisa negotiates with the building contractors to allow an archaeological dig before building progresses any further. She blackmails the School Principal, Skinner, into sending the pupils to take part in the dig. Skinner announces the outing, "All honors students will be rewarded with a trip to an archaeological dig. Conversely, all detention students will be punished with a trip to an archaeological dig". During the excavations, Lisa finds what appears to be a human skeleton, but with wings. Springfield's residents are convinced it is an angel. Lisa disagrees, but can't think of a more plausible explanation. Whilst everyone is discussing who the remains belong to, Homer steals the skeleton and puts it in the family's garage.

Neighbours begin to come around and ask if they can see the angel, and Homer starts charging an entrance fee. Lisa is seen discussing the issue with Marge who states that faith is important to her, to which Lisa retorts "But you're an intelligent woman!" Marge says that if Lisa can't sometimes "take a leap of faith" then she feels sorry for her.

Lisa takes a piece of the bone to the museum hoping that a DNA test can be performed. She takes the sample to Stephen Jay Gould, who 'guest stars' as himself in this episode. The next day Dr. Gould appears at the Simpson house to tell Lisa that the tests were inconclusive. Lisa is then seen being interviewed on a TV Programme called 'Smartline', where she compares a belief in angels to a belief in unicorns and leprechauns saying "You can either accept science and face reality, or you can believe in angels and live in a childish dream world".

We then see Springfield's religious community watching the programme at a meeting where one person describes science as "the blabbermouth that ruins the movie by telling you how it ends". The group then goes on a rampage destroying all scientific institutions including, in a side joke, the destruction of a Christian Science Reading Room. A news reporter is seen saying "Technocrats are learning a lesson in humility tonight as angel supporters lay waste to Springfield's scientific institutions".

Participant's responses

The participants were allowed to take notes whilst they watched the extracts if they chose to. Having watched the extracts they were asked to complete the activities outlined on the

worksheet (see Appendix III), which required them to write a descriptive overview of the extract; discuss why they thought this programme might appeal to audiences their age; identify any stereotypical representations³⁷ of both STEM and men and women; and then plan a presentation about these issues which they would then present to the whole group. Members of the research team watched the extract with each group and then ensured that the participants understood the task. The groups were then left to complete the activity on their own, although members of the research team checked back with the groups at regular intervals in order to answer any queries. The format for the group presentations was as follows:

- group introduces the extract
- extract is shown
- group presents the results of their analysis
- researcher asks if anyone has any questions/comments.

Once all of the groups had given their presentations, the participants were asked to discuss, within their groups, all of the extracts they had been shown. They were asked to focus on what sorts of images of STEM they felt were represented in the extracts.

- *Why do the programmes appeal?*

In their presentation on *The Simpsons*, Vision Productions stated “We think this clip appeals to people our age because it is funny and enjoyable to watch”. The discussion of the clip within the group, however, reflects a rather different picture:

Participant 1	Do you think this programme will appeal to your age group?
Participant 2	Yes, because it’s the Simpsons. It’s really funny
Participant 3	There’s more adult humour in that episode really. It’s not that funny.
Participant 2	Some ones are really funny. It’s funny.

One of the reasons why this particular extract had been selected was because the researchers had felt that represented a quite complex issue in a humorous way. The extract references the limitations of both science and religion in providing satisfactory explanations for phenomena and the narrative is underpinned by concerns about which explanatory framework should be privileged within society. The links to this issue, however, seem not to have been interpreted in the same way by the participants, highlighting perhaps that young people recognise when ‘messages’ contained within storylines are not aimed at them and the need for programme producers to be alert to the different possible interpretations of their representations of issues.

In the discussions where each group talked about all the extracts they had viewed, one group, SERLA, made a broader link to science, commenting that “Simpsons was science

³⁷ When introducing this activity to the whole group members of the research team discussed the meaning of the term ‘stereotypical’ and gave examples relating to STEM and gender.

because they try to prove theories”. The pH4 group felt there was little to link the extract to science:

- | | |
|---------------|---|
| Participant 1 | Simpsons had nothing to do with it. |
| Participant 2 | Just archaeology and a little bit of science. |
| Participant 1 | It didn't really show what it was like to be a scientist. |
| Participant 3 | The person in the museum. What was he? That guy? |

During their discussion of which of the extracts might provide the most positive representation of science, one member of Test Tube Babies commented “Brainiac shows like it's fun whereas The Simpsons is a lot about ruining things”, and another member responds saying “yeah, like science ruins people's beliefs.”

The role of humour in Brainiac Science Abuse was also discussed by pH4 during their analysis of the extract. They make the distinction between, for example, the explosions, which are ‘funny’ and which make “the boring bits of science more fun”, and the aspects of science that they consider to be ‘fun’ anyway – “the experiments and stuff”. Their discussion highlights that they think Brainiac Science Abuse appeals to young people their age because it includes both of these elements.

The discussions of Doctor Who Confidential focused on how the programme-makers had made the programme ‘exciting’, but again the discussions illustrated that this excitement was generated in a number of different ways. In their analysis of the extract, Test Tube Babies begin their discussion:

- | | |
|---------------|---|
| Participant 1 | Do you think that this programme would appeal to people your age and why? |
| Participant 2 | It's got fire in it and special effects. |

[Group laughter]

- | | |
|---------------|---|
| Participant 3 | And that's going to make people of our age group enjoy it?! |
| Participant 2 | No, cos its got like violence and action and stuff in it, it makes it exciting. |
| Participant 4 | Yeah. |

In addition to the *results* of special effects and CGI being viewed as exciting, they also comment on the appeal of the ‘behind the scenes’ approach of this programme and being able to see how the special effects are created and used, including the way they in which they are integrated with the ‘real’ aspects of the programme. One participant comments, for example, “I think the way in which the actors react to the monsters [without the monsters actually being there] and have to act to the monsters makes it a lot realistic as well, but that makes you feel like it's quite cool.”

During their discussions of all the extracts they had been shown, all of the groups highlighted the CGI and special effects used in Doctor Who Confidential, and all the groups discussed the links between this programme and technology. The only other programme thought to include images of technology was Brainiac Science Abuse, specifically the 'racetrack' clip, but this was classified as "really simple technology". One of the reasons for the researchers choosing the Doctor Who extract was that they viewed the use of the mobile phone and Internet to access information as a representation of technology as 'problem solving'. None of the groups made this connection, and this may suggest that these uses of technology are viewed by young people as being so commonplace that they do not warrant particular mention.

Discussions of the two fictional programmes, The Simpsons and Doctor Who, emphasised the role of the plot in plays in making a programme appealing. In their presentation to the whole group, Vision Productions say that The Simpsons appeals because "It always has a strange dilemma about one of the Simpsons characters. The storyline always goes the other way that you think it is going to go". Likewise, during SERLA's discussion of the appeal of the Doctor Who extract, one member comments "It's quite dramatic though, it keeps you, like, watching it, trying to find out what's wrong, what happens." During their presentation, SERLA summarise this as "the episode appeals to people our age because it creates tension".

- *Stereotypes of STEM*

Discussions of stereotypical images of STEM in The Simpsons and Brainiac Science Abuse tended to focus on physical appearance with aspects like white lab coats (the Brainiacs and Stephen Jay Gould) and safety goggles (the Brainiacs) being highlighted. The only other science stereotype identified in relation to The Simpsons was described as "very disbelieving of things without proof or facts"

A similar issue with physical appearance also arose in SERLA's discussion of the Doctor Who extract, where The Doctor puts his glasses on at certain points in the extract.³⁸ One participant states that "When he was working stuff out he puts on his glasses", and another agrees "Yeah, when he's working things out, glasses, you have to wear glasses if you're smart." Members of the group also linked this to representations of mathematics – for example, "He thought that he was smarter than.... he thought that everyone else should think that maths is fun". Here the participant is referring to a scene in the extract where The Doctor answers one of the password questions. The question is 'Find the next number in

³⁸ In a Doctor Who 'mini-episode' for the BBC's Children in Need appeal, two TARDIS collide which results in a meeting between the Fifth Doctor (Peter Davison) and the Tenth Doctor (David Tennant). Whilst the Fifth Doctor is trying to work out what is wrong with the TARDIS, he puts on a pair of spectacles. The Tenth Doctor exclaims "out they come, the brainy specs. You don't even need them; you just think they make you look clever". Later in the episode the Tenth Doctor also puts on his spectacles, turning to the other Doctor he says "Look, snap!".

the sequence 313, 331, 367...’ When Martha and Riley say that they don’t know the answer the Doctor responds, via the intercom system:

The Doctor: 379.

Martha: What?

The Doctor: It’s a sequence of happy primes.

Martha: Happy what?

The Doctor: Just enter it!

Riley: Are you sure? We only get one chance?

The Doctor: Any number that reduces to 1 when you take the sum of the square of its digits and continually replace it until it yields 1 is a happy number. Any number that doesn’t isn’t. A happy prime is a number that is both happy and prime. Now type it in! (*Directing comments to McDonnell*) I don’t know. Talk about dumbing down. Don’t they teach recreational mathematics anymore?

In their discussions of all the extracts the groups all identified Doctor Who as being the only extract that included representations of mathematics. Test Tube Babies, for example, commented that the extract was “showing Maths as really complicated”. One member of SERLA did identify a further example of mathematics within the Doctor Who extract: “And if you think about it, if you had to override the system they’d be like codes and numbers and terminology”.

The stereotypical image of the ‘mad scientist’ arose during the Test Tube Babies discussion of Doctor Who Confidential, but the discussion also highlighted the ways in which participants, in some instances, didn’t just accept ‘obvious’ stereotypes at face value:

- Participant 1 Have the programme makers used any stereotypical images of STEM or STEM professionals in this extract?
- Participant 2 All the scientists are slightly mad.
- Participant 1 Yeah, but that’s stereo..., is that, yes STEM, that’s science.
Um, it talks about that Lazarus guy who’s a scientist being, they’ve made him crazy and mad.
- Participant 2 Right.
- Participant 3 He’s only mad because he’s turned into a monster.
- Participant 2 No, because he’s mad to attempt it.
- Participant 1 Yeah, because he thinks he can actually do it.
- Participant 3 No, but to create something like that you’re not mad
- Participant 2 No, because he knows it’s not safe
- Participant 1 (writing on flipchart) Scientists are all mad.

Researcher enters the room.

Researcher Any other things about STEM?

Participant 1 We’ve only got ‘scientists are all mad’ at the moment.

Researcher	Is what they said? That's alright. But why? Perhaps, you know why did they...?
Participant 1	I don't know
Participant 2	Because they think they have control over all different things
Participant 3	They think they're control freaks

In their presentation the group summarise this stereotypical image as “the programme makers have used stereotypical images of STEM and STEM professionals by saying that scientists are all mad. The scientist in this episode is completely mad and wants to make himself young no matter what happens.”

Two further comments by members of the group about this particular aspect of the extract make links to the notion of science as dangerous:

- “Like science makes bad things”
- “Science can go wrong really easily”.

- *Stereotypes of men and women.*

In both their discussion of The Simpsons extract and their presentation to the whole group, Vision Productions didn't identify any gendered stereotypes.

The pH4 group, who watched the extract from Brainiac Science Abuse, spent quite some time discussing the issue:

Participant 1	They were almost the same.
Participant 2	Yeah, there wasn't too much difference between males and females.
Participant 3	Maybe they're trying to make it...emphasise like everything's equal.
Participant 1	Yeah.
Participant 4	Not sexist.

[Further discussion of the different clips within the extract]

Participant 1	The men would seem stronger?as they took part in the experiments more?
---------------	---

In their presentation to the whole group pH4 summarise this discussion: “The men were carrying out the experiments suggesting that the men were more hardy than the women³⁹.”

The issue of gendered stereotypes also led to a great deal of discussion within the SERLA group. In their presentation to the whole group they summarise the issue by saying “The Doctor in this episode is presented as being more important than everyone else but the captain of the ship is female and people will only take orders from her.” During the group

³⁹ One woman does take part in the electric fence 'experiment'.

discussion, however, there is further discussion about the female captain and whether, despite her status, she still provided a stereotypical female image:

- Participant 1 Emotional.
- Participant 2 Yeah, the woman was very emotional.
- Participant 3 She wasn't that emotional.
- Participant 1 Emotional's stereotypical.
- Participant 2 Yeah.
- Participant 3 Well it is quite, but she wasn't that emotional. She is quite upfront but it's only because her husband was possessed!
- [Two other participants say "yeah"]
- Participant 3 I'd be emotional!

The SERLA group identified a further stereotypical image in the Doctor Who extract - "The Doctor's a male and the nurse is a female. That's quite stereotypical". It should be noted, however, that the woman isn't identified as a nurse in the extract, and the group seem to have assumed this is the case. The Doctor does instruct her to carry out certain diagnostic tests, but she then informs him that she is already carrying them out and The Doctor says "ooh, you're good". The Doctor does leave her to carry out the tests whilst he returns to the engine room, and in a subsequent conversation accepts her expertise in interpreting the tests, so there doesn't seem to be any signifiers of a subordinate position.

Test Tube Babies also highlight gendered roles in the extract of Doctor Who Confidential stating in their presentation that "The scientist is a man and all his technicians are women". They also highlight a slightly more nuanced example:

- Participant 1 Is there any other stereotypical images of males or females?
- Participant 2 What like including the monsters? The monster has a man's face on it.
- Participant 3 Yeah, it's like he's got a picture of his face on it.
- Participant 2 It's like saying he's stronger than everybody else, which is a man.
- Participant 1 Clever, I'd have never thought of that.

In their presentation they state that "the monster in this episode is a man and quite often in most of the episodes the monsters are men. And that's saying that men are more evil than women and the monsters are stronger than the people and men are stronger."

A final example highlighted by the Test Tube Babies group was the relationship discussed by two of the actors between 'manliness' and carrying out your own stunts.

Summary

The qualities that these young people valued in these extracts were storylines that create tension and surprise; the use of special effects and CGI to produce scenes that were

exciting and appeared more 'realistic'; and, the use of age-appropriate humour. Both the girls and the boys rated these qualities as appealing.

Our approach of drawing on the participants' media literacy skills highlights that young people do recognise the strategies that programme producers deploy in order to engage the audience. The participants note, for example, that certain strategies are used to make "the boring bits of science fun", or to keep the audience "watching it, trying to find out what's wrong", or to make the audience "feel like it's quite cool". As such, it could be argued that these elements, if incorporated into TV programmes containing STEM, would increase the appeal of such programming to young people more generally.

In identifying stereotypical representations of STEM practitioners the participants linked certain denotive signifiers with broader connotative representations of STEM. For example scientists wear white coats and safety goggles (protective clothing), and science as dangerous and an activity that "can go wrong really easily". The stereotype of the clever, and bespectacled, mathematician was also observed. It could be argued that whilst denotive signifiers provide useful 'short-cuts' for programme-makers in terms of establishing the roles of characters within the plot, programme-makers should also be aware that the interpretation of these images can convey negative messages that young people may not find engaging, such as science as being inherently dangerous or mathematics as being "complicated".

