New approaches to the use of plastics in design and technology (It isn't all just acrylic!)

Rowan Todd and Mandy Hermitt

Senior lecturers in design and technology education, Sheffield Hallam University

Introduction

The Centre for Design and Technology Education at Sheffield Hallam University (SHU) is committed not only to training new design and technology teachers through its honours degrees and PGCE routes, but also to providing In-service Training (INSET) opportunities for practising design and technology teachers from middle and secondary schools. The design and technology INSET philosophy that we adhere to is one of providing teachers with the opportunity to experiment and develop new ideas for themselves. A group of well-motivated design and technology teachers in an appropriate learning environment faced with the challenge of dealing with new concepts, skills and materials, gives opportunity for creative development and ownership of the subject area. Over the past three years it has been good to see that after the dearth of the early 1990s, the number of teachers attending INSET courses has steadily increased. Hopefully this reflects a growing realisation of the importance of subject-specific INSET by senior management teams in schools. As a result of this increase in popularity for design and technology INSET, we have been able to expand the range of courses on offer to teachers.

This article describes work resulting from an INSET course for secondary design and technology teachers which ran for two days in July and was entitled: "*New approaches to plastics in Design and Technology.*"

The course

In recent years there has been a rapid increase in the popularity of plastics in design and technology departments throughout the country. Acrylic and styrene are the most widely used, both of which are available in a wide range of attractive colours and special finishes. There are other plastics that are less well-known and that have been slower in finding their way into design and technology project work. With new materials come new techniques and applications. The aim of the course was to introduce teachers to some of these 'less well known' plastics and give teachers the opportunity to explore and experiment with them.

The materials

1) Foamex (Expanded PVC sheet)
This is a dense, rigid sheet material that can be easily cut, shaped and glued but that does not crack or shatter as easily as acrylic and is about half the price! It comes in a range of colours, usually red, yellow, green, white and black and in thicknesses of 3, 6 and 12mm.

2) Plastazote (Expanded Polyethylene Sheet)
This is a low density closed cell foam sheet, tough and flexible with a satisfying tactile quality. It is cheap, lightweight and waterproof. Again it is available in a wide range of colours including white, blue, green, yellow, red and grey and in thicknesses of 3 and 5mm.

Table 1: Some effective ways of working the materials

Material	Cutting	Shaping and Forming	Non-permanent fixing	Permanent fixing	Surface Decoration	Finishing
Foamex	Vibrator saws, piercing and coping saws, band saws.	Abraded using metal files, needle files abrasive papers, Heat formed with line bender, vacuum former, oven, hot air gun.	Climbing rope, adhesive webbing reflective tape, elastic shoe laces, rope toggles, coloured Velcro strip, correx fasteners.	Tensol, glue gun, double sided sticky tape.	Permanent markers, sand blasting acrylic paints, coloured hot melt glue sticks, Stika Scan.	Sides pre-finished. Use metal files and abrasive paper on edges.
Plastazote	Sharp scissors, modelling knife or scalpel, rotary cutters, hot knife.	Heat formed using vacuum former, hair drier, domestic iron, line bender.	Climbing rope, adhesive webbing, reflective tape, elastic shoe laces, rope toggles, coloured Velcro strip, Supaclips, eyelets, staples, double sided sticky tape, correx ratchet fasteners.	Heat bonding, PVA, rubberised contact adhesive, glue gun, hand sewing, machine sewing.	Stitching, metallic printing using acrylic paints, coloured hot melt glue sticks.	None required, material pre-coloured.

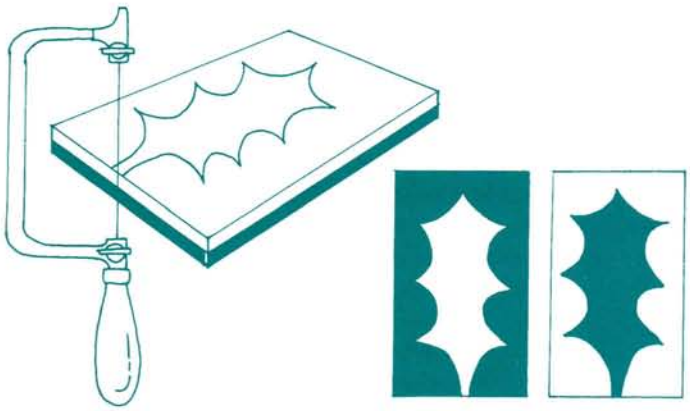


Diagram 1: Two-tone effects with Foamex

Some effective ways of working the materials are shown in table 1.

