

Using Design Fiction to teach new and emerging technologies

Design and Technology Education in England

Design and technology (D&T) is taught in most primary (for 5 – 11 year old children) and secondary schools in England (for 11- 16 year olds). Seen by some as a relatively new subject (White, 2011), some of its origins lie in craft tradition and domestic skills. This is partly reflected in classroom activities where children design and make, usually in response to a design brief or context. In the latest iteration of the curriculum (Department of Education, 2013) children are expected to learn about and use the full range of materials (such as electronics, metal, plastic, textiles and wood) in design and make projects. However, the English D&T curriculum does emphasise the importance of teaching children about technological developments (Department of Education, 2013) so they can understand them, use them in their design work and critique them (Barlex, Givens, & Steeg, 2015). This brings its own challenges as some new and emerging technologies are not available in the classroom for children to handle, explore, and design and make with. Design fiction is a teaching strategy D&T teachers could use to overcome this perceived barrier to designing with new technologies. Instead of the fall-back position of a ‘theory’ lesson, this article explores how design fiction could be the answer.

Another theory lesson?

Often, theory lessons are used to teach students about materials and technologies. The lessons are usually de-coupled from a design context because the (understandable) focus is on students learning and retaining the facts so they can pass their exams; but this is not the only (or best) way students learn and it is known that in D&T students learn about materials and technologies so they can make informed decisions about their designs and judgements about other designers’ work.

The topic of new and emerging technologies is exciting, current and introduces students to new ideas they may not have considered before. It would be too easy to teach this topic as a theory lesson, only passing on information. Another approach is to use debates to explore the ethical and economic implications of, say, autonomous vehicles and robotics.

Teaching students about new and emerging technologies does not have to be another de-contextualised theory lesson. By using design fiction, teachers can contextualise the facts about how new and emerging technologies might feature in a future world in which the students can visualise and understand. It involves them designing without the limitations of making a functioning product, as well as talking about the ethics and implications of new technologies. But first - what is design fiction?

What is Design Fiction?

Stories are created when new objects and systems are designed. The story evolves from the germ of the idea, when the idea exists only in the designer's minds' eye. As the design develops so does the story and both take on a more tangible form, culminating in a physical object or system that can be handled and tested. Users interact with the prototype imagining how the design may change the way they live. As they do this they create a story, and now the story helps to visualize the designs potential, its limitations and leads to new developments. A new world is created around the design, showing a previously unimagined possibility in a world that existed only in the designer's mind's eye, a place unseen by others. Design fiction takes this role play a step further and the story is part of the designing process. Design fiction uses fictional stories as a starting point to imagine design futures. Julian

Bleeker (2009) from the New Future Laboratory was one of the first to formalise the term in his publication “*Design fiction: A short essay on design, science, fact and fiction*”:

Design fiction is a way of exploring different approaches to making things, probing the material conclusions of your imagination, removing the usual constraints when designing for massive market ... This is a different genre of design. Not realism, but a genre that is forward looking, beyond incremental and makes an effort to explore new kinds of social interaction rituals. Design fiction is about creative provocation, raising questions, innovation, and exploration.’ (Bleeker, 2009, p.7)

Bruce Sterling, a science fiction writer, concurs with Bleeker’s view that design fiction is “an approach to design that speculates about new ideas through prototyping and storytelling” (Bosche, 2012, para. 1).

Sterling’s design fiction definition draws on film studies to explain it:

“[Design fiction] is the deliberate use of diegetic prototypes to suspend disbelief about change.” (Bosche, 2012, para.3)

A diegetic prototype is an object that is inside the film’s fiction world and appears to be ‘real’, that is it works and is fully functioning, yet when taken out of the film into the real world it is only a model or prototype. Recent dramas such as *Black Mirror* make use of diegesis to present a utopian/dystopian future to consider the potential, and unintended, consequences of emerging technologies. These dramas could be seen as examples of design fiction however the diegetic prototype in the film is only part of the narrative, in design fiction the prototype is central to the story and without the design the story is nonsense.

Lindley (2015) argues that design fiction is different from speculative design because whilst

both suspend belief, in design fiction the fiction story is a necessity, whereas as in speculative design the story is a sideshow or unnecessary to the designing process.

Although the idea of design fiction came to Bleeker (2009) through contemplating science fiction, it is different from science fiction. Imagined narratives are common to both science and design fiction but the imagined worlds are (theoretically) decades or centuries apart. Design fiction “are imaginable near future” (Bleeker, 2009, p7). In other words, science fiction is often about possible futuristic scenarios and design fiction is set in a context that is a known reality – a reality that is just around the corner rather than beyond the visible horizon. An example of a known reality could be a problem that the designers are familiar with, such as an aging population or a new technology that is gaining credence – an obvious one is autonomous vehicles. Using the known reality of an emerging technology is where design fiction comes into its own because whilst the designer will know about the technology, they are unlikely to be able to create a functioning design with it. Design fiction addresses this as it is a story told to explore the problem and potentiality of the new technology to resolve the problem.

