Design Mentoring and Designerly Attitudes

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Abstract
This paper explores the activity of mentoring design and make projects, with the intention of giving mentoring practitioners guidance and confidence in the activity, whilst developing designerly attitudes in their pupils. We as a team were frustrated by how little of this was observed in English secondary Design and Technology lessons, yet were aware that in many cases the teachers had on graduation been accomplished designers. It seems that the prevalent school assessment culture and inexperience of teaching the activity of designing was lowering the priority of 'designing' within Design and technology lessons. We set out to find out what University Design tutors did in mentoring and through this to establish a framework that we could use in schools with school pupils and their teachers. Our work was observed and aided by a psychotherapist and counselor who helped us to recognise some of the conscious and unconscious dynamics which exist between teachers and pupils in this setting and which can impede or act as a stimulus to the pupils creative output.

From analysis of a series of interviews we proposed that design mentors seem to have 3 roles

1. To act as teachers and managers of the activity
2. To act as mentors to the pupils, in getting them to define and manage their own learning and progress through the projectwork.
3. To act as an assessor in judging the kind and level of activity that the pupil is capable of.

We recorded and observed 12 pupil and teacher mentoring sessions using digital pens and voice recordings. The teachers then used these records to reflect on what they had said and done with the pupils and using the criteria, commented on the roles they were adopting.

The outcomes of this were that the teachers and observers gained a clearer insight into the roles of the project work tutor, and felt that their confidence in their own ability, which had previously been intuitive, was aided by having a structure on which to base their reflections. .

This was a very preliminary study, aimed at validating the 3 roles. Having done so, the team believes that through pupils being better engaged in design and making pupil autonomy will be better developed.

The next stage will be to use this structure and approach in a wider range of schools, pupils, and educational contexts.

Introduction

There is little dispute that fundamental to designing are the abilities to both deal with a complex and uncertain world and to produce 'answers', that make things 'better'. The accepted and educationally supported strategy to develop this capability is typically by engaging the learners or beginning practitioners in a series of designing activities. These activities are often presented as a series of 'open ended' briefs, with. learning objectives 'embedded' within the context and expectations as defined in the brief.

Designers are educated this way, and it is an accepted practice that through this means (approach?) their attitudes to themselves and their outcomes are 'formed'. Through doing design they become designers (Simon, 1992; Schon, 1987).

In the English school context there is an established argument through the Design and Technology National Curriculum that supports children at all levels being engaged in this activity. This is not because they are going to be professional designers, but because the skills and attitudes that are developed will enable them to be better able to make positive contributions to their own and others' lives. In short it will make them better human beings (Bronowski, 1973).

In the context of school teaching (as opposed to professional training) this means that the person running the activity has to be a teacher, a mentor and an assessor to the learners. Also the learners have to be on one hand managed and the other to be given autonomy to operate in uncertain and complex situations. And yet the teacher will try to ensure that each pupil should be shown a measure of success. Many teachers who do this well, relying highly on intuition and professional experience (Schon, 1983) to guide them, often viewing it as an 'art'. Those approaching it for the first time often find it complex and threatening.

This paper reports preliminary research that sets out to give some clarity to the activity of being a design mentor within the school teacher's role. This was approached by analysing the practice of design tutors on a higher education design programme and then using this analysis as a lens to observe school teachers' practice. The paper highlights the links and differences between professional mentoring and professional training for designers and explores the dilemmas between the complex attitudes and subsequent roles that teachers need to adopt, in order to do this successfully.

One of the fundamental yet most difficult areas of research in Technology Education is the desire to understand the act of designing and therefore be able to teach people to do it better. Attempts at an increased understanding have been influenced by both the means with which the evidence has been collected and analysed and the purpose of the outcomes: i.e. what you see, or choose to see; how you record it; and what you do with it. These aspects are intertwined, as was illustrated by the major study into Design and Technology capability (Kimbell et al., 1991) which at it's base set out to 'assess' capability. Before the research could start to assess, they had to define what they were looking at and then arrive at a 'rubric' for assessing design and technological capability.

