# Active Learning of Creativity through Clay-Modelling

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## ABSTRACT

Creativity is a key part of the teaching curriculum for product design students. A special one and a half day creativity workshop was organized for a group of postgraduate students in product design who were more used to conventional computer-aided design techniques. This pilot project was developed with the sculptor-in-residence who had conducted such exercises for other groups of students. The purpose of this project was to study the value and effectiveness of active learning of a creativity process through clay model making. The first exercise required the building of a part without direct visual contact, i.e. blind modelling. The second one was building the same part in a normal way with full eye contact. The remaining three exercises were group work for building the tallest structure with given clay material, representation of an engineering discipline and a car for the future. Discussions were held with students at the end of each exercise and feedbacks were received from each individual student through a standardized questionnaire. Results of this active learning project are discussed in details with supporting quantitative and qualitative data.

## KEYWORDS

Active Learning, Creativity, Clay, Modelling

## INTRODUCTION

Creativity is absolutely essential for product design. For students on the Masters programme in Product Design and Management at Liverpool University, creativity is taught and practiced using a variety of methods and tools. Lectures on innovation, techniques for creative thinking and seminar on TRIZ by industrial practitioner are given. Practical sessions on the use of creativity tools in groups also take place. All such methods share a common characteristic, i.e. use of words or a sketch. In other words, the results of such creative processes do not produce a physical object directly. However, it has been a long history for sculptors to create a 3D object directly without any intermediaries. Such methods are rarely used in Engineering Schools in the study and practice of creativity. This paper reports the experience and findings of a one and a half day workshop on creativity using clay-modelling though 5 exercises.

### *Sculptor in Residence Project*

At Liverpool University, a new initiative on 'Sculptor in Residence' was launched by Dominic Dickson as part of 'Liverpool- European Capital of Culture 2008 Project'. A part-time sculptor, Rodney Harris, was recruited for this project for one year. The main objectives of this project entitled 'EXCESS- Exploring Creativity in Engineering and Science with Sculpture' are as follows:

- To encourage creative collaboration across disciplines by providing opportunities to allow this to happen.
- To develop creativity and creative thinking in science and engineering students and staff through art.
- To promote new approaches to collective and individual learning in science and engineering.
- To explore fundamental aspects of science and engineering subjects by producing pieces of sculpture (three dimensional visual art) to illustrate these aspects (such as the relationships between structure and function).

The entire project ran for 8 groups of students in science, engineering and medicine and one interdisciplinary forum for a total of 327 participants. After realising the existence of such a project in the university, a discussion took place on the essence, the contents, earlier results and the relevance to Product Design students. With the intent to stimulate participants to think laterally, to gain cross fertilisation in a group working environment and to use one medium to explore another, it was decided to run a pilot workshop which could help product design students to see things in a different and hopefully enlightening way.

## CREATIVITY WORKSHOP

A pilot run on the use of clay-modelling as a creativity exercise was arranged for a group of 15 MSc students in Product Design and Management in the first month of Semester 1 in 2008. They had various academic backgrounds which are summarized in Table 1. They were all familiar with the use of Pro-E CAD package for product design. More than 60% of students had no previous experience of clay modelling and 20% of them were female students.

Table 1: Background of Participants.

| Subject of First Degree | No of Student |
|---|---|
| Electrical & Electronic Engineering | 1 |
| Industrial Design | 1 |
| Industrial Engineering | 2 |
| Machine Design | 1 |
| Mechanical Design | 1 |
| Mechanical Engineering | 8 |
| Product Design | 1 |

The one and a half day Creativity workshop took place in the Design Studio. The Sculptor in Residence and one instructor were in attendance throughout the workshop. Five exercises

were conducted in the workshop and they consisted of both individual and group work. In this workshop, creativity entails the basic 3Ps: a *person* engaging in a creative *process* which produces a creative *product* [Barron, 1999].

Before the first exercise, every student was given a lump of clay to get familiar with the properties of the material. As an unstructured material which requires little technical ability to manipulate, everyone was ready for the first exercise after a short while.

