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An Approach to Developing Creativity in the Field of Craft, Design and Technology Through Small Groups

Attempting to identify the separate components of the creative process creates an artifical atmosphere not immediately recognised by the classroom teacher in the workshop, as being of relevance to their job. And yet these components are essentially what is required. The "sensitivity to all areas of experience" and "the quality of being critical of ones products" are what is being demanded by teachers of C.D.T. (Whether or not they are recognised when achieved is another matter). What is obviously of value and coincidently what can be relatively easily recognised, is that of fluidity. The quality of ideas generated create an atmosphere which enables the qualitive aspects of the work to be enhanced. In other words if you have more ideas to choose from there is a greater relevance to the problem in hand.

If we can therefore take these and similar ideas from within the realms of psychological tests into the workshop and classroom and attempt to identify those traits which occur as part of the everyday work of our pupils we may help to promote a fuller understanding of the development of creativity in the practical situation of the school.

I am convinced that other aspects of creativity, such as originality, flexibility and elaboration could all be identified in the normal conversation of our pupils directed towards specific tasks. This research is therefore based primarily on the analysis of audio tapes recorded during a period of problem solving based in the workshop during a C.D.T. lesson.

Following on from earlier work I decided to try a change in methodology and substitute some small group work instead of the chalk and talk methods employed previously.

In my earlier work I analysed a lesson which was in two parts. In the first part I was aiming at the introduction of a project by talking to the group as a whole. In the second part of the lesson the pupils were working at a drawing board and I was discussing their work with them in a one to one relationship.

The conclusions arrived at were gleaned from data obtained from an analyses of audio tapes. These interpretations were obtained from an illuminative view as well as a statistical analyses of the quantity and nature of factual information delivered. In the second part of the lesson I looked at the teaching style employed.

The analyses appeared to suggest that a change in methodology would be advantageous, particularly in the higher level activities of 'designing'. This was based on the theory that the 'product-process' methodology is inappropriate for helping with 'understanding' tasks. The new approach was designed to substitute a methodology which involved a greater degree of intellectual participation so that more understanding could be achieved.

This hypothesis was derived in part from the work of Doyle (2) (1979) and also John Elliott (2) when he says:–

> "I have argued that understanding is developed by the student from 'within', through the exercise of his own rational capacities, and therefore cannot be caused from 'without'. However a student could hardly be described as exercising his rational capacities if he were closed to the reasons and arguments put forward by others. Intellectual development necessarily involves being open to discussion".

One of the objectives therefore was to try to create a learning environment which encouraged participation by the pupils in a manner which meant they could contribute meaningfully to the design process.

By concentrating on the design process I was deliberately ignoring the imparting of 'facts' or 'knowledge' as being of concern. I was more concerned that the pupils recognised the need to consider factors which contribute to the design process rather than they arrived at 'correct' solutions. I was in other words aiming at the initial stages of the understanding process; understanding the need to consider specific factors.

The 'quality' of the design of an artefact will of course be dependant on, at some stage in the

development of the design, the quality of the information used, rather than the quality of the creative skill. But the methodology of acquiring factual information is possibly different and could be equated to routine-memory tasks and outside the immediate concern of this study.

The group of pupils I was working with was of mixed ability and in the fourth year at a comprehensive school. The number of pupils involved for this lesson was artificially low as some six of the total group missed this one period to go to a link course at a college of further education, leaving a group of twelve to work with.

In the initial talk I consciously attempted to keep it as 'fact free' as possible trying to emphasise the approach to the design situation, rather than expecting perfect working solutions to the question posed. One of the problems discovered in my earlier work was the apparent lack of ideas from the pupils, there was a tendency on the pupils part to sit and apparently expect to be fed with ideas from the teacher. I desired a much more constructive or participatory approach from the pupils but was not obtaining it.

This initial talk therefore aimed at stimulating the pupils to produce ideas for a suitable project for work at their level. Apart from reducing the length of the introductory talk I also used a small number of slides which had a bearing on the task in hand. I was very conscious of the danger of using too many slides, or slides which illustrated the 'correct' answers as this very frequently leads not to 'fluency' but to a convergent approach. It was important that a range of ideas was produced.

The teaching group was then sub-divided into four smaller groups one of two pupils and the other three groups had three pupils each. By using groups of this size I was hoping to facilitate an exchange of ideas through a 'mutual exchange'. I felt that groups of four and over would allow for the introverted pupil to be 'hidden' and for one or two dominant personalities to monopolise the discussion. In fact there was evidence of dominant personalities surfacing within these small groups. (See Appendix 7, Glen, Gavin and Paul. Natural Sources) which had a negative effect on the group. I felt that a small group of two may not have provided sufficient mutual stimulation.

During the initial talk (See Appendix 2 Design procedure, introduction to lesson) I asked the pupils to produce from their groups two ideas for a project which could be used by a handicapped person in some way to improve their quality of life.

Each small group was equipped with an audio tape recorder and asked to simply leave it playing as they discussed the problem, obtaining a record of the whole discussion.

The groups were initially sent away to produce two ideas from each group to enable the lesson to proceed.

When the group reassembled after only three or four minutes I asked the groups to provide me with their ideas which I wrote on the blackboard. This resulted in eight projects of varying degrees of suitability, nevertheless a considerable improvement on the previous piece of research where the production of suitable ideas was the main stumbling block.

After these ideas had been outlined and I had written them on the blackboard the group voted on what they thought was the most suitable project to be developed for the next stage. The most popular exercise was the kitchen tools with adaptable handles for disabled people and this was adopted for the whole group to work within their small groups.

Before they split up again into their working sub-groups I elaborated on certain key factors and discussed some features indicating a method of approach. This method of approach was illustrated with a flow chart, of which each child had a copy and I had an overhead projector skin which had been prepared previously. (See appendix 9).

During the second phase of the experiment I introduced a new topic but attempted to use the same methodology employed in the earlier lesson. This meant that I first of all introduced the topic to the group as a whole. The topic this time was 'Using natural sources to produce energy'. (See Appendix 6.) They then broke up into their small working groups, which this week was four groups of three pupils each, one absentee child having returned. Apart from the extra pupil the groups were the same as those employed previously, an attempt being made to consolidate the group dynamics, based on friendship groups.

I really wanted this time to streamline the procedure by eliminating the chalk and talk work I had covered previously on design methodology. Thus enabling the work of the children to be developed or extended at the 'ideas' stage and also the consolidation or development of the design.

