A Study Investigating Indian Middle School Students' Ideas of Design and Designers

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Abstract

This paper reports on an investigation into middle school students' naïve ideas about, and attitudes towards design and designers. The sample for the survey consisted of students from Classes 7 to 9 from a school located in Mumbai. The data were analysed qualitatively and quantitatively to look for trends in students' responses. Results show that Indian middle school students, who had no experience in design and technology education, demonstrated an incomplete understanding of what design is and what designers do. Most students considered design as some artistic rendering process where the designer is engaged in decorating or making things look attractive. Very few students suggested design as planning before making. Students demonstrated a good understanding of the skills associated with designers and showed a positive attitude towards designers and design learning. Insights from the study have implications for design curriculum development at the school level.

Key words

middle school, India, understanding design, attitudes

Introduction

We live in a designed world and find ourselves surrounded by things that are designed; the houses we live in, the clothes we wear, the chairs, pen and books we use, the buses we travel in, and even the food we eat. Since design seems to be so much a part of our everyday life, it is worthwhile and also interesting to know how it is understood and perceived by people.

According to Mitcham, (2001) the term design has its root in the Latin designare, meaning to 'mark out', 'trace', 'denote', or 'devise'; and that there is no etymological counterpart of the word design in classical Hebrew or Greek languages, suggesting that it is a modern concept. In the English language, 'design' can serve either as a noun or a verb. As a noun, design can mean a form, arrangement, pattern, blueprint, template, model, outline, plan, plot, scheme, or sketch. As a verb, design may mean to draw, to impose a pattern, or to produce a template for subsequent iteration. In yet another sense, perhaps as an adjective, design could mean something trendy or fashionable, for instance when we use the word 'designer' in connection with clothes or accessories. In fact we presume that 'designer' artefacts, even when mass produced, represent in some way the distinctive creative flair of the designer (Raizman, 2003).

Design and designers

What do designers do? Designers provide a detailed description, usually in the form of a drawing, of what an artefact should be like to those who will make that artefact. A designer thinks about the design criteria and requirements which are set by the client (technical or legal criteria), or set by him/herself (aesthetic and formal attributes). Designers are also concerned with the evaluation of their design proposals. A designer proposes more than a single design and before communicating them to the client, he/she tests those proposals, finally to accept or reject them (Cross, 1990).

Designing is intellectually demanding since designers need to be aware of the procedural and declarative knowledge (Lawson, 2005). Cross (2006) considers design ability as a form of natural intelligence possessed to some degree by everyone. This intelligence is comprised of the core abilities to (a) produce novel solutions, (b) work with incomplete information, (c) use drawings and other media as part of problem solving (d) apply imagination to problem solving and (e) resolve ill-defined problems.

Design education as part of general education

In India, design education is generally considered to be a specialist education intended at preparing future designers rather than educating the general population. But as Cross (2006) and Lawson (2005) pointed out design ability is possessed by everybody, and thus design should become a part of general education. It has its own ways of knowing, thinking and acting, different from the established cultures of the sciences and humanities. Design and technology (D&T) educationists throughout the globe, have echoed this idea and advocated 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 ever advancing scientific and technological society (Kimbell et al, 2002; Owen-Jackson, 2008).

Undoubtedly, ideas about design and designers are a part of technology education and being sensitive and critical to designed products is one of the aims of technological literacy (Martin, 2007). Since design and technology are so closely linked, it is essential that in this increasingly scientific and technological world, every student have an understanding of design and go beyond the superficial appearance of everyday products that they purchase and use. Our students are future consumers, manufacturers, engineers or designers. They need to have a critical attitude towards designed product and need to be aware of the

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way in which products/systems affect individual, society and environment. They must become considered users rather than passive consumers of designed products (Mclaren, 1997).

While D&T education has already become a part of school curricula decades ago in several countries worldwide, Indian school curricula neither include design nor technology education. Inspired by Mahatma Gandhi's philosophy of Basic Education, the Education Commission in 1966 introduced Work Education and Socially Useful Productive Work in schools. However, today these subjects have become an adjunct to the already lopsided literacy-numeracy curricula as they rely on recipes and non-reflective practices, rather than on reflective practices like designing. 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, Ara et al, 2009, Shome et al, 2011).