It is important to note, however, that encouraging young people to draw on their media literacy skills can lead to them interrogating certain stereotypes. The discussions of the 'mad scientist' by the Test Tube Babies group and of the 'emotional woman' by the SERLA group both demonstrate that young people can, and when encouraged to do so, do, interrogate the contexts in which these images are represented. The 'mad scientist' does not become 'mad' as a result of being engaged with science, but rather he is 'mad' in that he wants to "make himself young no matter what happens". The emotional responses of the female captain of the spaceship were felt to be quite justified, suggesting that the participants feel it is possible to be a leader and still have humane responses.

It could be argued, therefore, that it is important for programme-makers to recognise the significance of contextual information and young people's abilities to interpret quite nuanced aspects of storylines if they are presented to them in a way that they find engaging, and that over-simplistic use of stereotypes may be counter-productive.

4.2.2 Designing a Television Series

The first task for each of the groups was to choose a name for their production company:

- SERLA – an anagram using the first initials of each participant's given name.
- pH4 Productions– When the participants had been put into groups for the earlier activity, the groups' names had been colours. This group was the 'yellow group'. In

deciding on their name they had tried to associate the colour yellow with a pH scale, and decided to call themselves pH4.

- Vision Productions – suggestion of one member of the group and others agreed, but no particular reason given.
- Test Tube Babies – suggestion of one member of the group and others agreed, but no particular reason given.

All of the groups also designed a logo for their production companies and when discussing the designs of the logo all the groups discussed 'copyrighting' their logo.

As already mentioned, this activity comprised of three stages, and the sub-sections below mirror these three stages. We begin each sub-section by summarising the presentations given by each team to the group as a whole. These summaries are then followed by a discussion section that draws on our analysis of both the presentations themselves and the interactions between the participants during the planning stages.

Stage 1 – An overview of the series

On the two previous occasions that we have carried out a similar activity as part of the reception study the participants have shown a preference for designing quiz shows and animated cartoons⁴⁰. This preference is also demonstrated in these examples, with two groups choosing to design quiz shows and two designing cartoons.

Series overview of 'Boffins' (SERLA productions)

Boffins is a comedy STEM quiz that will be transmitted 'live'. It is a series comprising of six episodes:

Episode 1 – getting to know the competitors and a general knowledge quiz

(After this episode, the competitors will be put into teams)

Episode 2 – science quiz

Episode 3 – maths quiz

Episode 4 - engineering quiz

Episode 5 – technology quiz

Episode 6 – 'The last STEM quiz' and 'Boff Champions'

Seven teams of 3 people. One team knocked out in each round, leaving two teams in the final. The teams will wear different coloured coats. There will be a different celebrity host for each episode.

The series is aimed at 7 to 16 year olds. It will be shown on BBC1 on Mondays at 17.30.

The audience at home will be able to join in by using the "red button", and there will also be

⁴⁰ Whitelegg et. al. (2008) p. 26 - 27

a phone-in competition, announced by Jon Tickle, at the end of each episode. The winning prize for the competition will be a 'Boffins' T-Shirt and a ticket to the next live show. The design of the series has been influenced by 'Brainiac Science Abuse' and "random" quiz shows.

The production team think the series will appeal to children and young people because: "A fun, friendly, educational way to teach 7 – 16 year olds about STEM." "It's bright, colourful, funny and it's got lots of music people their age can relate to."

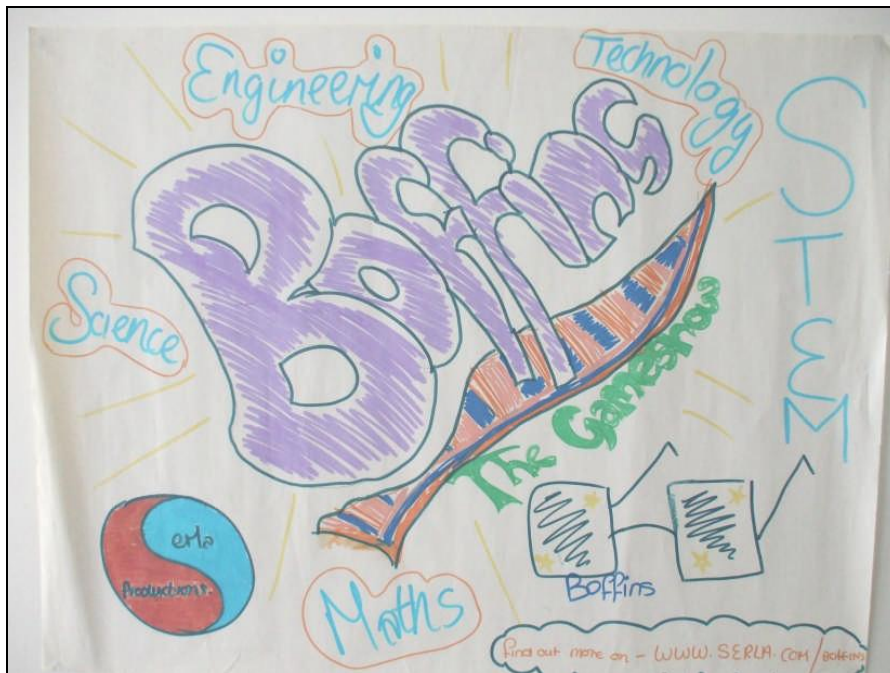


Figure 2: Poster produced by SERLA productions

Series overview of Go Go Science (pH4 Productions)

A comedy game show based on the three sciences. Each episode has three rounds – one on biology, one on chemistry and one on physics.

There will be a presenter who introduces the contestants and asks the questions. There will also be an "experimenter" who carries out an experiment and gets something wrong, "producing comedy". The contestants have to answer questions on what went wrong. The experimenter will be "stereotypical e.g. white lab coat", so they that are easy to identify.

Points are given for each correct answer and the name of the winner from each episode will be recorded on a leader board. The prize for the overall winner is a trip to NASA.

The series will be shown on BBC and Channel 5, and the audience will be able to buy DVDs of the series and watch online.

The design of the series has been influenced by Brainiac's Test Tube Baby⁴¹.

⁴¹ Brainiac's Test Tube Babies was a 'spin off' series, which unlike Brainiac Science Abuse, was transmitted live. Two Brainiacs, referred to as 'the test tube babies', carried out pseudoscientific experiments. Jon Tickle was the 'resident boffin', answering questions that had been submitted by the audience via an online forum.

The production team think the series will appeal to children and young people because:
 “We are using this type of programme to show children how fun and safe science can be”
 “It will appeal to children because it will be funny and easy to understand”

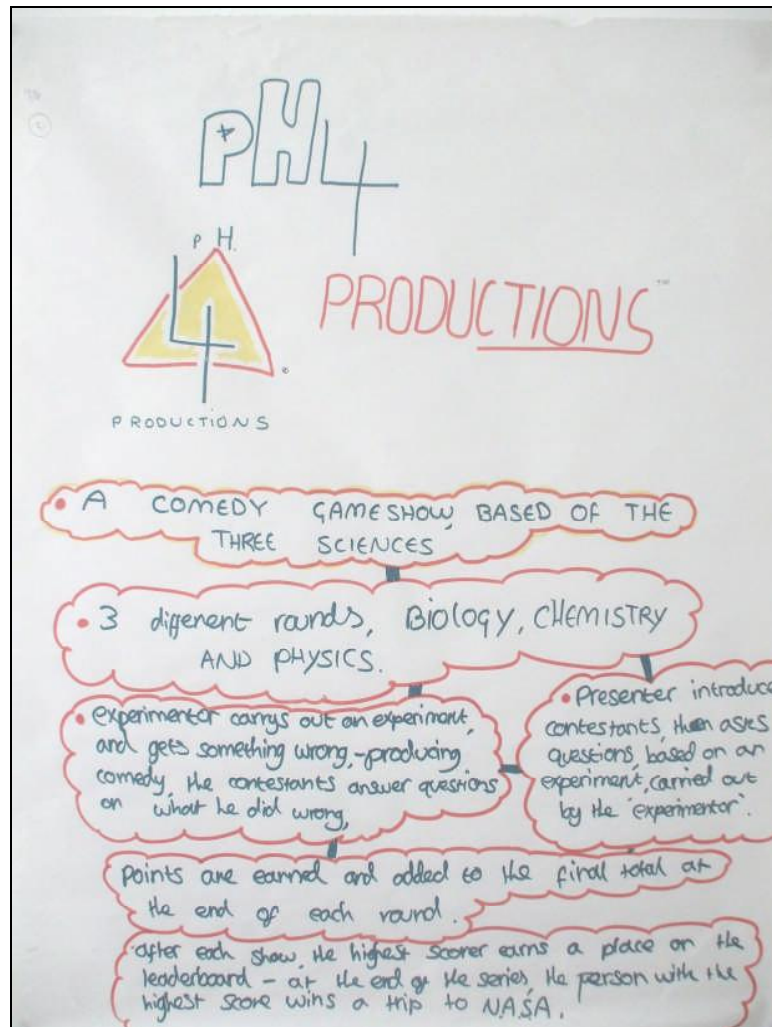


Figure 3: Poster produced by pH4 productions

Series overview of Super Sam Alacabam (Vision Productions)

An educational cartoon aimed at 3 – 9 year olds based on “superhero Super Sam and his science mishaps”.

It will be shown on Channel 5 and CBBC.

The production team think the series will appeal to children and young people because:
 “In each episode we aim to explain a science experiment in an enjoyable and simple way”.

There wasn't a great deal of detail in this presentation, and listening to the audio of this discussion shows that the group spent quite a good deal of time settling to the task they had been given. It should be noted, however, that this groups contained 3 of the youngest participants. Their work became more focused as the tasks progressed, and their series received the most recommendations in Activity 3.



Figure 4: Poster produced by Vision Productions

Series overview of Super Duper Babies (Test Tube Babies)

A comedy cartoon based on four babies (super geniuses), “One is good at science, one is good at technology, one is good at engineering and one is good at maths”. In each episode they have to “save the world by solving different problems using STEM”. They meet in a secret room hidden behind their play box. They have a cat called Stem who stands guard and warns them if their parents are coming. In the secret room they have tools that are provided by “their boss”.

It will be shown on CBeebies at 4pm, and lasts 15 - 20 minutes.

The design of the series has been influenced by ‘Space Pirates’ and ‘Rugrats’.

The production team think the series will appeal to children and young people because:

“We choose the programme because we thought it would appeal to younger children and make them know STEM at a younger age”

“It’s appealing to younger children because it’s fun rather than really serious”

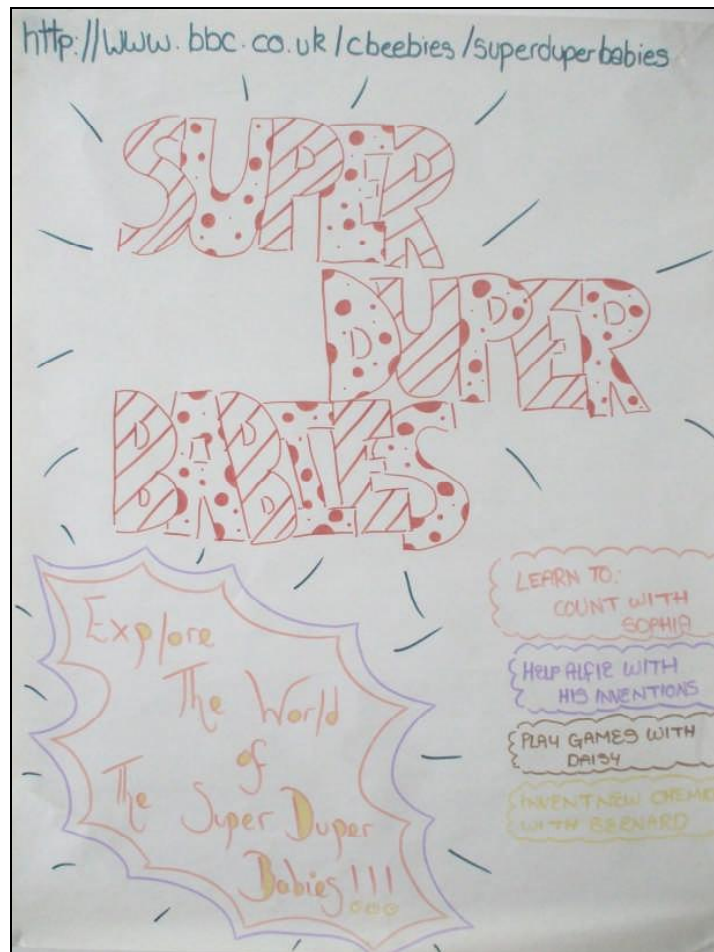


Figure 5: Poster produced by Test Tube Babies

Discussion

All of the groups hoped to sell their series to the BBC, with two groups specifying the BBC children's services CBeebies (aimed at under 6s) and CBBC (aimed at 6 – 12 year olds). During their planning the groups highlighted a variety of reasons for choosing specific channels.

The starting point for SERLA (*Boffins*), for example, was "we need something that they can get without Sky". Their first choices are ITV and Channel 4, and the BBC channels are dismissed because "they are boring". After a discussion about their dislike of "having a break half way through", to allow for the advertisements shown on commercial television stations, they decide on BBC1. Their discussion of the scheduling for the programme focuses on the age group their series is aimed at. They discuss the times they themselves arrive home from school and dismiss earlier timings because secondary school pupils will not be home to watch the programme. Time slots after 7pm are dismissed because they will be "too late for the little kids". In the end, 5.30pm is chosen as "they (the BBC) always have a programme on then that older kids can watch too" and because it is a suitable time "If you are eating a TV dinner or something". Test Tube Babies (*Super Duper Babies*) also relate their choice of channel to the specific age group their programme is aimed at - "it should be on, like, CBeebies for younger children and make them think that science and math and

engineering and technology are fun”. Neither Vision Productions (*Super Sam Alacabam*) nor pH4 Productions (*Go Go Science*) discuss their choice of the BBC – in each case the suggestion is made by one member of the group and other members concur. pH4 Productions, however, do discuss their choice of Channel 5 – “Channel 5 show a lot of programmes that are, like, on other channels”.

Reflecting developments in multi-platform programming, two groups, pH4 productions and SERLA, considered additional ways in which the audience might access the television series. pH4 productions planned to have their series available on DVD and for viewers to be able to watch online. During their planning SERLA discuss how the series might also have a companion radio show, although this idea is later abandoned. SERLA do, however, recognise the opportunities offered by interactive technologies to engage their audience in accessing related content through the use of the ‘red button’ and a ‘phone-in’ quiz.

Research focusing solely on the ‘access’ element of media literacy skills tends to examine participants’ ability to locate programming that the participants themselves want to watch. By drawing on the participants’ creative media literacy skills we can explore how they understand the notion of accessing ‘appropriate content’ in a broader context. In their presentations, all of the groups highlight informal learning aspects of their series, and the letters of recommendation that are written by the participants as part of the study also suggest that they view this aspect as important in this type of programming. As such, the BBC, with its public service broadcasting remit, would be an appropriate broadcaster to ‘pitch’ these series to. This might suggest that the groups have at least an implicit understanding of the role of public service broadcasting. At the least it would suggest that, despite the increase of channels now available to children and young people, the BBC is still viewed by these participants as playing a major role in broadcasting this type of TV programming. It is worth noting that all the groups emphasise that, whilst the informal learning aspect is important, the series should also be entertaining and fun.