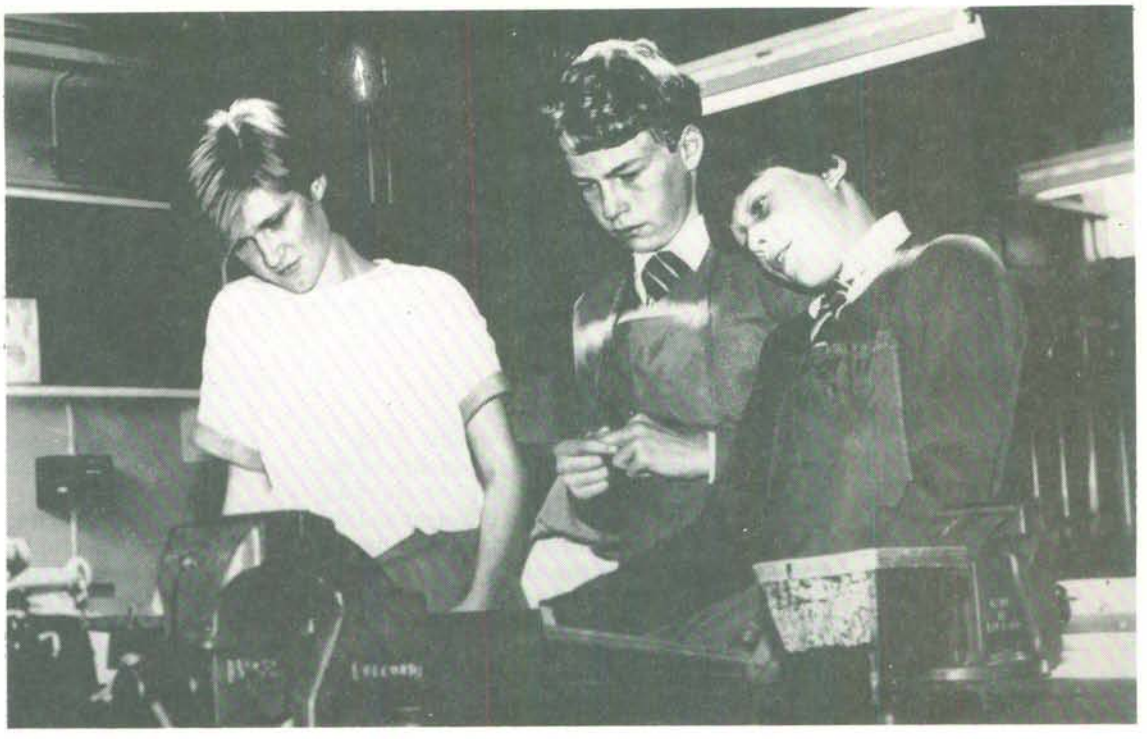
Again therefore I initiated the lesson by a brief statement of intent and directed the group to start working to produce a number of ideas.

The groups reported back after a short time and I again discussed their suggestions as I wrote them on the blackboard, providing a list of topics.

This time however I didn't require every group to work on the same idea but asked each sub-group to select one of the suggestions and then work individually after the sub-group's attempt at analysing the problem.

Finally the whole group was involved in a discussion when an attempt was made to evaluate the methodology from the pupils point of view. The tape recording of this discussion is included in the appendix.

During my earlier piece of research I was very conscious of the 'weight' of the task faced by the pupil. During the introduction to the lesson, in which I employed a lecturing technique as the methodology, I mentioned eighty nine facts or points of information to be absorbed by the pupil. In my analysis afterwards I suggested that this was absurdly high, particularly as a number of the



points were superfluous to the aim I had given myself, that of introducing the project.

In this experiment the first, and perhaps simplest, step I took to overcome this problem was to limit the length of the introductory talk to approximately half of the earlier one, (The transcript covers six pages as against eleven pages) and the total number of facts delivered was sixteen. In other words whilst the talk took up only fifty per cent of the time used previously the facts delivered were only eighteen per cent of those delivered earlier. Of the sixteen facts mentioned, five could be said not to have had direct relevance to the aim of the lesson. (This does not mean that they were of no value, facts delivered this way may be important as a method of improving the general education of the pupil.)

I feel, therefore, that my attempt at reducing the 'burden' of the lesson had been successful.

A further criticism I made of my earlier attempt was the lack of variety in the delivery. For this exercise I consciously introduced other aspects to increase the groups involvement both intellectually and physically. By using a set of slides (See appendix 13) in the first part of the lesson I introduced a variety of media, intending not only to 'feed' the pupils but also to stimulate through change and this appeared to be satisfactory. It certainly helped to provide more interest in the task than was evident in the work of the earlier group.

In the second half of the lesson I used an O.H.P. to help to illustrate the 'design' procedure and this was supplemented by a handout given to the pupils with identifical work on. Again I feel this helped to focus attention to the task in hand.

What of pupil involvement? Again there was a conscious attempt to promote this at two stages (one of which was employed twice) of the exercise.

By using small groups the pupils were able to come to grips with the work, within their friendship groups of their peers, and thus not initially exposing their ideas publicly to criticism from the large group and the teacher. After the groups had discussed their ideas amongst themselves I felt that they were more confident in contributing to the lesson as a whole, they were more prepared to volunteer their ideas as they had already been mutually approved by the sub-group.

The second stage of the pupils involvement was this contribution of the group as a whole to the choice of topic to be examined. They were first of all asked to provide suggestions and they voted on the most suitable subject worthy of extension. The evidence on page 2 of appendix 2 illustrates how easily this part flowed and was perhaps the most encouraging aspect, particularly when compared the earlier research which proved disastrous on this point.

The tertiary stage of development of the ideas within the small groups was an attempt at coming to terms with the ideas expressed by Doyle (1) (1979) which again I have elaborated on earlier in providing a basis for discussion to further the 'understanding task'. Again evidence on tape see both Stuart and Gary (appendix 3) and Glen, Gavin and Paul (appendix 4), in which ideas are being produced quickly and to a certain degree of sophistication applicable to pupils of their ability and at this stage of their education.

This fluidity was impressive not only in the number of ideas produced but also in the fluidity of the 'exchange of ideas'. Each idea produced was subjected to immediate, and in some cases quite vicious, criticism (appendix 4). The pupils were in other words subjecting their thoughts to:–

"Intellectual development necessarily involves being open to discussion" Elliott J (2) (1980)

The problem of apparently nonsensical ideas being presented is not one which I find daunting. After all who thought iron would float, or people would fly, it is in fact essential to stimulate more practical ideas. To illustrate this it is worth looking at what turns out to be an idea disregarded. (See appendix 4 page 2, Glen, Gavin and Paul, Design procedure.)

The topic is presented by:–

"How about something easy to open a bottle, a bottle opener, something like that. Just have a geet simple bottle opener like that, fixed on to the wall, just fix the bottle in like that".

This is obviously quite a practical and sensible topic, partly thought out and presented seriously, but the response is daunting.

"A crow bar"

"A brick"

The idea has not really impressed his two colleagues but he persists:–

"Fixed on to the wall so they can easily stick the bottle in like that"

This time is received a limited acceptance.

"A good idea"

But not totally:–

"Why not a brick, you can smash it open with a brick"

But the idea is persisted with:–

"Welded on"

We are now into the field of practicalities : ideas are being subjected to an intellectual analysis.

"Not welded, you'r not going to weld in a kitchen are you"

This participant has obviously not really understood, but nevertheless his contribution is received – and ignored. The initiator insists:–

"A piece of metal, you mack an ordinary bottle opener, put flux round and put that stuff in. Put holes in. Put it on the wall. Put it on the wall and you can stick it on like a bottle opener, like a can opener fits on the wall"

He has not only thought of how to make the object but also how to fix it on the wall. Welding is disregarded, but he has applied knowledge gained previously, he's going to braze the components. This is all in vain however as he can't possibly overcome the logic of economics:–

"They're only 65 pence in ....."

I feel that an exchange of this nature is very valuable even though the 'end-product' does not materialise in the form of an object, the pupils have learned from the experience presented to them.

What about the range of considerations, the depth of thought that is evident. In this exchange between the teacher and pupil these aspects are illustrated:– (Appendix 3 Stuart and Gary, Design procedure)

Teacher "What have you got Stuart?"

Pupil "One where you can change all the tools easily. It's got one handle thing they can use so you can change the tools, clip it on".

Teacher "Oh I see".