An analysis of Leonardo da Vinci's sketchbooks, for example, can easily be interpreted as the work of a designer, but our ability to learn from the work is limited by our inability to contextualise the work. The work of the 'design methods' practitioners like Jones (1970), went some way to assembling a 'toolkit' of 'what designers did' with attempts to contextualise the activities beyond a formulaic and universal 'process'. Cross, Christiaans and Doorst (1996) took the 'same' design activity and recorded it on video and then asked eminent theorists to produce a range of 'interpreta-

tions' of the designers work. With all of these works it is evident that the way that the evidence was collected and interpreted influenced the conclusions, but there was always a concern that because of the metacognitive nature of designing that much of the ephemeral data was all but lost.

The research for this paper was largely driven by a concern that, while new teachers entering the D&T teaching profession have developed personal capability in designing, they seem to find this difficult to initiate in their schools with their pupils. The normal role of the teacher primarily focuses on:

- authority, control and behavior management;
- outcomes and expectations of progression;
- learning objectives, and their assessment;
- Schemes of work, skills progression and attitudes.

Within this there is a tendency to prioritise quantified steps which are easy to teach and easy to test. Attitudinal 'constructs' such as autonomy and understanding their own learning are therefore less easy to incorporate. Teaching and managing designing with their pupils is an area that teachers have less opportunity to develop expertise in.

Within our research we were aware of the need to include the practice of teacher reflection to ensure continuing professional development possibilities for the teacher (Parsons and Brown, 2002). The journey that the pupil makes from problem to solution, provides opportunities for them to gain confidence and develop a self awareness that can encourage the capacity to take risks in search of finding creative approaches (Black and Wiliam, 1998). Yet it would seem that without the 'will' and 'ability' to develop autonomy in pupils through designing and making, other pressures on teachers force designing down their priorities. Design activity is then at best tokenistic, but often not present at all.

The research team

The research team consisted of four people: a higher education design and technology teacher educator, two design and technology school teachers and a psychotherapist. One of the school teachers is also trained as a school counsellor. The research took place in the teachers' school.

Methodology

The work was essentially us 'marking out the pitch' by validating criteria and strategies for mentoring which could then be used in further research. Our exploration of mentoring designing followed the following stages -

1. Interviewing university design tutors.
2. Exploring mentoring from a psychological viewpoint.
3. Observing and recording teacher/ learner tutorials.
4. Teachers reflecting on the records of the tutorials.

Stage 1: Interviewing university design tutors

Interviews were conducted with four university design tutors about the design projects that they ran. The questioning was around the areas of

- What made a good design project?
- What did they do if a student was failing?
- How did they recognize excellence in student performance?
- How did they conduct their tutorial interviews?

From their answers, the following were highlighted.

- The project brief and the structure of the project embody all of the learning objectives required of the learner. These may be both functional and attitudinal objectives. A critical aspect of the mentoring is to encourage students to understand and 'modify' the brief to open up the possibilities for 'better' outcomes.
- Whilst there is an emphasis on the outcome and its success, critical aspects of the objectives may be their emphasis on the 'process' of attempting to get to the outcome. Elements of this include argument, analysis, understandings of the outcome, the human situation and understanding themselves as designers.
- Overall project and programme aims of autonomy and becoming self critical were embedded in all project briefs.
- The tutoring aimed at 'becoming a voice inside their head' as a means to develop student's design capability.

The aspects that emerged from these interviews were then incorporated into our pupil tutorials.

Stage 2: Exploring mentoring from a Behavioral Psychology viewpoint

Originally the team did not contain any 'trained' counsellors or psychotherpists but we recognised that there were aspects of what teachers were doing that were close to counselling/psychotherapy. The initial thoughts were to interview psychotherapists to find out 'how they did it'. Instead we expanded the contributors to contain a psychotherapist and utelised the skills of our teacher with school counselling expertise. The therapists observed and commented on a range of the interviews between the teachers and learners, and were involved in the reflection on activity by the teachers. Thus we were all more able to both discern and record the counselling aspects of what we were doing.

Points that emerged from our collaboration with the therapists:

- The inclination of us as teachers to be more interested in measurable outcomes as opposed to aspects which showed movement and tendency to change.
- Viewing the pupils' responses to the situation as both showing the kinds of expectations for advice and solutions they would want as well as reacting to the interactions with the teacher.
- The tendency to ignore the dynamics of the pupil group and its influence on the individual pupil having a tutorial.

