

# Investigating Indian Elementary and Middle School Students' Images of Designers

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## Abstract

This paper presents an investigation into Indian elementary and middle school students' images of designers. A 'Draw a designer at work' test was used with 511 students from Classes 5 to 9 from a school located in Mumbai. Findings from the study indicate that Indian elementary and middle school students, who had no experience in design and technology education (D&T), perceived designers mostly as fashion/ dress designers or artists and designing was associated less with engineering and technology. These results are consistent with an earlier study on Indian middle school students' ideas about design and designers using written responses, where students demonstrated an incomplete understanding of design and what designers do and associated design with art (Authors, 2011). In the present study students, mostly older ones depicted gender and professional stereotypes. Design as engineering, making or building were mostly associated with male designers and depicted more often by boys. Insights from the study have implications for curriculum development at the school level in India.

## Key words

design and technology education, elementary and middle school students, images of design and designers, India

## Introduction

Imagine a nurse. What images come to mind? Probably the image of a caring female dressed in white (Glick, Wilk and Perreault, 1995; Carpenter, 1995). According to Glick et al (1995), the images of jobs have more to do with the people (their gender, status, life styles, personality traits) doing the jobs, than the tasks involved in those jobs. According to Gottfredson, (in Glick, et al, 1995), long before children are able to verbalize which occupations they might be interested in, they develop images of people, their personalities and work related to those occupations. Garrett, Ein and Tremaine, (1977) reported that children as early as first grade viewed certain occupations as being appropriate for women or men. In a study with Indian students, Rampal (1992) found that although many students reported not having seen a scientist personally, they were able to describe their own images of scientists' appearance, personalities and work. These occupational stereotypes or popular images of different occupations influence the choice of careers by students (Knight and Cunningham, 2004). Gottfredson

argues that like adults, children distinguish occupations primarily based on two dimensions; prestige (i.e. overall social desirability) and gender.

## Images and drawings

One way of finding out what images of professionals students hold, is to ask them to draw those professionals. Students' drawings have been used in the perception research literature to explore their ideas and images about various people and professions. Drawings are useful, since they require little or no language mediation. Henrion (in Picker and Berry, 2001) suggests that imagery can provide useful insights into students' underlying beliefs, assumptions and expectations. Early research on children's drawings focussed mainly on determining the intelligence level of a child. In 1926, Florence Goodenough developed the Draw-A-Man Test (DAMT) to measure intelligence. In the 1950's Mead and Metraux conducted a pilot study with a sample of thousands of American high school students, where the data collected was mostly qualitative. The study revealed that high school students described scientists in stereotypical terms such as elderly or middle-aged males wearing white lab-coats and eye-glasses, working in the laboratory, surrounded by test-tubes and flasks. Overall students were found to carry a negative image of a scientist (Mead and Metraux, 1957).

The Draw-A-Scientist-Test (DAST) focused on the image of a scientist (Chambers, 1983). Chambers studied a large number of students at different age groups and identified seven key parts of the stereotypical images produced by students: white lab-coat, eye-glasses, facial hair, symbols of research (scientific instruments and equipment), symbols of knowledge (books), products of science (technology) and relevant captions (formulae, 'Eureka!'). Chambers asserted that the stereotypical images of scientists held by students are powerful and stable and appear to get reinforced with age. Newton and Newton (1998) confirmed that these images about professions remain constant despite changes in the curriculum.

A series of studies have been conducted to learn students' images of scientists with more refined instruments (Finson, Beaver and Cramond, 1995) or including a modification in the instruction such as 'draw a scientist at work' (Huber and Burton, 1995). Variations of the DAST have been adapted in different countries, with mixed results. Chunawala and Ladage (1998), Turkmen (2008),

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Sjøberg (2002) and Akcay (2011) reported positive views of scientists held by students from non-western and developing nations. Several studies also adapted and utilized DAST to understand students' perceptions about other professionals namely mathematicians (Berry and Picker, 2000; Picker and Berry, 2001), accountants, archaeologists (Renoe, 2003).

In 2004, the DAST was adapted by Knight and Cunningham into a test known as the Draw-an-Engineer-Test (DAET) to probe students' images of engineers (Knight and Cunningham, 2004). They found that younger students get cued by the word 'engine' in engineer and think that engineers use tools to fix car 'engines' and build buildings. Older students however, were found to consider that engineers designed buildings and machines. Similarly, Cunningham, Lachapelle and Lindgren-Streicher (2005) found that students associated fixing, building, and vehicles with engineering. The findings from other studies on students' perception of engineering confirmed that students tend to associate engineering with fixing, building and working on things and depicted engineers as physical labourers (Oware, Capobianco and Diefes-Dux, 2007; Karatas, Micklos and Bodner, 2011). DAET has also been adapted to compare students' images of scientists and engineers (Fralick, Kearn, Thompson and Lyons, 2009). Most of the above studies indicated that students' perceived engineers to be mostly males.

It is important to ask why we should be concerned with the images that students hold about different professionals; where these images come from, and what they say about students' ideas and attitudes towards any profession or professionals. With respect to mathematics education, Rock and Shaw (2000) argue that if the images of mathematicians held by students reflect a negative attitude toward mathematics then the process of teaching mathematics would be challenging, and there would be fewer enrollments of students in mathematics courses (Berry and Picker 2000). Similarly only after investigating students' images of designers can one learn their perceptions and intervene to make changes in these perceptions.

### Rationale of the study

Design according to Archer (in Cross 2006) and Cross (2006) is the third culture, different from the established cultures of the Sciences and the Humanities. According to Cross (2006) design is a natural ability possessed to some degree by all individuals. We consider design to be a discipline, a process and a product. As a discipline it explores the relationship between the user, the product and the contexts in which the product is used. As a

process it refers to the intentional, iterative problem solving process that converts ideas into systems or products. As a product it may refer to the outcome of the design process such as specifications, sketches, models or shape of the products. Design can thus be considered as a problem solving process employed by professional designers who move through a series of iterative steps to create design solutions to meet people's needs. They integrate different kinds of knowledge and skills to solve these ill-structured problems.

As an aspect of technological literacy, Design and Technology (D&T) education is already a part of curriculum across the world for more than a decade. The importance of D&T education in the current scenario cannot be underestimated since it offers opportunities for students to develop innate abilities to *solve real world problems, to manipulate images in the mind's eye* and to develop a wide range of abilities in the *non-verbal thought and communication* (Cross, 2006). Although, in India educational researchers have been exploring the possibility of introducing D&T in Indian classrooms (Khunyakari, 2008; Mehrotra, 2008; Choksi et al., 2006; Authors, 2009; Authors, 2010; Shome, Shastri, Khunyakari and Natarajan, 2011; Shastri, Khunyakari, Chunawala and Natarajan, 2011), Indian school curriculum still lacks design or technology education.