At this stage Stuart has obviously come up with an idea which he feels worthy of consideration, but not fully explained.

Paul "Put a bread knife in".

A limited development here, I suspect that the pupil was reticent about amplifying his ideas to the teacher. What he needed was encouragement to procede with his explanation.

Teacher "Oh I see, that's interesting. So the handle part will be adaptable to the person but then the tools just clip in, oh quite good".

In this paragraph I have used two positive statements, sufficient to promote confidence and help Stuart to elaborate on a well thought idea.

Pupils "Bread knife, eh, (pause)
"Tin opener.....just like a metal pole you can push the doors open, it's got like a tee square. Like a metal rod can be fitted to the handle so that.....
"The handle will have to fit the hand, finger grips.....(pause).....eh".
"Got a plastic cover on the blades so that they can push it in without cutting themselves and then take the cover off"
"The economics of it, is it....."
"The blade coming out, and just put the handle on and twist"
"What'll we make the handle with?"
"Fibre glass or something, plastic".

The two pupils here have developed the idea extensively, they've brought in a discussion on materials, safety, ergonomics and the mechanics of the problem. The economics is shelved!

This part of the lesson has obviously been successful, the groups are working and they are producing ideas. I did, however want to extend the experiment. I wanted to try and formalise the situation, to initiate the pupils into a logical process, to follow the design procedure. It's interesting to see what happens'– (Appendix 3 Stuart and Gary, Design procedure.)

Teacher "Hows it going now, have you got some ideas?"

Pupil "Say it's like a rack on the wall and all the blades on the rack so you just push the handle, twist and clip and take it out"

This is a restatement of the earlier position, I now try to extend.

Teacher "That's a super idea isn't it. You're coming up with a solution though aren't you at this stage, rather than the investigation part of it. Does that make sense to you, do you know what I'm talking about?"

Pupil "Develop the idea"

Partial encouragement from me, I suspect he knows what I mean but I make sure.

Teacher "That's right you're developing the idea before you've really investigated the brief, so you can forget your solutions until you come up with answers to these sort of questions".

I now leave the two pupils to allow them to work by themselves.

Pupils "Right, function, (pause)
General use.....
Shape and form, general use, shape and form, right, fibre glass, a question mark.
Steel blade.
Steel blades.....;
You're gonna have.....economics..... oh.....
Economics, shape.
Shaping and forming eh.....
The handle.....
Right so it would fit the handle like a glove does.
Right so jointing.....
Jointing err.....
The blades.
Right so you'd (act) the blades".

The dialogue has become sterile. The pupils are not developing their ideas and they're not really following the design process. What has in fact happened is that I've stultified the earlier frutiful dialogue and not initiated what I'd hoped to. With the other group (Appendix 4 Glen, Gavin and Paul. Design procedure) the deterioration in the dialogue was even more marked.

Teacher "I see I think you're getting somewhere. Can I ask you however to look back at that stage there. You see what you are doing is you're jumping to here. Do you know what I mean? Think about it. Start making notes about what you think the function is going to be, then shape and form is going to be, then materials are going to be. Not what they're going to be but what considerations are going to be thought about".

I now leave the group to work by themselves.

Pupils "We have to mack notes.
You have to do the function, get some paper (Golly), function right. The main function is to be. The main function is.....
Simple like, ehm, is a handle that fits in a pan handle and can be adjusted.
You know those B.M.X. things.
Aye
Like that, that's looking on end it'll, that sort of stuff on geet sticky.
(Pause)
Right.
It doesn't sound like us on the tapes. I hate tapes.
You get a great handle grip here you see. I know what you mean but the main function is a single handle which fits on the existing handle of a pan".
(Degenerates into the end of the tape.)

It could be worthwhile to try and explain why this has happened.

The first reason could be that my intervention was inappropriate. I may not have explained the task adequately enough for the pupil's comprehension. Allied to this is the difficulty of the task itself. Was I asking too much of them? I rather suspect that this was in fact the case. I suspect that the language used and the problem itself was seen to be too difficult and consequently they just switched off. A much easier development is required to ease the pupils into the formal analytical situation. Instead of simply asking the pupils to look at the whole process, one aspect at a time could be developed.

The simplest reason could also, of course be applicable, the pupils were tired. This work was being undertaken about fifty minutes after the start of the session and their attention may have wandered.

In the following lesson I hoped to structure the procedure further. Following a similar plan or method of approach I again introduced the lesson briefly asking the pupils to split into their small groups and produce ideas for generating energy using natural sources.

After approximately five minutes they were recalled and asked to give their ideas to the whole group. I then listed them on the blackboard.

The ideas produced this time were again more numerous and more adventurous in the terms of the psychological tests of creativity using the components of fluidity, originality and flexibility. (See Appendix 6 Introduction to lessons)

Apparently indicating that the pupils had gained from their experience of the previous session.

My introductory talk this time was shortened even further and this time it consisted of only two and a half pages of transcript (as against eleven and six previously) and only nine 'facts' were imparted. Reducing still further the 'burden' on the pupils.

It's difficult to attribute the better response to this solely. The pupils for example, may have found the topic more interesting, nevertheless at this stage it certainly appeared more successful. In the small group session in which the pupils are discussing the topic and extending their ideas, they groups worked well.

Frequently the ideas were produced in quantity but the quality of the discussion at times was lacking in depth. This however is not surprising as this poor response is due to a lack in the factual background of a topic which is entirely novel to them. In elaborating the solution, further research into technological details would be required. In other words no one would know the answers at this early stage of the design process.

As a follow up to the group work I allowed time for the pupils to develop their ideas on paper and I have included these as reference material. These initial design sheets again indicate some careful thought. The pupils have managed to convey their ideas onto paper, a task which they found difficult earlier on, appearing to indicate a greater confidence in what they were doing.

It would appear therefore, after this piece of fieldwork, that:–

a) A much more conscious effort by the teacher is required when introducing creative work to limit his contribution to stimulating his pupils rather than confusing the issue with superfluous details.

b) The use of small group work is extremely beneficial in fostering creative work.

c) The teacher should be wary of attempting to direct the process into a formal structure at too early a stage in its development.

d) A close look at the language used in any model employed would be advantageous.

e) Children are able to deliver their initial ideas verbally with more fluidity than when they are required to write them down or sketch. In other words it is misleading to denigrate a pupil's creativity if the ideas are not expressed on paper. It is interesting to note that psychologists test the written word very freely in assessing creativity.

Development of this work would include research into the value of the 'structured' design methodology in fostering creative thought together with the adviseability of teachers intervention and the methodology they employ in the secondary phase of creative work within the field of Craft, Design and Technology.

Appendices

1) References.
2) Transcript of tapes:
   Design procedure. Introduction to lesson.
3) Design procedure. Stuart and Gary.
4) Design procedure. Glen, Gavin and Paul
5) Design procedure. John, Robert and Neil.
6) Natural forces: Introduction to lesson.
7) Natural sources: Glen, Gavin and Paul.
8) Natural sources: Stuart, Gary and Jeremy.
9) Hand out on Design Methodology.
10) Analysis of Introductory Lessons.

Appendix 1

References

(1) Doyle W. 1979, 'The Tasks of Teaching and Learning'. Meeting of the American Educational Research Association, San Francisco. 1979.

(2) Elliott J. (1980) 'Implications of classroom research for professional development' in Hoyle E and Megarry J (1980) World Year book of Education, 'Professional Development of Teachers' Kogan Page, London.