All of the groups appeared to demonstrate a well-developed understanding of genre and related narrative.

The two groups who designed quiz shows, SERLA and pH4 productions, discussed the format of their series at length. Their choices of format differ, one being a team-based ‘knock-out’ competition and the other being individuals competing to gain the highest score on a ‘leader board’, but both are familiar formats for this genre of programme. Both groups also decide at this early stage that there should be an element of humour/comedy in their series, but differ in their ideas about how this element should be incorporated into the programming. SERLA discuss the role of the “funny celebrity host” during their planning, whereas pH4 Productions decide to make comedy an integral part of the competition itself:

Participant 1: What type of programme are we producing?

Participant 2: I think it should be a little bit comedy. Not too much though.

Participant 3: a comedy or a game show.

Participant 1: we could have a combination of the two.

Participant 3: a comedy game show.

Participant 1: what you could have is a bit of comedy, like a video, and then have a game show about it.

[The group all agree]

Participant 1: you can have experiments going wrong and then asking questions about where they went wrong.

Participant 3: And then it's serious and funny at the same time.

Once again, these two groups emphasise this notion of 'serious and funny' as being part of the appeal of their series to their audience. This notion that learning can be fun is also emphasised by the two groups who designed series based on cartoon characters, and nine of the participants highlighted this notion in their letters of recommendation as being one of the reasons for their choice of programme.

The two groups that chose to design cartoons, Vision Productions and Test Tube Babies, draw on the 'superhero' narrative that is a familiar element of this genre. Vision Production's main character, Super Sam, is described as a superhero; whereas the Super Duper Babies are "super geniuses", but they do 'save the world by solving different problems'. In our previous report⁴² we highlighted this notion of STEM as 'problem solving', as opposed to 'problem-creating', as having the potential to provide a positive representation of STEM, but we also noted that this representation could be problematic when linked to images of superheroes whose powers are the product of an accident during a scientific experiment⁴³. Neither Vision Productions nor Test Tube Babies discuss how their characters have gained their superhero, or in the case of Super Duper Babies 'super-human', powers, but in the case of the latter the name of the production company did raise issues with some members of the group. Following the presentation by Test Tube Babies, a question was asked about the suitability of the name of the production company:

Participant 1	Isn't the name a bit offensive? Doesn't it provoke a few issues?
Response 1	It's called Super Duper Babies. Our company is called Test Tube Babies.
Participant 1	I know isn't that...
Response 2	It's just an idea
Participant 1	I know, exactly
Participant 2	Catholics are against in-vitro fertilisation.
Participant 1	Exactly, let's grow babies!

Listening to the audio recording of the group's discussion of what to name the company, there seems to be no indication that they made the same kinds of connections as other

⁴² Whitelegg et. al. 2008 p.30

⁴³ Whitelegg et. al. 2008 p.25

participants. They did, however, consider that certain versions of the logo might not seem appropriate.

- Participant 1 Just draw a baby in a test tube.
- Participant 2 You can't squeeze a baby into a test tube!
- Participant 3 A baby sat on top of a test tube
- Participant 2 Our logo will be slightly cruel having a baby stuck in a test tube!
- Participant 4 We could just have a baby holding a test tube.
- Participant 3 A baby with wild hair wearing a lab coat
- Participant 1 I've just done a baby inside a test tube!
- Participant 1 Oh, that's horrible!

The version that they use for their logo features a baby sat on top of, rather than inside, a test tube (see Figure 7 below)



Figure 6: Revised logo for Test Tube Babies

Similarly, contradictory interpretations of certain representations of STEM were raised in relation to SERLA's programme and the use of the term 'boffins'. Following the presentation by SERLA, a question was asked about the suitability of the name for the show:

- Participant 1 Isn't boffins offensive?
- Response 1 It's truly nice because it's saying you're an intelligent person.
- Response 2 It's not like we're pointing at anyone and saying "you're a boffin"
- Participant 2 You're just putting them on television and saying "you're a boffin"
- Participant 3 The winner of the show is a boffin!

Participant 1 They might not want to win it, like, because they would be embarrassed.

[SERLA group - shrugging shoulders and giggling]

Participant 3 Back to the drawing board.

Listening to the audio recording of SERLA's discussion of what to name the show, there seems to be no indication that they think that the term 'boffins' is in anyway offensive. Indeed, all of the names that they consider for the series as a whole and for individual episodes include some part of the word 'boffin', for example, cyboff; boffitech; boffimath; boffineering.

These two examples highlight the importance of not treating 'children and young people' as a homogeneous group and of acknowledging that, despite their age, their interpretation of representations is already contextualised within their broader life experiences. The development of programme-related interactive services have the potential for children and young people to feedback their thoughts and opinions to adult programme-makers, and in doing so provide those programme-makers with a perspective that is perhaps not otherwise easily accessible. It is important, however, that programme-makers do not treat these services as an 'add-on'. Children and young people are unlikely to contribute if they feel that their ideas and opinions are not taken seriously.

Other representations of STEM that are recognised, if perhaps only implicitly, in the overviews of the series are that STEM is complicated or difficult to understand. *Go Go Science*, for example, is going to be "easy to understand", *Super Sam Alacabam* will explain science experiments in a "simple way" and *Super Duper Babies* will help children "know STEM at a younger age". The participants, however, do seem to believe that these representations can be counteracted through the format of the series they have developed.

Stage 2 – Sample episode

All of the groups chose to 'act out' at least part of their presentation on their sample episode. As such, planning the presentations involved the participants in not only compiling storyboards, but in writing scripts. Although acting out sections of the episode was offered as a suggestion on the activity sheets given to the participants, they were not obliged to do this.

Sample episode of Boffins (SERLA)

The episode chosen to discuss in more detail is the final episode. Before looking at this episode, however, they give more details of the series as a whole.

There will be a different celebrity presenter each week:

1. Russell Brand
2. Alan Carr
3. Catherine Tate
4. David Walliams

5. Carol Vorderman
6. Dawn French.

The presenters are described as “middle-aged”. They will wear white lab coats and big square glasses (the logo for the ‘Boffins’ programme). They are funny, kind, but not too nice. In the final episode the teams will have guests to help them. The guests will be Paris Hilton and Orlando Bloom. The winners of the competition also get to go out with the guest stars after the show.

One of the participants acts out the role of Dawn French being the presenter, and the other four group members act as team members.

We don’t hear the questions being read out, just the teams giving the answers

Sample episode of Go Go Science (pH4 Productions)

The group start by giving more details of “attributes” of the characters.

The presenter is described as “adult, smartly-dressed, male, funny, sarcastic and witty”, whereas the contestants should be children, casually dressed and aged between the ages of 10 and 15.

The experimenter is described as “mad, stupid, wear a white lab-coat, have crazy hair”. One of the team members acts as the host, another as the experimenter, and 3 others as contestants.

The host introduces the experimenter and says that he will start by showing a “neutralisation reaction”. The experimenter [speaking in an American accent] announces that he is going to mix hydrochloric acid and sodium hydroxide. The experimenter uses plastic cups and juice bottles from the refreshments that have been provided as props. He spills the mixture on the table he is working on, and then proceeds to lick the mixture off his fingers and hand. He falls down and passes out.

The host steps in and says “to carry on with the reaction, he made water”!

The host turns to the competitors and asks them if they know what was worn in terms of safety issues. Responses are given and the host awards points, but then finishes the round by saying “OK – you missed the fact that he knocked over the experiment!”

The host then asks ‘What went wrong with the chemical side of the equation?’. One of the contestants answers “neutralisation reaction – salt and water are produced, not just water”. Another contestant then presses his buzzer and asks “Can I put that salt on my chips?” The host then announces the winner and write the name at the top of the leader board. There is laughter throughout this presentation from the participants watching.

Sample episode of Super Sam Alacabam (Vision Productions)

The group re-introduce their hero ‘Super Sam’, but they have also now drawn Super Sam’s “evil arch-enemy” Dr Gruntsworth, who is a cartoon male pig.

The group start with one person acting as the narrator and three others acting out the parts of Super Sam, Dr Gruntsworth and a young girl called Gertrude. The participant

who is playing Gertrude decides, shortly after they begin, that she doesn't want to perform, and she sits down. The participant acting as the narrator then plays both parts. He uses a high, squeaky voice to read Gertrude's lines, and as he is one of the older boys, the other participants watching laugh a great deal.

The story starts with Super Sam 'doing his rounds' in his chip van. Gertrude asks for "a bag of chips with lots of salt please". As Super Sam prepares the chips he finds out that he has no salt. Dr Gruntsworth then announces that he has stolen the salt. Super Sam flies away to the local beach. He pulls a beaker from his "utility belt" and talks to the viewers saying:

"Hey kids, I need salt and the best place to get it from is the sea. It's salt water! Now, by heating this, the water is evaporated, which means the water goes away! Leaving just salt!"

Super Sam pulls out a Bunsen burner and the narrator, realising that there is something that the group haven't thought of, improvises saying "and with magic gas that comes from nowhere, he boils the water". Super Sam then flies back to Gertrude and the chip van, and puts salt on Gertrude's chips. Super Sam finishes by saying "Ah, another successful day!" Dr Gruntsworth says "Damn! I've been defeated again!"

Sample episode of Super Duper Babies (Test Tube Babies)

The group start by introducing the characters in more detail. The two of the babies are boys and two are girls. Bernard is the scientist; Alfie is the engineer; Sophia is the mathematician and the technologist is Daisy. They outline some further details in relation to how the Super Duper Babies get called to emergencies. The nose of their teddy bear flashes and an alarm goes off. The babies then "slide down a tube and they change their normal clothes and get cloaks with SD on them." The group then outline the roles that the different babies play:

"The technology baby stays behind the computer and coordinates the mission. The engineer always gets stuck right in, and is very kind. The mathematician has lots of commonsense and the scientist is mad, witty and sarcastic."

Test Tube Babies then move on to acting out their episode, but they first announce that the enemy in this episode is played by Simon Pegg, and the character is called Elliot III. One of the group then narrates the story whilst two other members of the group act out the parts.

The alarm goes, the babies go down the slide and they talk to the 'Head Baby' who tells them about their mission. The two members of the group acting the parts out both talk with American accents. The emergency is described as "Choc Milk, it's disappearing!" The milk has been stolen by the evil Elliot III. Alfie, the engineer, designs a machine that can fire some of Bernard's chemicals to destroy Elliot's evil lab. Once the machine is

made, they drive “in their little toy car through the secret tunnels that are underground, everywhere, to get to the evil lab”. Sophia, the mathematician, works out the angles and the force they will need to fire the machine and hit the lab. They destroy the evil “turning machine” that turns chocolate milk into green slime. The babies then drive back with all the rescued chocolate milk. They get home and go for a nap, and their parents haven’t even noticed they’re missing.

The group have planned a theme tune, but the participant who was going to sing it decides that she can’t.

Discussion

The discussions between members of the two groups that are producing quiz shows again illustrate the importance that the participants attach to the series having an element of comedy in order to engage the audience.

When discussing which celebrities should present the programmes, SERLA decide that the presenters need to be “funny”, but they also want them to be “quite intelligent”. As we can see from the list of presenters, the majority are best known as comedians or comedy actors, the one exception being Carol Vorderman. In discussing whether or not Carol Vorderman was an appropriate presenter one of the group comments “She’s quite smart” to which another member responds “but she’s not funny”. The first group member then states “but we can make her funny”.

It is worth noting that the presenters chosen are not people who are usually associated with programmes that might be classified as ‘children’s television’. Although the group do not consider any established children’s television presenters as possible celebrity hosts, they do consider the possible interactions between the young people taking part in the competition and the presenters. They comment that the presenters should be “nice” but “not Michael Jackson sort of nice, we want middle nice”. The notion of “middle nice” is perhaps an important one for programme producers to think about when considering how to engage an audience of young people (members of SERLA were all aged 13 and above).

As already mentioned, pH4 envisage the comedy element of the programme as being integrated into the quiz itself. In planning their sample episode they decide that the humour should be “fairly slapstick” and that the experimenter should be “wacky”. This leads to an interesting discussion with regards to the gender of the experimenter:

Participant 1 The experimenter is going to be male isn’t it?

Participant 2 Doesn’t really matter does it?

Participant 2 Well if it is going to be a wacky scientist you don’t exactly get a female mad scientist.

The decision is then taken that the experimenter will be male. It is also suggested that the experimenter should be “Albert Einstein looking”, suggesting that this stereotype is one that still resonates with the participants. It should be noted, however, that the group do still want to emphasise the educational element of their programme, and they draw on their

experience of science experiments at school to ensure that the experiment that they are going to act out in their presentation is authentic:

Participant 1 It has to be one acid and one alkali for it to be neutralised

Participant 2 If you have an acid and an acid it can't be neutralised can it?

Participant 1 No, you need an acid and an alkali of equal strengths.

This discussion is followed by some 'teasing' comments about the group members that know this being "in the top science class". One participant points out that he is not only in the top class, but that his exam results make him "one of the top for the whole year" adding that "it is OK to be marginally intelligent y'know".

SERLA also consider how they will balance the educational and comedy elements of their programme when discussing who should be selected as guest team members for the final episode of their series. The first suggestion is that they should be "two really sciency scientists" in order to be able to help the teams with answering the questions. The final decision, however, is that the guest team members need to be "someone good because the prize is going out with them". Paris Hilton is chosen for comedic value:

Participant 1 Paris Hilton because she is really 'blond'

Participant 2 Yeah, the children will be smarter than her!

Participant 3 Yeah, Paris Hilton doing science, come on! But it will get some ratings.

Participant 1 Mostly from middle-aged men, but never mind.

Orlando Bloom is chosen because "he is hot". The only other option considered was Johnny Depp. It is, perhaps, worth noting that SERLA were an all female group.

Despite deciding that celebrities are more likely to appeal to their audience than "really sciency scientists", SERLA are also concerned that the programme maintains its educational value. The group spend a lot of time discussing how they will incorporate the various elements of STEM into the quiz. They decide that mathematics and technology can be tested through the use of quiz questions during the show, but that knowledge of science and engineering will have to be demonstrated through experiments. Showing a good understanding of the technical language of television programmes, they decide that these experiments should be recorded in advance and then shown as video clips during the programme.

