STORIES FROM HISTORY: MORE AUTHENTIC WAYS OF THINKING THROUGH ACTING AND TALKING ABOUT SCIENCE

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Abstract

This chapter will discuss and demonstrate how it is possible to introduce young people to scientists' life stories and draw on particular events or incidents that can inspire them to think more deeply about science. Noteworthy moments from historical scientific stories are dramatised in various ways to engage learners to consider these scientific happenings from different perspectives. The learning activities, adopted and adapted from established theatrical strategies, purposely oriented learners to think about the lives and work of scientists from varied viewpoints. Immersed and positioned differently in a range of historical contexts to work in-role enabled learners to consider science from alternate positions. This provided not only an historical dimension to learning about science, but many of the narratives the learners were introduced to offered insights about socio-cultural influences determining what and how scientists investigated in the past. Learners working in-role, in participatory ways, considering issues that faced scientists in the past, can inform and shape age-appropriate inquiry tasks. Drawn from a series of action research projects carried out in schools across the UK, ways that different theatrical strategies have been developed and trialled in classrooms to engage young people with stories form history are carefully described so that others might apply these approaches.

Key Words

Historical stories, Inquiry, Drama pedagogy, Participatory learning

Introduction

Texts used to teach scientific or technological concepts are often presented in an authoritarian style to learners that is impersonal and abstract. As such, science is portrayed as “a set of objective truths” and “absolute realities” (Avraamidou & Osborne, 2009, pp. 1684). Introducing ideas in a more concrete and personalised way, however, is possible through a variety of texts, including more fictional approaches that provide stories or narratives that capture students' imaginations (Davies & McGregor, 2017). Fictional stories in science can even be used to introduce factual content through the introduction of both conceptual ideas and narratives from “historical events” (McGregor & Precious, 2015, pp. 113-114). McCullagh, Walsh, and Greenwood (2010, p. 23), have described how this can make science “more relevant” to children's lives. That is, fictional texts can offer a medium by which science can be communicated in a more meaningful, relevant and accessible way (Avraamidou & Osborne, 2009). Utilising storytelling that places scientists' lives and work into a “real” context for children through theatrical approaches (McGregor & Precious, 2015, pp. 103-125) can therefore be seen as a personalised way of thinking about science. Stories can help develop an understanding (Mutonyi, 2016), respect and even appreciation of the discipline's historical roots, through narrations taking account of culture, time, place and situation (Meadows, 1987). The hybridisation of narratives of a fictional nature, brought to life through forms of drama or theatrical techniques (Neelands & Goode, 2015) whilst weaving in references to factual information can, therefore, be used as a culturally epistemic tool that naturalistically enables learners (even young children) to begin to understand more complex scientific ideas (Mutonyi, 2016; Anastasiou, Kostaras, Kyritsis, & Kostaras, 2015). This chapter therefore describes how stories or narratives that emerge from well-known scientists' lives can be transformed into immersive activities applying drama conventions to engage young learners epistemically in thinking about science from a more personalised and empathetic perspective.

Using historical stories

Traditionally historical stories have provided context when teaching older students or even science undergraduates. Narratives, for example, how Galileo Galilee famously dropped two cannonballs of different weights from the top of the Leaning Tower of Pisa to illustrate principles in physics about rates of falling bodies (VanCleave, 2004, p. 72), contribute to ways of thinking and teaching about the derivation of ideas in science. Engaging learners in thinking about the life and work of scientists, who might seem remote and disconnected from their daily lives, can enhance their appreciation of them as real people and even enable them to begin to understand why and how they come up with the discoveries they did.

Relating stories in scientists' lives to the science being learned can extend opportunities for students to more directly relate to part of their family, social context, their personal experiences, or even their struggles as children growing up without parents or being born poor. Considering stories relating to scientists and/or inventors they have heard of, for example, Isaac Newton or Alexander Graham Bell, can be drawn on to introduce how they might have felt or behaved when they were younger. Newton, for example, grew up without a father, he was lonely as a child with no siblings, brought up by his grandmother (Meadows, 1987, p. 70) on the family farm. Inspired by his surroundings he used tools (like his penknife) and made what he could from natural materials he found on the farm (twigs, leaves, hessian, twine etc.) to make things (like small model boats when he younger and larger 4-wheeled carts when he was a youth). Alexander Graham Bell had a deaf mother and his father taught deaf children with hearing difficulties. Growing up aware of the way that communication could be extended beyond just talking face-to-face, he was intrigued when he played the piano how his mother, by the way that strings, pedals and other devices could generate vibrations (and sounds), could detect his playing through an ear trumpet.