From our conversations within the team we were introduced to the concept of countertransference and how it was different from 'teaching'. Because of the significance of this we felt the need to have some guidance and took this from Brown & Pedder (2010). They explain

> *"Within the special field of psychotherapy, the concept of countertransference has had various meanings; we find it helpful broadly to distinguish two uses. As in development of the concept of transference, countertransference was at first thought of as an obstacle. Any strong feelings the therapist might have had about the patient were thought to represent his own unresolved conflicts and problems, from his own past or present life, transferred on to the patient...This then is one meaning of countertransference, when the therapist contaminates the field with his own problems from elsewhere.*
>
> *However, assuming the therapist comes to the patient not unduly ruffled by his own problems and is able to maintain an attitude of "free-floating attention" or "listening with the third ear" in order to hear the message behind the patient's surface communication, then the therapist's own spontaneous feelings and emotions, as his unconscious tunes in to that of the patient, may provide the key to understanding what is at first incomprehensible. Heimann (1950) was among the first to begin turning attention to this second aspect of countertransference, which, far from being an*

obstacle, becomes an important tool in psychotherapy. She assumed that the analyst's unconscious understands that of the patient, and that rapport at this deep level stirs feelings which it is the analyst's task to sustain and use as a source of insight into the patient's conflicts and defences." (Brown & Pedder, 2010, p61-62)

In exploring the difference between countertransference and teaching in practice, our therapist commented

"It seems to me that teaching & learning is largely a conscious process. e.g.. the teacher knows what they want to achieve and the pupil understands they are being taught.

Is the teaching of project work difficult because the teacher has to balance how you do or don't influence the learner? Probably yes because the teacher is balancing keeping the student on task and developing/expanding the pupil's thinking/creativity by pressing the right buttons rather than imposing his opinions. This is to some extent about reading the pupil's responses. One way of doing this is by examining the way that pupil is making you feel.

Psychoanalytic therapists try hard to avoid telling their patients how to fix things and try to enable them to recognise their own strengths, unhelpful behaviour patterns ("conflicts and defences"). Therefore there is definitely some similarity in the balancing act we have to perform. The countertransference kicks in when, for example, the therapist experiences his patient as helpless and impotent and his instinct is to pitch in with a list of suggestions. He's picked up on how hopeless the patient feels but is in danger of doing exactly what everybody else does i.e telling him what to do & reinforcing his sense of impotence. Not helpful. For this reason countertransference is not necessarily a good thing (it's a reaction). The skill is to examine your countertransference response and find some way of using it constructively in the work. Ideally you might aim to bring the stuck feeling to the patient's attention so he feels understood and ultimately liberated from it."

Stages 3 and 4: Pupil tutorials and Teacher reflections

When pupils were engaged in project work we were exploring the idea that by seeing the teacher/design-tutor role in the areas of;

- Being a teacher; manager of the learning;
- Being a mentor; or therapist;
- Being an assessor, making decisions as to the most appropriate course of action that the learner should next take.

In this way we could develop insights into design project work mentoring, that could be a way of improving ours and others' practice.

The data for this section has been collected using digital pens, which not only captured the notes and drawings of the user on paper, but at the same time recorded the conversations that created them. It was therefore possible to have tutorial interviews with the pupils about the progress of their work, make notes, offer suggestions, agree and share targets and record the conversations that initiated those things, and then analyse those conversations later.

In total twelve tutorials were recorded in this way. The results were then analysed in discussions between the teacher and one other member of the team to add the reflected comments of the teacher, as to what they felt they were doing using the three criteria of teacher/manager, mentor/counsellor or assessor. For the benefit of this paper the data has been 'characterised' through a series of 'incidents' between teachers and learners. These have been extracted from the three of the twelve tutorials, chosen because they illustrate different approaches taken by the teachers. The identification of which of the three 'roles' the teacher was operating in was noted in the teacher reflections column when the tutorials were reviewed.

Results

We have transcribed the interviews between teacher and pupil into the first column and then added the teacher reflections and the roles that they identified they were adopting in italics in column two.

Teacher/ Pupil tutorial 1

The pupil is designing a device to create an emergency phone connection for people who get into difficulty in areas where phone signals cannot reach.

The teacher's initial comment on this episode:

"This student is very creative with ideas and is sound in the research area but has most difficulty turning the ideas into tangible outcomes. He has chosen to explore a valid yet risky area, where the actual technologies and materials expertise is difficult to find.