Creativity can be inhibited by the limitation of the parameters of manufacture and commercialisation. It is the same for children in Design & Technology Education. When they are expected to make a functioning product, they are already trapped by the constraint of their practical skills and access to resources. Design fiction explicitly requires these limitations to be set aside. The focus is not on a completed output but on the exploration and investigation of possibilities. Therefore, the prototype is central to the story, without the prototype the narrative is meaningless.

Auger and Hanna (2016) developed a framework for good design fiction. Before designing commences the co-ordinates of the reality must be established and the fictional story world created. To establish the coordinates the design context must be understood, learnt about and clearly defined. “Establishing co-ordinates of reality” (Auger and Hanna, 2016, para 2) aligns with Bleeker’s idea of a near future and reinforces the truth that this is not science fiction. Using the earlier context of an aging population as an example, the designer would need to learn who the aging population is, their issues, the potential effects of the population shift on the economy, ecology and political behaviours. The co-ordinates of reality also include knowing about the new technology or concept that may be used in the design, such as autonomous vehicles.

The fictional story could begin with a personal experience, a news headline or an existing fiction story. A twist could be added to the fictional story, a “what if ...?” or a counterfactual such as “What if our bodies’ cells did not deteriorate?” This opens up alternative worlds for a designer to explore.

Once the reality and storyworld are understood and defined, designing begins. The story creates opportunity to explore ideas and test them. The unintended consequences of a design can be talked about as alternate storylines and the designer can “pretend before we mess the world up” (Ward, 2013, para. 12). Design fiction means the idea can be imagined in use, the limitations of technical know-how are removed and designers can discern whether their ideas are culturally or socially feasible.

Design Fiction in D&T Education

The idea of using fiction in D&T is not new. Stables (1992) explores the role of fantasy as a space for young children to design, using fictional characters and/or context as a reference

point similar to Auger and Hanna's first two features of effective design fiction; however, she acknowledges the potential limitations of this as the risk is that children use fantasy as an escape route from reality so their designs become out of touch with reality. McLain, et al. (2017) acknowledge this risk and demonstrate how fiction can be used as an effective context for designing solutions to real problems in a relevant context. Although both studies are with younger children, they illustrate that combining fiction, fantasy, design context and reality into design fiction can be an effective pedagogical strategy in D&T.

Design Fiction in Practice

This section of the paper begins with an analysis how one student teacher, Natasha, planned and delivered design fiction with one of her classes. The second part is a six lesson plan developed from this analysis. But first, the context for this is explained.

Using design fiction as a pedagogical approach to teach new and emerging technologies has been developed as an embryonic response to a recommendation made by the Office for Standards in Education, Children's Services and Skills (Ofsted, 2011) report "Meeting technological challenges? Design and technology in schools". One key recommendation from the report was for the D&T community, and others, "to explore how schools can access the latest technological advances in materials and processes" (Ofsted, 2011, p.7). So, the teacher training course at Nottingham Trent University (NTU) developed a new framework that incorporated modules focusing on teaching students about new technologies and their potential impact on society (Hardy and Barlex, 2012). In one module "*Design and Technology in Education and Society*" students taught their peers about a new technology and suggested pedagogical approaches suitable for teaching the technology in schools. An evaluation study of the module revealed that whilst the students "had grasped some essentials of the technologies, they were less secure in considering their disruptive nature" (Barlex,

Givens, Hardy and Steeg, 2016, p.8). New and emerging technologies have the potential to disrupt the status quo, and as discussed earlier, design fiction visualises and explores the potential of a new technology. Therefore, design fiction was introduced by the author of this paper to student teachers at Nottingham Trent University to address Barlex et al's (2016) findings.

One of the student teachers, Natasha, used the strategy with her 12-13 year old students. She planned five lessons:

Lesson one - introduced the topic of new technologies using existing products such as robots and 3D printers. Students evaluated the advantages and disadvantages of these examples.

Lesson two – students learnt about drones, which Natasha identified as a new technological product.

Lesson three – students created design ideas that used a new technology.

Lesson four – Natasha explained design fiction and gave them writing prompts to help create their stories.

Lesson five – students peer assessed each other's stories.

