

Learning Science Through Humour in Children's Media

Sai Pathmanathan

Science Education Consultant, Hertfordshire, England, U.K.

Abstract. This article describes work in progress, looking at the use of humour in informal science learning when young people (7–11 year olds) engage with children's media (animated feature films). The research described here is based on interviews and classroom observations around humour, which took place during a larger (currently unpublished) study. It would seem that humorous, entertaining animated feature films that are inherently scientifically accurate, purely for authenticity, can help young people learn science.

Keywords: Education, Science education, Edutainment, Entertainment, Learning through humour, Humour in children's media, Television series, Feature films.

1. Introduction

Within formal science education the television in the classroom has always been a useful resource to aid visual representation (Fisch 2004a) and to demonstrate experiments difficult to conduct in the classroom (Sewell 2006). Programmes such as *Sesame Street*¹ and *Cyberchase* (Pathmanathan and Ruffin 2012) can help children with literacy and numeracy, but these are educational programmes. What about entertainment programmes? And how can children's entertainment media aid science learning?

Whether entertainment or educational, programming needs to grab the viewer's attention, and this can be achieved through the use of humour and powerful narratives. These components motivate viewers to keep watching and as a result they can assimilate knowledge (Parkinson 2004). Animated cartoons, whether on television or the big screen, provide hours of fun entertainment for young people all over the world. In the U.K., children surveyed (Swann 2013) mentioned cartoons such as *SpongeBob SquarePants*² and *Phineas and Ferb*³ as programmes from which they had learnt something. This included learning 'how to catch jellyfish'. Although this may not be deemed beneficial knowledge by some, the findings of the survey suggest that young people are increasingly aware of the general knowledge gained from entertainment. Other examples of such entertainment include the cartoon series *Histeria!*⁴ covering world history in a fast-paced, light-hearted manner and *Pinky and The Brain*⁵ and *Futurama*,⁶ written by those with doctorates in mathematics and quantum mechanics (Sanderson 2009) which contained many science jokes and comical songs which children have picked up. Even *The Simpsons*⁷ contains references to mathematical theorems and equations. However, entertainment professionals are not in the business of educating audiences. They are more likely to convey this knowledge as a by-product of wanting to be credible.

¹ *Sesame Street*: <http://www.sesamestreet.org>

² *SpongeBob SquarePants*: <http://www.imdb.com/title/tt0206512>

³ *Phineas and Ferb*: <http://www.disney.co.uk/phineas-and-ferb/index.jsp>

⁴ *Histeria!*: <http://en.wikipedia.org/wiki/Histeria!>

⁵ *Pinky and The Brain*: <http://www.warnervideo.com/pinkyandthebrain>

⁶ *Futurama*: <http://www.comedycentral.com/shows/futurama/index.jhtml>

⁷ *The Simpsons*: <http://www.thesimpsons.com>

For example, in the Disney Pixar movie, *Finding Nemo*,⁸ the following conversation occurs:

Bill: Hey, you're a clownfish. You're funny, right? Hey, tell us a joke.

Bob: Yeah, yeah. Come on, give us a funny one.

Marlin: Well, actually, that's a common misconception. Clownfish are no funnier than any other fish.'

(Script extract from *Finding Nemo*)⁹

Marlin (Nemo's father) is a clownfish and the other characters pester him to tell them a joke. This running gag about clownfish demonstrates how closely the humour is interlinked to the narrative and the educational element. Anthropomorphism aside, clownfish appearance and behaviour in the film are completely accurate. The learning in the feature film is not that clownfish are not funny, but that the orange fish with three white stripes, which lives in a symbiotic relationship with anemones, is a clownfish. Anecdotally, a visit to an aquarium exhibit where there are clownfish will often be filled with the sounds of children (and adults) saying, 'Nemo, Nemo'. Most individuals who have seen *Finding Nemo* can accurately identify a clownfish, and even describe their habitat, and they frequently attribute their knowledge to this entertaining film.

Whilst humour in cartoons is expected, some believe that humour in education is undignified (Fisher 1997) and that education should not be fun (Teare 2006, Devlin 2007). Many educators however realise the need for 'fun' by referring to popular media in their lessons to grab their students' attention and get them thinking (Liddell 2006, Wright 2012). The only problem with this is if such creative teaching techniques result in students believing that these are dull subjects 'dressed up' as fun (Manning et al. 2009). If so, this can lead to negative reinforcement (Appelbaum and Clark 2001), with students being switched off science. Recent reviews (Falk et al. 2012) suggest this may be the case when informal science providers promote a 'science learning by stealth' approach, i.e. trying to 'make' science fun. But some informal educators do feel that what they do shows audiences just how inherently enjoyable and awe-inspiring science is through humour and storytelling (Ault 2013).