Connecting drama and historical stories

Drama can offer quite unique opportunities for students to learn in a participatory (O'Toole, 1992) and enjoyable (McGregor & Precious, 2015) way. The wide variety of ways that drama conventions (Farmer, 2011; Neelands & Goode, 2015) can be adapted and adopted to nurture curiosity and confidence in acting and talking about science can engage students in memorable learning experiences. It can bring to life a "story from the past" (McGregor & Precious, 2015, pp. 171-227) and conjure students' empathy to better understand historical situations and the context of important scientific discoveries. It can be used to develop an excitement and curiosity about science, but most of all it can introduce to students what it means to *be* a scientist (McGregor, 2012; McGregor, Anderson, Baskerville, & Gain, 2014). Used in sequence, drama conventions can enable students to be successively immersed in thinking about a scientist, their life and work, in a progressive and deepening way. One of the more unique ways developed (by McGregor & Precious, 2015) to introduce someone from the past, is to use a monologue, that is a mini-speech, given by a teacher or a student in-role, as if spoken by the scientist themselves. These short speeches can orally present listeners with interesting and thought-provoking information from the life of the scientist that is intriguing to think about.

It is possible to engage students in enacting a script of an historical play. A teacher or actor can dress up and speak like an historical scientist from the past (Stagg, 2019). The teacher, actor or student that has spoken in-role as the scientist can then be "hot seated" (Farmer, 2011, p. 28). This technique places the speaker "in-role" to be questioned about being that character. The person in the hot seat usually sits on a chair and is somewhat in the spotlight when questioned by the others in class. The person in-role might be an expert scientist or a character from history with a point of view that others are asking questions of, or, about. A useful convention to adopt subsequently, is the tableau (Farmer, 2011, p. 67; Neelands & Goode, 2015), whereby an idea or concept is represented as a 3D still illustration. Engaging with stories about scientists, students can adopt still or statue-like poses to represent the different attributes, scientific practices (Osborne, 2014), or "actions" (McGregor & Precious, 2015, p. 59) that are undertaken to solve a problem or make a discovery. A very frequently used drama convention is that of miming movement (Farmer, 2011, p. 79; Neelands & Goode, 2015), whereby participants are asked to mime or demonstrate with bodily movements, actions or gestures how they think something works.

This physicalisation of ideas to enact a "scientific process" or even "events" (McGregor & Precious, 2015, p. 47) in a scientist's life could include "freezing" actions to illustrate an important moment (Farmer, 2011, p. 63), a particular occasion or significant happening. Besides these adaptations of drama conventions, students can be positioned (Swanson, 2016) to work in-role as a particular scientist (McGregor & Precious, 2015, pp. 121-124) and are given the props or equipment reminiscent of that scientist's life and era, to work with to respond to a query, open question or inquiry. The ways that the story of a technological scientist's life and work has informed a series of related drama activities and inquiry-like activities is that of William Harbutt (the creator of plasticine) described below.

Bringing a story to life through drama: An example of a technological scientist William Harbutt

In a West-Midlands school in the UK, a nine-year-old child, dressed in a suit and tie, read a script as if he was William Harbutt (the creator of plasticine). His classmates listened as he read the "monologue" entitled "The most perfect material" (McGregor & Precious, 2015, p. 219). He read the script as if he were the scientist reflecting on his life and work. He indicated how as a boy he was creative in making things and then later as an art teacher using clay, he became frustrated that it dried too quickly before his students could manipulate it into its final form. The class listened to the story in absorbed concentration as he explained how the clay set hard too rapidly between classes and students could not refine the shapes and produce the detailed figurines he wanted them to create. He decided to create a clay that was more flexible for longer for his students to work on their sculptures. He asked a friend, an old soldier who knew about mixing different substances to make explosives to help him! He wasn't interested in blowing things up, but how combinations and proportions of different substances (some of which are used for explosives) like calcium salts, oils and petroleum jelly can be stirred together to make a flexible clay. He explained how he recorded what *mix* of salt, oil, jelly and clay was added together each time he tried a new combination. Each new *recipe* was stirred together in the gigantic vat in his cellar, which he then squashed or compressed to squeeze out the liquid and produce a more malleable modelling clay. His story included talking about how his own three children, who loved to play with the putty-like material, suggested he could make it more interesting and appealing by adding colour. The story finishes with an explanation of Olive, the eldest daughter, who when much older, helped him run the family business selling plasticine in England and even overseas in New York.