Day 1

The materials and processes we intended to introduce were very different from the majority of those traditionally used in secondary school design and technology departments. As a result, we thought it important to keep the demonstrations as concise as possible and then to give the teachers plenty of time to 'have a go' for themselves. Consequently, we used only the first part of the morning to introduce a wide range of techniques, allowing the rest of the day for the teachers to experiment with and develop the processes.

Foamex:

- As Foamex is a fairly rigid material, conventional techniques can be used for cutting and shaping. Demonstrations therefore centred around the use of coping saws, scroll saws and bench mounted band saws.

- Two-tone effects can be achieved by taking two different coloured pieces of Foamex taped together and cutting a profile using a jewellers piercing saw. The two Foamex sheets can then be separated and the parts reassembled as a positive and a negative.

- A chequered effect can be produced by laminating strips of different coloured Foamex together using double sided sticky tape. Recut at right angles to the strips using the band saw. Stagger alternate layers and rejoin using the double sided tape. Cut to the required thickness.

- TEP hole cutters were demonstrated as an alternative to drilling.

- Demonstrations were also carried out on the line bender and vacuum former (Foamex vacuum forms much more easily than acrylic!).

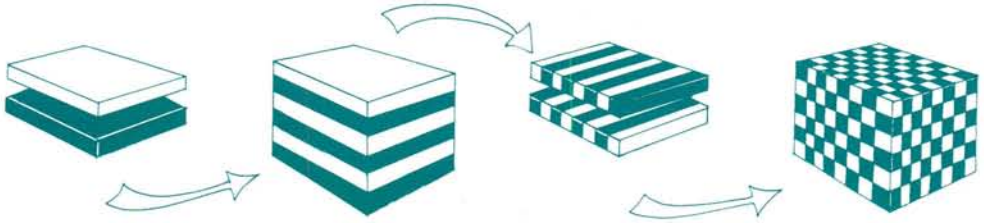
- A variety of mechanical fixings and fastenings were introduced for use both in construction and as decorative features. A series of small holes can be punched through Foamex sheet and thin (2 or 3mm) climbing rope threaded through to create a hinging effect. Correx snap fasteners can also be used, either singly to create a pivot or two or more to create a fixed join.

Plastazote:

Being a flexible material, a different approach to cutting had to be employed. We demonstrated the use of scalpels, craft knifes, compass cutters and a hot knife (similar to a soldering iron but with a craft knife blade attached). The teachers were particularly impressed with the hot knife which cuts through Plastazote with consummate ease, producing clean curves and straight edges.

- Hand and machine stitching techniques were introduced as a means of either joining two pieces of Plastazote together or for creating pattern and texture for decorative purposes.

Diagram 2: Chequered effect with Foamex



The TEP glue-gun injection moulding system was introduced as a way of combining materials to create different effects. The teachers later discovered through experimentation that more innovative results were obtained by using the glue gun and coloured glue sticks freehand.

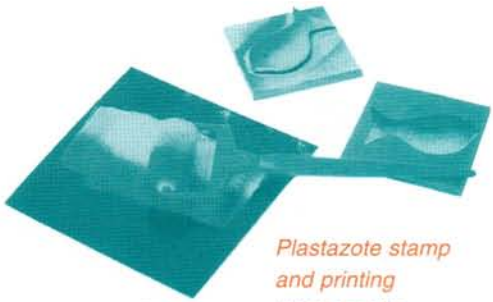
Although the glue gun is moderately effective, Plastazote is not an easy material to glue. As an alternative, we concentrated on joining through the use of mechanical fixings and fastenings. Effective results can be achieved with correx fasteners, coloured Supaclips or by using brass eyelets (either 4 or 6mm) threaded with rope or decorative cord.

- The printing demonstration proved to be particularly popular. Shapes were cut from odd pieces of Plastazote and then glued to blocks of wood, using PVA, to create a stamp. A small foam roller was employed to transfer acrylic paint onto the stamp.

- Demonstrations were also carried out using the line bender and vacuum former. The properties of Plastazote are such that when vacuum formed, it provides excellent internal definition and a softer external profile.

After seeing the breadth of techniques that could be used on the materials, the teachers were keen to experiment and try them out for themselves. A focused practical task was introduced. They were to explore the endless possibilities the materials have to offer and then, using their example and experimental pieces, put together a sample board containing a lively display of information which would provide a stimulating resource for pupils back at school.

The teachers set to work. Amidst great enthusiasm, many ideas were explored. One teacher began to look at heat bonding Plastazote using the hot knife. This technique was developed further by using the line bender to heat the pieces to be joined and then clamping them in a bench vice until they had cooled. As a result, some very clever hingeing was designed.