I have redefined this as a 'conceptual' project, where all of the details may not be defined but may be viewed as 'black box'. So the student does not have either the ability or the time to cover all aspects of the project yet is still able to make a valid contribution. They have got a sample of foil covered plastic which is a useful starting point"
(Acting as an assessor)

Transcript of tutorial 1	Teacher reflections and roles
pupil "…also I was thinking about the most basic shape to make the balloon I can make it into a sphere, but the problem with is there will be too many pieces and therefore too much tape joining them together. So the balloon will become too heavy the second most efficient shape would be a square shape. I was trying to make one out paper but it was hard to make it airtight because of the corners."	My task for this session was to move this student towards a 'made' outcome of some sort. So that they can start to confront some of the areas that they can and can't make progress in.
teacher "Have you ever made water balloons out of paper?"	*(acting as a teacher)*
pupil "You mean like an origami cube?"	"This is me giving guidance without directly 'telling' the student what to do."
other pupil "I know how to make one of those I think. Well I'll try it now."	
teacher "The other thing is (you will probably know much more about this than I do) could you base your concept on nanotechnology?"	*(acting as a mentor)*
pupil "What do you mean by that?"	

teacher “Is there anything that you can use that is very small to connect to the balloon?” Pupil “The problem with the cable from the phone to the balloon is that a wire has to be very special and that makes it very heavy.” teacher “Is there any way other way of getting signals up to the balloon other than by wire” pupils “Oh yes maybe use fibre optics?” teacher “Can you use that?” Pupil “Yes I think you could.” teacher “So why doesn't this exist at the moment if it seems so obvious?” pupil “I called up the phone companies and they say it is all possible but it will be the equivalent to creating your own phone mast which is illegal at the moment.” teacher “ OK so let's look at what has to be done now; research the material: check out the shape of the origami balloon: research fibre optic technology. Where will you be with this when we meet next?	This is me managing the progress of the designing and making *(acting as a teacher)* This is me pushing the student to consider other alternatives *(acting as a mentor)* This is congratulating and handing over the designing to the student. *(acting as a mentor)* Managing what the pupil will do between now and next time. *(acting as a teacher)*
Pupil “I’ll make a paper model by the end of this lesson, then I’ll research the materials before we meet. Is that OK?”	

Teacher/Pupil Tutorial 2

The student is designing a device to remove bees’ honey from honey combs. The present methods are messy and slow so they hopes to create a better way to do this.

Teacher’s initial comment on this episode.

This is a student who is very strong in the area of modelling and making, but lacks confidence to have and push their ideas. They have made a range of research models around the context of the project. They are now at the point of being moved from what ’might be possible’ to ‘what can be possible’. *(Acting as an assessor)*

Transcript of tutorial 2	Teacher reflections and roles
teacher “So it seems like what we've got here and what you’re suggesting is that something like this is holding the honeycombs that spin around the centre” pupil “That’s right if it's spinning then the distance from the middle is important.” teacher “You really ought to pour honey on this model and see how it works.” pupil “I’ll do that a bit later on when I’ve got something a bit better to test” teacher This bit is horizontal? Pupil “yes” teacher “OK what about if it's like this and spins vertically? Pupil “If it is fixed like that will we won’t need any gears at all. Teacher “Let’s go downstairs and try that out in the workshop. Does the distance of the thing you're spinning away from the centre make any difference? pupil	Tuning into the project and reviewing the progress since the last meeting *(acting as a teacher)* Relating the project back to the original concept. The student demonstrates a grasp of the concept and has a strategy for how they intend to deal with it. *(acting as a mentor)* Looking with ‘fresh’ eyes and making suggestions. *(acting as a mentor* Putting the investigation within the students strongest area of expertise. *(acting as a*
“Yes it is, the further away the more the centrifugal force. teacher “This might be a much simpler arrangements and you won't need any gears to make it go fast is that right? pupil “So let's make a model of what we just said. This feels like it will work, yes I'll go away and make and model of this.	*teacher)* Extracting the science. *(acting as a teacher)* Positive suggestions. *(acting as a mentor* Student defines the strategy of what to do next *(acting as a teacher)*

Tutorial 3

This is the design of a portable seating device for use both outdoors and indoors.

