

## Did the UK Digital Design and Technology (DD&T) programme lead to innovative curriculum change within secondary schools?



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### Abstract

Design and technology (D&T) requires teachers to continually update their knowledge and skills, with regard to new technologies, appropriate to the needs of the time (Design and Technology Association, 2011). In 2011, Ofsted identified the need for “England to keep pace with global technological change” (Ofsted 2011, p.5), in the report ‘Meeting technological challenges, a survey of schools from 2007-2010’. Following the report, the UK government funded a national programme called Digital Design and Technology (DD&T). The programme set up a network of regional support centres to provide up-to-date Professional Development (PD) courses on modern D&T subject knowledge.

The purpose of this paper is to analyse the data gathered from teachers that attended the e-textiles training element of the DD&T programme during 2010-2012, in order to elicit information about the impact of the training on developing e-textiles curriculum back at school. This paper contributes to the current debate on modernising the D&T curriculum and will support tutors of D&T PD with guidelines to improve future programme design.

The data was collected in three stages, using a mixed methods approach. Quantitative and qualitative data were collected at each of the three stages using: (1) end of training, teacher evaluation; (2) online, follow up survey; and (3) one-to-one semi-structured phone interviews (Creswell, 2009, Burton and Bartlett, 2005). The data identified that changes occurred in the schools in three ways: (1) through the sharing of new subject knowledge learnt during PD; (2) by developing links with systems and control (S&C) staff in the school; and (3) by (a) adapting curriculum to include e-textiles or (b) developing new e-textiles curriculum.

The e-textiles training within the DD&T programme has made a difference: to teacher’s professional practice, based on positive feedback from their pupils; and encouraged teachers to develop elements of integrated curriculum in their school, based on supportive departmental cultures. However, the study also highlighted the difficult nature of curriculum change.

## **Introduction**

Design and Technology (D&T) requires teachers to continually update their knowledge and skills, with regard to new technologies, appropriate to needs of the time (D&T Association, 2011). In 2011, Ofsted identified the need for “England to keep pace with global technological change” (Ofsted 2011, p.5), in the report ‘Meeting technological challenges, a survey of schools from 2007-2010’. The report acknowledged Professional Development (PD) as the route to up-to-date subject knowledge and recommended teachers access this where available.

Following the report, UK government funded a national programme called Digital Design and Technology (DD&T). The Department for Education (DfE) made funding available for secondary teachers to develop their professional knowledge via a programme run through the Design and Technology Association. DD&T Support Centres were set up across England to provide up-to-date PD courses on modern D&T knowledge. A popular element of the programme was the teacher training events designed to support knowledge around the integration of electronics and textiles, often referred to as e-textiles courses.

The purpose of this paper is to analyse data gathered from teachers that attended the e-textiles training element of the DD&T programme during 2010-2012, in order to elicit information about the impact of the training on developing e-textiles curriculum back at school. The authors believe, (along with Guskey and Yan, 2009) that there is merit in critically evaluating PD training to ensure that programmes achieve intentional aims. This paper contributes to the current debate on modernising the D&T curriculum and will support tutors of D&T PD with guidelines to improve programme design.

## **Literature review**

E-textiles are an exciting area within the engineering field (Buechley, 2006). The definition of e-textiles includes electronic and computational technologies that are imbedded into textiles. E-textiles can be applied in a variety of ways, including clothing, interiors, medicine and car industries. Braddock and O'Mahony (1999, p.6) argue that e-textiles are “narrowing the gap between the world of art, design, engineering and science”. This is important for D&T curriculum, as Hughes, Bell and Woofe (2011, p.58) argue for teachers to design activities, which relate to “technological, scientific and mathematical principles” and to “consider the perceptions of pupils” about the “utility of the subject”.

E-textiles are an example of ‘real-world’ technologies and have the potential to contribute to modern curriculum for D&T. The Ofsted report, discussed in the introduction, identified that electronics should be taught in “combination with new materials” and pupils should be taught how to “apply control systems in all aspects of the subject”. The new National Curriculum for England and Wales that will be taught from September 2014 also advocates an integrated approach across material areas.