When reflecting on the five lessons Natasha determined design fiction to be worthwhile approach to use for teaching students about new and emerging technologies. However, she appreciated there were limitations to her five lessons and when they were analysed against Auger and Hanna's (2016) framework for design fiction gaps were identified. The three steps to Auger and Hanna's framework are:

1. Establishing the co-ordinates of reality
2. Creating a fictional story world

3. Designing in the fictional world.

Analysis of Natasha's five lessons shows that steps two and three are covered in lessons three, four and 5 but in reverse order. In other words, the designing takes place before the fictional world is created. The co-ordinates of reality are touched on in the first two lessons when Natasha teaches students about new technological products (i.e. drones) but they are not fully established. What this means is that they have a superficial understanding of a new technological product but not a thorough grasp of a new and emerging technology. Natasha talked about drones, a technological product, but did not teach them about the new technology of autonomous vehicles. Hence, the students' designs fixated on the use of drones rather than the broader potential of autonomous vehicles.

From this analysis, the lessons have been redesigned. Below the new set of six lessons are outlined, which should give students a more meaningful learning experience about new technologies, where they create new futures that are grounded in a reality they can understand and explore the unforeseen consequences of them.

To prepare for the lessons Natasha would decide on the story's context, which means the students concentrate on designing, modelling and critiquing rather than using valuable lesson time to deliberate on who they will design for and the design's context. She would also decide which new technologies students would learn about; robotics and 3D printing are the two chosen new technologies used in the lessons described here.

In the first lesson, Natasha would use BBC news items and videos (search BBC, Click, and YouTube) to teach the students about robotics and 3D printing, so they had a technical

understanding of these technologies. This is the first stage of good design fiction:
understanding the reality of the technology.

The second lesson would start with Natasha explaining the context and market for the story. Following this, the students would explore the user's physical, intellectual, emotional and social needs. Next, using their knowledge about robotics and 3D printing from the first lesson they begin creating new ideas that meet some of these identified needs. Although they would individually generate these first design ideas, Natasha could arrange students to critique each other's ideas in pairs and small groups. This would prepare them for team working in the next lesson, when they will bring their ideas together as a small group and work on one idea as a team.

The focus of the third lesson is design development through modelling. The students are encouraged to make quick models, David Bramston calls these 'dirty models' in his inspirational book "*Idea Searching*" (2008). Because it's important for the students to modify their ideas as they talk with each other, rather than making a new model each time their idea changes, the students should only use materials that can be easily shaped, cut and joined, such as card, fabric, masking tape and other low cost, readily available resources. Throughout the lesson, Natasha would prompt the group's discussion with questions posted on the board related to their story (e.g. What would your design do? Where would it be? Who would be using it? Why would they use it?). By the end of the lesson the students should have a prototype and rough draft for their story.

In the fourth lesson, the students would work on their story using writing frames which could be written with support from the English faculty. The intention is for groups to write a story

with a good opening ‘hook’, a strong middle and ending that leaves the reader believing their design is possible, but also questioning the social and ethical dilemmas of using new technologies.

The groups would explain how their prototype functions using pictures and reading their story aloud to the rest of the class. So, in lesson five they could take photographs, edit their story and produce a PowerPoint.

During the final lesson, each group would have 5 minutes to share their design fiction with the class and after each presentation questions and prompts can be used to explore the classes understanding and the integrity of the design:

1. How believable is the use of the new technology? Explain your answer.
2. Which of the user’s needs does the prototype meet?
3. How well will it meet the user’s needs? Explain your answer.
4. What problems do you think this design might cause for: the user? The user’s family and/or friends? The manufacturer? Society?
5. Should this prototype be allowed to be made? Explain your decision.

Students will probably find these difficult to answer. However, the aim is for students to have a deep understanding of the new technologies taught in lesson one and these questions should help probe the students’ knowledge, their ability to apply it to a real context, and how well they can critique the social and ethical dilemmas of designing with a new technology.

Design fiction could help students develop their creative writing and other literacy skills including oral communication. Furthermore, design fiction opens new possibilities for cross-

curricular learning through linking with creative writing in English, ethics in RE, and learning from history (for instance, looking back at news articles from the twentieth century that attempted to predict the future).

New technologies could be taught as a theory lesson, evaluating existing products or abstract ideas from an unimaginable world. Instead, design fiction as a pedagogical approach offers students a deep understanding and way of thinking about new technologies in an identifiable context. Beyond the D&T classroom, design fiction has the potential to contribute to students' growth as a citizen in a democratic society. The value of good D&T education is more than what the child does in the classroom, it challenges how they think about the world beyond school. D&T's full value offers a long-term impact on the students' life and, in turn, a benefit to society (Hardy, 2017). Because design fiction makes them to debate about the potential unintended consequences of new technologies students will be better equipped to understand, question and challenge decisions made by governments, designers and engineers about artificial intelligence, autonomous vehicles and other new technologies. Thus, empowering students to become educated citizens in a democratic society.

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