When executed correctly, humour can be extremely effective in the classroom as it has positive effects on attention, (students need to pay attention to understand the jokes) attitude and engagement, especially when combined with cartoons for teaching difficult subjects (Rule and Auge 2005). Humour can inspire and motivate (Hawkey 1998) by breaking the tension and decreasing anxiety (Guthrie 1999, quoted in Rule and Auge 2005) therefore resulting in meaningful learning (Maslow 1970). Humour could sustain young people's attention towards, and therefore help them learn from, a television programme or feature film.

Individual tastes matter in the case of humour, and as Orton says (in Bushnell 2013), 'comedy will find an audience'. What an adult may find amusing may not be understood by a child, or can result in groans of embarrassment from tweens¹⁰ and teenagers (Kempton 2004). This can be attributed to brain development. The frontal lobes (involved in problem-solving, recognising punchlines in jokes (Shammi and

⁸ Disney Pixar's *Finding Nemo*: http://www.pixar.com/features_films/FINDING-NEMO

⁹ Script extract from *Finding Nemo*: <http://www.imsdb.com/scripts/Finding-Nemo.html>

¹⁰ 10–12 year olds, pre-adolescents, i.e., neither young children nor teenagers.

Stuss 1999), and our working memory, which makes sense of narratives during viewing) are still developing in the teenage brain (Sowell et al. 1999). As different age groups vary in what they find amusing, age-appropriate humour is vital in engagement, education and entertainment. The three theories of humour (James 2001, quoted in Rule and Auge 2005):

- superiority theory (someone who thinks themselves superior ridiculing an individual),
- relief theory (making light of a negative situation), and
- incongruity theory (wordplay, absurdity; requiring higher cognitive processing)

— when it comes to how people respond, are very much age-dependent. Older children find puns and insults amusing, whereas younger children prefer slapstick (Fisch 2004b). So perhaps it could be said, that whilst puns may cause older children to be more attentive (and therefore learn embedded educational material), younger children may not get the joke, will be distracted and therefore will not learn. Those who write for animation seem to be aware of this, and skilfully intertwine different layers of humour within the same scene to appeal to as wider audience as possible (Ferris 2007).

Children's media professionals, at a recent conference session (Bushnell 2013), agreed with one another on several points regarding humour in children's television. These included that children enjoy funny, memorable characters, laughing at other children doing silly things (often their peers are named as the funniest people they know) and mispronunciation. They discussed how it was important to never talk down to children, compliant with Bruner's thoughts on being honest with children (Bruner 1977) and that humour comes from empathy, real emotions and recognisable situations (Bushnell 2013). Previous research (Lloyd et al. 2012) also suggests that being able to relate to characters and situations is important for tweens, such as in *The Simpsons*. This could explain how cartoons and comedies, especially those aimed at young people, can also be a successful medium for tackling tricky topics (Ault 2013).

'Toilet humour' (i.e. 'poo/bum/fart' jokes) was agreed as a great comedic device, but only if integral to the story and not bolted on (Bushnell 2013). This supports current studies (unpublished)¹¹ focussing on dental health-themed picture books. As the stories were read out to groups of 5–6 year old children in East and North West London, they laughed at 'burps', 'gargles', other onomatopoeic noises described in the text, and in particular when one of the characters said he could see up his mum's nose. Parents and teachers also preferred the more humorous, slapstick stories for the children, because the humour fitted perfectly within the stories and that if their children found it enjoyable they would be more likely to revisit the stories and thereby take in the embedded dental health messages. The children stated that they loved the stories, saying 'it's a funny adventure' and describing the situations they could relate to.

In the same session (Bushnell 2013), Muller said that children's comedic tastes are sophisticated, and that those writing for children, should write what they themselves would laugh at. However, writing from an adult's humour perspective, does not always work. In the case of *Sesame Street*, it was important to not use negative behaviours (such as misbehaving and insults) just to incorporate humour

¹¹ Dental health randomised controlled clinical trial (starting in September 2013), in which the author is involved. Please contact the author for further information.

(Fisch 2004a), in case children began imitating the bad behaviour. The positive messages also must be just as memorable as (or more than) the negative in order for right messages to be taken away. Equally, it is important to be careful with humour in case it distorts facts and children take away misconceptions. This is a constant concern amongst educators when they discover what their students watch as entertainment, and for example, was a concern with Nickelodeon's *Barnyard*.¹² To add to the humour, producers thought 'male cows' with udders would look hilarious on screen. But have young children taken away the wrong idea having viewed this feature film, just because adults find inaccuracy funny?