An argument put forward by Buechley (2006) with regard to e-textiles, is that this field of study has the potential to not only ‘narrow the gap’ between subject disciplines but to appeal to a “different class of user”. The authors along with Buechley are excited by the possibilities of this field of study inspiring learners and attracting girls into a generally male dominated field. Statistics shown by Kirkup et al. (2010) cited in Bell, Hughes and Owen-Jackson (2013) identify that only 5% of UK working women have careers in science, engineering or technology (SET). This has economic consequences for the UK and signifies the need for

DT teachers to deliver curriculum that at least encourages pupils contributions to developments in technology regardless of their gender (ibid).

To support D&T teachers with curriculum change, regular PD is needed, which allows them to 'feel confident with new processes (and) materials' (Burton and Bartlett (2002, p.240). Teaching new processes and materials can be difficult for teachers as new forms of curriculum might cause problems (ibid).

It is important to recognise that change in the classroom is complex and to recognise that the journey will not be smooth. Teachers need regular feedback from their pupils on the effects of the change and on-going support (Guskey, 2010). 'Good' schools are recognised as effective and they provide time and opportunity for teachers to learn within and outside the workplace (Day 1999, p.20). However, not all schools may be termed as 'Good', and a teacher's capacity to write, talk about and do the things they learn at a PD event (Eraut 1994, p.25), will be influenced by the local culture of their school and department (Helsby (1996), cited in Burton et al. (2002, p243)).

Guskey et al. (2009) argue that research into effective PD is limited, which highlights the need for designers of professional development to evaluate current practice.

## **Methods**

The data was collected in three stages, using a mixed methods approach. Quantitative and qualitative data were collected at each of the stages using: (1) end of training, teacher evaluation; (2) online, follow up survey; and (3) one-to-one semi-structured phone interviews (Creswell, 2009, Burton and Bartlett, 2005).

The online survey and one-to-one interview questions were piloted, to check for ambiguity and validity (Cohen, Manion and Morrison, 2007). Feedback from the pilot led to changes in the wording of the online questionnaire to ensure clarity and the online tool needed to be adapted, due to technical issues.

Twenty teachers completed the end of training evaluation, collected from one DD&T support centre, after an event in March 2012. Twenty-two teachers completed the online survey from a field of over 140 teachers that attended training during 2011/2012, across England. The one-to-one interview sample was identified during the online survey and based on a teacher's willingness and availability. This sampling method is referred to in the literature as an opportunity sample (Bell, 2010) or a nonprobability sample (Creswell, 2009). The one-to-one interviews were conducted over a one-week period. The sample was 100% female.

The research followed British Educational Research Association (BERA) guidelines for 2012 and met with the authors' University ethical clearance procedures.

The data was collected and analysed using Guskey's (2002) model 'Five Levels of Professional Development Evaluation'. The 5 level's build on one another and success at each level is dependent on the level before. The levels include (1) Participants' Reactions to the PD activity (in this case one day training), which evaluates overall enjoyment of the course and is collected at the end of the event. (2) Participants' Learning from the event,

which focuses on checking to see if anything has been learnt during the training. (3) Organisation Support & Change, which shifts the evaluation to the organisation (school) in order to see how PD has been transferred to the teacher's workplace. (4) Participants' Use of New Knowledge and Skills, evaluates how new knowledge has made a difference to the teacher's professional practice and curriculum within school. (5) Student Learning evaluates how the PD training affected pupils learning in the classroom.

## **Findings**

### *Participants' Reactions*

Data from the end of training questionnaire identified that 15/20 teachers enjoyed the training and cited strengths of the course to be: range of activities; hands-on elements; new knowledge; resources and level/style of course teaching. One participant responded negatively citing that the course had not provided new knowledge. Only 16/20 teachers answered the training evaluation question.

### *Participants' Learning*

Data from the end of training questionnaire also identified that: (1) 20/20 of the teachers felt that the training had developed their subject knowledge, built confidence in delivering modern textiles and built confidence in developing activities that integrated skills, to a satisfactory or above level; and (2) that 19/20 of the teachers felt they had gained ideas for curriculum development from the training.

### *Organization Support & Change*

Data from the online survey identified: skill levels; cost of resources; time; and the teacher's job type as potential barriers to curriculum change. 6/21 teachers developed links with systems and control (S&C) staff to address the gap on skill level.

