Designing for Children

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Naïve Designers: A Study Describing Indian Middle School Students' Creative Design Solutions to a Real-World Problem

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Abstract: In India, design education is generally considered specialist education aimed at preparing future designers rather than educating the general population. However, there are at least two views advocating the inclusion of design in general education. The first is that of design professionals (Cross, 2006; Lawson, 2006) who consider design ability as a form of natural intelligence possessed to some degree by everyone. According to this view, design should become a part of general education as it has its own ways of knowing, thinking and acting, different from sciences and humanities. The second view is of educationists who advocate the inclusion of design and technology (D&T) education in school curriculum in order to develop among future citizens the knowledge, understanding, technical and interpersonal skills necessary for advancing scientific and technological society. While D&T education is a part of school curriculum in several countries worldwide, Indian school curricula neither includes design nor technology education.

The present paper is part of a larger study (Ara et al, 2009) that explored students' ideas about design and designers before and after they engaged in design related activities. The activities ranged from analyzing familiar and unfamiliar artefacts to designing artefacts and were conducted with 25 students of class VII, working in groups (7) of 3 or 4 members. Analysis of the activities revealed that students' working collaboratively on real-world problems generated ideas, developed solutions, considered design decisions, made sketches, evaluated solutions and wrote design proposals. Each group presented their designs to other groups, who questioned, evaluated and provided feedback. Students' designs displayed elements of creativity, imaginative thinking, and use of scientific and technological concepts. Solutions varied from simple to complex designs with some differences between girls' and boys' groups. This preliminary research with a limited number of middle school students over a short time provides insight into students' responses to a design situation. The study reveals that given an opportunity, students intervene creatively in developing solutions to a real-world problem.

Key words: creativity, design education, design solutions, middle school students, naïve designers, problem solving

1. Introduction

In India, design education is generally considered specialist education aimed at preparing future designers rather than educating the general population. However, there are at least two views advocating the inclusion of design in general education. The first is that of design professionals (Cross, 2006; Lawson, 2006) who consider design ability as a form of natural intelligence possessed to some degree by everyone. According to this view, design should become a part of general education as it has its own ways of knowing, thinking and acting, different from the established cultures of sciences and humanities. The second view is that of educationists (Kimbell et al, 2002; Owen-Jackson, 2008) who advocate the inclusion of D&T education in school curriculum in order to develop among future citizens the knowledge, understanding, technical and interpersonal skills necessary for the advancing scientific and technological society.

While D&T education has already become a part of the school curriculum a decade ago in several countries worldwide, Indian school curricula neither include design nor technology education. Gandhiji's philosophy of Basic Education motivated the Education Commission in 1966 to introduce Work Education and Socially Useful Productive Work in schools, but today these subjects have become an adjunct to the already lopsided literacy-numeracy curricula since they rely on recipes and non-reflective practices, rather than on creativity and reflection. Researchers at Homi Bhabha Centre for Science Education have been exploring the possibilities of including D&T education in schools (Choksi et al, 2006; Khunyakari et al, 2007; Mehrotra et al, 2009).

1.1 Design and Creativity

A global problem of present school education is that creativity is often undervalued and curbed. While all school subjects provide opportunities to develop creative potential, some offer better possibilities since they are free from traditional academic standards (Lewis, 2009). Mathematics and sciences receive primary importance while subject such as D&T providing opportunities to be creative, receives less attention. Creativity in D&T education lies in generating new problems, managing uncertainties, seeking possibilities and imagining alternatives while creating products/systems. Fisher (1997) in Barak and Goffer (2002) proposed two models that regard creativity to be:

- cognitive potential of a few,
- an attribute possessed by all, which can be fostered.

The UK report of National Advisory Committee on Creative and Cultural Education (NACCCE), 1999 (Barlex, 2007) viewed creativity in terms of the following features:

- using imagination
- pursuing purposes,
- being original, and
- being of value.

Research on the creative potential of D&T is being explored by many researchers (Barlex, 2007; Barlex and Trebell, 2007; Christiaans and Venselaar, 2005). Barlex and Trebell (2007) removed the constraints of ‘making’ what has been designed so that students’ creativity is not limited by their making skills, accessibility of tools, materials and equipment. The present study introduces naïve students to the designing activity without having to actually make their designs, but merely suggest ways of making.

1.2 Problem solving and Design

Design can be considered as a problem solving process employed by professional designers who move through series of iterative steps to create solutions. All people possess the ability to solve real-world problems that are ill-structured, with unclear goals and contain little information. These problems have multiple solutions and several ways of reaching them. Real-world problems provide opportunities to students to take risks and deal with uncertainty unlike problems in physics and mathematics, that are well-structured, have single right answers and can be derived by following a logical step-by-step process.

D&T deals with humans needs/desires and if it is related to students’ own needs/desires and experiences, it can provide meaningful learning opportunities. D&T allows students to make meaningful connections with the information gained, his/her personal experiences and prior knowledge. In traditional classrooms, however, students often fail to relate their experiences with the content taught in the classrooms, resulting in rote learning and de-motivation.