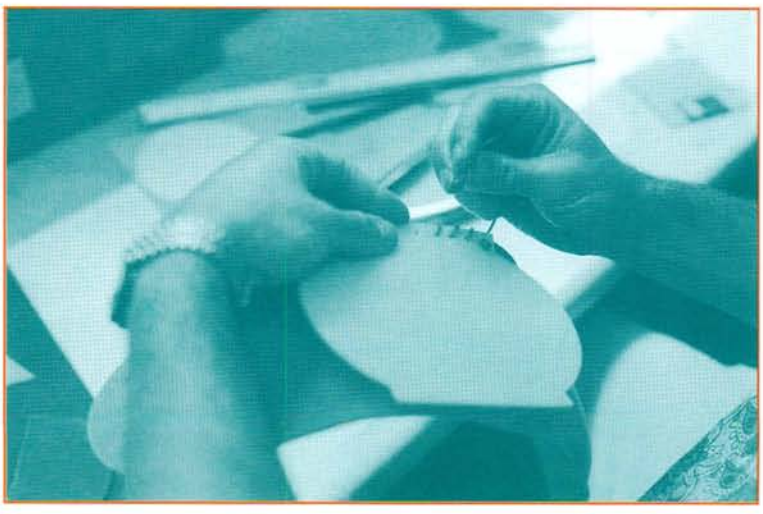
Plastazote stamp and printing using acrylic paints

Foamex and Plastazote sample board

Another teacher explored mechanical fastening methods where the Plastazote itself formed the fastening. This teacher also perfected the technique of fraying the climbing rope and using this as a decorative feature. She then went one step further and looked at substituting the rope itself with thin strips of Plastazote.

By the end of the day a series of display boards had been produced that were colourful, stimulating and varied. One teacher presented his ideas and techniques in the form of a book.

During the afternoon a session was given on the Internet. Teachers new to the system



A decorative hinge is produced using climbing rope on Plastazote

CURRICULUM DEVELOPMENT

Heat bonded hinge in Plastazote

were taught how to search for information on Plastazote. Many of them thought that it was a new material, but this is not the case. Plastazote has been used in industry for the past 30 years and is commonly used for orthopaedic foot support in the medical profession.

Plastazote skills book

Day 2

The focused practical tasks from day 1 had given the teachers a sound basis for tackling the design and make assignment that we had planned for day 2. Designing was carried out through card modelling. We decided to use this approach because of the limited amount of time available and as a means of encouraging rapid ideas generation.

The teachers were set two exercises and given 30 minutes to complete each task.

Exercise 1:

Using one sheet of card or paper, fold and cut it as many times as you require but still keep it as one piece and form a package for a single computer disc.

Exercise 2:

Using a triangle or circle as a basis for your idea, design a simple package, again for a single computer disc, that can also act as a display.

Discussions were held at the end of each 30 minute session where all the models were evaluated. Teachers found that in this situation card modelling was a very effective means of visualising their thoughts and were keen to try this approach to designing back at school with their pupils. By the end of the design sessions the teachers had produced a range of interesting and, in several cases, innovative ideas.

After the warm up exercises, the design and make assignment was introduced. This was to take up the rest of the day:

Design Brief:

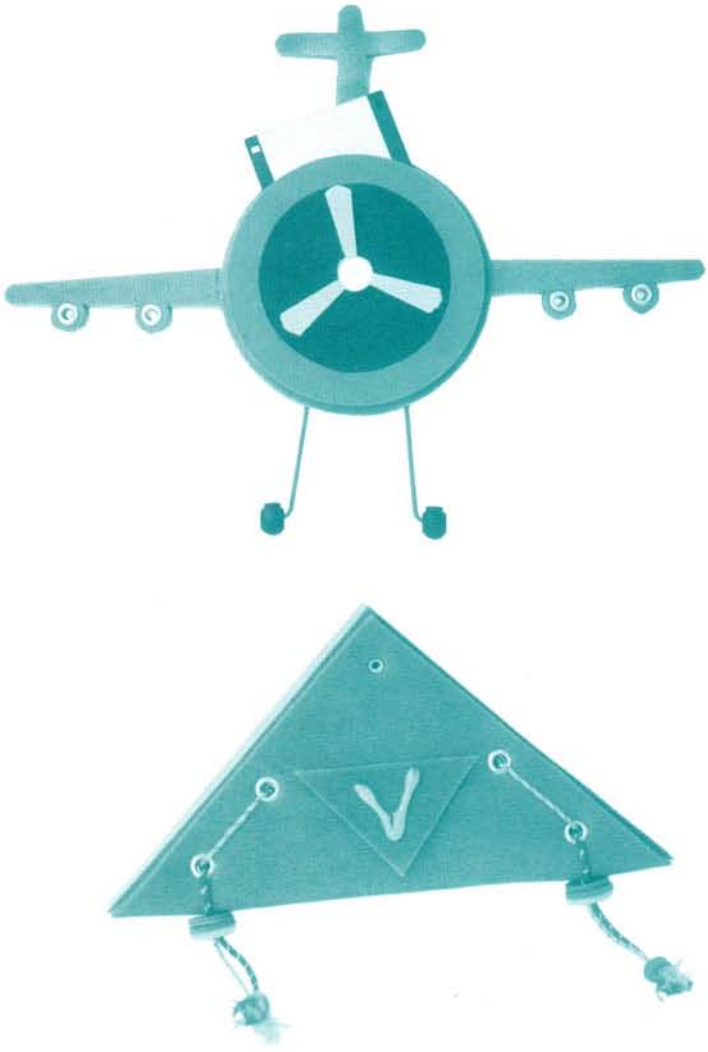
Almost all computers use a standard 3.5 inch floppy disk. These are often carried around loosely in pockets or bags and are therefore often damaged. Design using the sheet material, processes and skills that you have been shown, a holder for three floppy discs. The holder should be easy to carry around and must protect the discs.