Appendix 2

Design Procedure

Introduction to lesson

Teacher — One of the problems that is going to face you next year, one of the major problems, is deciding what to do in terms of a major project. And you have a big problem because you don't know what to do, it's as simple as that, you don't know what to do. Not how to do it or where to get your information from but what to do. Now this morning I want to have a trial run, I want to see if we can get you into a method of approach of thinking of how to do that and to help you to start with I've got a few slides. Now the project I want you to be thinking about, just the title is, I want you to be thinking of something that you can make, or could be made, ehm, something that you can make or could be made that will be useful to someone who is in fact suffering from some disability. Not necessarilly a chronic disability, not necessarilly someone who hasn't got any legs or something like that, but possibly an elderly person, possibly a child. In other words something which is going to have a social value, a value over and above a simple intrinsic value. In other words a thing like a coffee table is not what I'm thinking of. Right.
Now I've got a couple of slides, not really applicable but they'll perhaps

give you an idea of the sort of thing I've got in mind.
O.K. I'll tell you why they'r not really applicable, because they're of all different levels. That was made by an 'A' level student. And you probably saw it around, and your probably still seeing it around in the baths. It's a large rescue canoe. To rescue people who are in difficulty off the beaches at Seaburn. Obviously far too difficult for us at this stage in our school career. But nevertheless a project which has got some usefulness to society, or to other people.

(Next slide) That's interesting because that again is made by a much older student, but it's a design jig for people, for a chair, but possibly – or it could be adapted for people with special difficulties in sitting down. In other words you can see how the back can be altered to any position and how the arm rests can be altered to any position. In other words if you are an elderly person you need a chair which is a lot higher than an easy chair which you'd get at home. So you can adjust that to get to that particular position. Alright.

Next slide Now that is a small kart designed for a spina bifida child. Again made by an older student designed in the shape of a car, the engine goes on the back and it's controlled by the youngster inside. That's for a very specific person, someone who is really disabled. Wouldn't necessarilly have to be for that sort of work or of that intensity.

Next slide Again another chair but this one's different. That one is for a young person, for a child. It can be altered, the leg rest comes up and it can be altered as well. And we've got a further one of these.

Next slide There we are. Again in this case for a young child, specifically designed for that sort of situation.
There could be a lot. There are an awful lot of other projects which could be made which are no where near as complicated as that.
Absolutely nowhere near. The simpler the better. Because you people are going to be making them. You know the problems involved in making things so you want to keep it fairly simple. You want a specific aim in mind. I don't want you to run away from the problem by immediately saying that it's too difficult. We can discuss that later. If you think that it's going to come up and if you think its of value let's use it. Alright.
What I'm going to do now then to help you to do this I'm going to divide you into threes, or as near as possible to threes. Three threes and one two. I'm going to give you a piece of paper, a pencil and a tape recorder, and I want you, each of you, each group of you to come up with two titles of projects, that's all just two titles of projects at this stage. You'll obviously be thinking a little bit about it, but all I want from you is two titles.

Stage two

Stop what your doing, switch your machines off and come round here where we were before. Just leave your machines where they are.

Can you girls see the blackboard from there? Good. O.K. let's start having some ideas.

Pupil	Chair.
Teacher	What sort of chair?
Pupil	A child's chair.
Teacher	A child's chair.
Pupil	A wooden train set
Teacher	A wooden train set
Pupil	A wooden train set on little wheels with little carriages.
Teacher	Right three.
Pupil	A wooden sailing boat.
Teacher	A wooden sailing boat. Right. Number four. I've got four groups I should have eight.
Pupil	A walking stick.
Teacher	A walking stick.
Pupil	An adjustable one.
Teacher	An adjustable one.
Pupil	A chair with an adjustable back.

Teacher A chair, in brackets, adjustable. Right six I want eight, you've only given me one so far.

Pupil A push chair.

Teacher A push chair, good one we're getting far and fast. Another one from you people.

Pupil Kitchen tools with special handles.

Teacher Kitchen tools that sounds good. Yes. With adaptable handles is that a better word than adjustable? Right we should have one more eight. Who's only given me one? You people.

Pupil (Undecipherable)

Teacher Tray that's interesting, I'll put attachable. That's quite good, interesting, has any one come up with any more? Fine I've got the minimum number but I'll bet someone's come up with some more than that. There must be more than that surely. Nobody come up with three or are you just not volunteering them. I've got the evidence on the tapes you realise that. So if you have come up with more than three.....O.K. let's look at them.
A childs chair,
A train set on wheels,
A wooden sailing boat.
An adjustable walking stick.
A chair adjustable in terms of height with reclineability etc.
A push chair for youngsters, was that one for children? A push chair.
Kitchen tools with handles for people with various infirmities I suppose there.
Trays which can be attached to a chair.
You've got two votes each for what you think is going to be the best project.
Those of you who voted for the high chair. Number one. Right.
Number two the wooden train set with wheels. One, thank you. Three sailing boat. Four thank you.
The adjustable walking stick. Nobody?
The adjustable chair, I see.....
The push chair, Three.
The kitchen tools with adjustable handles. Seven, thank you.
The tray which can be attached to arm chairs or something, Four. That should end up with twenty two. Is that right? One, two, sixteen. Come on who hasn't voted twice? Alright we'll forget it, it doesn't really matter.
So what in fact has come up is the kitchen tools with adjustable handles alright. Kitchen tools with adaptable handles. Why? Why do you think that's of more value than the rest?

Pupil Use them in every day life.

Teacher Use them in every day life. O.K. What else. Why else what other reasons. Are there any other reasons.
The next stage, the important stage how are we going to do it. How are we going to do it? To do that we need, or it's useful to have a method of approach. Now we've come across this before. I'm sure you've come across this before but I will refresh your memory if you like using that model which you have in front of you.
The model is not as in a model boat, instead it's in the form of a diagram. If you can't read it clearly from the O.H.P. it's the same as the one you've got in front of you. We're talking about the first step which is the situation, the problem area. What would be the problem area in this one we've just identified, what is the problem area? What is the problem we're looking at?
Who thought of the idea? Was it one of you girls? Right why did you think it was a problem.

Pupil Undecipherable.

Teacher Can you elaborate on that? You're right, people with..... Why is it essential that they can? They have to eat. What else do they have to do?

(In response to pupils) Not only do they have to eat of course what else do they have to do in the kitchen? Making things, cooking, getting things out of drawers. They're

opening cans. Things of this sort so there's a danger element as well.
If we've identified the situation our next stage is to write the design brief. Now the design brief is a little bit more complicated because then you are writing down specifically, specifically what it is you want to solve. You've got to be able to write it more conscisely. After we've done that we then reach the research piece, the research, the data collection. You've got to consider the function of the particular article, the shape and form of it, the materials we're going to use. Are we going to make it out of toffee, or are we going to make it out of aluminium. The economics, is it going to be gold plated or even solid gold for that matter or is it going to be made out of something more economical. Jointing, shaping or forming rather that was next wasn't it. How are we going to do that? Jointing or fitting it, how strong is it going to be? Surface finish. If its going to be used in the kitchen what has it got to be? One of the major considerations of kitchen tools. Strong but what does kitchen tool conjure up immediately?

Pupil — Stainless steel.

Teacher — Stainless steel, you say stainless steel why, why do you say stainless steel? He's given me a material rather than an answer to my specific question.

Pupil — Doesn't rust.

Teacher — Doesn't rust, but why are we concerned with rust in the kitchen?