Although design is an integral part of our need to adapt to any situation by creating artefacts and tools, it is variously perceived by philosophers and lay people. The possibility of varied interpretation of design has also led to confusion among fledgling designers and has propagated a manufactured image of design and designers among the general public. The matter is further complicated since design has been transformed to something banal and inconsequential by the media. According to Heskett (2002) design today is assigned a lightweight and decorative role for fun and entertainment, and is considered useful only for monetary profits.

In the Indian context, it is more likely that students' ideas and images about design and designers are spontaneous and not learnt in school. Their ideas would be influenced by several factors other than schools like media, peers, parents, etc. The documentation of the ideas held by these non-tutored D&T students has implications for curriculum development. A recent study on Indian students' understanding of design and designers revealed that although we are surrounded by products of design in our everyday lives, students often do not understand what designers do (Authors, 2011). They often attribute an artistic role to the designer who is seen as more

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concerned with making things attractive, beautiful and fashionable for users. The authors reported that though students showed a fair understanding of the skills associated with designers, most of them failed to recognize planning as the central feature of designing. The authors echoed what de Klerk Wolters (1989) suggests, that is, curriculum developers should take students' interests, opinions and needs into account while developing technology curricula.

## Objective of the study

Several studies have been conducted to study students' perceptions of and attitude towards scientists, mathematicians and recently engineers. However, none of the studies explored students' images of designers. The objective of the present study was to explore the kind of images of designers held by Indian elementary and middle school students and to study whether these images of designers differed by gender. For the purpose of this paper, we focus on students' ideas of designers based on their drawings.

## Research questions

- 1) How do Indian elementary and middle school students pictorially depict a designer and his/her workplace?
- 2) What activities do they associate with designers?
- 3) How do students' images of designers vary by gender?

## Methodology

This study used a survey design and data were collected through a questionnaire distributed to upper elementary and middle school students in Mumbai.

## Sample

The questionnaire was administered to 511 students from an urban school located in Mumbai, in the vicinity of the researchers' institution. The sample consisted of students from Classes 5, 6, 7, 8 and 9 and ranged in ages from 9 to 15 years (Table 1). The school was co-educational

consisting of almost equal number of boys and girls in each class. The students' linguistic background was varied, with most students reporting different Indian languages spoken at home while the medium of instruction in the school was English. The instructions given by the researcher were also in English.

## Questionnaire

The larger questionnaire included several tasks and parts of it have been published elsewhere (Authors, 2011). The present paper reports only the drawing task. This task was adapted from Chapman's DAST (1983) and there were some questions based on Fralick et al's (2009) questionnaire on engineers and scientist. The drawing task featured an enclosed area where the students were asked to 'Draw a designer at work'. The task also included written responses in addition to the drawings. Below the drawing space the following questions were included:

1. *What is the name of the designer you have drawn?*
2. *The designer in your drawing is Male/Female (Circle any one)*
3. *Where is the designer working?*
  - i. *Indoor / outdoor (Circle any one)*
  - ii. *Home / office / other \_\_\_\_\_ (Circle any one)*
  - iii. *Village / town / city (Circle any one)*
4. *What is the designer in your drawing doing?*

Two experts in the field of D&T education and one professional designer and designer educator scrutinized and validated the questionnaire. Their critical comments and suggestions were incorporated into the final version.

## Procedure and data collection

The final questionnaire was administered to all students on the same day during the school hours. Three teacher volunteers from the school helped in administering the questionnaire. Students completed the drawing task before attempting the descriptive parts of the questionnaire. On an average, students took about 30 minutes to complete the drawing task.

Classes	Average age (yrs)	No. of boys	No. of girls	Total
Class 5	9.4	35	40	75
Class 6	10.4	57	61	118
Class 7	11.2	61	47	108
Class 8	12.4	43	52	95
Class 9	13.3	56	59	115
Total	11.4	252	259	511

Table 1. Sample for the study

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## Data analysis

The first author went through the drawings of all the students and examined each of the drawings for; the physical appearance of the designer, objects depicted, work settings and actions portrayed. A checklist, developed by Fralick et al (2009) consisting of the following indicators (1) Appearance of Engineer/ Scientist, (2) Location, (3) Objects, and (4) Inferences of Actions, was modified by adding; dresses and accessories worn by the designer and different kinds of designers depicted. The next step of data analysis involved descriptive analysis using SPSS for frequencies and cross tabulations of students' responses across gender and grades. The modified checklist is presented in Table 2.

Characteristics	Human / Non human figure
Appearance	Number (number of human figure/s; designer/ client/ user) Gender (male or female human figure) Age (young/ middle aged/ old human figure) Other Attributes (dress/ accessories worn by designer)
Location	Indoor / outdoor Home / office / other Village/ town / city
Objects	Tools depicted (writing tools/ construction tools) Products of design depicted (plans/ model/ cars) Artefacts other than tools and products of design (furniture)
Inferences of actions	What the designer was doing - explicitly mentioned or portrayed Designer's professions - explicitly mentioned or portrayed

Table 2. Checklist used for analysing the drawings

## Results

### 1. Appearance

#### i. Human / Non human figure

Twenty nine (6%) students did not draw any designer in the space provided and these questionnaires were excluded from the analysis. Of the remaining 482 drawings, most students portrayed a person (96%) while 19 students (4%) drew non-human pictures in the space provided. The non-human drawings included drawings of flowers, patterns and artefacts like dresses, cars, airplanes and robots.

#### ii. Number

The designer was often drawn as working alone (99% of those who drew a human figure). Only 4 students drew more than one designer working together and all four of them depicted hierarchy among the figures. Two of the designers were architects and two were interior designers depicted as giving instructions to their subordinates (Fig. 10). The subordinates (mentioned as designers by the students) were shown as painting walls. Interestingly all these 4 students were from Classes 5 and 6. None of the older students drew more than a single designer. The large number of students drawing a solitary designer indicates that they consider designing activity as an individualistic activity and not a team work. It is important to note that it is not the inability to draw human figures that prevented students from drawing more than one designer. This can be supported by the fact that 41 students (9% of those who depicted only human figures) did draw other human figures in their drawings as customers, clients with whom the designers were working and usually models in case of dress/fashion designers (Fig. 1).