Young people watch television when they wish to relax, if there is nothing else to and because it requires little physical or mental effort. This leisure time needs to be 'fun', but young people do not always necessarily mean 'funny', they mean 'easy' and not mentally taxing. Boys in particular do not mind 'learning while being entertained' (Lloyd et al. 2012). Educational programmes closely interlink humorous narratives with educational material. This is so that both are cognitively processed simultaneously and retained in the memory (Fisch 2000, 2004a), and young people do not seem to mind learning this way. The same happens with entertainment programmes containing accurate factual information either in the visuals or audio.

Humorous stories help with memory consolidation. So how are we more likely to learn the science embedded within a funny narrative? It is all because of our emotions (Fisch 2004a, Rowcliffe 2004). Emotional scenes in movies can trigger the release of noradrenaline in limbic system in the brain improving memory at that particular time (Southwick et al. 2002). Moderate emotion-causing (i.e. mild humour) events are better remembered than neutral ones (Gibb 2007). On the other hand, strong emotion-causing (i.e. side-splitting humour) events can result in less cognitive processing of the information, as all attention is on the humour (Fisch 2004a). Therefore we remember stories and films better if we have been moderately emotionally affected by them. A programme or film that produces mild emotion helps our long-term memory; improving two types of long-term memory: our declarative (facts and events) and procedural (habits and skills) memories (Kandel 2008). Since procedural memories occur as a result of no conscious attention, this could explain how children unknowingly gather and cognitively process accurate information from entertainment media.

2. Methods

One Year 3 class (7–8 year olds) and one Year 6 class (10–11 year olds) from a primary school in Hertfordshire, England, were tested as part of a larger study (Pathmanathan 2009) to see how much science knowledge they had gained from watching a 20-minute clip from the beginning of Disney Pixar's *Finding Nemo*, as the film is renowned for having consulted with marine biologists to ensure credibility (Kirby 2011). As mentioned earlier, although the film is not explicitly educational, accurate marine biology (such as information about clownfish, turtles, anemones, predator-prey relationships etc.) is inherent within the film, and the chosen clip contained significantly humorous scenes integral to the narrative.

Semi-structured small group interviews (maximum duration of 25 minutes each) were conducted with a group of four children (chosen by their teachers) from each of the two classes, to delve further into the children's likes and dislikes and their

¹² *Barnyard*: <http://www.imdb.com/title/tt0414853>.

understanding of content. For the purposes of this paper, to discuss entertainment and humour, the children's reactions, likes and dislikes gleaned from classroom observations and the interviews will be described here.

3. Results

As an entertaining film, with plenty of visual and wordplay jokes, it would seem that young people had also learnt accurate marine biology from this animated feature film (also seen from questionnaire gain scores as part of this study, not described here).

Observing students (24 students in Year 3 and 30 students in Year 6) as they viewed the clip indicated differences between the year groups as to which sections were found to be more humorous, based on when (during the film) the majority of each class laughed.

Year 3 students laughed more at 'butt' as a rude word, although it was actually a mispronunciation of 'boat' by the characters. They also enjoyed the slapstick, visual humour such as sharks bumping into objects.

Year 6 students also laughed at the 'butt' jokes, but seemed to realise this was a wordplay on 'boat' more than the younger students. With increased amusement, they continually repeated the character Dory's mispronunciation of 'escape' as 'esca-pay' too, which was a word that had to be read on screen to be understood. Year 3 students seemed to miss this piece of humour.

This supports previous literature on humour variation (James 2001, Fisch 2004b) at different ages, with younger students preferring 'superiority' humour (ridicule) and older students preferring 'incongruity' humour (wordplay). However, even within the small sample in this study, some of the older children equally enjoyed the comedic devices often reserved for younger viewers.

Both year groups liked *Finding Nemo* for its entertainment value, and the reasons given for liking *Finding Nemo* included:

Because it was fun! Because it was funny!

(Year 3 student)

Finding Nemo is funny...and I just like funny things.

(Year 6 student)

Because finding nemo [sic] was funny and you got to find out things in a fun way.

(Year 6 student, written in questionnaire)

'Fun' or 'funny' was the main descriptor given for the movie, confirming children's enjoyment of the film. However Year 6 students used the word 'funny' more frequently in conversation. As Lloyd et al. (2012) have found, 'fun' can mean many things and boys have learnt information whilst being entertained. When asked what they watched in their spare time, the boys were the first to mention *Discovery Channel*¹³ programmes, *Brainiac Science Abuse*¹⁴ and *History Abuse*¹⁵, probably because they felt it was appropriate to say so given the school setting in which they were being interviewed.

¹³ *Discovery Channel*: <http://dsc.discovery.com>

¹⁴ *Brainiac Science Abuse*: <http://www.imdb.com/title/tt0442633>

¹⁵ *Brainiac History Abuse*: <http://www.imdb.com/title/tt0479826>

Upon further questioning of what the students view in their spare time, 'fun' was often used synonymously with 'exciting', in other words not necessarily to mean humorous or laughter-inducing:

I like in The Bourne Ultimatum¹⁶ at the beginning and he's in the medical room because he's been cut...and he's running away...and these Russian guys come up behind him and he knocks him out and takes his gun...and it's really funny!