Listening to a speaker in the role as the scientist reflecting back on his life provided the context for subsequent dramatised activities (Neelands & Goode, 2015) related to Harbutt's life and work. The teacher then invited the class to question the boy, that is "hot seat" (Farmer, 2011, p. 28) him and question him to find out more about him. The students became very involved in this approach and asked many questions. What emerged was that they thought he was *artistic*, *had good ideas*, *cared about his students*, *was persistent, observant, tried different things systematically, wrote things down* and *was thoughtful.* The hot seating discussion enabled the students to appreciate that a scientist or inventor can be more than the often held view of a white coated, spectacled and balding man (Chambers, 1983). Many other "stories" like this (McGregor & Precious, 2015, pp. 103-126, 171-227)) can be developed to support students in realising how scientists' childhoods or aspects of their family lives may resonate with their own.

After being introduced to William Harbutt's story through a monologue the class in the Midlands school produced a series of tableaus depicting the ways he was scientific. An example of one of these, produced by a group of eight- and nine-year-olds is shown in Figure 1. To elicit from the students what their view of their pose conveys, tapping them on the shoulder invites them to "narrate" (Neelands & Goode, 2015, p. 129) what they are embodying. One student declares he is communicating *anxiety*, indicating how it is not easy to produce the "perfect" plasticine; another is gesturing as if *mixing* substances; another is *moulding the clay*; a girl is thinking about her list of *ingredients for the clay*; the kneeling boy represents the old soldier *helping Harbutt mix* his clay together; whilst the final child is *overseeing* the process, that is watching over and monitoring the drying and production of the plasticine.

Figure 1: Example of a student generated tableau, a still 3D depiction of the scientific traits they understood Harbutt demonstrated through their reflection on the monologue

Extending the dramatisation of an historical story to present a related inquiry opportunity to the students

Having some appreciation of the scientific approach Harbutt, as a technological scientist, applied in his life (after listening to the monologue, enacting episodes of his life in a tableau), the students are then invited to decide how to create their own modelling clay. It was made clear to the students that they were then in-role as Harbutt, applying his traits as a scientist. They (the students) had to decide within their groups what their ingredients were to be, the proportion in which they would mix them as well as clarify the other practical steps they would take to create their doughy clay. They needed to measure how much of each ingredient to add; consider how to mix them; think about what to add for colouring; record the outcome of the mixture; and test the mixture to assess its use as a modelling clay, its malleability but retention of a firm shape, consequently creating their own unique plasticine. As such they created their own original methods for making their clay.

The following photograph (Figure 2a & b) illustrates some of the steps the eight and nine-year-olds took to produce their Harbutt clay.

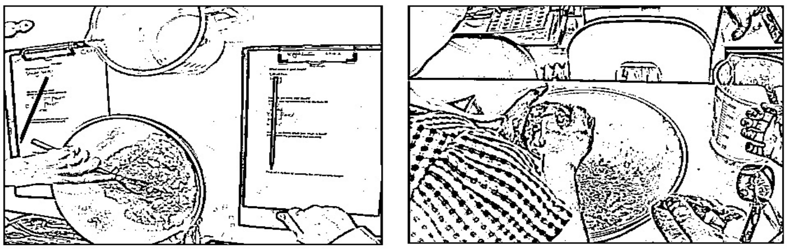

Figure 2a & b: Steps in the process of making the Harbutt clay

Once made, the students tested the “clays” in many creative ways. They laid out them out on a long roll of wallpaper (see Figure 3a), the length of the classroom, labelled their clay (see Figure 3b), and then tore off a small piece to test each in turn. The tests they devised included rolling the dough like a sausage and see which was the longest before it broke; gently pulling it from both ends to explore its length before it cracked to see how stretchy it was; dropping it from a certain height to see if it remained intact when it hit the floor, and making a standing arch with it and timing how long it held its shape (as illustrated in Figure 4).