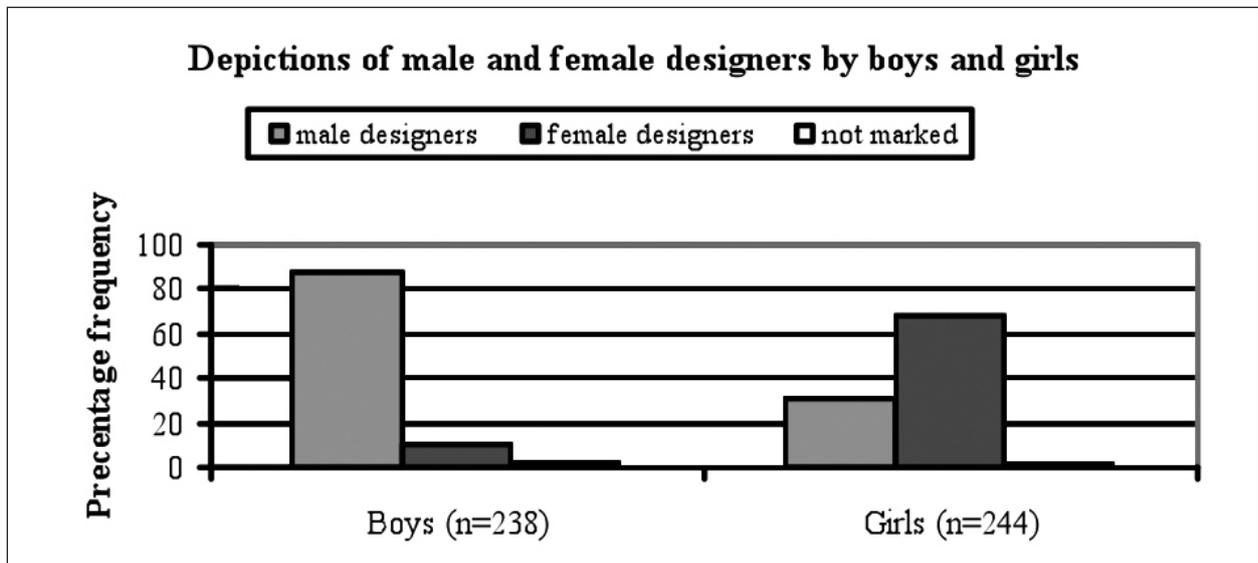
Figure 1. A young female designer dressing up a female model, (a girl of Class 8)

The analysis of students' writings revealed that of these 41 students only 13 referred to the other human figure as a client or a customer in their writing. However, another 37 students did mention in their writing that their designers were designing for some user/customer (mostly celebrities and models) though they did not portray the users.

#### iii. Sex

Students were asked to write whether their drawing represented a male or female designer and the mentioned gender was noted for all the drawings whether human or non-human. When the gender was mentioned

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Graph 1: Depictions of male and female designers, gender wise

by students (475; 98%), it was found that 59% of the students indicated their designers were males and 40% indicated that their designers were females. About 1.5% (7 students) did not mention the gender of their designers. In 2 of these 7 cases, the gender of the designers could also not be ascertained from the drawings while 5 had drawn non-human figures and hence did not mark the gender. The number of male designers depicted was significantly higher than the female designers [ $X^2 (1) = 165.330, p = .000$ ]. It can be seen from Graph 1 that more boys drew male designers while more girls drew female designers and the number of boys depicting male designers (87%) was significantly higher than the number of girls (68%) depicting female designers [ $X^2 (2) = 166.678, p = .000$ ]. This result is consistent with the findings in other drawing tasks where male figures are mostly drawn by boys while female figures are more often drawn by girls (Huber and Burton, 1995; Chambers, 1983; Chunawala and Ladage, 1998; Knight and Cunningham, 2004; Capobianco, Diefes-Dux, Mena and Weller, 2011).

However, the reasonable representation of female designers by students reveal that they did not associate the profession of designing as a predominantly male profession, unlike the findings on students' conceptions of scientists (Mead and Metraux, 1957; Chambers, 1983; Fralick et al., 2009; Finson et al., 1995; Chunawala and Ladage, 1998) and engineers (Knight and Cunningham, 2004; Fralick et al., 2009; Karatas, Micklos and Bodner, 2011; Capobianco et al., 2011) who are predominantly represented as males by students.

It was also observed that older students depicted more female designers than male designers. An interesting thing to note is that, regarding drawings of scientists there is an increase in stereotype with respect to gender, that is, fewer female scientists are depicted by older students (Chambers, 1983; Newton and Newton, 1998). In the present sample, however, the finding was contrary. However most of these females depicted by older students were stereotypically shown as dress/ fashion designers.

#### iv. Age

Judgment on the age of the depicted designers was subjective, based on the appearance of the designers, such as their physical appearance, presence of moustache or beard, dressing style etc. For the purpose of categorization, the "young" were considered to be below

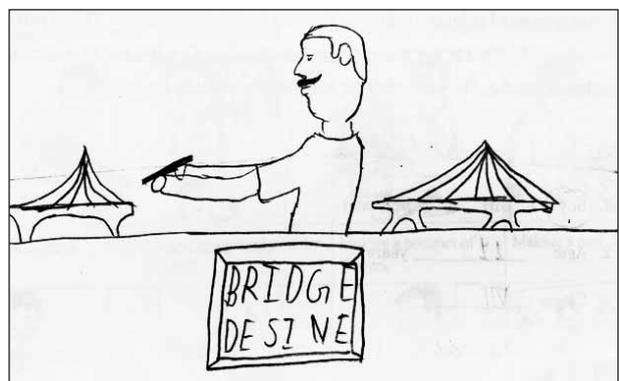


Figure 2. Middle aged male designer working on a 3D model; (Class 7, boy)

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30 years, "middle-aged" as between 30-60 years and "old" as above 60 years. Around 78% of the students depicted designers as young (Figs. 1, 3, 4, 6-8, 10-12); 8% of the students depicted the designers as middle-aged with a moustache on male designers (Figs. 2, 5, 13); and only 2 students depicted designers as old with beard and moustache and wrinkles.

Overall designers were depicted as young. This is different from the stereotypic image of an old scientist held by western students (Mead, and Metraux, 1957; Chambers, 1983). Interestingly Indian students have also been reported to depict scientists as young (Chunawala and Ladage, 1998).

### v. Other Attributes

Many students (55%) depicted their designers in modern outfits, such as trousers and shirts for male designers (Figs. 3, 5, 10, 13) and skirts and top or frock for female designers (Figs. 1, 4, 6). Around 9% depicted their designers in Indian dresses such as dhoti or kurta for male designers and saree or salwar kameez with dupatta for female designers (Figs. 8, 11). About 27% of student's drawings were not clear enough to recognize the dress worn by their designers (Figs. 2, 7, 9, 12). Both boys and girls, attempted to depict trendy or stylish dresses for the fashion designers but not for the other designers (Figs. 1, 3, 4). Regarding the overall appearance, students depicted designers in neat and tidy clothing. In fact most students were preoccupied with fashion and good appearance of the designers. Girls seemed to take some effort in drawing the designer's dress in detail. About 29% of the students

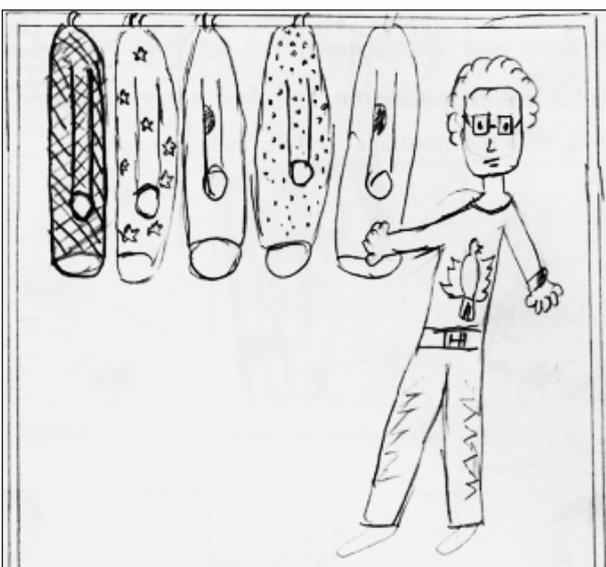


Figure 3. A young male dress designer in trendy outfit, selecting a dress, (Class 7, boy)

(mostly girls) showed the designer wearing accessories such as earrings, necklaces and bangles for female designers (Figs.1, 6, 11) and glasses, helmet or turban for male designers (Fig. 5).