Oh yeah and on Bear Grylls¹⁷ there was like a dead deer and its stomach was bloated because it ate something and its stomach burst. I like Bear Grylls. I like it when they cut the goat open! Yeah, that's so funny. And they eat it!

(Year 6 students — Boys)

Year 6 students also mentioned *Primeval*¹⁸ as one of their favourite programmes. None of these shows are of the comedy genre, or even a subgenre. In learning, as described by Gibb (2007), moderate emotion-causing events, whether humorous, exciting or unpleasant could help consolidate memory. The fact that these students remembered the programmes and what happened is a testament to the power of emotions in storytelling.

Year 3 students preferred *Basil Brush*¹⁹, *Tracy Beaker*²⁰, programmes on the *Tiny Pop*²¹ and *Cartoon Network*²² channels, and slapstick shows:

I like the programme called Stupid²³ where they mess around with people's brains.

(Year 3 student)

Although humour plays a huge part in most children's leisure time viewing, once again the examples above indicate a difference in humour preference for the two age groups, with the older children gradually moving towards 'grown up' programmes containing humorous and exciting narratives.

One of the Year 6 students described *Finding Nemo* as 'babyish', to which the others disagreed:

I find stuff like Finding Nemo funny and you want to find out what happens next, but it's a bit babyish.

(Year 6 student; others disagreed)

But then the same student proceeded to chant and giggle excessively at one of the scenes (the mispronunciation of 'boat') in the movie, thereby confirming his enjoyment of the aforementioned 'babyish' humour:

That's a big butt.

(Year 6 student)

The disagreement from peers and the continual referral to 'toilet humour' picked up from the *Finding Nemo* clip suggests that although older, Year 6 students still enjoy

¹⁶ *The Bourne Ultimatum*: <http://www.imdb.com/title/tt0440963>

¹⁷ *Man vs. Wild*: <http://www.imdb.com/title/tt0883772>

¹⁸ *Primeval*: <http://primeval.tv>

¹⁹ *The Basil Brush Show*: <http://www.imdb.com/title/tt0354271>

²⁰ *The Story of Tracy Beaker*: <http://www.imdb.com/title/tt0363378>

²¹ *Tiny Pop*: <http://www.tinypop.com>

²² *Cartoon Network*: <http://www.cartoonnetwork.co.uk>

²³ *Stupid*: <http://www.imdb.com/title/tt0499408>

the same comedic devices as younger children. This relates back to why animators incorporate such layers of humour (Ferris 2007), to give their films universal appeal.

Others stated that they enjoyed the film because they associated it with being a leisure time (non-academic) clip, which they were watching in an academic environment (school):

It was not factual.

(Year 6 student)

Using the term 'factual' suggests that they relate school and academia with the learning of facts, whereas this entertainment film clip was not giving them didactic information. Students also mentioned their happiness in watching animated films as part of this study:

We don't normally get to watch clips.

(Year 3 student)

The use of 'normally' suggests that watching an entertainment clip is a novelty within the classroom, so the fun described here could be less to do with enjoyment of the film, but because of the novelty of the situation. Especially amongst the Year 6 students who would have had an increased academic workload compared to the Year 3 students. The Year 6 students' teacher mentioned that they only watch clips in class that demonstrates phenomena or for a particular topic, and students are expected to write notes when watching clips in class. The Year 6 children had enjoyed watching *Finding Nemo* in this research study as all they did not 'have to work':

Yeah it's fun. I like it, it's fun and you don't have to work. All you have to do is watch.

It helps you...basically because you can actually see what's going on rather than having to read it in a book.

(Year 6 students)

The Year 6 students better understood the need for anthropomorphism and unbelievable situations to add to the humour, supporting previous research (Howard 1993), for example that sharks could be kind and vegetarian or fish are going to school:

I didn't believe the part, when the sharks are being nice.

Yeah, sharks don't do that, but that was just part of the movie...

(Year 6 students)

When the Year 3 students were asked about what they believed, they knew these same situations were unrealistic, but did not question these and also did not seem to attribute these scenes as for the purposes of humour. Delving further into their prior learning, a couple of Year 3 students had mentioned finding out about clownfish long before having ever viewed the film, and where they first came across these fish:

I went diving.

I went to a tropical fish pet shop and they told you what the name of it was.

(Year 3 students)

Did they believe *Finding Nemo* because of their prior knowledge? A piece of visual humour in the film clip showed a young squid releasing ink, saying, 'you guys made me ink', as though she had urinated. Whilst all students laughed at this part during viewing, Year 3 and Year 6 students differed in their beliefs as to whether a squid could actually release ink:

I have seen a squid, but I haven't seen it do anything.