Whilst the two groups may take different approaches when seeking to combine the humour and learning elements of their shows, both groups do stress the importance of not 'dumbing down' the STEM-related content in order to make the programmes funny. The two groups that designed cartoons also emphasised the importance of the educational value of the

programme, and in planning how to achieve this both groups drew on a ‘problem-solving’ narrative of STEM. When writing the dialogue for the Super Sam, the Vision Productions group discuss how they will explain the process by which Super Sam can produce salt from sea water. They also discuss the importance of the explanation being age-appropriate. As a result of the discussions it is decided that the term ‘evaporates’ should be used as it is the correct scientific term, but that Super Sam should say something that clarifies what the term means. In a similar vein, the Test Tube Babies group (*Super Duper Babies*) discuss how they will include the skills of individual babies and demonstrate the part each set of skills will play in solving the problem of the disappearing chocolate milk.

When the Vision Productions group discussed how to include the comedy aspect of their programme there are some disagreements, albeit very light-hearted, about the style of comedy to include. This discussion provides an interesting insight into the different ways in which the young people might interpret the language of a particular genre. In the extract below participant 1 was a 16 year-old boy, and the other two participants are two of the youngest participants (aged 11), a boy and a girl.

Participant 1	Gertrude, little Gertrude, ran out from her house
Participant 2	and got run over
Participant 1	what?
Participant 2	that would be quite funny
Participant 1	And then she died. Fairly dark for a children's show isn't it?
Participant 3	Yeah, but it's funny
Participant 1	It's really dark. What is wrong with you?

At various points in the discussion of the script it is suggested by the younger children that Gertrude breaks her leg, gets her face burnt off with oil, gets taken to casualty and that she gets “vapourised by an alien”. Participant 1 finally says “will you lot just stop with the darkness!” The series does, of course, involve cartoon characters rather than ‘real people’, and the younger children may be drawing on representations of ‘non-consequential violence’ that often do appear in cartoons. The older boy, however, appears to be recognising that this particular aspect of the genre is inappropriate in this context.

The Test Tube Babies group also seem to demonstrate an understanding of the language associated with different genre when they discuss how they will use the personalities of the individual babies to represent the different sets of skills each baby will have. In this discussion the group draw on some relatively negative stereotypes, for example:

Participant 1	the technology person is really up themselves because they like control
Participant 2	It's like “can you do this on your computer?” No problem. Done. Nah, nah, nah, nah, nah, I'm clever than you”

Participant 3 Yeah, the technology person always stays behind. The others do the mission and they just sit there co-ordinating it.

The engineer “gets grubby a lot. Always gets stuck in. He’s kind”. The only comment relating to the mathematician character is that “She is really clever”. In deciding the character of the scientist the discuss starts with one member of the group asking “What are scientists like?”:

Participant 1: Stingy. Grumpy.

Participant 2: Grumpy if he doesn’t get his nap. Mad

Participant 3 So he is a boy then?

These three participants, who are all girls, then say “Yeah!” The two boys in the group make no comment.

This group appear to demonstrate a good understanding of stereotypes and the role they play in providing ‘shortcuts’ to understanding for the audience. We would suggest, however, that in doing so they also demonstrate how persistent negative stereotypes can be and this should be a matter for concern.

Stage 3 – Websites and merchandising

Website and merchandising for Boffins (SERLA)

The series will have a website (www.serla.com/boffins). From the website the viewer can access “games, clips, facts, merchandise and competitions”. There is also a link to a forum where the viewer can “talk about your views about the show”, and a further link to news about upcoming series.

The participants then gave ‘fashion show’ exhibiting the branded merchandise, which they had made using the flip-chart paper. One participant acts as a presenter, another participant plays a music file via her mobile phone, and two other participants model the merchandise. The merchandise shown includes:

- a teddy wearing the ‘Boffins’ glasses (£4.99)
- the ‘Boffins’ glasses (£2.00)
- a hat with the ‘Boffins’ logo (£6.00)
- a science kit (£9.99) – “there are no dangerous chemicals, weapons, drugs or alcohol contained in it.”
- a T-shirt with the ‘Boffins’ logo

At the end of the fashion show, the presenter says “Some of the prices are not fixed and the merchandise is all fair trade”. The point about not selling dangerous chemicals, drugs, alcohol or weapons is then reiterated.

Website and merchandising for Go Go Science (pH4 Productions)

The group have designed an advertising billboard that provides details of the programme. The billboard will be displayed at roadsides so that “people driving past will see it, their children will see it”. The billboard it also displays the logos for the series sponsors (BBC, Nike, Adidas and Apple), and it is explained that this sponsorship “is where the funds for chemicals and stuff comes from”.

A member of the group then outlines some other ways that the brand will be promoted after the live series itself is finished:

- 'Go Go live' - the live show touring around this country.
- 'Go Go on Ice' [laughter both from members of pH4 and the rest of the group].
- 'Go Go behind the scenes'- a DVD released after the series letting people know what happens behind the scenes of Go Go science
- 'Go Go Abroad' - the show being broadcast in other nations as well as this country.
- 'Go Go games' - interactive games on many different games consoles.
- 'Go go science kits' – separate kits for biology, chemistry and physics. Presenter states that the kits will have “no dangerous chemicals at all”.

Another member of the group then outlines the contents of the series website (www.gogoscience.co.uk). There will be links from the homepage to videos; games; revision advice; exam papers for all Key Stages and GCSE/AS/A Levels; Go Go merchandise; Go Go quiz; Go Go downloads; and, the Go Go iplayer. The website will also be used to promote a Go Go competition “where you get to be on our live show if you win and you meet the stars. And also win a trip to NASA based in America”. The website is sponsored by McDonald's, displaying the logo and the slogan ‘I’m lovin’ it’, and there is an advertisement for “your free science toy included with every Happy Meal”.

The website will also show a selection of merchandise including a bag (£9.99), a mug (£4.99) and a T-Shirt (£14.99). The slogan used on the merchandise is ‘I’ve been neutralised’.

Website and merchandising for Super Sam Alacabam (Vision Productions)

One member of the group explains the website homepage (www.supersam.com) – “There's loads of downloads and games and things to buy. There's link-ups so that if you miss a series you can go on iplayer and watch it again. You can also buy stuff of the internet. On the games you can do loads of missions... And also on the 'buy' you can buy the magazine”

Another member of the group then describes some of the merchandise that will be available to buy – “A small Dr Gruntsworth (£3.99) press its feet and you hear it talk. Eight different

phrases. If you want a big Dr Gruntsworth it will be £10.99 and says ten different phrases. For the bedrooms and stuff, curtains and stuff. Food, lunchboxes and accessories.”

Website and merchandising for Super Duper Babies (Test Tube Babies)

A member of the group explains that the URL for the website homepage is www.bbc.co.uk/cbeebies/superduperbabies

Another member of the group then outlines the different links that will be available from the homepage – “Links to different places. Learn to count with Sophia. Help Alfie with his inventions. Play games with Daisy. And invent new chemicals with Bernard.” There will also be a link to “a virtual world that increases week by week with new missions, and games and things to do and lessons to learn”.

A third member of the group then outlines the merchandise that will be available:

- A teddy with a flashing noise.
- A doll of each of the babies that come with their normal clothes and also with their capes and costumes.
- Dressing-up clothes
- A magazine that has comic strip, puzzles and a free toy in it
- A little push-on car like the one they drive to all the missions.
- A lunchbox with the logo on it and school equipment with the logo on it - pencil case, calculator.
- Bed covers
- A toy chest, like the Super Duper babies’ toy chest.
- Food, such as yoghurts.
- Bowls, cutlery, cups.
- Clothing, for example t-shirts and hats that have the logo on them.
- DVDs of the episodes and CDRoms that have the games from the website.

Discussion

When discussing the URLs for the programme-related websites the participants demonstrate a good understanding of the rules and conventions of the Internet. Test Tube Babies decide straightaway that, as their programme will be shown on the BBC channel CBeebies, the URL will be www.bbc.co.uk/cbeebies/superduperbabies, and this is the format used by the BBC. SERLA take a different approach, and although they start with the idea of www.boffins.co.uk, they then discuss whether the URL should be www.serla.co.uk/boffins because “there’s loads of different things because we are a proper company”. Having decided that their company would be an international one, they change the .co.uk to .com. Similarly, pH4 discuss whether the URL should contain end with .co.uk or .com, but they also consider the suitability of .org and .edu. Having dismissed the other alternatives they decide on www.gogoscience.co.uk.

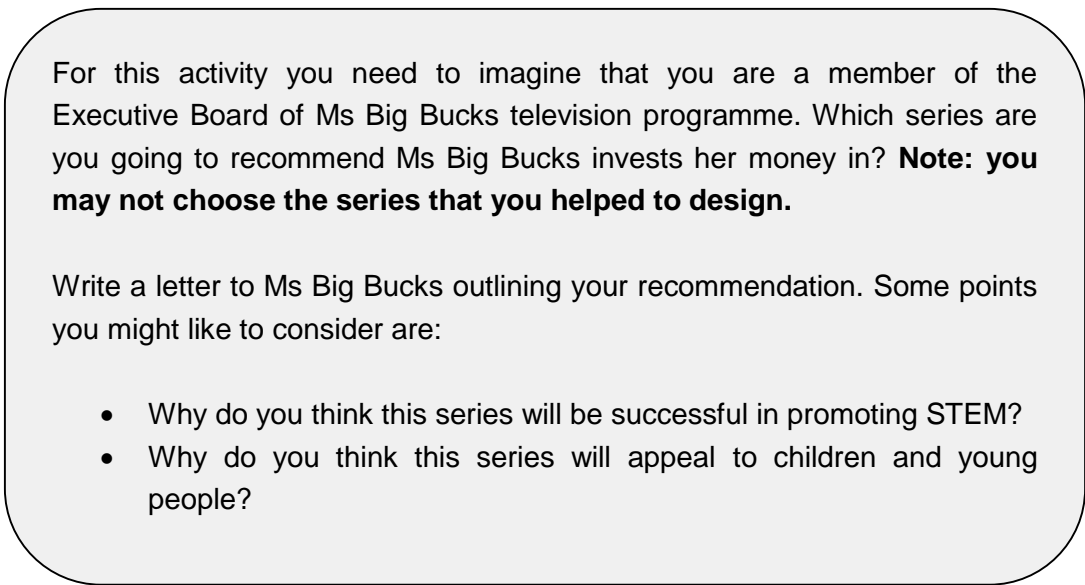
The participants also demonstrate a good knowledge of the type of content that programme-related websites would probably contain, and all the groups include some degree of interactive content. The nature of the interactive content that the participants included could be viewed as being fairly conventional, and we believe that it might be useful for this particular element of this activity to be developed further. The instructions on the activity worksheet could be re-written in such a way as to explicitly encourage the participants to try and design at least one innovative interactive element, as well as demonstrating their knowledge and understanding of the type of content that is used frequently by programme-makers.

Likewise the range of supporting merchandise focuses on the types of products that children and young people are regularly exposed to rather than products that may have the potential to promote STEM as such. It is perhaps worth noting, however, that pH4 did consider, if only briefly, producing a range of condoms as a way of promoting the biology element of their programme!

Three of the groups, pH4, Test Tube Babies and SERLA, do emphasise the educational aspect of their programmes on their websites, and this would suggest that they recognise the potential of these kinds of websites to help the audience build on the learning they first engage with via the television programme.

4.2.3 Writing a Letter of Recommendation

Figure 8, below, shows the instructions given to the participant for this activity.



For this activity you need to imagine that you are a member of the Executive Board of Ms Big Bucks television programme. Which series are you going to recommend Ms Big Bucks invests her money in? **Note: you may not choose the series that you helped to design.**

Write a letter to Ms Big Bucks outlining your recommendation. Some points you might like to consider are:

- Why do you think this series will be successful in promoting STEM?
- Why do you think this series will appeal to children and young people?

Figure 7: Writing a letter of recommendation

The series received the following number of recommendations:

- Super Sam Alacabam by Vision Productions 7 recommendations
- Super Duper Babies by Test Tube Babies 6 recommendations
- Go Go Science by PH4 Productions 6 recommendations
- Boffins by SERLA 2 recommendations

In the previous section we highlighted the importance the participants placed on the programme being both funny and educational. This aspect of the programmes is commented on by the participants when writing about the reasons for recommending a particular programme. All but two of participants rated the entertainment value of the programme they had selected very highly, but they also commented that alongside the programme being fun and making the audience laugh, it was important that it enabled something to be learnt.

- “They have also funny storylines that could change everyday, teaching children new facts without the traditional teacher approach.”
- “It will show children that science is not hard and it can be extremely funny and educational and it teaches you not to be dangerous”

The two programmes that received the most recommendations were both aimed at younger children, and the majority of the participants that recommended these programmes commented on the importance of the programme being appropriate for the younger audience.

- “it was simple enough for its audience.”
- “This is because they are a cartoon which is aimed at young children effectively.”

Many of these participants also linked these comments about age-appropriate programming to the importance of encouraging younger children to engage with STEM.

- “Because they are targeting a young audience the teaching in the programs about STEM is good because they will remember it at that age in a fun way, and the information they learn will be useful in the future.”
- “I think this is good because it is aimed at very young children and will promote STEM to them. They will grow up learning about it and will have a better knowledge of it whilst learning it in a fun, happy way.”

Participants felt it as important that the programme provided an opportunity to show the active nature of STEM, and should have opportunities to join in the STEM activity rather than just watch as a passive viewer.

- “Also it is a show that you can join in with rather than sit there watching”
- “It seems like small kids will like to watch as its adventurous and it will also improve STEM because they have to do activities.”

Eighteen of the participants commented on the importance of the associated merchandising and/or the programme-related websites.

- “Its website could be improved a bit. It could use the rest of STEM a bit more. I thought that the fact that you could buy costumes as merchandise was good and I think it would sell well”
- “Their merchandise would get sold out very quickly because it is eye-catching. Their website is planned out and organised.”

Two of the participants who recommended *Super Duper Babies* did so despite having reservations about the name of the production company, Test Tube Babies.

- “However I do think they should change their company name as it could be offensive to some groups/religions e.g. Catholics.
- “To improve their product, they should change their company name. ‘Test Tube Babies’ could be seen as potentially offensive to certain people.”

4.2.4 The Draw-a-Scientist Test

For this activity the CYP were asked to simply draw a picture of a scientist using the coloured pencils and paper provided. No other instructions were given. This research instrument is a well established procedure for investigating children’s perceptions of the images of scientists and stereotypical images they are familiar with. The drawing are then coded on a scale of 1-7 according to signifiers of science, such as the wearing of lab coats, spectacles; the presence of scientific equipment; etc. See the earlier report for a full description of the background to this procedure⁴⁴.

In contrast to other research (Maoldomhnaigh and Hunt, 1988; Bodzin and Gehringer, 2004) where a second administration of the DAS test produced more female representations, this was not evident with our sample. Only one participant drew a female scientist this time, compared to six in the previous implementation of the test. This participant had been involved the first time around and had not draw a female on that occasion, but drew a male science teacher (which had received a Chambers score of 4). The new drawing was of a glamorous woman wearing a short skirt and top and was not obviously showing any signifiers of science, so was recorded as having a zero score on the Chambers scale. The participant who drew the female scientist this time was herself female (as was the case with all 6 drawings of female scientists in the earlier study) and was the youngest in the group. This is in line with other research (Newton and Newton 1998; Knight and Cunningham, 2004) and with the results of the earlier study where five out of the six drawings of female scientists were drawn by the younger KS2 girls. So in this respect, the second study replicates the first where only one female scientist was drawn by participants in the older KS3 group.