2. The Study

The present paper reports a description of students' creative design solutions to a real-world problem. It was part of a larger study (Ara et al, 2009) that explored students' ideas about design and designers before and after they engaged in design related activities such as handling familiar and unfamiliar artefacts, discussing history of artefacts and designing artefacts. The aims of the designing activity was to introduce students to the nature of designing activity and provide them opportunities to intervene creatively by designing solutions for real-world problems.

2.1 Research Questions

- What design solutions do students generate for a real-world problem while working collaboratively?
- What elements of creativity, feasibility, use of technological and scientific concepts are evident in students' solutions?
- What feedback/critical judgement about their solutions did each group receive from others?

3. Methodology

3.1 Sample

The sample for the study was drawn from a school located in close proximity to the researchers' institution in Mumbai. There were 25 students (7 girls and 18 boys) from Class 7 (average age, 12-13 years). Students' participation was voluntary. The medium of instruction in the school and the language used by the researchers was English. On request students formed single-sex groups of 3 or 4 members (2 girls' & 5 boys' groups were formed).

3.2 Procedure and data collection

The interaction with students continued for five days, approximately two and half hours per day. The design problem was provided to all groups and was read aloud by the researcher. Groups were asked to work collaboratively and make a sketch of an artefact to solve the given problem. They were asked to take into consideration, factors related to users, materials and making. Each group was asked to sketch two different solutions for the given problem. Students worked for three hours to sketch their solutions and write design proposals. Each group was asked to select their 'best' design to present to other groups. The primary data of the study included design productions of each group and their written design proposals. The entire interactions were video-recorded. During the designing phase there was a special focus on two groups (1 boys' & 1 girls' groups).

3.3 The design problem

The design problem specified in this paper came up in consultation with Prof. Bapat of Industrial Design Centre, IIT, Mumbai, in February 2008. The problem was modified for the purpose of this study.

Some old people have difficulty in bending to pick up fallen things from the floor. Rita's grandmother is old and has a problem with her backache and vision. She usually sits on a chair/sofa and sews clothes/knits sweaters. Sometimes she drops the sewing/knitting needle on the floor but cannot bend to pick it up because of her backache. Design a device for Rita's grandmother so that she can easily lift the sewing/ knitting needle from the floor without bending.

4. Analysis

The present paper reports a qualitative comparison of students' designed solutions across different groups. Students explored their design ideas on sheets of papers, either individually or collectively in a group. A variety of design ideas were generated by students. These solutions varied from simple to complex designs. In general, most of the designs showed elements of creativity, use of technological and scientific concepts. The designed solutions of 4 groups are reported in this paper.

4.1 Elements of creativity

Creativity in students' design was observed with respect to the elements of creativity listed by the NACCCE report (1999) as shown below:

- **(i)** **Using imagination:** All the groups clearly drew and wrote about their best designed solution suggesting that they could mentally visualize the images of the product.
- **(ii)** **Pursuing purpose:** All the groups designed their artefacts for people with backache problem who need to lift needles from the floor. Except three groups all others considered both metallic/non-metallic needles in their 'best' designed solutions. Group 2 looked at the problem differently. While others

were trying to find a solution to lift the needles, Group 2 tried to prevent the needles from falling.

(iii) **Being original:** Since students were unfamiliar with any artefact that can lift fallen needles, the design problem was new to students. All groups however, generated solutions that could therefore, be said to be original. These design solutions were unique and different from each other (Tables 1-4).

(iv) **Being of value:** The designs of all groups aimed to improve people's quality of life. Two groups (2 & 3) also enhanced the quality of their design by increasing the possible uses of their artefacts.

Besides creativity other elements as follows were also observed in students designed solutions.

4.2 Elements of feasibility

Lifting a knitting needle (especially non-metallic) was a challenge to students. Four groups used magnets in their design but the complexity involved differed. Although all the groups kept the user in mind, only 2 out of 7 groups' (Groups 1, 2) designs were easy to make and feasible. The other designs were either too ambitious/big (Group 3) or too expensive, thereby indicating that students seemed to have failed in making appropriate decisions regarding prioritising choices.

4.3 Use of scientific and technological concepts

Students showed an understanding of the use of some scientific and technological concepts, such as magnetism, air pressure, air suspension, electricity, telecommunications and use of remote controlled car, telescopic rod, radio sensors, pulley/gears, wheel chair, alarm and battery.

4.4 Design presentation

Students not only presented their design solutions to other groups but also critiqued/provided feedback on the presented designed solutions. Despite limited experience in presenting their work before others, students were able to communicate their designs to the other groups and provide feedback to others. The feedback provided by students, involved logical reasoning and critical thinking (see Table 1-4).

