

Designing efficiently and effectively: do we encourage children to use 'design sheets' appropriately?

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■ Introduction

Pencil and paper sketches/drawings are possibly the most used and potentially useful forms of modelling in most design situations. Yet in my travels around schools and when interviewing potential undergraduates, I am aware that the presentation of the design sheet itself appears often to assume a greater importance to the child than the process of design it is being used to support. Whilst these sheets may be attractive, they are often inefficient and ineffective in their primary function because too much time is spent making them look attractive. As teachers of Design and Technology we should be aware of this potential problem and address it.

In this article I first define the terms efficiency and effectiveness in relation to designing. Then the role and functions of the design drawing sheet in the process of design are examined before turning to the central questions of why many children use them inefficiently and ineffectively. Finally, some points are made as suggestions to teachers and examiners of design.

■ Efficiency and effectiveness in designing

Design is an open-ended process. Given more time, we can usually improve any design proposal. A dictionary definition of the term effectiveness is normally given as being productive: to have an effect. In this respect virtually any design solution could be said to be effective. In practice we usually judge effectiveness as the extent to which design objectives are met. One person's designing may be more effective than another's in that they meet these objectives better; for example, by producing the artefact at lower cost whilst satisfying all other objectives.

The efficiency of design work could be seen as the effectiveness of the outcome against the inputs made, time being a key aspect. Within design work either at school level or commercially the ability to produce effective designs with efficiency is important. If we are efficient we can effectively spend more time developing the design and so gain more from the exercise and improve the effectiveness of the outcome.

■ What is the role of the design sheet in the process of designing?

The process of designing is essentially one of generating and developing ideas within any given context. This context will differ from the highly specific, for example, the design of a gear wheel in an automotive gearbox to the relatively open in the case of the design of a sculptural form. In this paper I am taking the 'design sheet' to mean those sketches and drawings used to put down and develop initial ideas into a final proposal. Of particular interest are those early sheets where the first thoughts are crystallised.

It is possible, especially with experience, to design 'in the head', but the ability to generate new ideas and manipulate them effectively is limited as is the level of complexity that an individual can manage. If we crystallise, or 'fix' our initial ideas into forms which can be manipulated the process of designing can be more effective. Without doing this it can be very difficult to gain a firm enough 'grasp' to enable manipulation and development. This is particularly important with children, who lack the experience of the practising designer who may be able to manipulate fairly complex ideas and forms in his or her mind. This concept of 'fixing' is similar to the way we establish and classify concepts in order to think in general. For example, the concept of 'car' covers a huge and expanding range of different individual cases; by classifying in various ways we can more easily think about this area. If we were unable to classify, the huge diversity within any class would make thinking far less manageable.

The forms into which we crystallise design thinking can be called models. These models vary and one of the important skills of the designer is choosing the most appropriate modelling technique at any point in the process. To some degree we can all model in our minds with the personal conceptual models we all build. An example would be 'house'; we all have a conceptual model but this will vary depending on personal experience, culture and many other factors. Nevertheless the broad conceptual model suffices for a certain degree of manipulation. The obvious problem is that it requires very careful communication to a second party in order to ensure that the models align.