Pupil — It's washed.

Teacher — It's washed all the time. Why is it washed all the time? It's mucky. So what are we concerned about in the kitchen.

Pupil — Hygiene.

Teacher — Hygiene. O.K. So the surface finish in fact is concerned very much with that. Any other special factors. Safety is essential. If you are going to pick up a hot pan. A hot pan with a tool that's specially designed. If it collapses and you've got a big pan full of boiling water you're got trouble.
And looks, the aesthetics of it. It's got to look pretty. Not only because it's nice for it to look pretty but it's got other considerations as well. It makes life that little bit more pleasant. If your living in an environment thats attractive you function better. You work better. Right after we've sorted this lot out we'll start looking at solutions. In other words we've got a number of solutions haven't we. Not one, a number of solutions. We then sort out the best solution.
Then we would make a model then a working drawing, then we realize it. What do we mean by realize it. Make it. Evaluation. What does that mean again? Evaluation.

Pupil — Undecipherable.

Teacher — Does it work, is it any good. Yes, and then use our little flow chart which we've got in front of ourselves here, if it says no we go right up to the top again and start all over again. If it says yes that says O.K. stop, or something like that.
Straightforward, any problems? Right well we've identified the problem as kitchen tools with adjustable handles. I want you to get back into your huddles again into your particular groups. Switch your machines straight on and I hope they're recording, if not I'm going to jump on you. And let's start working to this design brief. We've identified the situation I think, I think we can forget that one. Would you start by quickly writing yourselves a design brief. Discuss it amongst yourselves, write a brief. What do I mean by a brief? Can you give me an idea? Design a tool which can be used by a disabled person to open a tin can. That is a brief. I don't want you to use that one. If any one uses that one, tch.... That is a brief. Give yourself a brief and then start looking at the

investigation. Make notes, make sketches, understood. Repeat, lets get your ideas down on that machine, that's my important consideration.

Appendix 3

Stuart and Gary (Initial discussion after introduction)

Design procedure

It's a disabled one or.....
Kitchen things
Kitchen things with handles on.
Kitchen things, oh.....
Aye,
Spoons on.....(long pause)
They're going get down stairs and travel (Long pause)
Something they can write with
Aye.
Tin openers.....an idea.....
I'm trying to think it's getting we...
It can't be too big.
Benches.....wheel chairs eh.....
Chairs to.....
Chair that'll swing round – swivel-leg rests.....
It'll have wheels and so on.....
(undecipherable)
After further talk to group by the teacher (See transcript)
We want something we can change and sort of – why – we can use different things to open tins – knife, fork, handle cups ..... well so you can change the thing.
Right.....

(The pupils are writing down the points as they arise)

.....with interchangeable things, with different blades etc., can be fitted like a screwdriver.

Teacher What have you got Stuart.

Pupil One where you can change all the tools easily. It's got one handle thing they can use so you can change the tools, clip it on.

Teacher Oh I see.

Pupil Put a bread knife in.

Teacher Oh I see. Now that's interesting. So the handle part will be adaptable to the person but then the tools just clip in, oh, quite good.

Pupil Bread knife, eh, (pause) tin opener.... just like a metal pole you can push the doors open it's got like a tee square. Like a metal rod can be fitted to the handle so that.....The handle will have to fit the hand, finger grips..... (pause) eh. Got a plastic cover on the blade so that they can push it in without cutting themselves and then take the cover off. The economics of it, is it.....the blades coming out, and just put the handle on and twist. What'll we make the handle with, fibre glass or something, plastic.

Teacher How's it going now, have you got some ideas.

Pupil Say it's like a rack on the wall and all the blades on the rack so you just push the handle, twist and clip and take it out.

Teacher That's a super idea isn't it. You're coming up with solutions though aren't you at this stage, rather than the investigation part of it. Does that make sense to you, do you know what I'm talking about.

Pupil Develop the idea.

Teacher That's right you're developing the idea before you've really investigated the brief, so you can forget your solutions until you come up with answers to these sort of questions.

Pupil Right, function, (pause)
General use.....
Shape and form, general use, shape and form, right, fibre glass a question mark.....
Steel blade
Steel blades.....
Your gonna have.....economics....ah...
Economics, shape.
Shaping and forming eh.....
The handle.....(a lot of interference)
Right so it would fit the hand like a (glove) does.
Right so jointing.....
Jointing, err
The blades.
Right so you'd (act?) the blades.

Appendix 4

Glen, Gavin and Paul (Initial discussion after introduction)

Design Procedure

Ideas
.....toys for kids, ideas, we've told him that.
We use wood an all man.
It's not metalwork, it's only design studies.
This is for the whole course, were both metalwork.
One idea for a childrens toy, right say (parks and talks) right.
Ideas for a children toy.
A wooden train and small carriages, a wooden boat with small sails to float in the pond.

After further talk to group by the teacher (See transcript)

Brief, design the brief.
You need summit, eh, like design, summit, like a tool, if she's got a bad hand or summit she can't hold the knife to spread the bread. I mean spread the butter, on the bread.
Spread the bread.
Spread the bread, Ha, Ha.
Or open a bottle, a bottle opener or summit like that.
That's a good idea.
It is, it's easy.
You can use summit like the one to open the tin.
You need ehm. You need a pan handle.
.....tries to lift the pan.
Any way you could use the handle, geet fixable handle like that. You can see theres a geet pan with a handle like this. The person only has to fix the handle on like that just clip it on so he can lift it up like say. Cos if youve got the rheumatism or summit you can't clench your hand tight like that.
You'll have to have something hard.
Say you have the pan and then say summit like foam summit like ..... things. So it clips on.
Plus if its the foam.
The foam might melt.
Yes the foam could burn.
Not if you have a little ehm, element or summit.
Well that's only an idea.
Howay Colly think of something man.
Stacks used in the kitchen.
A cup with two handles.
Two handles?
Aye so it's easier to make the tea with.
Might only have one hand.
Write it off.
You could have something like ehm....
Making the tea you need something (tea cup, tea pot) sugar, milk. I can think of nought else.....
Knives and forks, a (spackers?) trolley to get round the kitchen in.
(Giggles etc.)
How about something easy to open a bottle, a bottle opener, something like that. Just have a geet simple bottle opener like that, fixed on to the wall, just fix the bottle in like that.
A crow bar.
A brick.
Fixed on the wall so that can easily stick the bottle in like that.
A good idea.
Why not a brick, you can smash it open with a brick.
Welded on.
Not welded you're not going to weld in a kitchen are you.
A piece of metal, you mack an ordinary bottle opener, put flux round and put that stuff in. Put holes in. Put it on the wall. Put it on the wall and you can stick it on like a bottle opener, like a can opener fits on the wall.
They're only 65p in.....
I think if you had a pan handle, woman with rheumatism couldn't grip it easily. Just like a little ehm thing and then you could clip it on and lift it up easily.

Teacher A foam thing?

Pupil Well just something that doesn't conduct the heat the pan handle gets hot.

Teacher But how does this actually grip the handle?

Pupil Aye a little like clip or something at the first joint, so fit it on and they just clip pull it down, just lift it up.

Teacher I see I think your getting somewhere. Can I ask you however to look back at that stage there. You see what your doing is you're jumping to here. Do you know what I mean think about it. Start making notes about what you think the function is going to be, then shape and form is going to be, then materials are going to be. Not what they're going to be but what considerations are going to be thought about.