Data from the phone interviews supported survey data by identifying that time was an issue for one teacher who cited that time available for the e-textiles activity was "restricted" by "delivery at lunchtime" (extra-curricular activity) which could "put (pupils) off if they wanted to go outside" at lunchtime. Two of the teachers also cited examples of the role that a teachers job may have in potential for change. One teacher identified that if the teacher had responsibility for a curriculum area within D&T, then they were free to make decisions about resources and curriculum for that area. However, another teacher felt that developing curriculum was "not my role" and felt that she "couldn't change curriculum" although she could "add on" (to existing curriculum). One teacher interviewed also felt that she needed more scientific knowledge and support with how to make links to S&C staff within her school.

The phone interviews also identified data about the culture of the school/department. One teacher commented that she "knew the head of department (HOD) wanted (her) to take it (e-textiles) forward" and another cited the support of senior leadership. A different teacher spoke about how her department felt "no benefit" in the change and another discussed how initially sceptical attitudes of her colleagues changed once they saw successes and then they "got on board" with change.

### *Participants' Use of New Knowledge and Skills*

Data from the phone interviews identified that all three teachers shared their knowledge learnt on the training day during department INSET and one teacher explained that new links were created with the science department. The teachers also integrated e-textiles into their

school curriculum. The data identified changes to the curriculum at KS3 (11-14 yr. olds), through: (1) adaptation of existing (Bag) schemes of learning; (2) a lunchtime club (extra-curricular) and (3) a new (Lantern) project. The teachers discussed the use of: (1) bought in battery kits; (2) soft circuits; (3) LED lights; (4) conductive thread; (5) soft switches; (6) sensors and tilt switches and (7) pre-manufactured components (e.g. press-stud, hook and eye). One teacher discussed the integration of hard circuits, which needed “to be soldered”.

This echoed the data collected from the online survey showing that 22/22 teachers shared their new subject knowledge with colleagues in the department and 11/22 developed curriculum that integrated electronics and textiles. Again the trend for KS3 teaching was evidenced through 5 citations that discussed KS3 activity. The online survey also revealed that teachers showed the technology to pupils “for choice within projects” at KS3 & KS4 (14-16 yr. olds) and that some teachers led extra curricular activities with KS3 & KS4. There was no mention of KS5 (16-18 yr. olds) activity.

### *Student Learning Outcomes*

Data collected for this level came from the teachers’ perceptions of pupil learning within their classrooms and was collected during the phone interviews. One teacher mentioned how pupils “enjoyed” the scheme and another commented about how pupils learn about e-textiles. Two teachers mentioned how pupils “didn’t make connections” with S&C learning from other lessons and one of these teachers felt that in her opinion the pupils “struggle to transfer knowledge from one material area to another” and “they don’t tend to draw on their S&C knowledge when in textiles”.

All three teachers discussed how an integrated curriculum could change pupils’ perceptions about the subject. One teacher cited that pupils “now see S&C as part of textiles” and another commented that “e-textiles had the potential for pupils to see technology as a combination of material areas, with links to other subjects and a gateway to breaking down gender stereotypes within the subject”. This was echoed by one teacher’s comment about how “boys see textiles as (a) girls subject” and that because the “boys like science”, this type of activity (which combines the two areas of the curriculum) could get the boys “hooked” on textiles. The same teacher also went on to comment “girls don’t like electronics” and explained that she felt “this is wrong” and “once they are into it, they enjoy it”. The teacher felt that e-textiles (along with smart/technical textiles) have the capacity to increase General Certificate of Secondary Education (GCSE) take up of textiles.

The data also identified that one teacher thought the technology was “too modern for pupils” and not linked to the ‘real-world’ (‘Lady Gaga’ given as an example – “too gimmicky”). Another teacher cited that she worked hard to create projects that would appeal to boys and girls, with a combined science & fashion theme.

### **Analysis and Discussion**

Our original research question was: Did the UK Digital Design and Technology (DD&T) programme lead to innovative curriculum change within secondary schools? From the data gathered we could elicit information about the impact of the training on developing e-textiles curriculum in schools. The change occurred in the schools in three ways: (1) through the sharing of new subject knowledge learnt during PD; (2) by developing links with S&C staff in the school; and (3) by (a) adapting curriculum to include e-textiles or (b) developing new e-textiles curriculum.