Students' ideas of design and designers

In science education, the intuitive concepts of students are well documented and are regarded as significant for teaching and learning. Research on students' ideas about and attitude towards technology, is around a decade old. In order to take account of students' interests and need in technology curriculum, the Pupil's Attitude Towards Technology (PATT) project was initiated (Ratt and de Vries, 1986), adapted and used across various countries and have provided useful insights into students' perceptions of technology (de Klerk Wolters, 1989; Khunyakari et al., 2009, Mehrotra et al 2007).

In the recent past, there has been an increased interest in integrating engineering education into technology education in US and UK primary and secondary schools (Hynes, 2010; ITEA, 2007). This has simultaneously attracted researchers to study students' perceptions, attitudes and understanding of engineering and engineers (Karatas et al., 2010; Fralick 2009). The common findings from these studies indicate that students consider engineers as males 'building buildings' and 'fixing engines'.

Not many studies have been devoted to students' ideas about design and designers. Also these studies are limited to those students who either have D&T education in their curriculum or had an exposure to the process of design. A study with Canadian and English students' and teachers' understanding of design found that students exposed to D&T curriculum tended to consider design as an activity such as making things or drawing (Hill and Anning, 2001). Another study with Georgian graduate students of

computer science and engineering fields revealed that these students tended to consider design as a product and not an activity, and associated designing with creativity, invention, brainstorming and arts and rarely with their own fields (Newstetter & McCracken, 2001). Welch et al. (2006) studied elementary students' naïve beliefs about design and designers and found that students have robust perceptions of design and designers which remain rigid even after completing designing and making activities (Welch et al., 2006). However, despite not being trained in D&T education, Welch's sample demonstrated considerable knowledge of what designers do and what skills they need to have. Donna Trebell (2009) complimented and reported similar findings.

The present study is significant because D&T has not yet been introduced as a subject in the Indian school curriculum. In this connection it is important to note that de Klerk Wolters (1989) suggests that it is important to take students' interests, opinions and needs into account while developing technology curricula.

Objective of the study

The objective of the present study was to study middle school students' naive understanding of design and designers.

Research questions

1) What do students understand by the term '*design*'? What ideas, activities, artefacts and occupations do they associate with '*design*'?
2) What activities, values, skills and qualities do they associate with *designers*?
3) What are students' attitudes towards design and design learning? Are there any gender differences in students' attitudes towards design and design learning?

Methodology

A survey was conducted with middle school students in Mumbai by a questionnaire in two phases: the pilot and the final version. The questionnaire was administered to 25 students of Class 7 in the pilot phase where eight of these students were also interviewed. The results of the pilot study, reported elsewhere (Ara et al, 2009), guided the framing of the final survey questionnaire.

Sample for the final survey

The final questionnaire was administered to 318 students, who were drawn from another school, but were comparable to the pilot. This sample consisted of students from Classes 7, 8 and 9 (10-15 year olds). This school was co-educational consisting of almost equal number of boys and girls in each class. The students' linguistic background

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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.

Another sample of 22 students (Classes 7, 8, & 9) volunteered to participate in interview-based sessions for responding to the final questionnaire. The interview sample was studying in the same school where the pilot questionnaire was administered. They could not be drawn from the school where the final questionnaire was administered as all the students from this school in the relevant grades had already filled the questionnaires. Table 1 presents details of the sample.

	No. of boys	No. of girls	Total
Questionnaire	160	158	318
Interview	12	10	22
Total	172	168	340
Average age (yrs)	12.3	12.2	12.3

Table 1. Sample for the final study

Questionnaire
The studies by Welch et al. (2006) and by Newstetter and McCracken (2001) informed the authors' construction of the questionnaire. The questionnaire included several open-ended and closed ended questions. However, only a part of the questionnaire is reported in this paper. The questions reported here are
• Open ended questions:
  – *'What comes to your mind when you hear the word design'?*
  – *Designers are people, who…(Complete the sentence)*
  – *Can animals design? Yes or no (circle one option); Give reasons for your answer.*
• Close ended structured questions on
  – *Attitude towards design and design learning*
  – *Nature of design*

Before the final survey, the questionnaire was evaluated for its validity for several aspects such as appropriateness of language in terms of age, gender and context, logical validity of the content, clarity and appropriateness of pictures and other content in terms of gender.