Pupils We have to mack notes.
You have to do the function, get some paper (Gally?) function right. The main function is to be. The main function is..... Simple like ehm is a handle that fits on a pan handle and can be adjusted.
You know those BMX things
Aye
Like that. That's looking from one end it'll that sort of stuff on – geet sticky.
(Pause)
Right
It doesn't sound like us on the tapes. I hate tapes.
You get a great handle grip here you see. I know what you mean but the main function is a simple handle which fits on to the existing handle of a pan.
(Degenerates into the end of the tape.)

Appendix 5

Tape 2. First Draft. John Mackie, Robert Burk, Neil Rodgers.
Start about 9.

Mentally handicapped persons wouldn't be able to use their hands properly but would be able to use a

button so they could press it like that and cut material like that and garden and some thing. What do you think? I think it'll be alright John, I think it'll be alright.
Stainless steel.
Stainless steel, it cannot rust.
The handle will have to be wood.
There's nothing about hygiene.
What handle?
The wooden handle what the button's in.
The handicapped person cannot handle a button man.
He can.
Nah.....
So it's like a button it presses the blade down.
Wooden handle.
Wooden handle everything else is stainless steel.
Stainless steel like blades.
What about the guards.
The guard's rounded and.....
It'll have to be steel.
No
I.....steel it'll have to be.
It wouldn't be wood or ought
Stainless steel again
Strong – it'll have to be canny strong again.
The blade'sll have to be strong because they're cutting.
Safe.....Safe with the guard on.
What about the shape and the form?
It's got to look good.
That's its function – It'll come in handy like.
That bits have tons of little holes in.
What for?
So you can see what your doing.
Why make it like a plastic so you can look through.
Who's gan a stop it? It's easy take your finger off press the button and it stops right up. Make it with some springs in. That's getting complicated, that man.
Just press it down and.....
Just press it down.
Press it down.
We'll have to make it big.
Have to make certain shapes at a time, not just one one man.
Not just dee one man, for eh.....
It'll take years to dee a geet lot
We'll dee five at a time eh.....
So the guards going to be plastic.
Aye so you can see through it – you can see what's going on.
Tin foil will fall off.
Tin foil.
Just something silver to conduct.
Like copper.
Conduct, therefore heat and light is conducted, wire conducts the heat to the boiler where the hot water is heated.
Water goes to the radiators.
We'll scald Paul by pressing it on him, right.
Economics.
Cheap
Aye.
Very resourceful.
Cheap in the long run, heat the house up good.
Shape and form, joining and fitting.

Teacher Youve looked at the function, what about the shape. This is just a rough sketch. What sort of shape should this be?

Pupil Like a rectangle.
Like a curve.

Teacher Right can we do that, can we elaborate on that theme. I think the best shape or the most effective shape is a parabola. Do you know what a parabola is? No. I thought perhaps you wouldn't. Well its something, something of that sort of order shaped like that. Also it's got a focal point there so that any beam that hits that is focussed on to that source.
Well it depends I'm not terribly sure, whether that's the shape that you do want for a solar panel. It depends on how your going to construct it.
What do they have normally? They have radiators in reverse. Have you ever seen these on tops of houses?

Pupil Uh, uh.

Teacher Panels. Think about it anyway lets have you thinking.

Pupil You could have a dish, like a radar.
Glue it on the roof.
Glue it on the roof Paul
A dish.
Go away Paul.
Fix it on.
On a square.
Rays come down and then
Some of them'll just miss.
So I reckon you'll need a curve.
A semi-circle.
No. It's a square
Are you sure now?

(The conversation degenerates into a period of silly noises) Pause.

Some rays. Right
Heat rolls down.
Why heat at that energy.
Collects. Runs down into rain pipes.
Rain pipes.
A pipe. If you have a copper pipe and have wire in. Not use any heat, wire

	inside.
	Wire in the boiler so it heats it up.
	Strong boiler.
	That's only my control box.
	What do you want a control box for?
	(Undecipherable)
	Aye, Colly, well done.
	(Degenerates into talk on pop records)
	Right, right lads.
	Ehm.
	What are you doing.
	What is this?
	One more word and your out.
	Have a dish like that right.
	We'll shape it, it'll go that way. There's the sun. The sun goes that way. It'll get the sun's rays.
	That's for catching rain water.
Teacher	How's it going lads?
Pupil	If you had a dish like that we thought that if the sun is high. The sun would move, it'll be there and the dish move with it.
Teacher	Oh I see so your sort of following.....
Pupil	Yeh, more power from the sun during the day. You'll have the suns ray's ..... at one point, generated down.
Teacher	That's interesting. How are you actually going to ..... concentrating the heat, from the sun you say. How are you going to collect the heat? Does that make sense to you? What in fact are you heating up?
Pupil	It's water.
Teacher	Water, right. If thats clear, if your heating. What are you going to do to it then. To get to your container for instance. Its no good pipes as you know so what you'll need more than just pipes won't you.
	Do you need a pump?
Pupil	Ehm no.
Teacher	Lets think of.....
Pupil	Paul has not done anything of this idea, he's just sitting there.
	Right.....
	Right do you need a pump for.....
	You can produce some more energy from the sun. Feed the pump as well.
	The water could turn the pump.
	You can get water pumps.....
	(degenerates)
	(Long gap)
	Right (undecipherable) think of a (Undecipherable) for a water pump.
	We'll need some way of getting energy from the sun.
	Somehow we'll get the power from the sun.
Teacher	That's interesting 'cos your extending it as well. There's things these days like light sensitive, what do you call them? Anyway there are electrical
	components that will convert light into electricity. Did you see that on television. That car that went across Australia powered by solar cells.
Pupil	Aye cells on top.
Teacher	That sort of thing presumably. What happens if its cloudy.
Pupil	They'll not work.
	Some of them work when it's cloudy.
Teacher	The solar panels work, but you'll not get much heat would you? Well what could you do there?
Pupil	A back up system
Teacher	A back up system. You could get over it partially. Is there any method of storing it? Can you store the hot water. Sun, cloudy, I should imagine most people need the water in the evening times. They're more likely to need it for bathing in the evening or in the morning than they would in the day. So your collecting hot water during the day. So it's going to cool down. What are going to do?
Pupil	Put like a flask in.
Teacher	Like a flask. O.K. What do we mean by a flask then? I know what you mean. Like a tank.
Pupil	Like a thermos
Teacher	Like a thermos flask, O.K. Can you get that down on your paper to extend it 'Cos this is what we need to do to extend it. Its only a model so we know we're only asking you to design a model. You could get it pumping around into a thermos flask. Have you thought of instead of pumping it how else could the water move?
Pupil	On a slight bank.
Teacher	Yes gravity. O.K. what else. Do you know what happens to water when its heated?
Pupil	It evaporates.
Teacher	Yes. What happens to air or gas when it's heated?
Pupil	It rises.

Appendix 6

Introduction to Lesson. Natural Forces

Teacher	What I want us to do today is to split into the same groups that we were in before. The same small groups. We've got someone else extra here today, have we? Who wasn't here last week? You, well, there was one group, this group, I think where there were only two people in that's right – good. You could join these two.
	What I want you to do this time, you know the procedure, I want you to go

away, take a piece of paper. And this time I simply want you to think of two methods, thats all, between the three of you. Two methods of harnessing energy, harnessing energy, from natural sources or from nature. Harnessing energy from natural sources. So I want you to take the tapes away, plug them in, switch them on, introduce yourself, like you did last time, and let's have harnessing – simply at this stage – what methods could be employed.
I mean an example, an easy example looking from this place, if we look across there we can see the windmill, harnessing energy using the wind. There must be lots of other methods, there are lots of other methods, I want you to think about them and simply give me ideas at this stage.