Finally, they gave each clay a score to decide which was most malleable, retained its colour and could effectively be shaped as required, all features that resonated Harbutt’s plasticine.

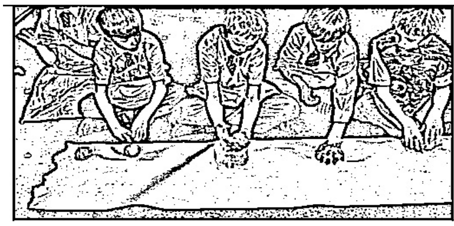
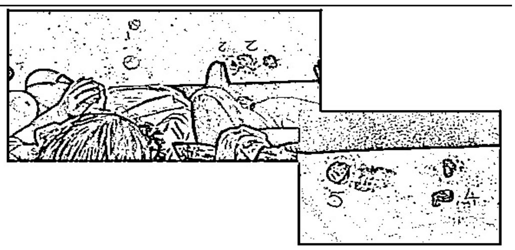

Figure 3a: Lining up the different clays; **Figure 3b:** Labelling the clays ready for testing

This kind of activity provided the opportunity for the students to discuss their ideas about what were the most useful ingredients to include, so they were beginning to discuss materials and their properties. They questioned each other about the final recipes that contributed to each different clay, so they began to compare whether there were particular ingredients that worked better to make it more flexible or colourful, for example. The students appeared to easily relate to being scientists and to imagine how they needed to act when working as such. They used a wider range of scientific vocabulary when discussing which ingredients for the different clays were best for retaining their shape, staying smooth, keeping their colour and not drying out too quickly.

	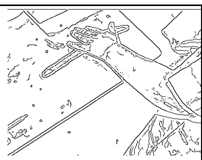		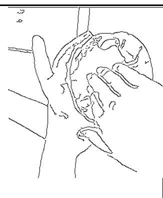		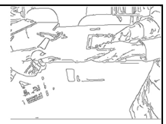
How squashy is it?	How well does it roll into sausage?	How long before one breaks and drops to floor?	How long does it stay in shape?	How long before the bridge breaks?	How far can it be stretched before it tears?

Figure 4: Illustrations of some of the ways the students tested the clay material

This kind of dramatised approach engaging students to work in-role, to not only think about the lives of scientists (Baskerville & Anderson, 2015; McGregor, 2016; McGregor, Baskerville, Anderson, & Duggan, 2019), but to also participate in an inquiry related to their context, aids their appreciation of what a scientist is and what a scientist does. They grasp how scientists had real families, siblings (e.g. Wedgewood who had ten siblings), pet dogs (e.g. Darwin who had beagles), and may have had disabled family members (e.g. Graham Bell's deaf mother), or needed to earn money to buy them food (e.g. Mary Anning beach combing with her pet dog, finding fossils on the Lyme Regis coastline and selling them to visiting Edwardian tourists).

However, another tack to grab their attention is to select a scientist they may not have heard of, but whose contribution they encounter in everyday life, e.g. the creator of Velcro (Mestral) or plasticine (Harbutt), or rubber for car and bicycle tyres (Dunlop). Introducing lesser well-known people through monologues spoken as "mystery scientists" (McGregor & Precious 2015, p. 103) can deeply engage students in thinking about the social, historical and cultural aspects of scientists' lives.

Integrating more personal information into the drama activities for the students when they are acting in-role, inspires them, enables them to relate science to their everyday lives, and even helps them appreciate that they *can* work scientifically, better understand science, and even become a scientist or technologist in the future and make a real difference to the world (McGregor, Baskerville, Anderson, & Duggan, 2019).