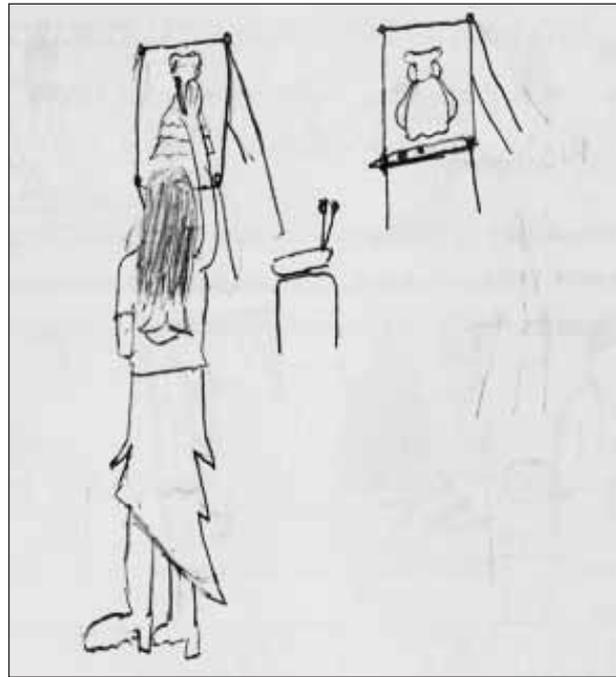


Figure 4. A female dress designer in western outfit, sketching, Class 8, girl

In a study on public's attitude and perception towards engineers and engineering (Marshall, McClymont and Joyce, 2007) it was found that when the engineers were conceptualised as designers, people tended to perceive them as 'cool-looking'. This finding regarding the neat and tidy designer is also in conformity with the Indian students' depiction of scientists where Indian students depicted the scientists as tidy and neat persons (Chunawala and Ladage, 1998) in contrast to the western stereotype of a clumsy and untidily dressed scientist (Chambers, 1983; Mead and Metraux, 1957).

## 2. Location of the designer

### i. Indoor/ outdoor

While reporting the location of where the designer is working, about 69% of students reported that their designers were working indoors while 31% marked outdoors. Even in the depictions, most of the backgrounds suggested an indoor location (43%). For example, students made use of vertical lines and perspective, or depicted furniture around to depict the indoor location (Figs. 1, 6, 10, 11). For the outdoor location, students depicted natural objects like sun, trees or mountains (Fig. 7).

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It is interesting to relate this study with studies on students' depictions of scientists and engineers. Fralick et al. (2009) found that engineers were depicted outdoors by students twice as often as indoors, whereas scientists were depicted twice as often indoors than outdoors. This could be due to the nature of the activities assigned to them. Designers who were shown as sketching, painting, decorating, making/modelling things, were depicted indoors more often than outdoors. Designers shown in indoor location were usually dress makers or fashion designers while those depicted in outdoor location were usually painters, architects and few engineers.

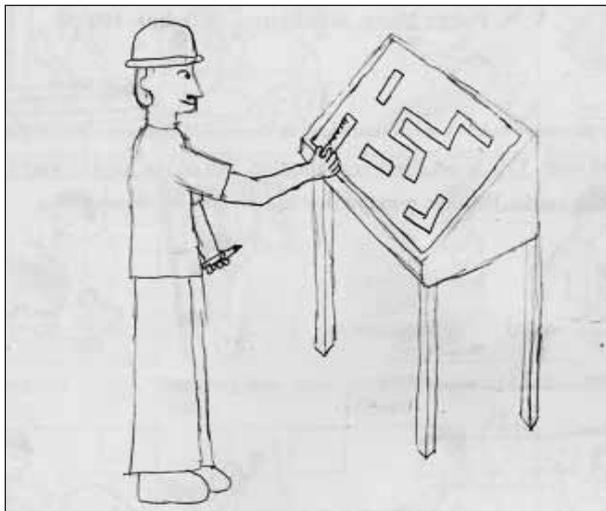


Figure 5. A middle-aged male designer, sketching (Class 9, boy)



Figure 6. A young female designer, sketching (Class 6, girl)

### ii. Home/ office/ other

Within the indoor location, about 38% of students reported that their designer was working in an office (Figs. 1-4, 9, 13) while 30% indicated their designer was

working at home (Figs. 6, 8, 10, 11). Around 26% of students indicated different locations such as factories, plants, ramps in fashion shows, etc. The designers working at home were usually females (Figs. 6, 8, 11).



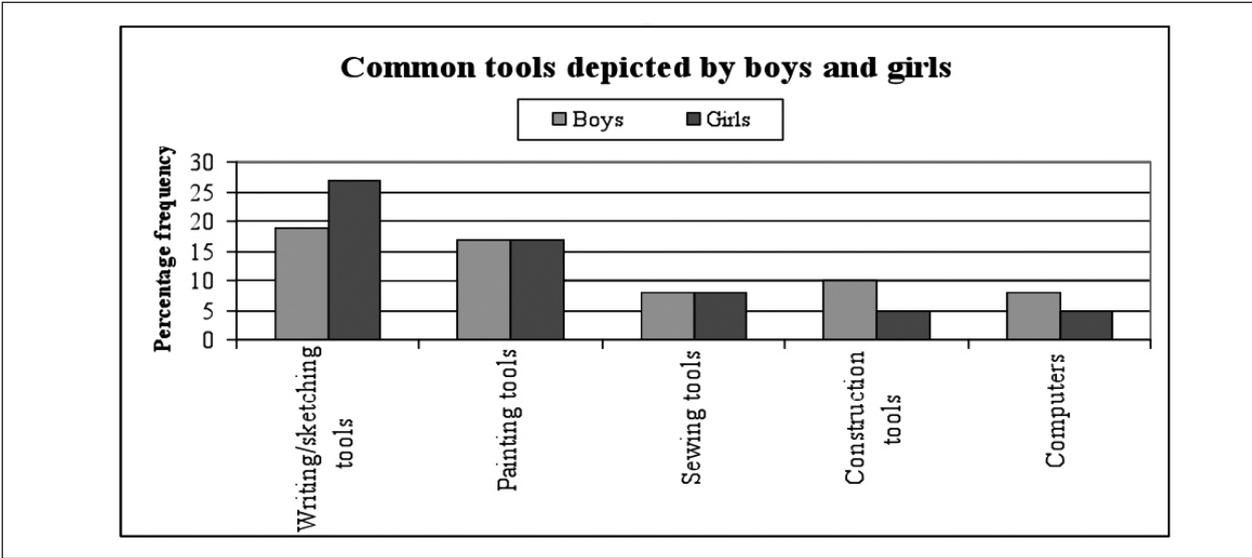
Figure 7. A young male designer, painting in a village (Class 9, boy)