Foamex product developed from card modelling

The teachers again used card modelling to work out their ideas and then moved on to manufacturing their products. It is interesting to note that most of the final designs were manufactured from Plastazote rather than Foamex. When questioned, the teachers gave several reasons for this:

- Limited time was available and manufacturing in Plastazote was faster
- The properties of Plastazote are more similar to those of card
- Working with Foamex was very similar to working with acrylic, techniques the teachers were familiar with. Working with Plastazote presented a different range of techniques that were less familiar to them and they wanted to try them out
- Plastazote was a more appropriate material to use for this particular design brief.

Although time was short, everybody was able to produce a completed realisation. The outcomes were colourful, varied in design and all of a very high standard. The final feedback session resulted in an extremely positive response by teachers – they were very clear about the benefits of the materials, the projects and the course as a whole.



The final products

Comments

It is always difficult to assess how successful a new course will turn out to be. The real acid test is whether or not the teachers have been inspired to such an extent that they then incorporate the work into their teaching schemes on their return to school.

The early signs were good; demand for places was astounding. During the two days of the course, fun was had by all. One of the most exciting aspects was the ingenuity and innovation demonstrated by teachers, particularly in developing constructional techniques and project applications for Plastazote foam. Although other materials were introduced, this one was undoubtedly the most popular both when the sample boards were made and when the teachers tackled the design project. So, what did the teachers think?

"A really informative introduction to materials and processes which were totally new to me." T. Rysdale, Don Valley High School

"Nice to have the chance to experiment with new materials. Appreciated being able to speak with supplier and have a list of where to find materials and how much they cost. Always good to share ideas with colleagues from different schools." V. Skelton, Ridgewood School

"....a good range of opportunities to experiment." G. Drabble, Newfield School

"An excellent opportunity to experiment with a range of plastics and to be creative" R. D, Hungerhill School

"Great way of learning ideas from other (teachers) !! Now got some useful ideas for next term!" C. Caravan Stancliffe Hall School

"Excellent.....loved it!" J. Cooke, Heathfield High School

...and what do teachers want from INSET in the future?

"More of the same with new products or tools for any resistant/non-resistant material.... access to information on suppliers or school aimed resources." V. Skelton, Ridgewood School

"...What will I be teaching in 12 months!?" P. Brooke, Hatfield High School

Conclusion

By its very nature, design and technology is a dynamic, exciting, ever evolving subject. If we are to do justice to the pupils in our schools, it is important that we keep abreast of new developments and constantly update the curriculum accordingly. In order for teachers to be able to do this, they in turn must be provided with the necessary tools – time, resources and a fertile learning environment in which they can contemplate, experiment and learn from each other. In other words regular, relevant and supportive INSET provision..... Roll on July '98!

Resources

Plastazote and Foamex sheet, hot knives and various fixings and fastenings are available from:
J.B Hindley Limited
26 Lion Works
Ball Street,
Sheffield S3 8DB
Tel: 0114 278 7828

Further information on working with Plastazote is available from:
http://www.bp.com/edu
B.P. Teacher Support Material: Science and Technology

Hole cutters and glue gun injection moulding sheets are available from:
Technology Enhancement Programme
Middlesex University
Bramley Road
London N14 4SX
Tel: 0181 447 0342