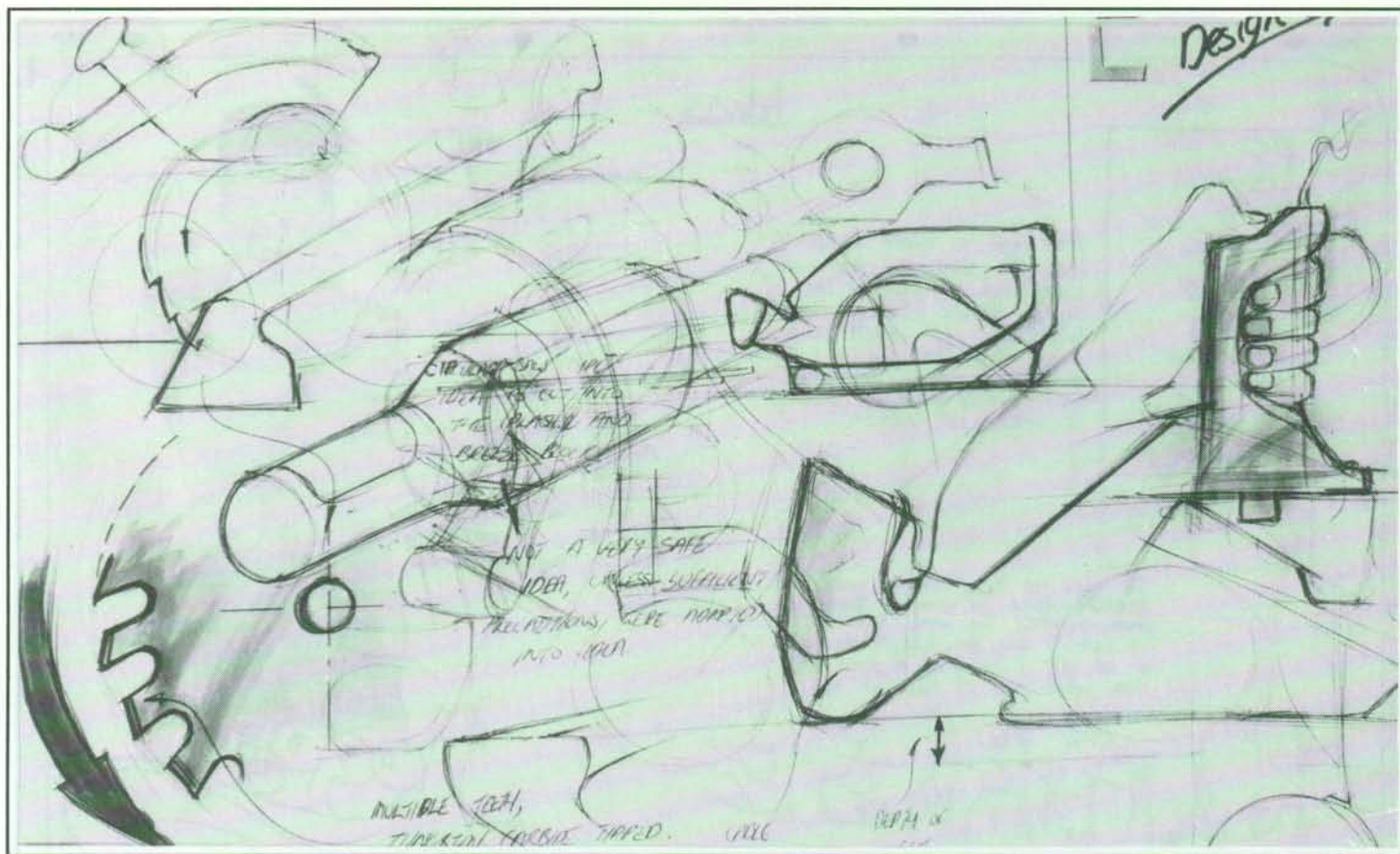


Figure 1: an example of the effective use of design drawing. Here the student is using quick sketching techniques to explore as well as to record. There is evidence of development in thinking.

The models that we refer to most frequently in designing are those where concepts are externalised. Techniques include drawing of various forms, mathematics and types of three-dimensional modelling. We all have a conceptual model of 'stiffness' but we can only fix and communicate ideas of stiffness reliably by use of mathematical models that describe the concept. This aspect of ensuring that individuals are using the same conceptual model is important to designers when developing ideas for others and when communicating to others in design teams or to clients. A further example of the potential difficulty is that of individual's conceptions of colour. These do not naturally align, and it is necessary to externalise them with colour carts to ensure that two people agree.

Models, therefore, have two basic functions: to assist in the development of an idea by facilitating manipulation and to communicate ideas. Whether a designer is working alone, within a team or having to confirm thinking at various stages with outside bodies, influences the choice of appropriate modelling technique at any stage of the process. Looking more specifically at the area of 'drawing' and the 'design sheet' it is possible to identify three broad types of drawing: simple sketches;

engineering drawing and presentation drawings. These are simplifications; there are overlaps.

Simple sketches can be done very rapidly by the experienced designer and can be used to 'fix' ideas and then to manipulate them. Sketches can be satisfactory as communications if the recipient is also familiar with the technique and the informal conventions. Engineering drawings use more formal conventions and are used as models to check fit and to communicate to others, usually in construction. Presentation drawings could be typified by high quality drawings using techniques such as rendering and airbrush. They are time consuming but very effective at presenting an accurate image of a finished product in order to communicate to a client or consumer.