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
Students took about 75 minutes to complete the questionnaire (which also had a drawing task that is not analysed for this paper) which was administered during the school hours. The interview sessions with the students were aimed at detailed exploration of their ideas about design and designers. The same survey questionnaire was used in the interviews. However, the drawing task was omitted for the interview which was done on a one-to-one basis and took about 75-90 minutes for each student. The probing basically sought students' justifications/reasons for responses, and the interviews were audio recorded and transcribed verbatim.

Data analysis
Data analysis was done in two steps. The responses to the closed ended questions were coded using a pre-code (i.e. codes prepared before administering the questionnaire) while the open ended responses were coded using the coding categories that emerged from the data itself (D.A. de. Vaus, 1986). Two researchers coded the data. First one researcher coded a student's response and then discussed it with the second researcher. Confirmation on a code was done through mutual discussion and agreement with each other. The second step of data analysis involved descriptive analysis using SPSS to test the frequencies and cross tabulations.

Results
'What comes to your mind when you hear the word design?'
In response to the above question, all the students came up with a number of spontaneous ideas related to design. Of the 340 students, 306 (152 boys, 154 girls) students answered this question. The total number of ideas related to design suggested by students was 647 (306 by boys, 341 by girls) while the mean number of ideas was 2. The ideas suggested by students indicated the spontaneous associations that they made with the term design. Students' ideas were coded and categorized to find a general trend.

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The spontaneous ideas associated with design	From Boys (Nos.)	From Girls (Nos.)	Total ideas Nos. (%)
Ideas related to the meaning of Design (49%):			
– Art (art, painting, decoration, patterns, geometrical shapes)	73	90	163 (25)
– Drawing (drawing or scientific drawing)	23	22	45 (07)
– Making/transforming/repairing things	22	3	25 (04)*
– Plan/drawing to show how something is made	10	21	31 (05)
– Invention/creating new things	13	9	22 (03)
– Coming up with New idea/ theory/ imagination	10	9	19 (03)
– Shapes of things	5	3	8 (01)
– Keeping things in order	0	2	2 (less than 1)
Other ideas associated with Design (51%):			
Examples of things/artefacts designed	74	57	131 (20)
Examples of design professions	11	38	49 (08)
Attitude towards design and design learning	25	21	46 (07)
Skills associated with design/designers	12	23	35 (05)
Examples of design professionals	15	22	37 (06)
Attitude towards designed products (fashionable, attractive)	8	12	20 (03)
Design is for a purpose	4	5	9 (01)
Presence of design (present everywhere, required in every profession)	1	4	5 (01)
Total	306 (47)	347 (53)	647 (100)

Table 2. Student's spontaneous ideas associated with the word 'design' (* significant difference)

Table 2 indicates the different spontaneous ideas of students for the word design. The largest number of ideas (49%) was related to the meaning of the word design; design as art, drawing, plan, modeling/making, invention, new idea, shapes of things or keeping things in order.

About 25% of these ideas were related to design as art such as painting, decoration or pattern making. Very few of the ideas were related to making (4%) and *planning* (5%). Other ideas associated with design were examples of designed artefacts (20%), such as, clothes, structures (building/bridges), art work, vehicles, machines/computers, jewelery, furniture, books, software and even people. Students who wrote that people could be designed usually considered dressing up as being designed. For example one student wrote, '*an ordinary girl is designed and then she is beautiful*'. The various professionals in design (8%)

were from fashion designing, architecture, engineering, interior designing, pottery, etc. About 5% of the ideas were related to the skills associated with design namely, creativity, imagination, hard work, expertise and knowledge. Other ideas associated with design and expressed in some students' responses were attitude towards design (e.g. '*design is interesting*', '*design is liked by girls*' etc.), design learning ('*all can design*', '*I cannot learn to design*' etc.) and designed products ('*…are attractive*', '*modern*' or '*comfortable*' etc).