### iii. Village/ town/ city

Majority of the students (72%) mentioned in their writing that the designer was working in a city (Figs. 1-6, 8-13), 14% stated the designers were working in towns while 6% of students indicated the designers were working in villages (Fig. 7). A large number of students depicting designers as working in cities can perhaps be explained by the fact that these students were themselves urban. The designers depicted in the cities belonged to a variety of professions such as fashion designing, architecture, interior designing, engineering and art. In contrast, those depicted in towns and villages were not just limited in number but also in variety of professions. They were usually artists (painting landscapes), engineers (working in factories) and a few potters.

A large percentage of students indicating that designers work in offices and at home, reflects students' understanding that designing was both a professional as well as a non-professional field. As a professional activity, students seemed to perceive design as a 'white-collared' job in contrast to the 'blue-collared' job mostly assigned to engineers in other research studies where engineers are often shown as labourers fixing machines and engines and working outdoors (Fralick, Kearn, Thompson and Lyons, 2009; Karatas, Micklos and Bodner, 2011). Designing as done at home is reflected in the work of people such as homemakers, tailors, artists. However, the fact that most designing at home was done by female

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Graph 2. Common tools depicted by boys and girls

designers (drawn mostly by girls) suggests that more girls than boys considered design as an everyday act.

### 3. Objects

#### i. Tools

Tools are items that help us accomplish a task in hand. People often choose appropriate tools to perform the intended task. Thus the choice of tool gives an indication to the task being performed. Each drawing was analyzed for the tools in it (Figs. 4-10). The variety and frequency of tools depicted in students' drawings is represented in Graph 2.

As seen from Graph 2, the most frequently depicted tools included: writing tools, painting tools, sewing tools,

computers and construction tools. Writing tools usually included pen, pencil or chalk while painting tools included paint brush, palette and canvas. Construction tools usually included hammer, saw and paint brushes and dispensers for painting walls. Ten students (2%) showed a mixed set of tools in their drawings indicating more than one step of the design process. For example, a combination of writing tools and sewing tools or writing tools and painting tools (Fig. 10) suggest that the students have depicted their design process beyond the conceptualization phase. In Figure 10, the student shows the interior designer with the writing/sketching tool, instructing his subordinate designer who is shown to be painting the walls using the painting tools.

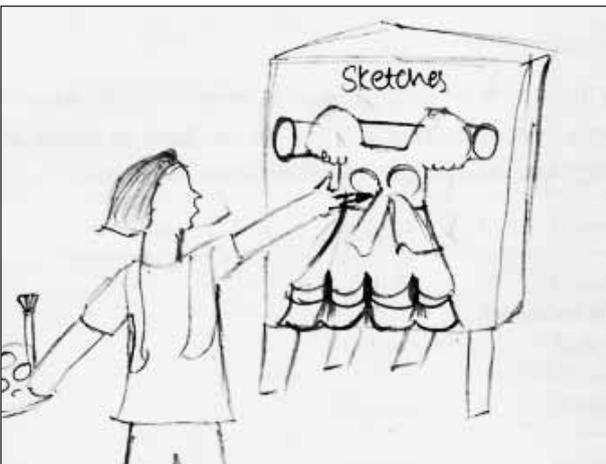


Figure 8. A female designer using painting tools for designing a dress (Class 9, girl)

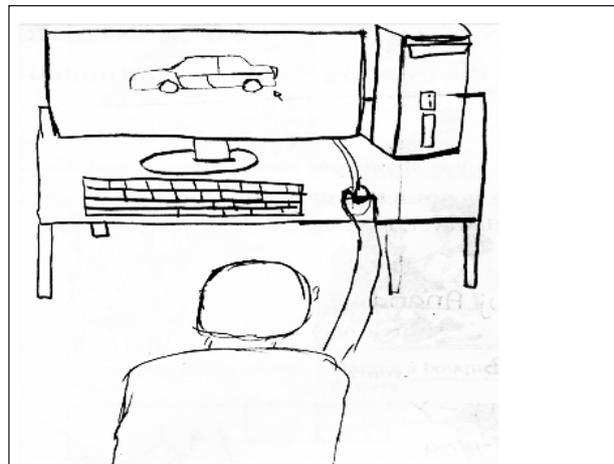


Figure 9. A male designer designing on computer (Class 8, boy)

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As seen from Graph 2, overall more girls than boys depicted writing/sketching tools. However slightly more boys than girls were found to depict their designers as sketching (Table 3). This apparent discrepancy could be explained by the observations that although many girls depicted the writing/sketching tools in their drawings, indicating that writing/sketching has occurred, their designers were engaged in different activities such as displaying their work (Fig. 11), making something, or just handling things. About 8% of students depicted construction tools usually a painting brush (for painting walls as in Fig. 10) and a hammer. Only about 6% depicted computers as tools for designers (Fig. 9).

### ii. Products of design

Products of design include those artefacts which are created during the process of design (such as sketches, blueprints, models) and those which result from designing (finished products like dress, paintings, cars, buildings). The artefacts which were created in the process of design were coded as 'process products' and usually entailed a conceptualization phase of the design process. The artefacts which were created as the result of the design were coded as 'designed products'. Any attempt by the students to depict either of the artefacts were coded accordingly and matched with the writings of the students. If a student depicted an artefact such as a car without indicating anything in the writings, it was labeled as 'unclear'. If the student mentioned that a designer has designed the car, it was coded as 'designed product' and if the student showed the designer working on a sketch of a car either on paper or on computer, it was labeled as 'process product'.

Students depicted the 'designed products' (either finished or incomplete) (Figs. 1, 3, 6, 7, 10-13) more often (52%) than the process products (either complete or incomplete) (Figs. 2, 4-6, 8-11) (21%). Very few students (3%) depicted both the type of products (Figs. 6, 10, 11). A cross tabulation across gender revealed that about 75% students depicted the products of design in their drawings (Figs. 1-13). There was no significant difference found between boys and girls in depicting the products of design as represented in Graph 3.