As in the earlier study there was also one ‘neutral’ scientist, this time drawn by a boy and this was labelled ‘Ying and Yang’ perhaps indicating that scientists can be balanced people

⁴⁴ Whitelegg et al. (2008) p.10

having a variety of qualities, and drawn for similar reasons to the gender can have a variety of qualities, and drawn for similar reasons to the gender neutral figure in the earlier study.⁴⁵

There was no trend observed in this study for the girls' drawings to have fewer signifiers of science than the boys, as was noted by the earlier study. The range of Chambers' scores was 0-5 (out of a possible 7) for both boys' and girls' drawings.

A significant number of the scientists were portrayed as clown-type figures, had 'mad' hair and 'angry' teeth and were accompanied by signs of explosions. Names were also assigned to these figures such as: Dr Frank-in-Stein; Adam ("The Mad Scientist"); Dr Works too Hard; and, Dr Disaster. 12 out of the 22 new drawings showed these characteristics. When the drawings from the earlier studies were combined with these, this produces a new figure of 29 out of 64 drawings – 45% showing these characteristics. This suggests that a substantial number of the young people see the stereotypical image of a scientist as a comic or mad figure, perhaps one they wouldn't want to espouse for themselves. Could this image of science be being promoted by programmes such as *Brainiac Science Abuse*?



Figure 8: Examples of participants' drawings of a 'mad scientist'.

⁴⁵ Whitelegg et al. (2008) p.20

As in the earlier studies, if the type of scientist was identified, they were mostly chemists. In this study there was only one scientist identified by type who was not a chemist, and this drawing was interpreted as a being of a medical doctor or teacher. The earlier studies showed more variety in types of scientists, having drawings of a number of planetary scientists and astronomers. This does not seem to be dependant on the age of the participant.

Other research suggests that the DAS tests produce less stereotypical drawings when they are repeated, especially after a time lapse. However, there was no evidence for this here. The drawings produced by those participants who had been in the earlier studies did not consistently receive lower Chambers' scores the second time around – some were lower and some higher.

4.2.5 The Evaluation

As their final activity the participants completed an evaluation form. Questions in Section 1 of the evaluation form asked the participants about their expectations of the day, and focused on determining whether the arrangements we had made to secure informed consent had proved effective.

Sections 2 and 3 however, asked the participants to advise us on which activities were most/least enjoyable and why, and make suggestions as to how we might develop activities for use in future studies.

From the comments⁴⁶ recorded in the table directly below, we can see that, as with our previous studies, the activity that the participants enjoyed the most was designing the television series. The activity that seemed to be enjoyed the least was the letter writing activity. It should be noted, however, that suggestions to complete the recommendation as a group activity would result in the loss of data relating to individual opinions. We therefore need to explore further ways of making this activity more engaging for the participants to complete as individuals.

Enjoyed most	Enjoyed least
The one where we designed what programme we were going to make	Writing the letter because it wasn't very exciting
Designing a TV programme one. all three stages. They were fun and let us use our imaginations	The writing a letter. It was boring and we weren't working in group and the activity didn't have any exciting parts in it.
I enjoyed designing the website and merchandise because there was a lot of different things to do within that so everyone was doing what they wanted.	I didn't enjoy analyzing as much because it wasn't creative, we were just looking at a TV show

⁴⁶ The participant's exact words have been used.

I enjoyed making the television series and the production team design.	I didn't enjoy writing the letter. It was slightly boring and unexciting.
The activity I enjoyed the most was designing the website because I like designing things.	The activity I enjoyed the least was designing the front page because I can't draw very well.
I enjoyed designing the TV programme because I like working in the groups and it was really fun.	I didn't like writing the letter because you could have made it like voting slips instead.
I liked coming up with ideas for the TV series and the name etc.	The letter was too much effort – would have been better just to write fav idea.
I enjoyed making the TV show because it was really fun (as well as funny) and I learnt about the others in the group!	I didn't enjoy writing the letter because we could have done it all together! / put in on slips.
I enjoyed designing and presenting a show because we really worked together in a group and put forward some really good ideas.	Writing the letter because we had to write loads and it would be better if we just wrote on slips the name of the group.
I enjoyed designing the TV programme and all the details the most because we got to use our imaginations and put our ideas together to make something.	Writing the letter because you have to think and put effort into writing when we could have just discussed our opinions
Making the TV show because we worked together as a team.	Watching Brainiac as I had seen it before.
The Brainiac activity because I enjoyed watching Brainiac.	Going outside because there was nothing to do
Making the TV program and designing the merchandise.	Walking around at break without a football. Watching the programmes and them analyzing them.
Stage 2 because we acted out the episode.	Walking around the field.
Designing a TV program. As it involved prolonged group work.	Walking around the field for 25 minutes.
Designing products. It was a fun activity and people had there own ideas.	The analyiesing. It was a bit to dragged out and some people got to watch better things than others
Creating a tele programme because we got to design.	I enjoyed all of them.
Doing are storey board but I enjoyed it all	Nothing
All especially creating our own TV series	N/A
The various aspects of the TV show designing – it was funny.	none
I enjoyed all of it the same way.	Nothing
I liked the one with the play.	N/A

14 of the participants made suggestions for developing the activities.

- We could have played games.
- We could have played more group games.
- Given more time for each of the activities.
- Maybe making theme tunes for the television series the group designed.
- I think the groups should have chosen their DVD.
- I didn't know what we were actually doing, so you could explain it better.
- The 1st task I did not understand fully and so if it was described more easily, but it was really fun.
- Doing a physical activity involving the subjects and asking us which one we like the best. More engineering!
- Designing a car.
- Maybe magazine. More types of programmes.
- Dressing up as stereotypical people.
- Perhaps some more engineering based programs, rather than programs that only hint at it.
- The use of computers in the activities to help with better presentations.
- Designing a big web link about STEM

As the comments above illustrate there is potential for the methods to be developed to include different kinds of media representation (magazines and music) and to involve the use of different media for the participants' presentations (computers and 'props').

5. Conclusions and Recommendations

In this final section we will reflect on how the research reported on here builds on and enhances recommendations made in the original report⁴⁷.

1. In our original report we noted that, in identifying and analysing STEM content within television programmes, we had employed a broad categorisation of STEM content. As a result of this, we had found much STEM content 'hidden' within fictional programming. We also noted that this would seem to indicate that STEM is a significant cultural resource that is drawn on by these programme makers. We recommended that a complementary production study was commissioned in order to investigate these issues in more detail, one that particularly focuses on how fictional representations of STEM in children's television programmes are produced. Such a study might proactively track the production of a fictional STEM children's television programme from its inception to broadcast (including examination of the commissioning process, casting, filming and post-production).

Our analysis of the series *Doctor Who* and *The Simpsons* generated further examples of the ways in which makers of fictional programmes draw on STEM-related content. Additionally, listening to programme-makers' contributions to the commentaries that accompany these programmes provided some insight into the role that they believe this content plays within the narratives they create. We believe this provides further evidence for the notion that STEM content is a significant cultural resource that is drawn on by programme-makers. Given the popularity of these particular programmes and, more generally, the genre of which they are examples, we would reiterate our original recommendation that a production study be commissioned to investigate these issues in more detail.

2. In our original report we noted that the nature of science portrayed in some of the extracts from fictional programmes that we analysed represented science as a 'problem creator' as well as a 'problem solver', and that this indicated that representations of the nature of STEM more generally might also require attention. We recommended that greater emphasis be placed on diverse, authentic representations of STEM in fictional children's television programming, and suggested that such an approach would promote pluralistic portrayals of STEM as it is currently enacted in a range of 'real-world' settings.

In our discussion of the themes that emerged from our analysis of *Doctor Who* and *The Simpsons* we again identify representations of STEM as 'problem creator', and we link these representations to the ways in which the programmes draw on debates surrounding

⁴⁷ Whitelegg et.al., 2008, p.35 - 38

controversial issues. Whilst we would want to reiterate our recommendation that a greater emphasis be placed on programmes that provide pluralistic portrayals of STEM in 'real-world' settings, we would also like to draw attention to the potential for other genres to provide resources that can be used to engage children and young people in these issues and debates. We would suggest that science fiction programmes, with their focus on imagining future worlds and potential outcomes of current developments within STEM, might be particularly useful in this context.

3. In our original report we noted the potential for cartoons and animations, dramas and science fiction to provide representations of human relations in many diverse and idealised forms. As such, we suggested that it was a matter of concern that, according to our analysis of content, many of these programmes reconstructed gendered images of STEM. We highlighted the fact that other programmes, such as the BBC drama *Silent Witness* (featuring the female forensic pathologist Professor Sam Ryan); *Star Trek Voyager* (featuring the starship Captain Kathryn Janeway); and *The Simpsons* (featuring the child character Lisa Simpson), have demonstrated that it is possible to cast female STEM characters in important roles and produce a successful television series.

In this report we have explored the character of Lisa Simpson in more detail, and through our analysis we have tried to highlight similarities and differences between Lisa Simpson and the character of Martha Jones. In discussing our analysis of these characters we have highlighted ways in which they could be viewed both as characters with which young people can identify, but also as characters that provide positive role models in terms of their relationship to STEM.

4. In our original report we noted the relative absence of actual female STEM professionals on children's television. We recommended that action should be taken to ensure that representations of STEM experts in UK children's television programmes should reflect *authentic* and *diverse* portrayals, in terms of gender, but also in terms of age, ethnicity and other socio-economic factors.

Our analysis of the series *Brainiac Science Abuse* and *Doctor Who Confidential* highlighted again the relative absence of female STEM professionals, and we believe this reinforces our suggestion that this issue needs to be addressed. We would like to highlight the potential of multi-platform programming and companion programmes, such as *Doctor Who Confidential*, to provide opportunities for 'real life' STEM professionals and the work that they do to be made more visible to children and young people. We would also recommend that organisations whose role it is to promote careers within STEM, for example Sector Skills Councils, seek to work in partnership with broadcasters to look at how links can be made between the information they provide and relevant multi-platform broadcasting.

5. In our original report we noted that the storyboarding activity had produced some very interesting outcomes and that the participants had engaged with the activity with considerable enthusiasm. We recommended that programme makers should engage with children and young people to find out what sort of programmes about STEM they would like to watch, and we suggested that inviting children and young people produce, discuss and then pitch their ideas for programmes may be a fruitful avenue for this type of activity. We also suggested that, given further development and sufficient resources, it should be possible to develop a pack of teaching and learning resources that encourages children and young people's creativity in developing ideas for future STEM programmes. Such a pack could be used by teachers to facilitate reflection by children and young people on the portrayals of STEM that they witness on television.

In Section 4 of this report we discuss how we developed and built on the storyboarding activity that the children and young people participated in during the original study. Once again, the participants engaged in these activities with a great deal of enthusiasm and, in their evaluation of the activities, they make constructive suggestions as to how these activities could be developed further. The participants demonstrated their media literacy skills in both their ability to interrogate the representations they were presented with by the researchers and their ability to conceptualise an audience, and design programmes for that audience that are both entertaining and have the potential to promote STEM.

Both of these sets of media literacy skills would be useful within more formal learning settings. Focusing on how young people access information via a variety of media, and the ways in which they attempt to make sense of that information, helps make explicit, to both teachers and learners, the complex influences that shape our knowledge of a particular topic/issue. Being actively engaged in creating media representations of topics/issues helps learners understand the processes through which they make use of that knowledge and understanding when communicating with others. We would, therefore, reiterate our recommendation that the possibility of developing teaching and learning resources that support children and young people in developing these skills be explored further.

In their report on Phase 2 of the current review of Public Service Broadcasting (PSB) Ofcom (2008) outlines the results of its research into stakeholders' concerns in relation to the current provision of children's programming, and how providers state they intend to try and address these concerns. Two areas that are identified as being of key concern are the lack of suitable provision for young people over the age of 12 and the falling levels of provision of UK produced content. The BBC, Channel 4 and Five have all made commitments to try and address these concerns and to increase their investment in these key areas. The specific remit of PSB, with its focus not only on entertainment but on education and learning, suggests that developments in this area should be of particular interest in terms of exploring how this form of media can be used to encourage children and young people to engage with STEM. Additionally, broadcasters who are looking to ensure that best use is made of the increased investment in these areas need to develop strategies that help them to understand the audience that they seek to engage. As such, we would

reiterate our recommendation that further development of the activities used in this research could provide programme-makers with a fruitful avenue through which to both engage this audience and make best use of its 'expertise' to inform their own practice.

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Research Briefing No.8

(In)visible Witnesses: Young people's views of images of scientists, technologists, engineers and mathematicians on UK children's television from a gender perspective

For over 30 years there has been interest in how young people's, particularly girls', images of scientists, technologists, engineers and mathematicians (STEM) are constructed. Studies have examined how children's views of science and scientists develop as they grow up and why girls' (and boys') participation in school science declines with age. Key factors include a decline in many girls' self-belief in their abilities in science, particularly the physical sciences, as they grow older. In addition many girls reject the stereotypically masculine images of science and scientists as one that they could adopt for themselves. The images of STEM that some girls (and some boys) are uncomfortable with are still pervasive and do not evolve from the educational environment alone.

This briefing looks at the (re)construction of gendered representations of STEM on children's television and investigates the ways in which these images affected children's and young people's perceptions of STEM. It is based on the (In)visible Witnesses study by a team of researchers lead by Liz Whitelegg and Richard Holliman at the Open University. This project is one of five commissioned by the UKRC to explore issues around the role of the media and representations of women in STEM.

To undertake this project the content of two weeks of children's television was analysed. Following this, 45 children and young people were involved in a study which looked at how children and young people made sense of the STEM they watch on television. Several methods were used to elicit children's and young people's perceptions of STEM and their place within these fields in the future - a questionnaire, 'draw-a-scientist' test, reflective writing about their future selves as scientists and the creation of a 'storyboard' for a TV programme.