In the early stages of designing it is important to get ideas down quickly for outline exploration. Speed is important for two broad reasons: because time is always limited and because it can help develop a flow of ideas at this point of the process, as will be explained below.

In these early stages children, particularly, find it difficult to get initial ideas flowing. Teachers

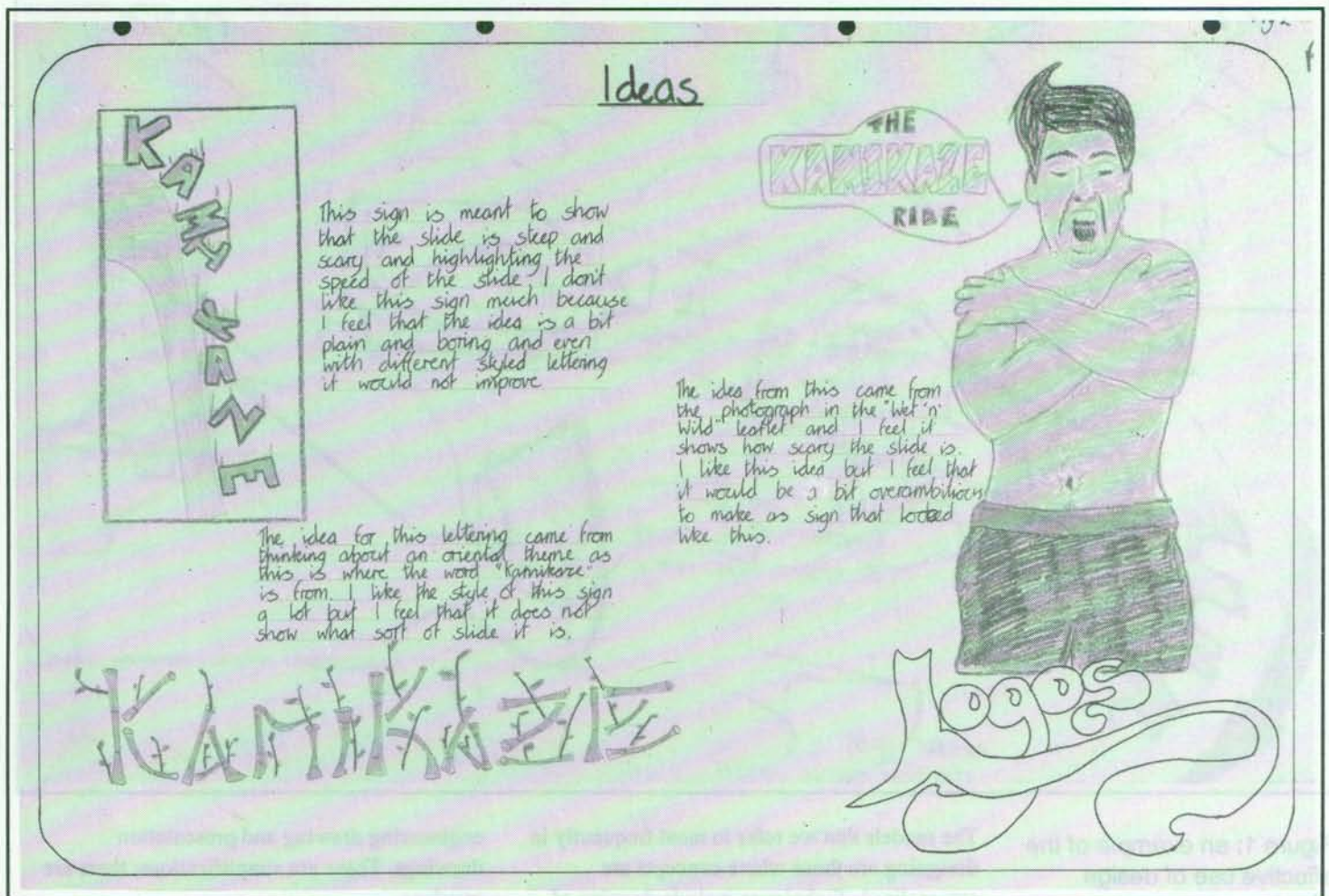


Figure 2: a sheet from a GCSE major project folder. Titled 'ideas' and following research sheets. There are several similar 'ideas' sheets. Note how the 'ideas' are obviously reworked drawings from earlier thinking. Time has been spent ruling lines for notes and using colour needlessly in initial ideas drawings. There was no evidence of initial thinking. This is inefficient use of valuable time.