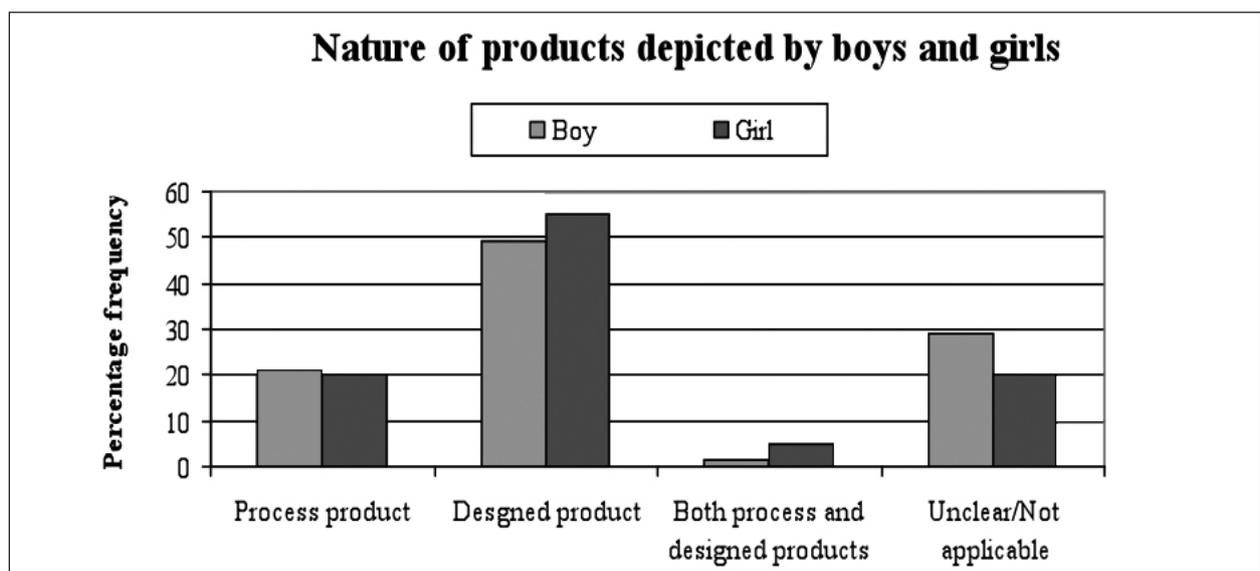
### iii. Artefacts other than tools and products of design

Students' drawings were also analysed for the artefacts other than the tools and products of design. Nearly half the students (45%) depicted furniture, mostly desks, chairs and easels. Mannequin/hangers were the next artefacts that were very common in about 14% of students' drawings. Girls, significantly more than boys, depicted mannequins/hangers [ $2(1) = 12.97, p = .000$ ] (Figs. 6, 11). Girls were also found to depict fashion/dress designers more often than did boys and thus had the need to depict mannequin/hangers (Graph 4). Other artefacts depicted by few students were cars and buildings which were not indicated as products of design unless mentioned by students in their writings.

### 4. Inferences of actions

#### i. What the designer was doing

Attempts were made to infer the actions of designers depicted in students' drawings. An action was coded as working when a student has attempted to show some activity through a moving hand/s, or holding a tool/artefact



Graph 3. Nature of products of design depicted by boys and girls

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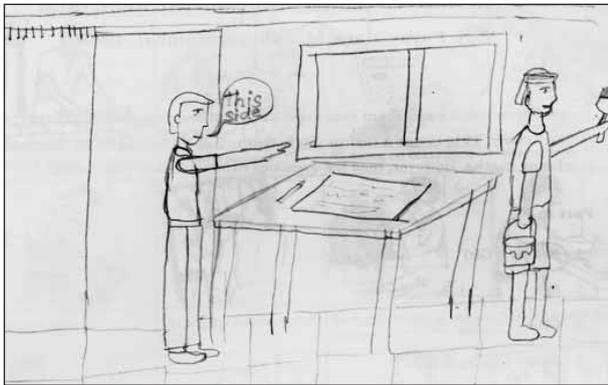


Figure 10. A male designer giving instruction to a subordinate designer (Class 6, boy)

in hand, working with tool/artefact. The actions depicted in the drawings were then matched with the description given by the students.

However, in cases where the descriptions did not match the drawings, the actions were coded on the basis of what was shown in the drawings and not what the student wrote. For example if a student wrote, 'He is designing the interior of a house', and the drawing by the student suggested the designer to be giving instruction to somebody then it was coded as 'giving instruction' (Fig. 10). Again for example if a student just wrote, 'the designer is designing', while actually the drawing represented a person painting walls, then the action was coded as 'painting walls'. Coding in this way allowed the researchers to list the kinds of activities that students considered as designing, or which they thought were subsumed in designing. Most students (90%), including about equal number of boys and girls showed their designer as working. Both boys and girls equally showed their designers working.

Table 3 represents the top ten depictions of designer's actions based on gender. The activity that was depicted by 20% students was sketching (on paper or on computer) (Figs. 4-6, 8, 9). The other activities that were depicted by students as designer's actions were doing artistic work (18%; Fig. 7), making/modeling (16%; Figs. 2, 13), displaying (11%; Fig. 11), handling things (6%), reading/writing (5%), trying/testing (5%), doing personal work like cooking, playing (4%), doing manual labour (4%; Figs. 10, 12) and operating on something (3%). Many students, both boys and girls (18%) showed their designers engaged in some artistic work like painting, decorating, doing embroidery or making some patterns on clothes etc. As seen from the table, there was little difference between the number of boys and girls in depicting the different actions of designers except for the activities of 'making', 'displaying' and 'testing'.



Figure 11. A female dress designer displaying her work (Class 6, girl)

Designer's action inferred	Total %	Boys n=238	Girls n=244
Designing (sketching)	20	21	20
Art work (painting/ decorating)	18	17	18
Making, modeling, repairing	16	21	11
Displaying /advertising	11	7	14
Handling things	6	6	6
Trying, testing, evaluating	5	3	7
Personal work (playing, dancing)	5	5	5
Reading /writing/observing	4	4	5
Labour (painting walls, laying bricks)	4	5	4
Operating on, driving	3	2	3

Table 3. Designer's action depicted by boys and girls

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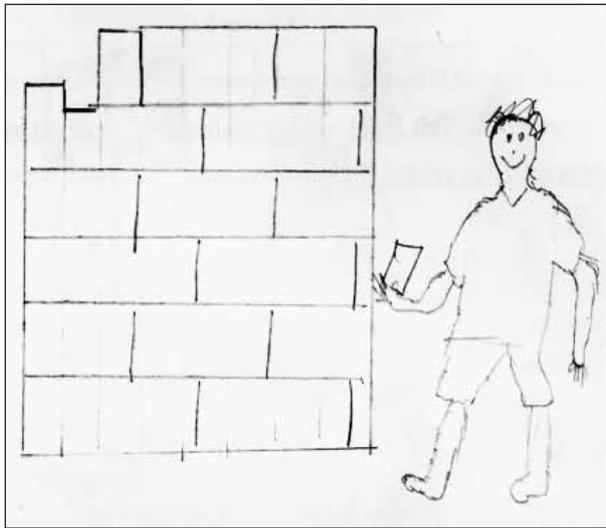


Figure 12. A male designer laying bricks on walls (Class 5, boy)

More boys than girls depicted their designers as making (Fig. 13), modelling (Fig. 2) or fixing some things (Fig. 12). Designers were usually shown to make dresses and buildings (Fig. 12). Boys also depicted their designers as making/fixing cars and robots (Fig. 13). More girls than boys showed their designers as displaying their products either through literal display (Fig. 11) or through modeling like walking on the ramp in designers' clothing. A display of products by designers represents the completion of the design process and thus represents students' emphasis on the final products of design. More girls depicted their designers as testing or evaluating the products (mostly dresses). The testing or evaluation of products was shown

by dress designers through trials of the dresses on models (Fig. 1) or mannequins.