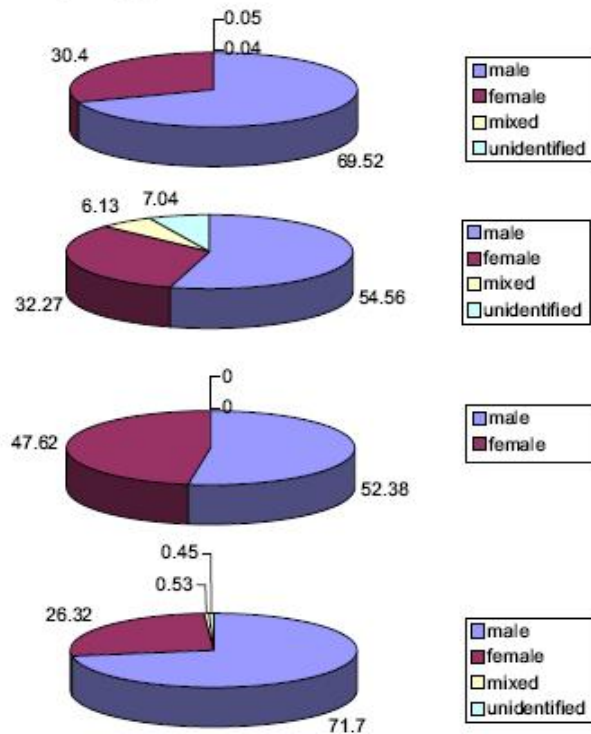


Gendering of STEM on children's television

The programmes broadcast within two sample weeks in specific schedules for children and young people were divided into the following categories:

- News and current affairs
- animated cartoons
- educational
- pre-school
- other

and extracts containing STEM were coded for all recorded speech and analysed by gender. The results are show below:



1. In each type of programme more words are spoken by males than females, but only marginally so for the 'News and current affairs' and 'Pre-school' categories.
2. Educational programming formed the largest proportion of programmes for children and young people (41%), and the gender distribution of words spoken within this category was 70/30 in favour of males.
3. Cartoon and animations had the largest gender difference in words spoken with over 70% spoken by males and less than 30% by females.

Children's images of STEM on children's television

Do you know a Scientist or Engineer?

Slightly less than half of those who completed the questionnaire said that they knew a scientist or engineer; only four of these scientists and engineers were female). All the primary aged children defined engineers as 'people who fix things' and all of these were males. (These children were based in an area where mechanical

engineering was an important local employer. The question the children were responding to required them to draw on real-world experiences, and it is therefore likely that the children's focus on one set of roles that engineering as a profession plays in the workplace reflects these experiences.) This highlights the potential for other representations, such as those experienced through television, to enable children and young people to imagine a more diverse set of roles for engineering.

However, very few participants identified STEM as a subject more suitable for boys than girls and similar numbers of girls and boys said STEM was important for them. It was mostly the younger children who identified a possible future for themselves working in STEM. This is in keeping with other research findings suggesting that liking for science declines with age.

What do scientists look like?

The children were asked to 'draw a scientist' and then give them a name. 73% of the drawings of scientists were identified as drawings of males. Only six drawings were of female scientists and these were all, except one, drawn by the younger, primary-aged girls.

On average, the drawings done by girls had fewer stereotypical signals of science and scientists than those drawn by males. Three girls drew pictures of themselves, but only one of these drawings contained any definite indication that the girl was drawing herself 'as a scientist'. One girl drew an androgynous figure with added notes implying that scientists could be either gender. In this respect, this participant demonstrated a sophisticated understanding of the nature of stereotypes and role models. These findings are consistent with other recent large-scale 'draw-a-scientist' tests where images of female scientists have also been produced by girls, but very rarely by boys.

1. When attempting to represent a visual image of scientists in their own drawings the majority of participants chose to represent the scientist as male.
2. We have found some evidence that some girls are willing to imagine women as scientists, and also that they could become these scientists. These particular images have far fewer of the stereotypical codes associated with male scientists.





What sort of scientist or engineer would you want to be?

In order to examine whether the children saw a place for themselves in STEM in the future we asked them to undertake a reflective writing activity, where they imagined themselves as adults working in a STEM career.

Of those who identified themselves as scientists, four were associated with teaching and the remaining eighteen had a variety of careers such as working in: laboratories and research centres; a sewerage treatment plant; a science museum; offices; and a hospital. Unlike those who aspired to be engineers, participants felt that scientific careers didn't appear to offer the same conditions of self-employment, or consultancy; and only two of the future scientists mentioned financial reward as an incentive. Science was seen in the role of 'problem solver' for such areas as disease or environmental issues. The themes that did emerge, however, may be more realistic in terms of working as a scientist than the future engineers displayed, and reflect the diversity of work that scientists might do.

Several of the children who described careers in engineering again referred to the mechanical aspects to do with fixing things. However, equal numbers of girls and boys put themselves in these roles. The children felt that careers in engineering offered opportunities for 'problem solving', as opposed to 'problem creating'; independence; status and financial reward; travel; and job satisfaction.

One girl said:

'My job is especially fun at times because being that I'm allowed to experiment with energy production, where there is some risk involved! Brilliant! It's also very interesting and motivating work. Of course my job is exceptionally vital in the world of science presently: with the horrible truth of global warming – and time running out....' (Quote from KS4 female participant)

The three participants who imagined themselves as mathematicians all interpreted the role as a mathematics teacher in a school.

1. For these children and young people, scientists and engineers 'solve problems'.
2. Jobs in engineering were perceived to offer more flexibility than those in science.
3. Children had difficulty identifying roles, other than teaching, that mathematicians might play in the workplace.

No single image of a scientist, engineer, technologist or mathematician will appeal to all children. Rather, we need multiple, diverse television portrayals of females and males working in these roles.

Who is the scientist, engineer or mathematician?

Most children and young people were able to identify who were the scientists and engineers in the TV extracts they were shown, most often when they were male figures, and when screen captions made it really clear by naming them and giving their title. In some instances however, when a woman was the expert scientist and was not clearly named as such, the participants were not able to identify the female as the expert. This issue of non-identification could be a problem.

The children and young people were very aware of the difference between presenters who talk about STEM and STEM experts. However, whether these non expert presenters have a positive affect on children's self-concept and subsequent participation in STEM requires further analysis of what children think it means to work in STEM occupations.

The importance of animated cartoons

In the study animated cartoons showed the greatest gender differences and the images presented in these programmes were remembered long after these programmes were broadcast. They are therefore likely to have a significant impact on how children and young people conceptualise STEM particularly as they are part of long running series and are often repeated.

Children and young people demonstrated the ability to accurately recall STEM-related storylines from a range of television programmes and interpret the personalities of characters, identifying both positive and negative connotations.

There were very few instances where they identified a programme as containing mathematics, which suggests that children and young people have very little exposure to representations of maths and so may not think about engaging with this area in the future as a career.

1. Participants use certain indicators (e.g. body language, how other people react to the expert, the job title on the screen) to identify which characters within programmes are STEM experts, and have some difficulty identifying those experts when those indicators are not present.
2. Animated cartoons provide a significant cultural resource where children have access to images of STEM.

How would children present STEM on television?

The children and young people designed and planned a television programme about science, technology, engineering and/or mathematics, by creating a storyboard. This proved a very rich source of data and was the most popular activity with the children and young people. The most sophisticated idea adopted a format that combined a game show with that of 'reality TV'.

This approach could be useful as classroom activity and may produce guidelines for TV production staff to consider.

Children were capable of demonstrating sophisticated media literacy skills when creating ideas for their own television programmes. They demonstrated extensive knowledge and experience of programme formats and the ways that science, technology, engineering and mathematics have been and might be portrayed on children's television.

Selected Recommendations

1. Greater emphasis should be placed on increasing the range of diverse, authentic representations of female scientists, technologists, engineers and mathematicians in fictional children's television programming particularly within animated cartoons; not only those who conform for instance to a slim, attractive, bespectacled image. noted as emerging by other research.
2. When a woman is used as an expert, programme makers should display her as an authority figure, using her title and profession on screen.
3. Targets should be introduced for the number of female and male experts in a wider range of children's television programmes. Achievement of these targets should be published regularly by broadcasters, alongside short—medium—long-term plans for how they are being improved.
4. There is scope to present imagined, idealized images of STEM in animated cartoons, including ones that feature female scientists and engineers in central roles.
5. Programme makers should engage with children and young people to find out what sort of programmes about STEM they would like to watch.
6. Further work could be commissioned to investigate how pre-school children make sense of STEM in TV programmes and the representations of gender (neutrality) therein.
7. A complementary production study could be commissioned to investigate fictional representations of STEM on children's television.

The UKRC aims to increase the visibility of women in SET and work with individuals to raise their profile. As well as the research on the mass media, activities include the creation of case studies of women at all levels in SET, the Play your Part campaign, the GetSET Women database, the Women of Outstanding Achievement Photographic Exhibition, media training, a programme to get more women onto SET public bodies and work with Public Awareness of Science (PAWS).

Further copies of this research briefing, the others in the series, and the full reports are all available from: www.ukrc4setwomen.org

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Appendix II: Questionnaire

Question 3

Table IV.1a: Does anyone you live with work as a scientist or an engineer?

	KS2		KS3/4		Combined sample	
	Yes	No	Yes	No	Yes	No
Scientist or engineer	6	24	9	20	15	44

Table IV.1b: Are they male or female?

	KS2		KS3/4		Combined sample	
	Female	Male	Female	Male	Female	Male
Scientist or engineer	0	6	4	5	4	11

Question 4

Table IV.2.a: Do you know anyone who is a scientist or an engineer?

	KS2		KS3/4		Combined sample	
	Yes	No	Yes	No	Yes	No
Scientist or engineer	13	17	14	15	27	32

Table IV.2.b: Are they male or female?

	KS2		KS3/4		Combined sample	
	Female	Male	Female	Male	Female	Male
Scientist or engineer	0	13	4	10	4	23

Question 5: Scientists and engineers as people

	Untidy, sloppy	Tidy, neat and orderly
KS2	3 (10%)	20 (67%)
Female	2	11
Male	1	9
KS3/4	1 (3%)	19 (66%)
Female	0	11
Male	1	8
Total	4 (7%)	39 (66%)
Female	2	22
Male	2	17

	Intelligent, bright and clever	Not intelligent bright or clever
KS2	25 (83%)	2 (7%)
Female	16	1
Male	9	1
KS3/4	22 (76%)	4 (14%)
Female	14	2
Male	8	2
Total	47 (78%)	6 (10%)
Female	30	3
Male	17	2

	Lacking ideas and imagination	Imaginative and full of ideas
KS2	2 (7%)	23 (77%)
Female	1	14
Male	1	9
KS3/4	1 (3%)	20 (67%)
Female	1	7
Male	0	13
Total	3 (5%)	43 (73%)
Female	2	21
Male	1	22

	Lazy	Hardworking
KS2	1 (3%)	26 (87%)
Female	1	16
Male	0	11
KS3/4	0 (0%)	23 (79%)
Female	0	16
Male	0	7
Total	1 (1%)	49 (83%)
Female	1	25
Male	0	7

	Caring for others	Selfish
KS2	23 (77%)	1 (3%)
Female	12	1
Male	11	0
KS3/4	13 (45%)	2 (7%)
Female	11	1
Male	2	1
Total	36 (61%)	3 (5%)
Female	23	2
Male	13	1

	Doesn't have many friends	Has lots of friends
KS2	1 (3%)	22 (73%)
Female	1	13
Male	0	9
KS3/4	5 (17%)	8 (28%)
Female	1	6
Male	4	2
Total	6 (10%)	30 (51%)
Female	2	19
Male	4	11

	Boring	Interesting and exciting
KS2	2 (7%)	25 (83%)
Female	1	15
Male	1	10
KS3/4	2 (7%)	16 (55%)
Female	0	14
Male	2	2
Total	4 (7%)	41 (70%)
Female	2	29
Male	3	12

	Kind	Unkind
KS2	25 (83%)	2 (7%)
Female	15	2
Male	10	0
KS3/4	8 (28%)	3 (10%)
Female	6	2
Male	2	1
Total	33 (56%)	5 (9%)
Female	21	4
Male	12	1

Question 6: When you think of science, what comes to your mind?

	KS 2		KS3/4		Total	
	Male	Female	Male	Female	Male ⁴⁸	Female ⁴⁹
Interesting and exciting	11	12	10	10	21 (88%)	22 (63%)
Boring	2	5	4	7	6 (25%)	12 (34)
Creates problems for society	5	1	3	3	8 (33%)	4 (11%)
Creates pollution	2	2	4	4	6 (25%)	6 (17%)
Useful for everyday life	8	10	10	14	18 (75 %)	24 (69%)
Doing experiments	11	14	8	17	19 (79%)	31 (87%)
Most suitable for boys ⁵⁰	3	2	1	1	4 (16%)	3 (9%)
Most suitable for girls	1	2	0	1	1 (4%)	3 (9%)
Powerful	6	10	2	8	8 (33%)	18 (51%)
Important for everyday life	8	8	10	13	18 (75%)	21 (60%)
Important for me	3	8	6	11	9 (38%)	19 (54%)
Destructive and dangerous	6	3	4	4	10 (42%)	7 (20%)
Difficult to understand	8	10	4	7	12 (50%)	17 (49%)
Easy to understand	6	7	6	6	12 (50%)	13 (37%)
Something I would like to do when I have left school	4	7	5	4	9 (38%)	11 (31%)

Question 7: Things I like to learn about

- Topics that 50% or more of KS2 female participants indicated that they would like to learn more about

Things I like to learn about	Female	Male
Plants and animals	77%	31%
What are colours and how do we see different colours?	71%	31%
Sounds and music from birds and other animals	71%	46%
Why dinosaurs died	71%	46%
Earthquakes and volcanoes	65%	92%
How mountains, rivers and oceans change and develop	65%	46%
The moon, the sun and the planets	65%	77%
How we can protect air, water, woods and the environment	65%	39%
How animals like birds and fish navigate	59%	23%
How the eye can see	59%	46%
Poisonous plants and mushrooms	59%	62%
Why the sky is blue	53%	8%
Bacteria, virus and how they cause diseases	53%	54%
What we should eat to be healthy	53%	39%
How things like mobile telephones, radios, computers and televisions work	53%	62%

⁴⁸ % of all males in study

⁴⁹ % of all females in study

⁵⁰ Participants that answered either 'yes' or 'no' to both 'more suitable for boys' and 'more suitable for girls' have been excluded from these figures. The figures, therefore, represent the number of participants who indicated that science is more suitable for one gender rather than the other.

- Topics that 50% or more of the KS2 male participants indicated that they would like to know more about

Things I like to learn about	Male	Female
Earthquakes and volcanoes	92%	65%
Rockets and space travel	77%	47%
The moon, the sun and the planets	77%	65%
X-rays and ultrasound in medicine	69%	47%
How the body works	69%	29%
How things like mobile telephones, radios, computers and televisions work	62%	53%
Poisonous plants and mushrooms	62%	59%
The car and how it works	62%	35%
Bacteria, virus and how they cause diseases	54%	53%
The possible dangers of science and technology	54%	35%
Important inventions and discoveries	54%	35%

- Topics that 50% or more KS3/4 female participants indicated they would like to know more about.