(Year 3 student)

I believe that. It's true, I've seen it.

(Year 6 student)

Although this would suggest that beliefs are also age-dependent, it is most likely that they are life-experience-dependent, with students' beliefs being based on their prior knowledge, regardless of what they may see in an animated film. However, as the film does not explicitly state how the squid releases ink (the scene seems to be included in the film purely for comedic effect), students in both year groups assume the reasons, either with no prior knowledge or having seen a nature documentary:

Because they get angry and they might pinch somebody and hurt them.

The ink might actually have poison in it or something.

(Year 3 students)

It's to blind its predator.

Is it like pepper...it makes your eyes hurt?

(Year 6 students)

Other comments were made to induce laughter in their peers:

Is it its wee...or when it farts?

(Year 6 student)

When 'knowledge' is explicitly delivered within the animation, such as the 'clownfish joke' given earlier, children can take in the accurate knowledge. When accurate behaviour (squid releasing ink) is for comedic effect and not explained, children have to access prior knowledge about the same situation to explain the behaviour, use related prior knowledge to make an educated guess, or simply create their own explanation.

Year 6 students were more likely to state that they had learnt from *Finding Nemo*, suggesting that older students recognised educational elements in the film, and that this included social learning as some mentioned 'listening to your parents' as something they had learnt. Despite enjoying watching the clip as part of this study, they did not think it was appropriate to watch cartoons in class, almost as if to say that humour and formal education are not compatible:

You can sometimes, but cartoons are mainly for humour.

(Year 6 student; others nodded in agreement)

But they agreed you could learn from cartoons in general:

Actually, when I was watching The Simpsons once, we had a test and one of the questions in The Simpsons, was...to learn some of the times tables and it made me learn them. It was helpful.

(Year 6 student)

Year 3 students mentioned that if they had to create their own science programme it would be different to *Finding Nemo*, but they were more amenable to including an animated cartoon format within their proposed idea, within reason:

I'd probably get a documentary and a cartoon and put the two together, and a scientist in cartoon-style.

(Year 3 student)

We wouldn't actually have things like fish that could talk.

(Year 3 student)

As mentioned earlier, Year 3 students knew what was inaccurate and seemed more preoccupied with correcting this (such as fish talking) should they have their own production, and did not associate the need for anthropomorphism simply for comedic purposes.

4. Comedy Conventions and Devices in the Film Offering Opportunities and Limitations for Learning

Finding Nemo is not an animated comedy-film, it is an animated narrative of a young clownfish that has been 'kidnapped' and therefore the powerful, emotional storyline and the adventure of a father's search for his son (alongside his fish friend who has short-term memory loss) gives rise to many comical situations. It is the environment and the interactions between the characters that give rise to the comedy.

Yet, comedy is an important factor in animated feature films and the medium of animation can incorporate within it many codes and conventions of comedy and comedic devices (Dobson 2009, Bushnell 2013). As mentioned earlier these include: 'toilet humour', surprise actions (timing), characterisation, visual and verbal (mispronunciation and repetition) gags and puns, and if these are able to elicit moderate emotions in the viewer, any associated educational material or facts can be retained in their memory. But some of these may afford opportunities for learning, whilst others provide limitations.

Visual gags such as the young squid releasing ink could have less of an effect on learning if not coupled with accurate information. But due to the visual superiority hypothesis (as described by Fisch (2004a) whereby visual information is cognitively processed instead of aural information as the working memory has limited capacity during viewing), the image of the squid may be retained in the memory. As the squid character actually mentions 'ink', this accurate factual information was retained by students, even though they did not know why or how the squid released ink.

Whilst verbal gags including mispronunciation and 'toilet humour' ('escap-ay' and the 'butt'/'boat' joke) were purely for comedic effect, the situations where these laughter-producing wordplay and puns occurred could have helped viewers remember the social issues surrounding the gag. For example, the 'butt'/'boat' mispronunciation occurs when Nemo neglects to listen to his father, and then gets captured. Students in this study stated learning that you should listen to your parents from the film, but

whether this is a result of the linked jokes or emotions would need to be tested further. However based on previous studies (Fisch 2004a) the laughter caused by this particular scene could mean that strong emotions were elicited in the viewers and therefore from a cognitive perspective, all attention would have been on the humour and little learning would have occurred. Again, this would need further investigation.

Repetition is a technique in formal education to help reinforce learning. Throughout the film Marlin is repeatedly asked to tell a joke because he is a clownfish, and this could remind viewers that Marlin is a clownfish and to associate the visual image of the fish with the name of the species.