Engaging in and with scientific inquiries

Extending thinking about and introducing simple open tasks related to different aspects of a scientist's life and work can offer illustrations and/or opportunities for students to practice the development of various enquiry capabilities as indicated in Table 2. Posing an investigative question or query that the students could work on in-role as a scientist provides additional motivation because they recognise the context of working the way they are. They can better appreciate the purpose of their working out an answer or response to questions that make sense to them, as outlined in Table 2. Drawing on the William Harbutt story, for example, to set-up an inquiry, the focused questions were: i. What is the best recipe for a modelling clay?; and ii. What kinds of tests can you carry out to find out which is the best clay? Answering each of these open questions resonates with aspects of Harbutt's work, in the way he experimented with different ingredients to create the best modelling clay for his students.

To engage in more authentic inquiry situations, extending the opportunity for students to each work out an original solution, requires good quality "open" questions to be posed. Framing the Harbutt activity with given instructions (pre-determined by the teacher) to make a clay and then test it, constrains the extent to which the students can devise their own approaches to creating a material and then testing its properties. Posing a question such as those outlined above *(i. What is the best recipe for a modelling clay? ii. What kinds of tests can you carry out to find out which is the best clay?)* intimates that there are potentially multiple ways of making and testing the clay. This approach certainly provided authentic inquiry learning opportunities for the students.

Adopting the stories of scientists' lives and work is possible, as indicated in Table 2. There are varied ways of generating opportunities for students to work in-role as a particular scientist, especially if the context of their work is introduced through the use of drama conventions described earlier that serve to immerse the learners in a rich and meaningful context generating purpose in the inquiry activity. To complement this, appropriate resources can be introduced to increase the authenticity and challenge in responding to the open inquiry questions (as indicated in Table 2). Practical experimental work experiences, then, can be designed to consolidate the development of a range of inquiry and scientific practices (Osborne, 2014). Trialling these approaches with teachers through professional development approaches can result in many of them adapting their teaching to include a range of freshly developed inquiry opportunities for students (McGregor, 2012).

Table 2: Example of the ways that monologues (McGregor & Precious, 2015, pp.171-227, 156-160) can be used to emphasise a part of the scientists' story, which can then inform a related inquiry activity

Scientist	**Aspect of their "story" that can be drawn upon**	**Inquiry practices that could be emphasised**	**Materials for the suggested inquiry**	**Possible inquiry question**
Marianne North (monologue: McGregor & Precious, 2015, p. 209)	Travelling overseas to exotic places, with no instant camera, drawings and paintings had to be made to capture details of the observations of the different species seen.	Thinking creatively to explain things Making comparisons looking for simple patterns Using observations and measurements to draw conclusions	Coarse paper (black and white), charcoal, chalks, water colours, pencil, different plants, range of fruits, vegetables & a variety of seeds (the more exotic the better)	Which seeds could be produced by which plants? Why do you think that?
Joseph Shivers (monologue: McGregor & Precious, 2015, p. 207)	After repeated experiments eventually Shivers created a much sought after material, lycra	Testing ideas using observation and measurement Trying things out (deciding about evidence, equipment and materials) Generate a fair test Check observations and measurements	Range of materials: jersey, cotton, wool, paper, card, bubble wrap Bowl, bucket, jug, spoons, tape measure, ruler, water	What have you found out about the materials? How could you find out which material is best for an Olympic sport?

		by repeating them when appropriate Make comparisons and identify simple patterns Use observations and measurements to draw conclusions		
Ben Franklin (monologue: McGregor & Precious, 2015, p. 211)	The experience of an electrical charge when flying his kite with his father	Thinking creatively to explain things Asking questions Testing ideas using observation and measurement Trying things out (deciding about evidence, equipment and materials) Making comparisons and identifying simple patterns Deciding whether the conclusions made are supported by evidence	Balloons: different sizes, shapes, colours Different fabrics, spoons, tissue, space blanket, foil, feathers, comb, rulers, paperclips, rocks, metals Plant sprayers and water (to create different humidities)	What have you found out about static electricity? How does static electricity effect our everyday lives?
Michael Faraday (monologue: McGregor & Precious, 2015, p. 213)	Abstract conceptualising to explain the behaviour of an electrical circuit	Testing ideas using observation and measurement Trying things out (deciding about evidence, equipment and materials) Designing a fair test Checking observations and measurements by repeating them when appropriate Making comparisons and identifying simple patterns	Range of different batteries (3), battery tester, additional wires, foil sheet, cork, rubber, shells, graphite pencils (9B, 6B, 3B, HB), charcoal, wire wool, range of 3 rocks (including haematite), old fork, small squares of metal (nickel, cobalt, copper, iron)	How many different ways can you make a circuit that works? What (variables) might make a difference to the circuit?