Things I would like to learn more about	Female	Male
The possible dangers of science and technology	83%	64%
Important inventions and discoveries	72%	46%
How animals like birds and fish navigate	67%	36%
X-rays and ultrasound in medicine	61%	64%
Bacteria, virus and how they cause diseases	56%	27%
How radioactivity affects life and my body	56%	55%
How things like mobile telephones, radios, computers and televisions work	56%	73%
Rockets and space travel	56%	64%
Why the sky is blue	56%	73%
What are colours and how do we see different colours?	50%	55%
Why birds and planes can fly	50%	55%
Vaccination and the prevention of diseases	50%	27%
Dinosaurs and why they died out	50%	27%
Poisonous plants and mushrooms	50%	56%

- Topics that 50% or more KS3/4 male participants indicated they would like to know more about

Things I would like to know more about	Male	Female
How the eye can see	91%	44%
Why the sky is blue	73%	56%
How things like mobile telephones, radios, computers and televisions work	73%	56%
Earthquakes and volcanoes	64%	33%
The greenhouse effect and how it might be affected by humans	64%	22%
Rockets and space travel	64%	56%
The moon, the sun and the planets	64%	44%
How science and technology may help us to get a better life	64%	44%
The possible dangers of science and technology	64%	83%
The car and how it works	64%	33%
X-rays and ultrasound in medicine	64%	61%

Chemical elements and their properties	55%	39%
How radioactivity affects life and my body	55%	56%
Famous scientists and their lives	55%	22%
Alternative sources of energy: from the sun, from the wind etc.	55%	28%
Electricity, how it is produced and used in the home	55%	22%
Poisonous plants and mushrooms	55%	50%
Why birds and planes can fly	55%	50%
What are colours and how do we see different colours?	55%	50%
How the ear can hear	55%	33%

Question 8: What was the most enjoyable thing you have done in a science lesson⁵¹?

Key Stage 2

- Making flubber
 - 20 of KS2 participants identified making flubber⁵² as the most enjoyable thing they had done in a science lesson.
 - Where participants expanded on their answer, the following comments were made:
 - When we finished the curriculum for the term, and got to do loads of experiment. We to make 'flubber', a rubbery, stretchy substance.
 - I think the most enjoyable lesson was making flubber on science morning in class six.
 - Volcanoes
 - 5 participants identified making 'volcanoes' as the most enjoyable thing they had done in a science lesson.
 - One participant expanded on their answer with the comment:
 - Making volcanoes - because it was really hands-on!
- Sorting materials
 - 3 participants identified sorting materials as the most enjoyable thin they had done in a science lesson.
 - One participant expanded on their answer with the comment
 - How to separate lentils, pasta, staples and bulldog clips into each container
- Car ramps
 - 2 participants stated that 'car ramps' were the most enjoyable thing they had done in a science lesson.
 - Only 2 participants mentioned other activities – 'learning about planets' and 'the rainforest'.

Key Stage 3/4

- Eleven participants identified doing experiments, but with no mention of specific activities, as the most enjoyable thing they had done in a science lesson:
 - Experiments – I enjoy them all!
 - Chemistry experiments. Anything hands on.

⁵¹ Five participants identified more than one activity

⁵² <http://www.oms.edu/visit/playground/activities.cfm>

- Practical experiments. When I see the reaction of different gases.
 - Experiments with reactions and finding out what substances cause reactions with others
 - Different explosive experiments
 - Blowing things up and burning stuff
 - Blowing things up
 - Science experiments.
 - I like doing practicals and experiments in science. It is cool to see things explode or bang and I like the chemical reactions of things mixed/combined together.
 - We did explosions.
 - Doing practical work and experiments, for example, dissecting animal parts and mixing chemicals.
- Fifteen participants identified specific activities, one of which was making flubber. The other activities were:
 - When we made a pink cement turn to lime green by heating it up by a Bunsen burner
 - Hard decision because my science lessons normally very good - it's between exploding an egg dissecting a sheep's heart (more interesting than enjoyable!)
 - Make shampoo and explode an egg
 - When we do gas mixed with water, threw in a match - and there was a big explosion.
 - Making hydrogen - and making it 'pop'!
 - Exploding eggs, making shampoo, running around the school to investigate respiration.
 - Seeing sheep's lungs being dissected and seeing a sheep's heart
 - Experiment with burning metals and the different colours they made.
 - Burning food
 - Building a parachute to protect an egg
 - Designing an egg parachute
 - Make chemical reactions like setting magnesium alight
 - Dissection of the parts of the body such as eye, heart, lungs etc.
 - dissected a pig's heart
- Two participants identified 'topics' rather than activities
 - Learning about DNA and genes
 - The digestive system and how your body works

Questions 9 and 10: Can you think of a famous scientist? Do you know what they were famous for?

Key Stage 2

- 5 participants could think of a famous scientist (4 males and 1 female)
- 4 participants identified Albert Einstein, with 1 identifying Isaac Newton.
- Only 1 participant attempted to identify what Einstein was famous for. They wrote 'cycling things?' The participant who identified Newton wrote 'I think he discovered why the sky was blue'.
- A further participant identified Bon Jovi as a famous scientist.

Key Stage 3/4

- 28 participants could think of a famous scientist. 1 participant identified 2 famous scientists and 2 participants identified 3 famous scientists.
- 14 participants identified Albert Einstein. 11 participants attempted to identify what he was famous for:
 - Einstein did a lot with chemicals
 - $E=mc^2$?
 - He did stuff about time and space
 - $E=mc^2$
 - relative power $e=mc^2$
 - He developed the theory of relativity. He made the formula $E=MC^2$ where 'E' is the energy, 'M' is the mass, 'C' is the velocity of light.
 - I think he found out $e=mc^2$
 - Theory of relativity. Every action has an equal and opposite reaction.
 - He was best known for the theory of relativity (specifically mass-energy equivalence $E=MC^2$)
 - $E=MC^2$
 - theory of relativity
- 5 participants identified Isaac Newton. All participants attempted to identify what he was famous for:
 - Discovered gravity
 - Discovering gravity
 - Created the theories of gravity, created many opportunities and broadened peoples thoughts on why things fell from the sky!
 - Discovered gravity (didn't invent it!)
 - Force/gravity
- 4 participants identified Marie Curie. All participants attempted to identify what she was famous for:
 - Radioactivity
 - Discovered polonium and radium. She received several Nobel awards. She mainly was known for her discovery of radiation.

- I think radioactivity
- she worked with radium and discovered xrays
- 3 participants identified Thomas Edison. All participants attempted to identify what he was famous for:
 - invented the light bulb
 - inventing the lightbulb
 - electricity/lightbulb
- 2 participants identified Charles Darwin. Both participants attempted to identify what he was famous for:
 - Theory of revolution
 - The theory of evolution
- Other famous scientists identified were:
 - The man in a wheel chair with a voice box -Not sure, all I know is that he is very clever
 - The person (man) who discovered x-rays (but not the dangers originally).
 - Mr Bunsun - He is famous for creating the bunsun
 - Werner von Braun- Creating the V2 rocket
 - Thomas J. Crapper - Inventing the toilet

Question 11: Important for your future job?

- Aspects of their future job girls stated were important/not important

	Important	%	Not Important	%
Have an exciting job	34	(97%)	0	
Developing new knowledge and skills	27	(77%)	3	(7%)
Use my talents or abilities	26	(74%)	3	(7%)
Get a secure job	25	(71%)	1	(3%)
Make my own decisions	22	(62%)	2	(6%)
Help other people	22	(62%)	1	(3%)
Earn lots of money	22	(62%)	3	(7%)
Have more time for my family	15	(43%)	1	(3%)
Have more time for interests/hobbies	15	(43%)	3	(7%)
Make and invent new things	15	(43%)	9	(26%)
Work with people instead of things	14	(40%)	5	(14%)
Have more time for my own friends	14	(40%)	4	(11%)
Become famous	8	(23%)	11	(31%)
Have an easy and simple job	5	(14%)	16	(46%)
Control other people	3	(9%)	25	(69%)

- Aspects of their future jobs boys thought were important/not important

	Important	%	Not important	%
Have more time for my family	22	(92%)	1	(4%)
Have an exciting job	20	(83%)	1	(4%)
Developing new knowledge and skills	20	(83%)	2	(8%)
Get a secure job	19	(79%)	0	
Use my own talents and abilities	18	(75%)	2	(8%)
Make my own decisions	18	(75%)	1	(4%)
Help other people	18	(75%)	0	
Earn lots of money	17	(71%)	2	(8%)
Have more time for interests/hobbies	16	(67%)	0	
Make and invent new things	15	(63%)	3	(13%)
Have more time for my own friends	13	(64%)	1	(4%)
Work with people instead of things	12	(54%)	5	(21%)
Have an easy and simple job	10	(42%)	6	(25%)
Become famous	10	(42%)	3	(13%)
Control other people	8	(33%)	9	(38%)

Question 12: What are your three favourite programmes?

- 85 programmes were listed in total
- Of these, 47 were listed by more than one person.
- Most popular programmes

	All Participants	
The Simpsons	23	39%
Hollyoaks	10	17%
Doctor Who	8	14%
Tracy Beaker	8	14%
Eastenders	6	10%

	All female participants	
The Simpsons	10	29%
Hollyoaks	8	23%
Tracy Beaker	7	20%
Doctor Who	5	14%
Eastenders	5	14%
Big Brother	5	14%

⁵³	All male participants	
The Simpsons	13	54%
Doctor Who	3	13%
Futurama	3	11%
Top Gear	3	11%

⁵³ The four programmes listed are the only programmes that were identified by more than two male participants.

Question 13 and 14: Can you remember watching a programme that was about science, or that contained a scientist? What was the programme called? What was it about? What did the scientist look like and what were they doing?

- 21 participants could not remember a programme that was about science. 15 of participants were KS2 pupils (50% of all KS2 participants) and 6 of the participants were KS3/4 (20% of all KS3/4 participants).
- Of the remaining 38 participants:
 - 5 named two programmes
 - 7 named a programme, but did not describe it.
 - 6 described a programme, but did not name of the programme.
- A total of 17 programmes were identified, but only 4 programmes were identified by 2 or more participants:
 - *Brainiac Science Abuse* (12 participants). The participants remembered the following things about this programme:
 - Fun and exciting experiments, fun science facts. Scientist looked like the guy off of top gear.
 - They blew things up. They were dressed in yellow overalls wearing safety goggles.
 - Mainly blowing things up (e.g. caravans) and finding out what should be better in different situations fat or thin. Scientists were in white coats, most of them like normal people in white coats.
 - The scientists just looked like normal people.
 - The scientists wore white coats
 - He does different tests e.g. explosions, technology
 - Many experiments were carried out and the 'scientists' wore yellow T-shirts and were often tested on or involved. There are usually explosions to interest the watchers.
 - Many experiments were interesting as it had exploding caravans. The scientists wore lab coats, however, were yellow
 - A man, brown spikey hair. He was blowing things up (caravans, microwaves, mannequins).
 - The Brainiac team would also test science theories or myths and test them on large dangerous skills. The Brainiac team were dressed in white coats.
 - *Whiz, Whiz, Bang, Bang* (5 participants). The participants remembered the following things about this programme:
 - making crazy inventions
 - camera helicopter
 - making a robotic horse
 - A child tells a scientist what to build and they build it
 - *Rough Science* (2 participants). The participants remembered the following things about this programme:
 - It was about a team of scientists doing experiments like building and launching rockets where the fuel power had to be water.
 - Scientists were given a challenge like making something out of a certain amount of materials. The scientists were dressed normally except when doing the experiments. Viewers would write in to the show and challenge people on the show to do science.
 - *House* (2 participants). The participants remembered the following things about this programme:
 - It is medical science - although storyline fictional

Question 15: How often do you usually watch TV?

	KS2	KS3/4	Total
Everyday	16	14	30
Most days, but not everyday	12	12	24
A few days a week	2	3	5

Question 16: Rules about watching TV

Two rules mentioned in the question received no responses. These were:

- I am not allowed to watch TV in other people's homes
- No, I don't watch TV at home

	KS2	KS3/4	Total
I'm only allowed to watch a certain amount of television	7	11	18
I'm only allowed to watch certain programmes	8	13	21
I can only watch at a certain time	2	5	11
I can't watch TV before breakfast	10	10	20
When I have finished my homework	18	10	28
It has to be turned off at mealtimes	12	8	20
When I have finished special jobs or things like music practice	9	7	16
No, I can watch anything I like	18	10	28

Question 17: Where do you mostly watch TV in your home

	KS2	KS3/4	Total
In the lounge	24	24	48
In the family room	2	6	8
In the kitchen	0	3	3
In own bedroom	4	3	7
In parents' bedroom	0	1	0

The final question in this section asked the question 'it is now possible to watch some TV programmes on your computer by connecting to the internet. Please put a tick in the box if you have ever watched TV this way?' 41 (72%) participants responded that they did, with three adding that they only watched clips.

Appendix III: Overview of Series

Doctor Who

[\(http://www.bbc.co.uk/doctorwho/\)](http://www.bbc.co.uk/doctorwho/)

Doctor Who is a science fiction programme that focuses on the life of a time-traveller called The Doctor. The Doctor is not a human-being, but from a race of aliens called the Time Lords, originally from a planet called Gallifrey. Time Lords have the ability to regenerate their bodies when they are near death. This narrative device has enabled the character of The Doctor to be played by a number of different actors, with The Doctor regenerating in a new body each time an actor has left the series. The Doctor travels in a spaceship called the TARDIS (Time And Relative Dimensions In Space). The TARDIS can travel across both space and time. The Doctor is almost always accompanied on his travels by at least one companion.

The first series of *Doctor Who* was transmitted in 1963, and the programme ran for 26 series until 1989. The format was 'revived' in 2005, and is now produced by BBC Wales and transmitted on Saturday evenings on BBC1 (with repeats on BBC3). Two 'spin-off' or companion series have been launched in the wake of the success of the revived Doctor Who franchise. *Torchwood* (<http://www.bbc.co.uk/torchwood/>) is aimed at a slightly older audience than is Doctor Who. The lead character in this series is Captain Jack, who originally appeared in Doctor Who. Likewise, the lead character in *The Sarah Jane Adventures* (<http://www.bbc.co.uk/sja/>) originally appeared in Doctor Who in 1973 – 76. *The Sarah Jane Adventures* is designed to appeal to a younger audience, and it is broadcast as part of the CBBC programming.

All the episodes from Series 3 of *Doctor Who* were included in the study (Episode guides for Series 3: <http://www.bbc.co.uk/doctorwho/episodes/2007/index.shtml>).

This series begins with The Doctor (played by David Tennant) meeting Martha Jones (played by Freema Agyeman), who is a medical student. Having detected signs of abnormal alien activity centred on the hospital where Martha works, The Doctor pretends to be a patient in the hospital. Another patient is, in fact, a 'shape-shifting' plasmavore who is wanted for murder on another planet, and is attempting to hide from the inter-galactic police force, the Judoon. At the end of this episode The Doctor invites Martha to take "just one trip" in the TARDIS, but Martha becomes the Doctor's next travelling companion, staying with him for the rest of the series.

In the episode of *Dr Who Confidential* that accompanies the first episode of the main series (*Meet Martha Jones*), David Tennant, the actor who plays The Doctor, describes the reason for The Doctor choosing Martha as his companion:

"Martha seems to have a spark and a life about her that chimes with the Doctor's own, and that's something that's always going to appeal to him."

Describing the appeal of The Doctor for Martha, Russell T. Davies, lead writer and executive producer of this series of Doctor Who says:

"The story for Martha is unrequited love, and actually I think far more people in life feel like Martha than do like Rose (The Doctor's previous companion). Rose met the most fantastic man in the universe who thought that she was the most fantastic woman in the universe, and that doesn't actually happen that often."