of design know from experience that providing a good range of stimulus material can help this initial flow. In the same way if a range of ideas can be got down quickly they can provide their own stimulus by being juxtaposed with the original stimulus material and the sketches themselves as they are generated. This is more successful if children try to develop a range of initial ideas rather than labour over one. Slow, laborious, drawings at this stage damp down the establishment of a range of initial ideas and so limit the potential for cross-fertilisation and continued creative flow. At this initial stage drawings should be fast and contain only enough detail to convey the idea behind them. Fast, simple sketches enable more exploration at this stage. In this way effectiveness may be promoted and efficiency potentially increased.

As ideas begin to firm up it will be necessary to examine aspects in greater depth. This means more detailed sketches and possibly engineering type drawings. This process continues until the designer can go firm with a full set of production drawings. At various stages within this process it may be appropriate or a requirement for the designer to produce

presentation drawings in order to communicate the developing ideas to a client.

Typically a child's design sheets should contain an initial phase of outline exploration in response to an analysis of the context. This outline exploration on paper (there may also be quick 3D models) should be rapid and use only enough detail to develop the ideas. Emerging from this phase one would expect to see a firm direction established and explored in more detail. Aspects of this detail may require the child to revert to simple sketches and exploration as a part of this consolidation and detailing. Following this, or as a part of it, the child may use engineering drawings to clarify dimensions, fits and joining techniques amongst other details. Details of component dimensions and materials types, costs and finishes may follow together with a well worked presentation drawing if it is required. All of this should proceed in parallel with any 3D modelling which is appropriate at any time.