		Using observations and measurements to draw conclusions		

Teacher reflections on the use of drama and historical stories to teach about science

Teachers report that using stories from history is one of the most challenging aspects of applying drama techniques to engage students in thinking (and inquiring) in/about science (McGregor & Precious, 2015). However, after practicing the strategies and becoming more familiar with the way they could be implemented, teachers noticed that some of their students were more able to: i. design their own bespoke investigations; ii. develop more informed justifications and reasons to explain their findings; and iii. discuss their ideas using a wider scientific vocabulary. For example, in developing an inquiry from the story of Joseph Shivers (McGregor & Precious, 2015, p. 207), who created lycra to make clothing more stretchy for different kinds of (exercising or fashion) purposes. One teacher reported how she adapted this story as a prompt for thinking about properties of materials. She gave her students a range of different materials from which to explore which was the most waterproof. After asking an open question, *Which material is the most waterproof?*, the students offered lots of ideas. So, the teacher provided them with limited equipment, such as 10cm^2 squares of different materials (cotton, plastic sheet, bubble wrap, foil), two beakers, teaspoon, jug, bowl, pegs, timer, and in groups they had to devise a way of finding out which material was most waterproof. When asked, *Why are you doing it that way?*, they would reply with a variety of reasons, indicating, *because of this and that and the other…* What the teacher noted was that at first they found it difficult to really focus on one variable at a time. However, after more practice responding to open questions and devising their own inquiries, the pupils became more confident and it was easy for the teacher to just say, *Right, now investigate what would happen if…* and they could! Other teachers reported how this approach to inquiries even helped students with learning disabilities, i.e. those with Special Educational Needs (SEN). The stories really captured their imagination and resulted in focused work because they (the SEN students) were interested and really motivated to find a solution to the open questions (McGregor & Precious, 2015).

Students' reflections on the use of drama and historical stories to learn science

Often students will say they enjoy engaging in drama activities in science lessons, but they highlight how it is fun for different reasons. They may suggest: *It is better than sitting down*; *You don't have to write*; *It is more interesting*; *You can act it out*; and because it is active they appreciate it is participatory learning and not just sitting down writing. Interestingly, they recognise the inclusivity and the social aspect of drama, providing an opportunity for everyone. Quite a significant proportion describe how it explains more through observing others acting out interpretations. It provides a visual conveyance or alternate presentation of ideas. Some students even feel it helps them empathise with others' situations, people or objects more, because they say: *It is like you are the person and then you learn more*.

This is the kind of connection Neelands (2002) describes as understanding ourselves in relation to what goes on around us. For students it is an opportunity for them to share what they know with their peers and make sense of it through talking and deciding how to "perform", "move", "make sounds", "act like a…" etc. One student described how after enacting the process of being a living creature in the sea and eventually becoming fossilised on the seashore where Mary Anning might have found her, said drama was good because, *We know what it feels like*. Incorporating student's prior-knowledge and embedding activities into their everyday experiences can help them start to see connections between science and their close surroundings, which it is argued acts as a motivating factor (Koballa & Glynn, 2007). Typical comments from students, after being involved in a Mattie Knight related inquiry (McGregor, 2016) for example, include: *I like science…but what we did last [..] made me enjoy science even more* and in, *normal science lessons, we mixed and solved stuff, but in this you were using your imagination as well and creativity which I really like*. However, one particular student, indicated how it is the immersion in the activity that it not only motivates but focuses and extends the attention paid to science, because y*ou are concentrating more […] you have put yourself in the person's shoes*.