In the final episode of this series, however, Martha chooses to end her travelling with The Doctor and return to the hospital in order to complete her medical studies.

Doctor Who Confidential

Episode guides for Series 3: <http://www.bbc.co.uk/doctorwho/confidential/index.shtml>

Doctor Who Confidential is a documentary series that was developed to accompany the revival of the *Doctor Who* series in 2005. *Doctor Who Confidential* is transmitted on BBC3, starting immediately after the relevant episode of *Doctor Who* has finished on BBC1. The programmes each last for 45 minutes, but are also transmitted at other times on BBC3 in what is referred to as 'cutdown' format, which last for 15 minutes. It is the 'cutdowns' that are included as an additional feature with the boxed set of DVDs⁵⁴.

The programmes include 'behind-the-scenes' footage of the making of the main programme, and interviews with members of the cast and crew. Interviews with the writers, directors and actors often include them talking about their reasons for creating characters and developing storylines in a particular way. Interviews with the crew include details of how special effects are planned and executed; how prosthetics are made; the process of producing CGI; and, particular aspects of photography, camera and lighting techniques.

Brainiac Science Abuse

This programme is produced by Granada Productions, and is broadcast in the UK via Sky Digital (The 6th, and last, series was broadcast on Sky 1, beginning January 2008).

The series used for this project, Series 1, consisted of 6 45-minute episodes. The DVD viewed contained edited 'highlights' of the series. The series was presented by Richard Hammond, who is currently one of the presenters of the BBC Series *Top Gear*, and Jon Tickle, who was a contestant on Series 4 of the reality television series *Big Brother* (Channel 4). Tickle is a physics graduate of the University of Leicester.

The each programme features a series of 'quasi-experiments'⁵⁵ that are carried out by a group of people who are referred to as 'Brainiacs'. Some of the topics explored on this DVD are:

- Does nitrous oxide make everything funny?
- Will the signals emitted from a mobile phone ignite petrol fumes?
- How many people does it take to start a 'Mexican wave' in a football stadium?
- What's the fastest way to make toast?
- Can eating a poppy-seed bagel make you fail a drugs test?
- The effects of caffeine on concentration and co-ordination. (Is it better to be tired or wired?)
- The lazy man's guide to making a kebab.
- Can a person walk on custard?
- Using fire extinguishers to propel people on wheeled objects (skates, skateboard, office chair). Which is the fastest?
- How do you use insulation to prevent getting an electric shock from an electric cattle fence?

⁵⁴ The cutdowns can also be downloaded from the Doctor Who website.

⁵⁵ The programme has been criticised for inaccuracies in the experiments shown. See, for example: <http://www.badsience.net/2006/07/brainiac-fake-experiments-scandal-make-it-to-the-evening-standard/>

- What happens when you put different objects (metal pan scourer, light bulb) in a microwave?
- What is the level of g-force generated on a playground roundabout?
- How much weight do you lose when you defecate?
- Are 'unbreakable' household goods really 'unbreakable'?

The Simpsons

(<http://www.thesimpsons.com>)

The Simpsons is an animated 'sitcom', produced by the Fox Broadcasting in the US. The Simpson family consists of Homer (father); Marge (mother); Bart, (son and eldest child); Lisa (eldest daughter); and Maggie (younger daughter). The family live in the fictional town of Springfield, and Homer is employed as a safety inspector in the town's nuclear power plant.

The series uses the narrative device of a floating timeline, which means that the storylines are set in the year the show is produced, but the characters never age. Lisa Simpson, for example, is 8 years-old now, and has been the same age throughout the programme's history.

Lisa is extremely intelligent, with an IQ of 159. She excels at mathematics and science, but she also a great fan of music. She plays the baritone saxophone. She is a vegetarian and a practicing Buddhist.

Executive producer of the programme, Al Jean (2007), said Lisa is 'often the voice for the writers, even though she's eight years old, a lot of us identify with her'. Talking on the commentary for the episode *Lisa the Skeptic*, Matt Groening, creator of The Simpsons, states "I've said it before and I'll say it again...When you have an episode that has a real moral or philosophical point, Lisa is your 'go to' character, and you really buy her as caring about it."

There are a number of STEM-related recurring characters who appear in the programme:

- Professor John I.Q. Nerdelbaum Frink, Jr – inventor, scientist and professor at Springfield Heights Institute of Technology. When the character originally appeared in the Simpsons, he was referred to only as a 'mad scientist'.
- Dr Julius Hibbert MD – the Simpson's family doctor
- Dr Nick Riviera MD – Dr Riviera gained his medical degree from "Hollywood Upstairs Medical College". The character is often depicted as incompetent and unethical.
- Apu Nahasapeemapetilon Jr.- Apu is the owner of the local supermarket 'Kwik-e-Mart', but he does hold a PhD in computer science, which he studied for at Springfield Heights Institute of Technology.
- Seymour Skinner – Principal of the Springfield Elementary school and amateur astronomer.

The programme was first shown in 1989, and it is currently in its 20th series. The episodes used in this study were taken from Series 9:

- Lisa the Simpson
- Lisa the Skeptic
- Lost our Lisa
- This Little Wiggy
- Trash of the Titans
- Treehouse of Horror VIII

Appendix IV: Coding for content analysis

Themes	Sub- themes	Examples/explanation
Science	Not 'hands-on'	Activities that must only be carried out by experts and non-experts warned not to touch/handle.
	As being the only source of proof/facts/reality	Lisa Simpson "you can either except science and face reality or you can believe in angels and live in a childish dream world"
Mathematics	As difficult/complicated	The Doctor and his explanation of happy primes. The Doctor being the only character that understands the significance of the Shakespeare's Globe Theatre being designed as a tetra decagon.
Engineering	As requiring physical strength	When engineering problems arise, they are shown as only being resolved through use of physical strength
Technology	As taking control away from people	Password-protected security system that cannot be over-ridden in an emergency. Prevents ship's crew accessing auxiliary engines.
	As adding value	Use of CGI and special effects in making programmes.
Cross-cutting All STEM	As problem-solver	Use of sophisticated diagnostic equipment to assess nature of a 'mystery illness'.
	As problem-creator	The motorways of a New York in the future are gridlocked because there are too many cars. No-one can leave the cars and go outside because pollution levels would kill them.
	As 'geeky'	When character/person carrying out STEM-related activity is referred to as a geek, nerd or similar.
	Female characters/real people in STEM-related activity	Bart Simpson is turned into half-fly, half-boy through an accident with a 'matter transporter'. Lisa Simpson works out how to return her brother to normal. Woman creating CGI in Millennium FX studio
Martha and Lisa	As 'taking charge' or acting independently	When no-one will support Lisa Simpson's suggestion of a protest against the development of land for a shopping mall, she hires a solicitor and confronts the developers herself.
	Family relationships	Role within the family, particularly extracts that show the characters as having a 'rounded' or 'normal' life.
	Acting as mediator of the narrative for the viewer.	Lisa is described by the writers as the 'go to' character when an episode 'has a real moral or philosophical point' that they want the audience to identify with. Examples that

		<p>illustrate this.</p> <p>Martha is described by the writers as providing the viewpoint that 'allows the viewer in'.</p> <p>Examples that illustrate this.</p>
Issues and debates	Genetic screening/manipulation	Daleks screen humans and select only those with "superior intelligence" to help create a creature that is half-human/half-dalek in their "transgenic laboratory".
	Misuse of natural resources	Using an illegal mining method to take energy from a sun to power a spaceship. The ship's crew have not "scanned for life" on the sun before mining it for fuel, because they were rushing the process. The sun turns out to be "a living organism", which then attacks the crew of the spaceship.
	Religion/science	A skeleton is found during an archaeological dig in Springfield. Members of the religious communities claim it is a skeleton of an angel. Lisa Simpson argues that, although the skeleton looks like an angel, there must be an alternative, scientific, explanation.

Appendix VI: Activity 1: Watching Short Extracts

For this activity you will be watching a short extract from a television programme. You will need to take notes whilst you watch the extract. Read through the activities below so that you know the kinds of topics you will be discussing. Once you have discussed the extract, you will then need to prepare a short presentation about the extract.

Describing

1. **Write a short narrative describing what happens in the extract you have watched.**

You might like to think about the descriptions you have read in television listings magazines that inform the viewer what a particular programme is about.

You will use your narrative to introduce the extract to as part of your presentation to the whole group.

Analysing

2. **Do you think that this programme would appeal to people of your age group? Why?**

If you do think that the programme would appeal to young people, try to write down at least three different reasons. You might like to think about issues like storylines; what type of programme the extract is from; the characters in the extract; or things like music and special effects.

3. **Have the programme-makers used any stereotypical images of STEM or STEM professionals in the extract?**

Try to write down your reasons for identifying these images as 'stereotypical'.

4. **Have the programme-makers used any stereotypical images of males or females in the extract? Who do you think these**

Try to write down your reasons for identifying these images as 'stereotypical'.

You will use your analysis to talk to the rest of the group about the extract you have watched.

Presenting

5. **Now you need to plan your presentation.**

There are some notes to help you plan your presentation on the other side of this sheet, but remember:

- You should make sure that everyone in the group who wants to talk during the presentation has a chance to do so.
- If anyone doesn't want to talk during the presentation, they don't have to – but those of you who are doing the talking need to make sure that everyone's ideas are included.
- You should start your presentation by giving your audience an overview of the extract (point 1). It is probably a good idea if one person presents this part, so that person will need to make some notes to remind themselves of what it is they want to say.

- Now the audience will watch the extract.

- After your audience has watched the extract, your group needs to tell the audience about the things you discussed during your analysis (points 2,3 and 4)
 - i. It is probably a good idea for more than one person to present this part – so decide who will present each point.
 - ii. The person who is presenting the point will need to make notes to remind themselves what it is they want to say.

- Practice your presentation – missing out the part when you play the extract.

Appendix VI: Activity 2: Designing your television series

Stage 1: Overview of the series

You need to produce a general overview of the series you are proposing. You might like to consider some of the issues below.

- What type of programme series are you producing?

Choose from: cartoon; natural history; news and current affairs; schools/learning programme; comedy; drama, reality television, game show, soap opera, documentary.

- What is your series about?

Imagine that you have to make a series of six programmes. Try thinking about what the series will involve. For example, if it is a quiz show, will it be the same format each week? If it is a drama, how will the plot develop? If it is a news or current affairs programme, will you have special reports on topics? What sorts of topics might they be?

- What are your reasons for choosing this type of programme for promoting STEM?
- How will you make sure that it appeals to children and young people?
- Are there examples of programmes on television that have influenced your choice? If so, what are they? What is it about these programmes that you like?
- What will your programme be called?
- Which television channels do you hope will want to buy your series? Why did you choose these television channels?

Once you have discussed these issues, decide how you are going to present your ideas to the Executive Board.

- Remember to introduce yourselves (tell everyone the name of your production company)
- Break the presentation down into sections, with different presenters for each section.
- Use the flip chart paper and pens to help present your ideas.
- Make notes for each presenter.
- Remember you are trying to sell your ideas to the Executive Board – so try and make your presentation lively and interesting!

Stage 2: Sample episode

For this activity you need to choose one episode of your series and think about it in more detail.

Remember that Ms Big Bucks wants to fund programmes that promote science, technology, engineering and mathematics – so remember to emphasise how your episode would achieve this.

You also need to think about what characters/presenters might be in this episode. Make a list of the names of any presenters or characters that you would like to include and the roles they are playing in your programme.

- How old are they?
- Are they male or female?
- What will they wear?
- What kind of personalities do they have?
- What do they do in this episode?

- Are there any 'real' people in this episode? For example, will you use presenters that already work on television programmes? Sometimes people make 'guest appearances' on television series – will you have any guests appearing in this episode?

Once you have discussed these points, decide how you are going to present your ideas to the Executive Board

- It would be useful to produce a 'story-board' for this episode that you can use in your presentation.
- It might be useful for a different member of the group to talk about each of the characters/presenters. You could choose to 'act out' the characters/presenters rather than just talk about them!
- Use the flip chart paper and pens to help present your ideas.
- Make notes for each presenter.
- Remember you are trying to sell your ideas to the Executive Board – so try and make your presentation lively and interesting!

Stage 3: Websites and merchandising

Many television series now have websites that contain more details about the programme and its characters. The websites also often include interactive games, short clips from the series or pictures and music that viewers can download.

- Will your series have a website?
- If so, what sorts of things will be included on your website.
- If not, why have you chosen not to have a website?

Many television series now have additional 'merchandising' – products that help promote the television series. These might include doll or action figures, board games, comics or books, lego models or clothing.

- Will your series have this kind of merchandising?
- If so, think of three items that you think will be 'best-sellers'.
- If not, why have you chosen not to have this kind of merchandising?

Once you have discussed these points, decide how you are going to present your ideas to the Executive Board

- Use the flip chart paper and pens to help present your ideas.
 - You might like to draw the 'homepage' of your website.
 - You might like to draw some of the merchandising items.
 - If you have chose not to have a website or merchandising, write down your reasons on the flip-chart paper.
- Make notes for each presenter.
- Remember you are trying to sell your ideas to the Executive Board – so try and make your presentation lively and interesting!

Appendix VII: Transana Organisational Structure

Importing data

Series – a collection of related audio/video files

- Example - all the recordings of the group discussions and presentations for Activity 1

Episodes – The individual files within the series.

- Example - the Vision Productions group discussion for Activity 1

Transcript – Each episode can contain one or more transcripts. For this project a single transcript was produced for each episode. The transcripts contained verbatim transcriptions of any sections of the recordings thought to be significant in terms of data analysis, and more general notes and observations made by the researcher.

Data analysis

Collections – a group of analytically-related extracts (called clips) copied from the episodes.

- Example - all mentions of the role of humour in STEM programming.

Clips – the majority of coding is done at the clip level. Clips are copied to one or more collections.

- Example - a discussion of reasons for using well-known comedians as programme presenters may be copied to a collection relating to the role of humour and another collection relating to the role of 'celebrity'.

Keywords and keyword groups – this function complements the inductive coding done at clip level by allowing you to link to specific codes (keyword groups and keywords) that you are aware will be of interest before beginning the inductive coding. As part of the process of creating collections a dialog box enables you to name the collection, provide a brief description and allocate keyword groups to the collection. As part of the process of creating clips a dialog box enables you to name the clip, provide a brief description and allocate keywords to the clip.

- Example of keyword groups - the focus for this project was media literacy skills, and two of the keyword groups that were created in advance of coding were 'access' and 'understanding'.
 - Example of the allocation of keyword groups – the collection relating to the role of humour in STEM programming was allocated the keyword group of 'Understanding'
- Example of keywords – included in the keyword group 'understanding' were the keywords 'language', 'representation', 'industry' and 'audience'
 - Example of the allocation of keywords – the clip containing the discussion of reasons for using well-known comedians as programme presenters was allocated the keywords of 'language' and 'audience'.

Keyword searches – you can carry out searches (including complex searches using Boolean logical operators) of your episodes or clips using allocated keywords. The results of these searches can be converted into collections.

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