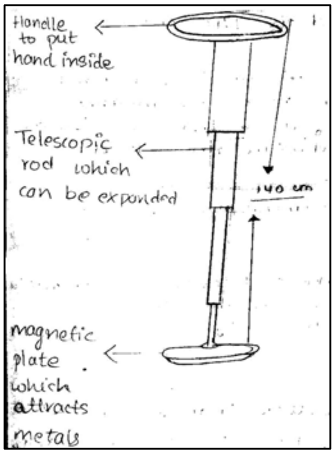
Figure	Description	Feedback/Criticisms
	**Use of magnet:** An aluminum telescopic rod is used, one end of which has a magnet for attracting metallic needles and the other end has a handle for holding. Cost: Rs. 300/-	1. Cannot lift non-metallic needles. 2. Problem of locating the needle for people with poor vision. 3. Lots of trials required. 4. Strong magnet will attract all metallic things on the floor.

Table 1. Design solution of group 1 (girls' group)

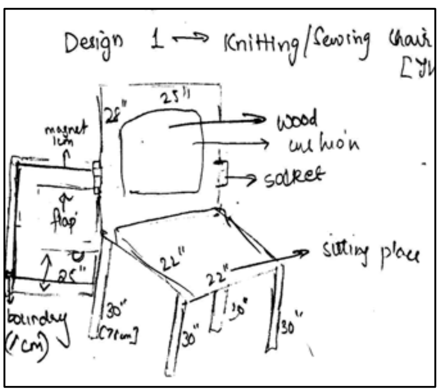
Figure	Description	Feedback/Criticisms
	**Preventing needle from falling:** User sits on this chair and puts on the flap attached to the chair. If the needle falls, it will remain on the flap and can easily be located. The flap has a thin magnet around the perimeter for metallic needles. Cost: Rs. 500/-	1. User is restricted to sitting on the chair while knitting/sewing. 2. If the needle falls on the floor, it is difficult to pick it up. 3. Prevents needle from falling but cannot pick fallen needles.

Table 2. Design solution of group 2 (girls' group)

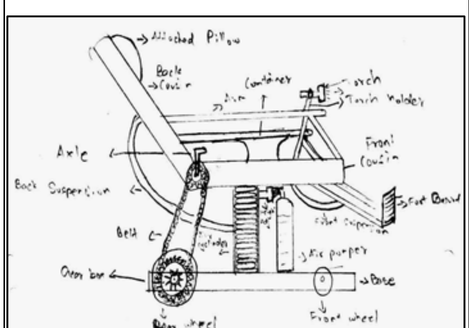
Figure	Description	Feedback/Criticisms
	**Manual lifting by adjusting height of chair:** Principle of air suspension is used to raise and lower the height of the wheel chair. Any object can be lifted from the floor. It can also be used by people who cannot walk.	1. Bending becomes necessary since there is a limit to which the chair can be lowered. 2. Not feasible to make it/buy it. 3. Cannot be steered to different directions.

Table 3. Design solution of group 3 (boys' group)

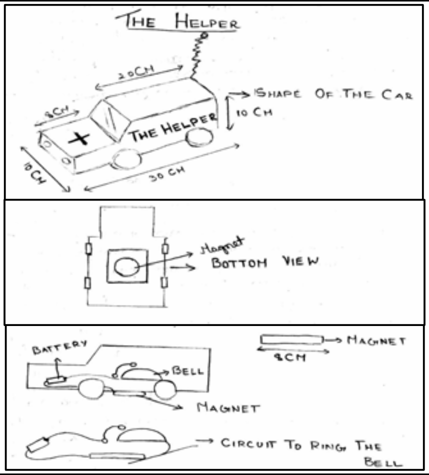
Figure	Description	Feedback/Criticisms
	**Use of magnet:** Remote controlled car is used with a magnet attached to its bottom. When needle gets attracted to the magnet, it completes a circuit in the car and an alarm rings. The car can then be controlled to climb up the ramp against the sofa to the user.	1. Cannot lift non-metallic needles. 2. User must learn to operate the remote controlled car. 3. Car might slip from the ramp

Table 4. Design solution of group 4 (boys' group)

5. Conclusions

The present study indicates that given an opportunity, students can intervene creatively to design solutions for real-world problems. Students never exposed to D&T education, came up with an amazing range of solutions, from simple to complex. All the solutions showed elements of creativity with an indication of using imagination, pursuing purpose, being original and having value. Students used a variety of technological and scientific concepts to achieve their purpose. They enhanced the quality of their design by increasing the possible uses of the artefacts. While both the girls groups' design were simple, most of the boys' designs were complex and involved a variety of technological concepts such as remote controlled car, alarms, radio sensors, etc. In fact the design of group 1 (girls' group) was very close to what the professional designers have designed solution for the similar problem. Although all the groups kept the user in mind, only 2 out of 7 groups' (Groups 1, 2) designs were easy to make and feasible to use. The designs of other groups were either too huge or too expensive. Students seemed to have failed in making appropriate decisions regarding prioritising choices about the size, cost, technology and materials used in making the artefacts. This could have been the consequence of not requiring any actual making of the artefacts. Students communicated their designs to the other groups and also provided critical and logical feedback on the presented design solutions. The present study was limited to only 5 days and to a group of 25 middle school students. The findings of the study would enable the researchers to try out more and different design activities with students.

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