Second Stage Natural Forces

Teacher What do you mean precisely by water power?
Pupil When it goes through a dam – turbines.
Teacher Turbines etc. – O.K.
Two any more
Pupil Geysers
Teacher Geysers – you arn't being funny there are you? How do you spell geysers? Is that right? Hot springs? We'll put that down anyway – so we know what it is. O.K.
Teacher Three.
Pupil Solar power.
Teacher Solar power?
Pupil Using mirrors and that.
Teacher Solar power. Any more? Four.
Pupil Wind power.
Teacher O.K. wind power.
Pupil He nicked it.
Teacher He nicked it, what was yours? I did ask for two. We've got nothing original, that that I expected anything original I suppose but we've got.....
Any fresh ideas.
Pupil Harnessing lightening.
Teacher Harnessing lightening, gosh that's interesting isn't it?
Harnessing lightening, O.K. What else? Any more? No more ideas at all.
What about, for instance, I know we've got water power can we sub-divide it? What about tidal power? Yes?
Pupil Wave power.
Teacher Say wave power.
Say, what did I say tidal power. Power of tides. Tidal power, are there any other types. Water power – there – I suppose you simply mean turbines, I mean the old traditional water wheel.
That the miller would have had.
Pupil Volcanoes and that.
Teacher A bit intermittant, but never-the-less. Volcanic yes, in a way that ties in with this but not quite. The geysers very similar sort of thing isn't it – anything else. Come on were getting a lot of ideas now its becoming a lot more – a lot more fluid – we're thinking a lot more, anything else. Solar power, wind power ehm. Types of solar power what are we thinking about.
Pupil The sun.
Teacher The sun yes but in what form. O.K. we'll leave it at that. Right what we'll do then, we'll stop what we're doing now. We'll stop what we're doing and break back into our groups. I want you to take a piece of drawing paper this time, and last time we had a voting session on which is the best one, I don't want to do it this time. I want each group to vote amongst themselves if you like because I want each group of you to do one particular type, and what I want you to do is to design a model which I could use to demonstrate one of these features. Design a model. Now to help you design the model, as to help you in the design procedure we've got these design sheets again which will help to remind you about the design process. So bear in mind all of these sort of considerations. So what your going to do is go away into your groups switch your machine on, decide what you are going to do and then make an attempt at it.

Appendix 7

Glen, Gavin and Paul (Initial discussion after introduction)

Natural Sources

Ideas
Pupil Methods of harnessing energy using natural resources.
Wind power and solar power. Sun
Water power like dams
Dams yeah. The water goes from the dams and turns the turbines in the generator.
And the windmill. Then the sails.
Teacher Can you stop now.

After further talk to group by the teacher (See transcript)

Pupils A magnifying glass hold it up to the sun, heat.
(Undecipherable.)
Right solar panel will have to be black

(like Fuggle, said in an aside, Fuggle is another boy in the group, who incidently is not coloured)
Black takes in heat, white rejects heat.
Aye white reflects heat.
Are you making a sketch of this?
A boiler though
Who's ideas was this?
(Undecipherable)
Aye it'll have to be a coil like
It could be a battery recharger thing.
Wire conducts heat.
Are we on the air?
Aye.
Good idea.
Sir is it just the one idea.

Teacher — Paul yes, develop the one idea so we can, you know how to do the design sheet. Lots of ideas I want you using the sheet to find out the sort of things I want you to consider. Remember we went through this last week. You know lets pick up all these requirements.

Pupil — Situation, problem area, shape and form. Its got to be a little tank.
Tank.
Is that a mirror is it? A manky mirror.
What
A solar panel.
A mirror.
Nah just a solar panel
What's mirrors got to dee with solar panels?
Diven nah
Right materials
One solar panel six by three.
About that big.
Lots of little solar panels put on a big sheet of silver tin foil.

Teacher — Yes water will rise too won't it. Do you know that it circulates. A lot of hot water systems new ones tend to have pumps on them, but old ones relied on the fact that when you heated the water it rose up to the top to a tank. And then it kept circulating that way, it's got to circulate it hasn't it. O.K. You keep getting these ideas. But I'd like you to record this on the paper. But on the tape and on the paper.

Pupil — Right. Right heated water. Paul you didn't say a word then its disgraceful, no bright ideas.
Its his man.....
(Degenerates)

Appendix 8

Stuart, Gary and Jeremy (Initial discussion after introduction)

Natural Sources

Ideas.

Pupil — Design Mr Shield's group, alternative power sources. Jeremy Fuggle.
My name is Gary, my name is Stuart.
Water power
Wind power
Use volcanoes
Nah.....
Volcanoes
Wind
Canny boring wind
Water, water
Any ideas Stue?
Err waves, you can use waves.
Well I'll tell you what just get a few..... for each one.....
What did you say?
Water, I dinna, I'll say a geyser, we'll try and get a few ideas down right.
Got to decide on some ideas.

After further talk to group by teacher. (See transcript)