Comedy timing (slapstick), the anticipation of the punchline, empathy for the characters (watching the weak overpower the strong, such as Marlin being able to save his son from a human), all play on viewers' emotions. But these conventions could be more likely to produce strong emotions (side-splitting laughter, fear and anxiety) and as mentioned before, when the emotions are strong, viewers are less likely to cognitively process the associated information, and therefore little learning can take place (Fisch 2004a, Gibb 2007).

5. Limitations of This Study

As this piece of research was a small part of a larger study (which looked at other emotions in learning, and also used comparisons to a live action documentary), further studies in humour and science learning from animated cartoons would need to be carried out.

With a sample of four for each year group it was impossible to generalise from these interviews and suggest that this school and pupils are typical of the general population. Taking this research further, it would be useful to work with Year 3 and Year 6 students from different schools from all over the country, taking into consideration factors such as varying abilities, ethnicity, cultural backgrounds and socio-economic status. This would give a better representation of the general student population for each age group. The school has an above average achievement in science, which also makes it difficult to generalise from this research and could explain the children's remarks about their interest in viewing *Discovery Channel* programmes and *Brainiac Science Abuse* at home.

There are many cultural aspects to humour. For example children in Europe found Gromit's use of porridge as ammunition in Aardman's *A Close Shave*²⁴ hilariously funny, whereas children in South Africa did not find the scene amusing at all, as the character appeared to be wasting food (Swann 2012). Swann (ibid.) suggests that cultural approaches to humour require trusting the indigenous production teams, and although she describes different countries there may even be differences in humour within the same country based on factors such as geographical location and ethnic background (especially with regards to language and wordplay).

Teacher bias and researcher bias are other limitations that cannot be overlooked. The teachers may have been unwittingly biased against entertainment cartoons as some of their comments made in the classroom about what students may believe from the film ('fish don't go to school') soon after viewing the clip, may have subconsciously influenced their students and could explain why these students did not

²⁴ *Aardman's A Close Shave*: <http://www.aardman.com/rights/our-properties/wallace-gromit-'a-close-shave'>

see the need for entertainment animations to be shown at school. Students who made remarks such as 'you got to find things out in a fun way' indicate that the class had been pre-warned that the animated film was being shown in class for educational research. This again could explain why although reassured that they were not being marked on their replies, students gave educated answers in the interviews (such as they watched educational programmes in their spare time) and seemed more aware of their learning. This could also explain previous studies where students stated that they had learnt how to catch jellyfish from *SpongeBob Squarepants* (Swann 2013). If they are aware of the educational research taking place, perhaps they think more consciously about what exactly did they learn that was new, even though it is a programme they were watching 'for fun'? Future studies could be carried out in non-academic settings (if possible, within the home, town hall, youth clubs or sports centres) in order to negate the inferences to academia and assessment.

Only short-term impacts are described here, so further studies could be conducted, even longitudinal studies following students throughout their school years (from Year 3 to Year 6 and beyond) to study the retention of facts gained from entertainment media viewing over a period of time.

6. Conclusions

This study gives a small insight into humour in children's entertainment media and how it could give rise to young people remembering accurate scientific information embedded within animated narratives.

No learning can take place if students are bored by content. However moderately inducing emotions, such as humour in the case of *Finding Nemo* could have resulted in a positive effect on engagement, attention and memory consolidation.

Year 3 and Year 6 students laughed at different places in the *Finding Nemo* clip, supporting the age-dependent humour theories, and the older students were more likely to believe what was real or possible, and what was added into the film purely for humour and entertainment. Year 6 students believing in the squid releasing ink more than Year 3 students also suggests that discriminatory skills can increase with being older due to an increased general knowledge, prior learning (Driver 1997, Bennett 2003), more television viewing and life experiences (for example, travelling abroad).

The film clip contained many references to marine biology, but also covered social topics such as parent-child relationships, starting school and friendship as well as qualities such as creative thinking, determination and trust. Therefore the interviewees in this study believed that programmes and films could be both entertaining and educational, which is in agreement with previous studies (Fisch et al. 1997, Fitch et al. 1993).

Before watching the clip as part of this study in the classroom, students often mentioned that their knowledge about marine life had come from *Finding Nemo*. Most students had seen the film several times before (from repeats on television and their own DVD copies). The Year 6 teacher was surprised at the scientific accuracy of *Finding Nemo*, and how much her students already knew about marine biology, just from prior viewing. This may seem like one isolated case, but it is possible that many formal educators could be separating entertainment from education, completely unaware of their students' learning from outside of the classroom, especially during their fun, leisure time viewing.