### *Exercise 1: Creation of a Clay Elephant Behind the Back*

The first exercise was in fact a familiarity exercise and an elephant was selected for the modelling because it had very distinctive features. This exercise was performed behind the back with the purpose of maximising the sensory touch to create a mental 3D image through clay manipulation as shown in Figure 1. After the completion of this exercise, all elephant models were placed on a worktable as shown in Figure 1.

Figure 1. Modelling an elephant behind the back in exercise 1.

Figure 2. Results of clay modelling exercise 1.

With a variety of accurate and less accurate models, it lightened the atmosphere immediately and this exercise achieved an unexpected by-product of ice-breaking. Only 80% of the models had the characteristic feature of a trunk and it was also difficult to identify at least 20% of the models as elephants as shown in Figure 2. However, the main purpose of this exercise was to build up confidence in modelling with clay and not entirely concerned with accuracy. In a feedback session, it was noted that one student had never seen an elephant in real life.

### *Exercise 2: Creation of a Clay Elephant in sight*

Exercise 2 represents the normal way of creating a clay model as shown in Figure 3. A few observations could be made in this case. First, use of eye does not necessarily mean that the resultant model is more accurate as shown in Figure 4. Second, there is a tendency to take more time to complete the task as participants are keener to improve the model. The maximum time taken for exercise 2 was 22 minutes compared with 18 minutes for the previous exercise. Finally, expression of originality started to appear as one model was a symbolic representation of an elephant instead of an accurate mock up. In this case, it was strongly influenced by the traditional African culture.

Figure 3. Modelling of a clay elephant in sight.

Figure 4. Comparison of results of exercise 1 (inner circle) and exercise 2 (outer circle).

### *Exercise 3: Creation of the Tallest Tower*

In this exercise, the 15 students were divided into 5 groups. The aim of this exercise is to construct the tallest tower they could make based on the materials given. Although the aim is simplistic, this will require students to think about the form of the structure, agree on the right form, build the structure without drawings, analyse the problems encountered and optimise the structure to reach a greater height. While a conical shape was common, the final structure created by each group was different as shown in Figures 5 and 6. During the feedback session, discussions were focussed on the question of an optimum structure, i.e. the existence of only one single tallest structure with a given amount of clay.

Figure 5. Example of a tall tower.

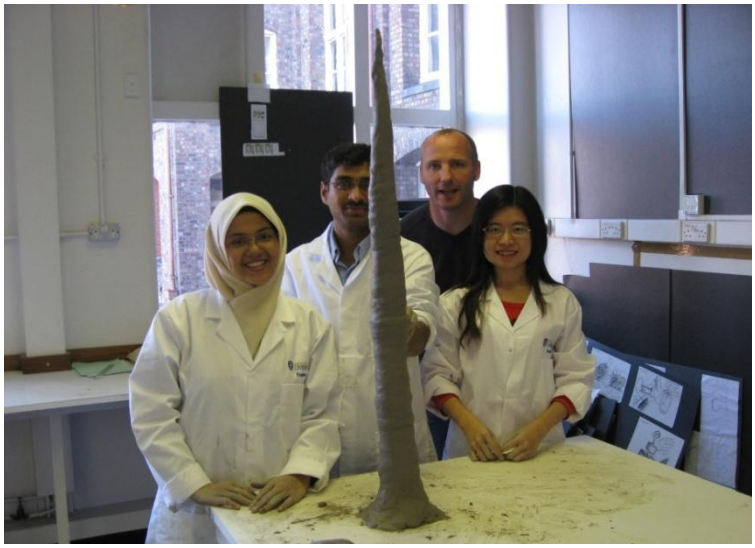

Figure 6. Another example of a tall tower.

### *Exercise 4: Representation of an Engineering Discipline*

Students were asked to produce a model which was a representation of their previous discipline. This exercise, unlike the previous ones, was entirely open-ended and students were given full freedom to express themselves. Some of the models produced were conventional, for instance, a set of gears to represent mechanical engineering. Other examples were more sophisticated, for instance, a hand to represent design and the hand broke free from shackles implying unbounded space for innovation for design as shown in Figure 7. One example departed from the given remit, i.e. linking the previous discipline of mechanical engineering with the current discipline of product design as shown in Figure 8. This symbolises the single facet of mechanical engineering to multi-facet product design.