Teacher's initial comments on this tutorial;

This is a very bright student, who lacks confidence in realising their ideas. It was important in this interview that they moved towards a valid outcome within a material area that they understood, that was simple enough for them to both understand and make it. It was important that the made outcome could well made. *(Acting as an assessor)*

Tutorial 3 transcript	Teacher reflections and roles
pupil "So I'm looking at something like this one, which sort of twiddles out and have something like an upturned tray on the top." (Shows drawing and photo from research) teacher "Aha that looks interesting. So when it's folded up what does it look like this? pupil. "Yes but that's not good. If it was a kind of triangle, what would that be like?" teacher "Yes that would be very good and a lot more comfortable. pupil "Do you think if it was something like that anyway, with a hinge out of metal or something, it would be strong enough? teacher "It doesn't have to be metal or magnetic it could just be fabrics couldn't it?"	This is me interrogating the ideas that the student has produced since our last meeting. *(acting as a mentor)* This is me reinforcing their ideas and contribution. (confidence is important for this student) *(acting as a mentor)* Giving ideas *(acting as a mentor)* Giving specific solutions. *(acting as a teacher)* Questioning so that the pupil pushes and develops their ideas. *(acting as a mentor)* A non specific answer, to encourage the student to come up with their own answer *(acting as a mentor)*
pupil. "So how could we make it? teacher "you could use a fabric 360° hinge like this, It could be fabric or leather and would be easy. Pupil "Oh yes. I was thinking that it might be carried with a handle like this but that means it's can only be this long between your hand and the ground." teacher "Could it be carried in a different way, like with a strap over your shoulder? pupil "I guess that would make it a lot more possible. But wouldn't that be too heavy to carry around?	

teacher “How big do you think it should be?” pupil I am worried that this will be a difficult object to carry. what will we make it out of? teacher “from anything that is not too heavy.” pupil “If I make it out of plywood how can we stop it being so heavy? teacher “Oh well how will you reduce the weight? Pupil “I could cut pieces out of it” teacher “Show me by drawing on this how you would do that. Show me several alternatives of how you would reduce the weight by cutting pieces out. Yes I can see that one what about another one give me several ideas do it draw it on here.” teacher “that seems very good, there seem to be a lot of lovely things you can do with that. How are we going to move this from here?” Pupil “Well I can draw some more but I think I need to make a model of this. Teacher okay how long do you think that will take to do? Pupils	Questioning the weight issue. *(acting as a mentor)* Engaging with and sharing the ‘designing space’ *(acting as a mentor)* Managing the rest of the activity. What next? *(acting as a mentor)* Managing progress *(acting as a teacher)*
“Err I can do that in about half an hour.” Teacher “Okay lets see it. Does that help at all?” Pupil “yes that helped me a lot.”	Reassurance and reinforcement *(acting as a mentor)*

Conclusions

Our initial thoughts were that the three areas of Teacher, Mentor and Assessor would be valid as ways of interpreting the activity and could be reliably identified. What we had supposed was that particular learners would require particular emphasis of one of these areas, For example the 'less able' pupils would require more managing and less mentoring. What we actually observed was a more complex and subtle movement of emphasis between the learner and teacher around all of the 3 areas in 'all' pupils, independent of their ability.

It would seem that the ways that we chose to categorise the activity of design mentoring could be reliably identified within the activity. The insights that this reflection gave us aided the progress of the tutorials, and thus that of the pupils. We all recognised that this was an activity we had previously done intuitively, but which we were now able to recognise, as criteria in our own practice.

So what are the implications for pupils being better mentored in designing activities in their project work?

In a world where the future is increasingly uncertain and complex, the ability of citizens to make improvements to their lives can be seen as crucial. Yet conversely within societies the need for politicians to justify spending on education forces a greater emphasis on measurable progression of children into mature adults. On one hand the 'society' (business and the creative industries) recognise the need for the population to be 'autonomous, nimble, creative, capable and brave in situations of uncertainty and able to make changes for the better; in our case, be 'designers'. Yet, the people tasked with the education of young people in those same societies, by their politicians, must achieve this via a series of small and measurable 'bite sized and easily tested pieces' of educational experience.

For example, knowing the names of a series of designers and what they designed is easy and cheap to teach and test, whereas giving learners the confidence to operate in the way those designers have, is much more complex to do and assess. We in the team have no doubt, however, which of these in the context of human development is more important. We would hope that this way of looking at design mentoring of pupil project work would make it more possible for teachers to encourage their pupils to behave as designers and to achieve greater successes.

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