Those who produce children's entertainment are not trying to educate but perhaps they could be made more aware of just how powerful age-dependent humour is on memory and learning, and therefore what it is that their young viewers are taking away. The same would apply to informal science educators, for example those working in science museums and schools outreach. And instead of solely using popular media clips within the classroom as a 'fun' starter or to stimulate discussion, perhaps formal educators could use the knowledge gained from humorous, entertaining films and television programmes viewed by students in their spare time, to encourage them to think about science within their lives and the wider world.

References

- Appelbaum, P. and Clark, S. 2001. "Science! Fun? A Critical Analysis of Design/Content/Evaluation". *Journal of Curriculum Studies*, 33(5) pp. 583–600.
- Ault, J.D. 2013. *Tackling Tricky Topics for 10+*. Session blog from the Children's Media Conference, 4 July 2013, Sheffield.
<http://www.thechildrensmediaconference.com/blog/2013/07/04/thursday-workshop-tackling-tricky-topics-for-10>
- Ault, J.D. 2013. *Entertainment — It's Natural*. Session blog from the Children's Media Conference, 5 July 2013, Sheffield.
<http://www.thechildrensmediaconference.com/blog/2013/07/05/friday-workshop-entertainment-its-natural>
- Bennett, J. 2003. *Teaching and Learning Science: A Guide to Recent Research and Its Application*. London: Continuum.
- Bruner, J.S. 1977. *The Process of Education*. Second edition. Cambridge, Massachusetts: Harvard University Press.
- Bushnell, N. 2013. *Top Ten Tips to Make 'Em Laugh*. Session blog from the Children's Media Conference, 4 July 2013, Sheffield.
<http://www.thechildrensmediaconference.com/blog/2013/07/04/top-ten-tips-to-make-em-laugh>
- Devlin, K. 2007. "We Will Finally Get Mathematics Education Right". In: J. Brockman (ed.), *What Are You Optimistic About? Today's Leading Thinkers on Why Things Are Good and Getting Better*. New York: Harper Perennial, pp. 216–218.
- Dobson, N. 2009. *Historical Dictionary of Animation and Cartoons*. Lanham, Maryland: Scarecrow Press.
- Driver, R. 1997. *The Pupil as Scientist?* Milton Keynes, England: Open University Press.
- Falk, J. Osborne, J., Dierking, L., Dawson, E., Wenger, M., and Wong, B. 2012. *Analysing the U.K. Science Education Community: The Contribution of Informal Providers*. London: Wellcome Trust. <http://www.wellcome.ac.uk/About-us/Publications/Reports/Education/WTP040865.htm>
- Ferris, S. 2007. *How to Be a Writer — Secrets from the Inside*. West Sussex, England: Summersdale Publishers Ltd.
- Fisch, S.M. 2000. "A capacity model of children's comprehension of educational content on television". *Media Psychology*, 2, pp. 63–91.
- Fisch, S.M. 2004a. *Children's Learning from Educational Television Sesame Street and Beyond*. Mahwah, New Jersey: Lawrence Erlbaum Associates.

- Fisch, S.M. 2004b. "Characteristics of Effective Materials for Informal Education: A Cross-Media Comparison of Television, Magazines and Interactive Media". In: M. Rabinowitz, F.C. Blumberg, and H.T. Everson (eds.), *The Design of Instruction and Evaluation: Affordances of Using Media and Technology*. Mahwah, New Jersey: Lawrence Erlbaum Associates, pp. 3–18.
- Fisch, S.M., Yotive, W., McCann Brown, S. K., Garner, M. S. and Chen, L. 1997. "Science on a Saturday Morning: Children's Perceptions of Science in Educational and Non-Educational Cartoons". *Journal of Educational Media*, 23(2/3), pp. 157–167.
- Fisher, M. 1997. "The Effect of Humor on Learning in a Planetarium". *Science Education*, 81, pp. 703–713.
- Fitch, M., Huston, A.C. and Wright, J.C. 1993. "From Television Forms to Genre Schemata: Children's Perceptions of Television Reality". In: G.L. Berry and J.K. Asamen (eds.), *Children and Television: Images in a Changing Sociocultural world*. Los Angeles, California: Sage, pp. 38–52.
- Gibb, B.J. 2007. *The Rough Guide to the Brain*. London: Penguin Books Ltd.
- Guthrie, P. 1999. "Knowledge Through Humor: An Original Approach for Teaching Developmental Readers". Presentation at the *International Conference on Teaching and Leadership Excellence*, Austin, Texas.
- Hawkey, R. 1998. "Have You Heard the One About... Science?" *School Science Review*, September, 80(290), pp. 29–36.
- Howard, S.M. 1993. "How Real Is Television? Modality Judgements of Children". *Media Information Australia*, 70, November, pp. 43–52.
- James, D. 2001. *Split a Gut and Learn: Theory and Research*. Unpublished manuscript, quoted in Rule and Auge (2005).
- Kandel, E. 2008. "We Are What We Remember". Talk given at the Royal Society, London. <http://royalsociety.org/author.asp?id=6405>
- Kempton, T. 2004. "Using Paintings and Cartoons to Teach Ethics in Science". *School Science Review*, December, 86(315), pp. 75–82.
- Kirby, D.A. 2011. *Lab Coats in Hollywood: Science, Scientists, and Cinema*. Cambridge, Massachusetts: MIT Press.
- Liddell, A. 2006. "Now Do This — Teaching Suggestions". Presentation given at Enhancing Scientific Literacy — Using the Media to Motivate Students. The Guardian Newsroom, 20 October 2006, London.
- Lloyd, R., Neilson, R., King, S. and Dyball, M. 2012. *Review of Informal Science Learning*. London: Wellcome Trust. <http://www.wellcome.ac.uk/About-us/Publications/Reports/Education/WTP040865.htm>
- Manning, A., Glackin, M. and Dillon, J. 2009. "Creative Science Lessons? Prospective Teachers Reflect on Good Practice". *School Science Review*, March, 90(332), pp. 53–58.
- Maslow, A.H. 1970. *Motivation and Personality*. New York: Harper and Rowe.
- Parkinson, J. 2004. *Improving Secondary Science Teaching*. London: Routledge Falmer.
- Pathmanathan, S. 2009. "'Edutainment': Obtaining Factual Scientific Knowledge from Entertainment Cartoons". *Master of Arts in Science Education Dissertation*. London: Institute of Education. <http://www.scribd.com/doc/61314364/My-MA-Dissertation-Sai-FINAL>
- Pathmanathan, S. and Ruffin, M.A. 2012. "Mystery, Math, Media: PBS's 'Cyberchase' Gets It Right". *LiveScience*. <http://www.livescience.com/19405-mystery-math-media-pbs-cyberchase.html>