Figure 7. Representation of design discipline.

Figure 8. Representation of mechanical engineering discipline.

***Exercise 5: A Car for the Future***

This is the final exercise of this workshop. As every student is familiar with a car, the theme of this exercise is to model a future car, 30 years from now. A number of imaginative features were introduced in this exercise, for instance, detachable modular structure, new forms of fuel energy, energy saving profiles, etc. Two examples are chosen as a demonstration of the creativity process. First, students use tools to add features to the clay model as shown in Figure 9. This is entirely based on their own initiative. Second, some students used lateral thinking. They propose a new form of transport 'transport gate' instead of a car as shown in Figure 10.

Figure 9. Example of a future car.

Figure 10. Future model of transport through a 'Transport Gate'.

## DISCUSSIONS

This series of five exercises allows students to build up experience and confidence in using clay and progress to total freedom of expression as a creative process. Exercises 1 and 2 serve as skill acquisition and ice-breaking. Exercise 3 is quite different as it covers the whole spectrum of idea generation, design, build and re-think, re-build due to the collapse of the tower structure mid-course. Exercises 4 and 5 are more directly related to creativity as there are open-ended questions.

After the completion of the workshop, every student completed a simple questionnaire including both numerical and qualitative assessment of the overall activity. Each exercise, except 3, was rated from 1 (most boring) to 10 (most interesting). The averages for Exercises 1, 2, 4 and 5 were 9.07, 8.00, 8.13 and 7.80 respectively. The fact that the future car has a relatively lower rating is probably because this is a well known topic and some students feel that the level of creativity is more constrained. The histograms of the satisfaction ratings of the clay modelling are given in Figures 11 to 14.

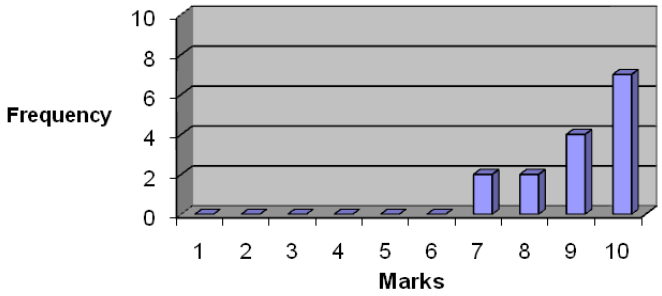


Figure 11. Questionnaire results for Exercise 1.

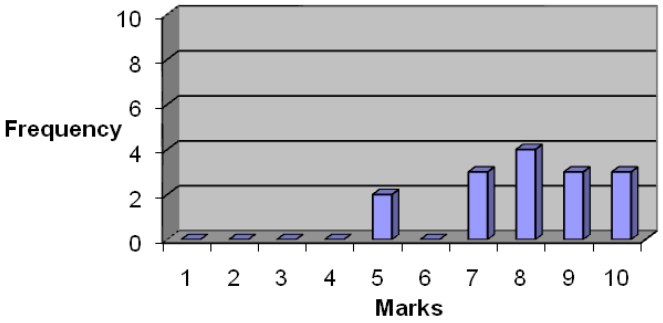


Figure 12. Questionnaire results for Exercise 2.

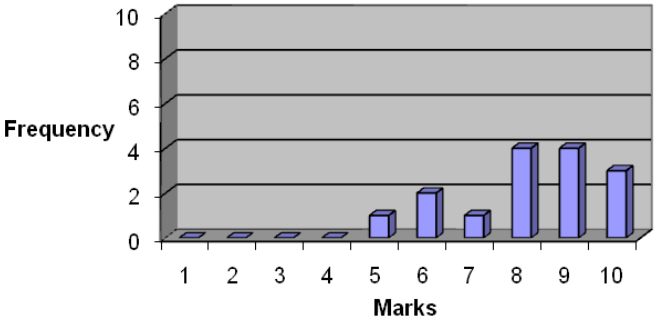


Figure 13. Questionnaire results for Exercise 4.