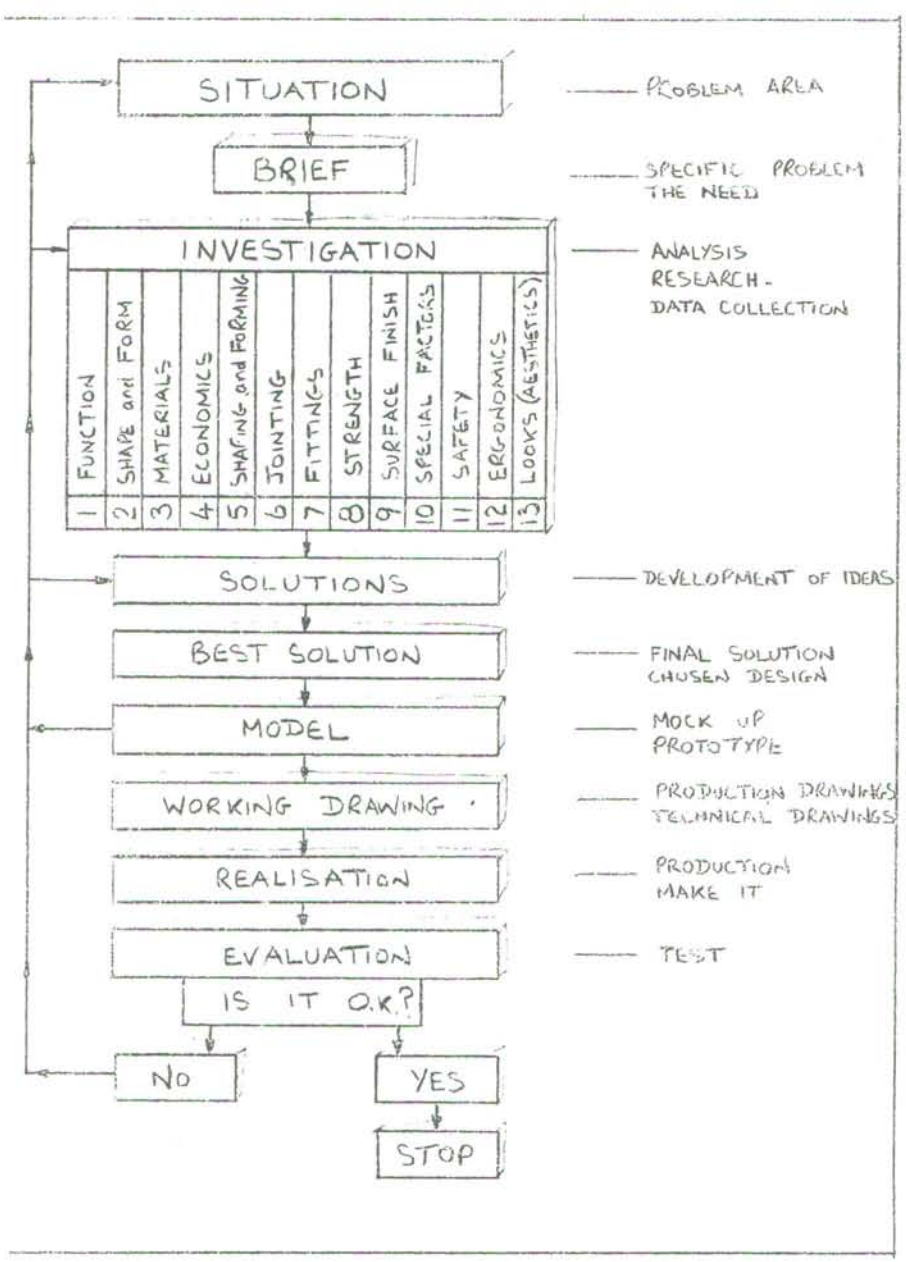
Pupils — You just have to get a basic shape thing, carry on from there you know.
Have a look at the design sheet thing.
Right we've got to find out about power, function.
You get energy from it. Shape and form, I don't see.....
Why it just wants.....you haven't got to worry too much about that at the moment. What form and shape it's going to take you know.
Materials. I'll tell you what, forget about the shape and form for the moment and write down materials.
Just write them down, you haven't got to worry about the shape too much.
Water power, we'll just do water power. It doesn't really matter, the function is to obtain energy.
To obtain energy from natural sources.
Materials. Its gonna ehm.....to get water to be pretty strong if its gonna be taken in the sea.
Its gonna have to be canny strong to stand up to the waves and that .
Metals, ehm.....it can't go rusty.
Steel an all.....metal and steel.....What's the next one?
Erm.....(pause)
Need a water wheel.
Right we need a water wheel
Then you need summit that.....fixes on the bikes what have you?
Speedometer?
No not a speedometer.

	Oh I know, dynamo, say a dynamo, yeh.
	Needs to be canny, yeh..
	Water power.
Teacher	O.K. What sort of considerations are you going to have in mind here? You'r going to have to bear in mind for instance the shape of this. I mean is that going to be like the old fashioned wind mill, or can you think of other sort of shapes, which are more useful.
Pupil	It's gonna be metal anyway, steel or something.
Teacher	What the model, or.....
Pupil	It would probably be too expensive.
Teacher	Cos in the old days, for centuries they've been made out of wood. But ehm.....make a note of that. Put it down as a comment. Think of the shape you'r gonna be doing. You may not, it may be like an old fashioned paddle wheel on a boat for instance, or it may be like a series of buckets, why not. Why not, these days a thing like a turbine shape. I mean like a screw, like an Archimedean screw, like a spiral. What I'm getting at is that there are a lot of different ideas. And you shouldn't really be thinking of just one.
Pupil	(Undecipherable)
	At the moment a sort of wheel. Also used in a dynamo, we don't want to stick to one idea.
	(Undecipherable)
	I think the one with cups is gonna be better like. When it gets summit a bit...
	I don't, nah, really.
	The one with cups is better cos it's like a waterfall.
	If the cups are hanging down the water's just gonna hit the side of the cups.
	The cups hanging ..... the water comes in here, will work. That is all right.
Teacher	Would you be better round the other side, can you see what's going on?
Pupil	So which ideas are we gonna stick with like?
	I know but as you said, the water's going to bounce up against it
	I you put them on an angle they should be alright.
	It would be canny hard to get the cups at an angle like on the wheel.
	Use plastic cups like they would be better.
	The round ones a canny idea.
	I'd like to get away from that idea, think of something new.
	(Undecipherable)
	Use a hose pipe or something, it's only a little model we can use that. Tell you what I'll do, you draw up your idea and we'll see if there are any faults.
	Use that, draw it right big down there.
	So thats the idea we gonna try and work with.
	Cups on strings so they can go different ways, depending on the way the waters flowing. This one using cups for the little model but perhaps cups later on.
	You can have, err, the water coming out of the buckets into a trough.
	Yeh.
	Boil the trough up, you get the steam to turn the dynamo we'd get even more electricity.
	It's not a bad idea that like.
	You need a canny lot of heat to boil it up.
	You could have, ehm, one of the little calor gas stoves. Just something little.
	The trough hasn't got to be big.
	One of little camping like things, something like that, heats the water.
	And it perhaps heats, together.
	Something else.
	We're not making a blooming steam engine. Doesn't matter about that, mebbe two or three like.....
	Doesn't need to be hot.....
	Anyway.....
	Stick with the light bulbs at the moment. The chances are it might work. It's not a bad idea that.
	Sir.....are we gonna make it like.
Teacher	It depends would you like to? You certainly could be making them if your doing the Technology. But we're doing the Design aren't we.
	There's no reason why we shouldn't make them. If we are going to make them we've got to think of a lot more details than we are at the moment arn't we. Get these ideas down.
Pupil	Steam engines. Stick to the light bulbs.
	You'd get more power.
	Just stick more light bulbs to the dynamo. They wouldn't be as bright now. You'ld be using heat as well, it's not like an alternative power source.
	The ideas supposed to be just the water.
	I suppose it wouldn't matter like if it's an experiment.
	Do that, and we can try that other one.
	If those cups are gonna go round like

that surely the water's going to pour out.
If the water's coming this way, it just pushes the water round, it turns the wheel round. The water would just pour out if they were going like that though.
Some way those cups are gonna go round with the thing.
Your gonna have to put .... if you had them swinging. Water would swing cups and then it would just spill out.
You see, if they swing like that .... you see the water .... and they'd straighten up ..... do you see? (Undecipherable)
.....stays in one place that moves with like the cup as if thay're going up, then the water's just going to tip out.
As long as it turns.....
It doesn't matter how many cups you have does it?
If you have any angle it's all gonna tip out.
I suppose if they went to a certain height, and if they tipped you would have the trough catch it all.
It would have to be a pretty weird plan. If that's gonna be the case it's gonna be pretty hard.
Something that moves with a trough, something that catches the water.
What might be better to do instead of getting the cups.
Just have to put the troughs over where so it catches the water. You cannot have it there though as that water just gonna trip over.
It's gonna fall out from there.
I know it's what I mean.
As long as it turns the wheel it's all right.
I know but theres a hole in the (undecipherable) like that.
Teacher Can we stop there.

Appendix 9
Hand-out on design methodology

THE DESIGN PROCESS



Appendix 10

Analysis of Introductory Lessons

Page	L	F	S	I	Design Procedure
1			1	3	
2			3	1	
3	1				
4			2		
5		2	2		
6			1		
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Page	L	F	S	I	Natural Sources of Energy
1	1	2	1	1	
2		2			
3				2	
	1	4	1	3	

Key
L Explanation of language
F Scientific or technological fact explained
S Explanation of skill or process
I Information of general nature.