- Rowcliffe, S. 2004. "Storytelling in Science". *School Science Review*, 86(314) pp. 121–126.
- Rule, A.C. and Auge, J. 2005. "Using Humorous Cartoons to Teach Mineral and Rock Concepts in Sixth Grade Science Class". *Journal of Geoscience Education*, 53(5), November, pp. 548–558.
- Sanderson, J. 2009. Personal communication with Series Producer for *How2* and Director, *StoryCog*.
- Sewell, K. 2006. "Why Science?" *Primary Science Review*, 95, pp. 20–21.
- Shammi, P. and Stuss, D.T. 1999. "Humour Appreciation: A Role of the Right Frontal Lobe". *Brain*, 122, pp. 657–666.
- Singh, S. 2013. *The Simpsons and Their Mathematical Secrets*. London: Bloomsbury.
- Southwick, S.M., Davis, M., Horner, B., Cahill, L., Morgan, C.A. 3rd, Gold, P.E., Bremner, J.D. and Charney, D.C. 2002. "Relationship of Enhanced Norepinephrine Activity During Memory Consolidation to Enhanced Long-Term Memory in Humans". *American Journal of Psychiatry*, 159(8), pp. 1420–1422.
- Sowell, E.R., Thompson, P. M., Holmes, C. J., Jernigan, T. L. and Toga, A.W. 1999. "In vivo Evidence for Post-Adolescent Brain Maturation in Frontal and Striatal Regions". *Nature Neuroscience*, 2, pp. 859–861.
- Swann, A. 2013. "Make Up Your Favourite TV Host': Discussion of the U.K. Element of a Global Study on Children's Television Presenters". In: L. Whitaker (ed.), *The Children's Media Yearbook 2013*. London: The Children's Media Foundation, pp. 145–151.
- Swann, A. 2012. *Research: Under The Sesame Tree*. Presentation at the Children's Media Conference, 5 July 2012, Sheffield.
<http://www.thechildrensmediaconference.com/sessions/research-under-the-sesame-tree>
- Teare, H. 2006. "Education Shouldn't Be Fun". In: T. Gilland (ed.), *What Is Science Education For?* London: Academy of Ideas, pp. 73–76.
- Wright, J. 2012. Personal communication with A-level Biology teacher at Joseph Chamberlain Sixth Form College, Birmingham, England.

Dr. Sai Pathmanathan completed a doctorate in neurosciences and decided to pursue a career in science communication and informal science education. She has worked in science education at The Physiological Society, the National Endowment for Science, Technology and the Arts, Planet Science, the *European Science in School* journal and Ignite! Her Masters research (and further independent research) looked into how young people learn accurate science from the entertainment media and saw her take up an International Fellowship at the National Science Foundation, Washington, D.C. She is currently a Research Fellow at Queen Mary, University of London and a freelance science education consultant.

Address correspondence to Sai Pathmanathan, at sai.pathmanathan@googlemail.com