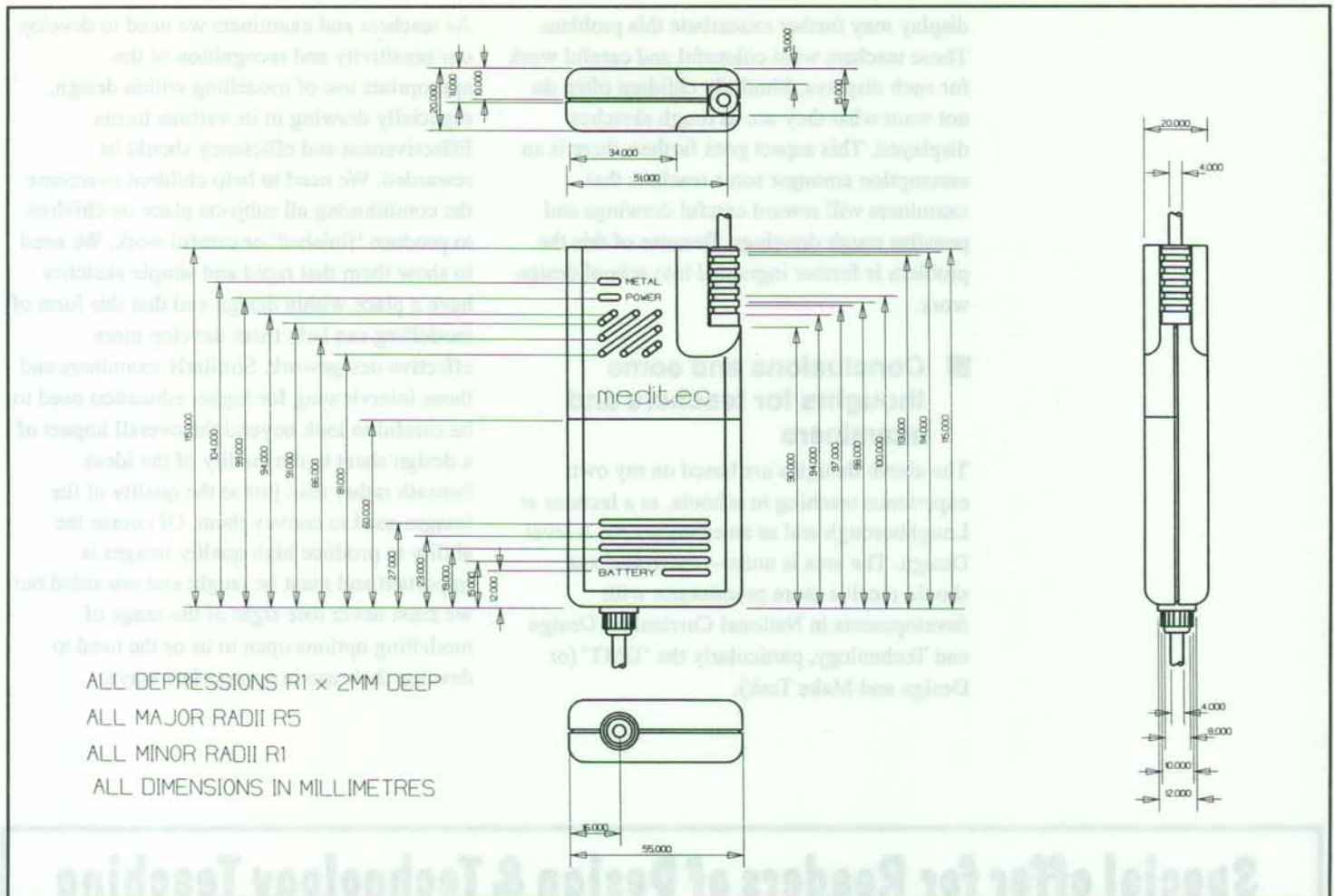


Figure 3: an example of an engineering drawing. Carefully done and time consuming like a presentation drawing. Important but only to be used where necessary.

■ So what's wrong?

Many design sheets in school are overworked, using detailed and slow drawing techniques at the points at which ideas need to be fixed and manipulated with speed. It is also common to see 'design sheets' obviously produced after the initial stages have been completed and probably based on earlier sketches that have been discarded. The reasons for this appear to lie in various directions. Teachers of all subjects encourage good presentation, whether it be the layout of a laboratory report or a mathematical exercise. Good presentation is essential in design, but in the right place. Many children do not appear to recognise the fact that initial design sheets do not have to be well presented in order to be appropriate. Indeed well-presented initial design sheets are only done by spending time which is limited and by reducing the opportunity for developing a creative flow of ideas.

Children are often shown design work done by undergraduates and professional designers. This is sensible but staff need to help children recognise that experience enables these designers to put down relatively complex and

accurate drawings very quickly. Similarly, at exhibitions such as degree shows, designers tend to exhibit those drawings that communicate to the outsider more easily. These are typified by being more carefully worked and often including colour. The child takes these images of design and misunderstands. This leads to children producing carefully worked drawings, often with colour applied, in the early stages of design when rapid sketches are necessary. This then slows down the fixing of ideas and their development. In the worst cases children are so dissatisfied with their initial drawings that they discard them and use valuable time producing new, careful ones.

Another possible reason for this general problem is that some design teachers may not fully understand the roles and functions of various forms of drawing in designing. Teachers may be actively encouraging children to work 'carefully' in the initial stages of design. They may be failing to help children appreciate that there are different types and functions of drawing and that these should be used in the appropriate place. In some respects teachers' requirements for design work for

display may further exacerbate this problem. These teachers want colourful and careful work for such displays. Similarly children often do not want what they see as rough sketches displayed. This aspect goes further; there is an assumption amongst some teachers that examiners will reward careful drawings and penalise rough drawings. Because of this the problem is further ingrained into school design work.

■ Conclusions and some thoughts for teachers and examiners

The above thoughts are based on my own experience teaching in schools, as a lecturer at Loughborough and as an examiner for A level Design. The area is under-researched and should receive more prominence with developments in National Curriculum Design and Technology, particularly the 'DMT' (or Design and Make Task).

As teachers and examiners we need to develop our sensitivity and recognition of the appropriate use of modelling within design, especially drawing in its various forms. Effectiveness and efficiency should be rewarded. We need to help children overcome the conditioning all subjects place on children to produce 'finished' or careful work. We need to show them that rapid and simple sketches have a place within design and that this form of modelling can help them develop more effective designwork. Similarly examiners and those interviewing for higher education need to be careful to look beyond the overall impact of a design sheet to the quality of the ideas beneath rather than just at the quality of the images used to convey them. Of course the ability to produce high quality images is important and must be taught and rewarded but we must never lose sight of the range of modelling options open to us or the need to develop their use in appropriate ways.

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