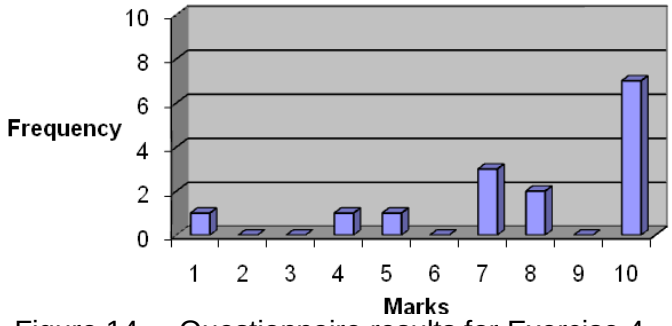

Figure 14. Questionnaire results for Exercise 4.

In terms of the relevance of this workshop to product design, the results show a bi-modal distribution with two peaks at 7 and 10 and an average of 8.67 as given in Figure 15. Responses on the best aspects of the workshop include: innovative thinking, creative skills, teamworking and wider perspective. On suggestions for the next Clay Modelling workshop, 4 students suggested that more time should be allocated while one opted for less. Other suggestions include the provision of more tools and more challenging tasks. There was a clear majority supporting the idea that this should be part of the core curriculum in the future.

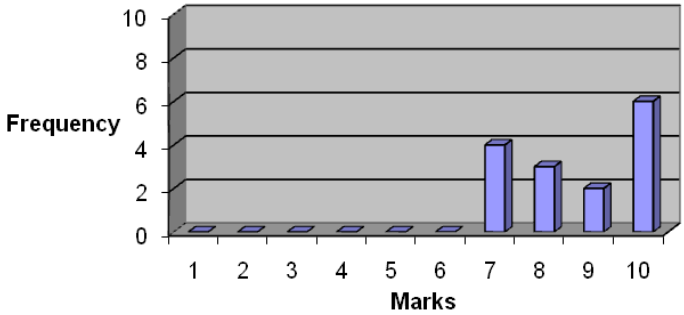

Figure 14. Overall relevance of the workshop to product design.

## CONCLUSIONS

As an unstructured material, unlike lego or meccano, clay is a very versatile, low cost and reusable material for modelling. Clay modelling is more common with students in arts or design schools but much less common in engineering schools. This case study of a pilot workshop in an engineering school has demonstrated that clay modelling is also attractive to engineering product design students because of its simplicity and ease of use.

Unlike normal CDIO activities where a full detailed design is required before making the parts, clay modelling has a shortened process chain from the mind to direct fabrication of an 3D object. This has a positive impact on the creative process as students are not diverted on the fine details of engineering. Clay modelling also enhances active learning as demonstrated by exercise 3 in building a tall tower. Building a tall tower with clay is entirely different from sketching a tall tower as one has to cope with the properties of material and gravity effect.

Finally, based on positive student feedbacks, it is planned that this workshop will extend to more MSc programmes in engineering to stimulate the creative process.

## REFERENCES

[1] Barron F.X., 'Creative Person and Creative Process', Holt, Rinehart and Winston, 1969

### *Biographical Information*

Bernard Hon is the holder of the Founding Chair of Manufacturing Systems at Liverpool University. He is the Director of two popular MSc Programmes: *Advanced Manufacturing Systems and Technology* and *Product Design and Management*. His current research interests cover new manufacturing processes, design and manufacture for sustainable development and virtual manufacturing. He is also introducing active learning into his MSc programmes.

Dominic Dickson is Honorary Senior Fellow in the Department of Physics at the University of Liverpool and Director of the Science Communication Unit. He has a particular interest in the use of the creative and performing arts in science, engineering and medical education.

Rodney Harris is an award winning Sculptor. He has been commissioned for major Public Sculpture Commissions throughout the UK and is a leader in using sculptural methodologies in professional development and education. He was the Sculptor in Residence at the University of Liverpool in 2008.

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