All of the teachers from the online survey and interview shared their knowledge with other colleagues at school. The e-textiles training allowed the teachers to develop confidence in the new (subject knowledge) learning by providing a platform for contact with new processes and materials as discussed by Burton et al. (2002) earlier.

6/21 teachers, from the online survey and one teacher from the interviews developed links with the S&C staff in their school. This was a disappointing finding, as on-going support (Guskey, 2010) followed up in a teacher's school (Day, 1999) is a key component to curriculum change success. It was interesting to note that one of the teachers interviewed identified a need for further support with how to work with her department (S&C) staff as this implies that D&T departments don't currently support work in an interdisciplinary way.

Actual curriculum change occurred with all three interviewed teachers and with 11/22 of the online survey teachers. The curriculum change occurred through (1) timetabled lessons or (2) lunchtime clubs (in the proposed initial stages). It was positive to see these changes that involved the teaching of electronics in combination with textiles (Ofsted, 2011). Evidencing the adoption of modern curriculum (D&TA, 2011), which reflects the interdisciplinary nature and exciting developments in the current engineering and textiles industry (Braddock and O'Mahony, 1999 & Buechley, 2012).

### *Barriers to change*

From the data we can also see that the teacher intentions for curriculum change (19/20), didn't match the reality (11/22). Something changed once the teachers returned to their school, their capacity to action change became more complex (Guskey, 2010). Teachers felt that either their job, did/or didn't permit them to implement the changes. Based on status, time or support from the school/department. An example of this was the teacher who described her department's initial scepticism, and how she could only teach the new curriculum to her pupils, through a voluntary lunchtime club. This evidences the commitment and tenacity required of individual teachers to ensure change, when the path is not always easy. Burton et al. (2002) point this out to us, when they observe that "sticking with the norm" is safer in an age when teachers are constantly being monitored. This highlights the importance of local school culture in any change (Eraut, 1994 & Burton et al, 2002).

When the school culture was "good" (Day, 1999), it was positive to hear the experiences of teachers about how pupils had reacted to the new curriculum content. Teachers saw positive changes in their learners' attitudes towards the subject and its possibilities for integration with other material areas. They commented on "breaking down gender stereotypes within the subject", supporting the arguments put forward by Buechley (2006). The teachers also talked about pupil enjoyment and new learning with regard to modern textiles.

The classroom experience for the pupils is as important to curriculum change as the department culture. Teachers need feedback from their pupils (Guskey, 2010), to decide if the change will stand or fall. The data evidenced that in one school (lunchtime club), after positive feedback from the pupils, the local culture changed and "initially sceptical" teachers decided to adopt the new curriculum across the department. In another school the new curriculum was dropped after one period of teaching. This was decided due to the teacher's observations, that her pupils, thought the content was "too modern" and "gimmicky". It is interesting to note that the teacher felt unable to explore more 'real-world' applications for the technology as part of on-going PD, within the workplace (Day, 1999).

Teacher's also discussed the difficulties around the transference of electronics knowledge from one material area to another. The data was unclear about whether the teachers were saying this had changed through the integrated curriculum or was still an issue? Future research could focus on the correlation between pupil knowledge transference from electronics into textiles (and vice versa) in the lessons of teachers that developed links with S&C staff within their school.

## **Conclusion**

It appears that the e-textiles training within the DD&T programme has started to make a difference to teacher's professional practice and encouraged teachers to develop elements of integrated curriculum in their school. The study has also highlighted the difficult nature of curriculum change.

Work still needs to be done to support teachers with implementing curriculum change once back in their school and to allow teachers to work in an integrated way at a department rather than individual material level. Integrated planning has the potential to support pupils with the desired knowledge transference across material areas. The authors have already referred to the complex nature of change and the importance of the school culture. If a modern curriculum is the desired outcome, then D&T departments need to re-evaluate their attitudes towards integrated approaches to D&T delivery.

The study has evidenced that teachers were encouraged to develop the new curriculum when they saw positive reactions from pupils. The response from the interviewed teachers was overwhelming in regard to pupil enjoyment and changed attitudes around the utility of the subject e.g. the potential to support girls with electronics and boys with textiles. This was a small-scale study, however, the authors feel confident that positives can only come from this type of activity, which allows teachers to design curriculum with the potential to encourage pupils regardless of their gender.

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