## ii. Designers' professions

This section describes how students differentiated designing as a profession. It describes the kinds of designers (dress designers, interior designer, etc.) that students depicted in their drawings. Graph 4 represents the characterization of designer's professions as depicted by boys and girls. The professional that was mostly portrayed by students as designers was a dress/fashion designer (33%; Figs. 1, 3, 4, 6, 8, 11). It was found that more girls (42%) than boys (24%) depicted dress designers. Also,

except a few depictions, most of these dress designers were females. A cross tabulation analysis between gender of designer and the professions assigned to them were done. A significant difference was also noted in the depiction of more female fashion designers (17%) than male fashion designers (6%) [  $\chi^2(1) = 14.259, p = .001$ ].

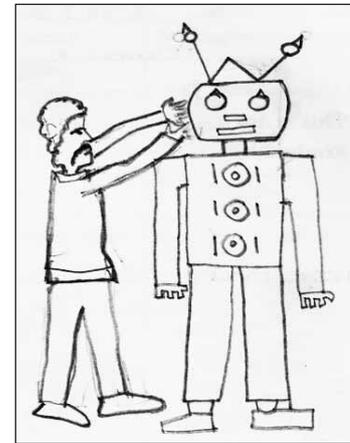
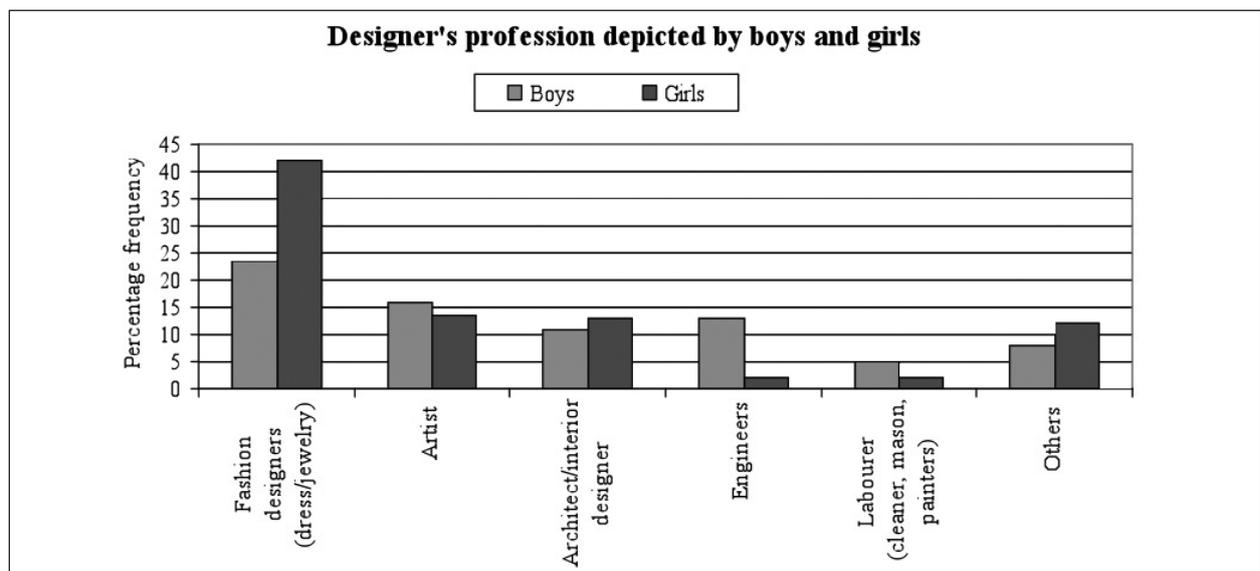


Figure 13. A male robot engineer making a robot (Class 6, boy)



Graph 4. Designers' professions depicted by boys and girls

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Both boys and girls thus seemed to have assigned a gender and professional stereotype to their drawings by depicting more female dress designers. Owen (2005) suggests that there is confusion among the general public about the nature of design due to the extensive use of the word 'design' to mean fashion. While fashion designers are stylists mostly concerned with the aesthetics without much regard to functionality, performance or human factors, other design professionals do not deal with aesthetics exclusively. Perhaps this leads to the strong association of design with beautification or aesthetics among the general public.

In this study, more girls than boys were found to assign an occupational stereotype by depicting more female fashion designers than any other design professionals. This could perhaps be due to more exposure to fashion and trends in style in girls than in boys. According to Willemsen (1998), in many countries, the general interest magazines for teens are actually meant for girls consisting of gender stereotypic contents, whereas the teen magazines for boys are rare or do not exist. If there are magazines for boys, they usually cover topics which may be of interests to both boys and girls.

Other professionals depicted were artists (15%; Fig. 7), architect/interior designers (12%; Figs. 2, 5, 10), car/robot engineers (7%; Figs. 9, 13), labourers (4%; Figs. 10, 12) and others such as a scientist, models, teachers, doctors etc (10%). More boys (13%) than girls (2%) depicted their designers engaged in engineering work and depicted designers mostly related to software, car (Fig. 9), civil and robot (Fig. 13). Students' drawings showed considerable evidence of designers of mostly one profession: dress/fashion designing. These images were present through the products of designing like dress, clothes, and sketches. This is in agreement with the previous research findings wherein most students in their written responses, gave examples of dress/clothes as things that are designed while fashion designers were the most cited examples (Authors, 2011).

An interesting observation was that though younger students depicted more artists in their drawings they also depicted more cars and robot designers (13%) and less fashion/dress designers. A plausible explanation could be their limited awareness of the popular media and less identification with the culture of fashion than the older students who are more familiar with the popular media and hence more influenced by fashion.

### Conclusions

The survey provides useful insights into Indian middle school students' images of designers. These students had no D&T education in their school curriculum. The findings of this study indicate that students have preconceived ideas about design and designing. Many students, especially the older students associated designing with fashion designing while younger students associated designing with artistic work like painting and sculpturing. Students primarily conceptualized a designer as a fashion designer, artist, architect, engineer and a few even as a laborer. Younger students seemed to conflate artists such as painters with designers. Older students were more likely to think that designers are involved in designing dresses and to a lesser extent buildings and machines. According to students' depictions, the work of a designer involved sketching, painting, displaying their prepared products, or making or fixing, and using artefacts such as dress materials, writing tools and painting tools.