The impact of using stories in drama to improve inquiry learning in science and the nature of science

Engaging in inquiry practices that are contextually informed by a story from history (McGregor, 2016) can provide learning opportunities to rehearse and enact scientific practices (Osborne, 2014) as well as develop an appreciation of the nature of science (McGregor, Anderson, Baskerville, & Gain, 2014; McGregor, Baskerville, Anderson, & Duggan, 2019). The kinds of scientific practices that it is possible for students to engage in through a dramatised inquiry includes them being able to ask questions of each other as they devise their group approach to an investigation. They might, as in the example provided earlier, ask questions of another student in-role as a scientist. They can contribute to class discussion about what kinds of scientific questions they could all answer. During the Harbutt activity, for example, they had the opportunity to construct explanations from their observations, for example, the students striving to explain why one clay is more malleable than another. In the clay-making activity, they used the evidence from all the groups to begin to discuss and argue which ingredients (oil, flour, water, salt, food colouring etc) were important in which combinations and proportions to create a flexible clay. As indicated in Table 2, they devised various ways to test the clays so that they could consider the evidence they generated to evaluate which clay material was best for creating models or objects that could be made from clay.

Engaging in inquiries, students themselves could recognise the development of different kinds of scientific practices. Asked about the kinds of things they had done after they had participated in dramatic inquiries, they were able to indicate a range of scientific activities that they had taken part in. For example, after involvement in the Mattie Knight related inquiry, students reflected on their activities as summarised in Table 3, below.

Table 3: A summary of student perspectives reflecting on the kinds of scientific practices they experienced in a dramatic inquiry experience (from McGregor, Baskerville, Anderson, & Duggan, 2019)

Inquiry practice reflected upon	**% pupils' responses**
asking questions	100
thinking of new ideas	100
testing ideas	96
observing how things change	68
comparing things	86
using evidence to make conclusions	91
using scientific words	100
making decisions like a scientist	86
thinking like a scientist	96
acting like a scientist	96
being a scientist	96

Conclusion

The various ways that stories can be drawn upon, adopted, adapted and brought to life through engaging in different kinds of drama strategies has been illustrated in this chapter. Drama conventions can be successfully employed in a progressive way to help students think about science and enact being a scientist in-role. Immersing learners in thinking about what scientists' lives were like, how they came up with their ideas and drew on resources available to them at that time, through taking up roles of well known (or not so well known) characters from the past can provide informed insights into historical events that shape how the world is today.

Dramatising historical stories engages students in a different way of thinking and learning about science. It can enable learners to enter an imagined world, an "as-if" context (Anderson, 2004), where they can envision themselves to be someone or something different. This new perspective means that they are positioned differently and so find it easier to consider what science is from an alternate viewpoint and ask different kinds of questions. Working in-role creates different kinds of spaces for learning where there are more opportunities to discuss and negotiate what something means as well as how it might feel. Through the dramatised inquiry activities students can engage in processes by which unknown scientific outcomes can emerge. Through this lived experience, where in-role they make decisions about what to do, they can authentically experience the true nature of science (McGregor, Anderson, Baskerville, & Gain, 2014; McGregor, Baskerville, Anderson, & Duggan, 2019).

Providing students with these kind of inventive opportunities to engage with the development of scientific ideas through dramatising episodes of historical stories, teachers generate opportunities for learners to explore alternate forms of expression that can enrich reading, writing (McGregor & Precious, 2015, p. 166) and scientific literacy. As Neelands (2002, p. 8) indicates this kind of learning activity means that students with "a broader range of ability [have] access to an expressive form". It, therefore, appears that bringing alive stories from history can offer a range of scientific insights for learners, as well as enhance their literacy, motivate them to solve problems and even inspire them to want to become scientists.

Acknowledgements

The author would like to acknowledge that aspects of this project were supported by the Primary Science Teachers Trust (https://pstt.org.uk/resources/cpd-units/dramatic-science).

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My research work centres on teaching and learning processes that span subject disciplines especially in STEM and STEAM contexts. As a former primary and secondary teacher and now researcher, my educational experiences inform the multiple ways that I consider, examine and articulate pedagogical enactments and the relational nature of teaching and learning. The application of drama conventions to enable an "as-if", imagined, or even Figured World, can be a powerful pedagogical approach that extends ways for learners to act in-role as scientists, engage in thinking like a scientist, and even aspire to become a scientist. https://orcid.org/0000-0001-7413-6902