Our earlier findings on students' understanding of design (mostly as art) through their written responses (Authors, 2011) are consistent with the findings in the present study where students depicted artists painting landscapes or engaged in some artistic work. Students' writings and drawings both are indicative of the fact that students related design more with art and less with engineering and technology. Research studies on students' attitudes towards technology have found students' strong association of technology with computers, electric and electronic equipments (Khunyakari, 2008; Jarvis and Rennie, 1998; Mehrotra, 2008; de Klerk Wolters, 1989). Even students' drawings of engineers revealed students' depiction of machines, vehicles, rockets and robots (Knight and Cunningham, 2004; Cunningham et al., 2005; Fralick et al., 2009; Karatas et al., 2011; Capobianco et al., 2011). In the present study however, students were not found to mention or depict any electrical or electronic equipments or machines as designed product. This observation can be extended to the analysis that students were not able to see any strong link between design and technology or design and engineering.

Both boys and girls seemed showed a gender and professional stereotype in their drawings by depicting more number of female dress designers. Interestingly, these stereotypes seem to grow progressively stronger with age, with older students depicting more female dress designers. A large number of students depicting dress/fashion designers may be the influence of the association and use of the word design with dresses. Colloquially, the word design is used to represent any pattern or form of

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dresses. It is one of the most common words in a conversation between a customer and tailor in India. It can also be due to the prevalence of only a few kinds of designers such as fashion or interior designers in the commercial media namely television, hoardings and magazines.

Among the designerly activities depicted by students, sketching was the most predominant one. However the act of sketching was shown more by older students than the younger ones, suggesting that older students have started to develop ideas of the nature of design. Even though planning was nowhere mentioned in the descriptions of students' drawings (except a few), at least a few older students seemed to have an idea of the nature of work that designers engage in; quietly seated at a desk and sketching. Very few students, however, mentioned the work of designers as planning or modelling. Only 4 students depicted signs of thinking such as a bubble to depict a thinking activity in their drawings. Just as in the written responses where very few students invoked more than one step of the designing process, namely ideation and making/modelling (Authors, 2011), even in their drawings, few students showed evidence of more than one step of designing process by depicting both 'process' products (such as blueprints, sketches) and 'designed' products (finished products). This merging of the design phase with the making phase was also evident from students' depiction of solitary designers who themselves were engaged in designing and making.

According to Mitcham and Holbrook (2006), before the Industrial Revolution design was 'hidden' in the act of making. Craftsmen and artisans were themselves designers, makers as well as the users. During Industrial Revolution, design became distinct from the act of making with the invention of mechanical processes and increased mass production. Designers were required who would contemplate about the structures of the products such that it can be mass-produced using technology. Design thus became a means of constructing the final product without undergoing trial and error, which otherwise would incur money and time. Students in the present sample seemed to have assumed that designing includes making the artefacts as well. This finding confirms our finding in our previous work where a large number of students assigned designing ability to animals on the basis of their home making activities (Authors, 2011). This is not surprising since students lack the understanding about the nature of design activity. Also, in India the culture of craft is still embedded in the lifestyle of people and continues to play a significant role even in the modern lives of people.

An aspect about designer's work that got revealed only in students' writings but not in their drawings was the location where a designer worked. It is important to note that while the general perception of the activities of science is usually restricted to the laboratories (Mead and Metraux, 1957; Chambers, 1983; Chunawala and Ladage, 1998; Fralick et al., 2009), those of mathematicians to classrooms (Picker and Berry, 2000) and engineers to factories (Cunningham et al., 2005), designing seems to be perceived both as a professional and as well as an everyday activity.

Students' indication of the designer's location as office indicate that they perceived design to be a professional and 'white-collared' job in contrast to the 'blue-collared' job mostly assigned to engineers. Again students' indication of designers' location at home seemed to suggest that many students considered designing as an everyday act that can be pursued even at home. However, the activity depicted as being pursued at home mostly involved artistic work, such as painting, decoration, mostly depicted to be undertaken by females. Designing as students understand, is also reflected in the work of people around them such as a homemaker, a tailor, an artist, and even labourers and construction workers. On the one hand, this perception is fruitful, since students consider designing activity as something which is accessible and done by all. On the other hand, it restricts their perception about design as something which is trivial, commonplace and rendered superficial.

While a scientist is represented as an eccentric male wearing a laboratory coat, designers were shown dressed neatly and often trendily. Students' ideas and images of any profession and their practicing professionals are very important since students' perceptions of professions are closely related to the choice of their careers (Knight and Cunningham, 2004) and images of those occupations (Gottfredson in Glick et al., 1995). If students believe that designers are artists or fashion/dress designers or women who should be well dressed/groomed or beautiful to look at, and that designing involves soft skills such as decorating or making things attractive then certain groups of students (those academically and scientifically inclined) are less likely to consider design as important for their career. A designer can be considered an artist to the extent that he/she bring a sense of aesthetics into his/her design, but designing is much more than mere aesthetics and decoration. The findings of the study reveal that Indian middle school students have an incomplete understanding of design since they associate the work of designers more with artistic design than with technology. As Heskett (2002) pointed out that the part should not be mistaken for the whole, educating these students that

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designing is not just about decoration may lead more students to consider design as an option of study.

The scientifically and technologically advanced world demands citizens who are not only scientifically literate but also technologically sound; citizens who have the ability to look for problems in society and design solutions for them as well as citizens who look beyond the superficial appearance of products that they would purchase and use. If students consider design as something artistic, it would be difficult for them even to evaluate their everyday products on design grounds. They would face difficulty in engaging in authentic design activities, wherein they need to work in teams, recognize problems, identify and implement possible solutions, work within constraints, construct models and evaluate their solutions. Thus understanding the nature of design and the way in which designers work will assist students in participating to future design developments and discussions, as well as make use of designed products and appraisal in a critical way.

Engaging students in authentic design activities can provide students with exposure to the types of activities that designers engage in. A student may realize what it means to design and the types of concerns a designer needs to consider while designing. It would also allow students to understand the interdisciplinary approach to design and how designers need to bring different kinds of knowledge, besides scientific knowledge (for example, technical understanding, knowledge about materials, costs, risks, etc.), skills (for example skills of using different tools, selecting appropriate tools for the task in hand, critical and creative thinking, drawing, using scientific and technological tools etc), and values (aesthetic, economic or moral values etc.) in designing a solution for a real world problem.

Learning about students' ideas about design and designers is important to plan for the future design and technology education. From the constructivist point of view, it is important to assess what the students already know and understand about designing, and what their past experiences with design have been. If we desire that our students should progress from naive thinking about design to an expert thinking about design, we first need to be aware of the prior knowledge that students come with, to the classroom. This prior knowledge of students needs to be refined and 'not replaced' (Roschelle, 1995).

The finding of this study will help instructors and curriculum developers in identifying the missing concepts of design among students and addressing them. Suitable design literacy programs in schools would help design

schools at the higher education/university level to attract innovative, young people to careers in design.

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