Cross tab analysis to determine any differences in responses of boys and girls and among students of different classes, revealed that there was a significant difference between boys and girls about considering *design* as making [$\chi 2$ (1) = 15.99, p = .000] (*marked with asterisks*). More boys than girls came up with ideas of

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A designer is a person who…	From Boys (Nos.)	From Girls (Nos.)	Total ideas Nos. (%)
Ideas related to the work of designers (47%):			
Designs	93	92	185 (26)
Makes art (paints, decorates, makes patterns, makes things fashionable)	31	35	66 (09)
Makes (some things/a model/improve/give shapes to things)	17	16	33 (04)
Draws to construct	10	9	19 (03)
Invents	10	8	18 (03)
Plans/makes drawing to construct	8	9	17 (02)
Comes up with ideas/theories	2	1	3 (0.4)
Operates	2	0	2 (0.1)
Other ideas associated with designers (53%):			
Skills of designers (creativity, imaginative, talent)	56	80	136 (19)
Examples of things that designers design (clothes, buildings, cars etc)	69	66	135 (19)
Designs for a purpose (for fashion shows, for special occasion etc.)	22	15	37 (05)
Examples of design professions (fashion designing, architecture, pottery)	13	12	25 (03)
Attitude towards design and design learning	6	11	17 (02)
Attitude towards designed products (fashionable, attractive)	8	9	17 (02)
Examples of design professionals (fashion designers, architects, etc)	4	7	11 (1.5)
Designer workplace (office, home, company)	4	2	6 (01)
Total	355	372	726 (100)

Table 3. Student's spontaneous ideas associated with 'designers'

design as making, modeling, transforming, repairing or giving shapes to things.

'Designers are people, who…'
When asked to complete the above sentence, 292 students responded (143 boys, 149 girls). The total number of ideas on designers was around 726 (354 by boys, 372 by girls). Overall 47% of the ideas by students were related to the work that designers do. About 26% of the ideas on designer's work were tautological since students just wrote '*design'*.

The activities that were mostly associated with designers were engaging in artistic work (like painting, decorating, making beautiful patterns), making, improving, drawing to construct, planning and coming up with ideas and

operating. Students' responses to this question on designers conformed to the last question on design. In response to this question, students again cited several examples (19%), mostly dresses/clothes that designers design. Some also cited examples of buildings, automobiles and handicraft like embroideries, baskets and pots. For example, students wrote, '…*designs things like baskets, clothes or '…he designs the dress perfectly.'*

Students also spontaneously suggested certain skills (19%) which they thought were essential designing skills; such as creativity and having ideas and imagination, talent, intelligence, specific knowledge, expertise in the field and drawing skill. However, students did not come up with any specific knowledge that is required in design. Other skills very infrequently associated with designers were being

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Justifications for design by animals	From Boys	From Girls	Total valid %
– make their own shelters	31	33	64 (42)
– make patterns with paws/footprints	13	10	23 (15)
– have creativity and imagination skills/ideas/plans	7	13	20 (13)
– have patterns on bodies	4	6	10 (07)
– design but people are not observant enough	4	5	9 (06)
– have brains/common sense/ intelligence	4	5	9 (06)
– design indirectly since people get ideas from animals	4	4	8 (05)
– plan for a living hunting/defending/learning to fly/	2	4	6 (04)
Humans have evolved from apes, so design is evolutionary	2	1	3 (02)
Total	71	81	152 (100)

Table 4. Student's justifications for why animals can design

artistic, hardworking, patient, technical and having presence of mind.

Only about 5% of the ideas were related to the purpose of design. A few students pointed out that designers design for other people especially great and popular people such as actors and models. Also that a designer designs for specific events like fashion shows and makes people look good. A few students also considered that designers design for fun and entertainment. That designers design under constraints and for specific needs (besides the aesthetic ones), was present in a few responses only.

While responding to this question, most students did not refer to the gender of the designers (79%). However, from among those who did bring in gender, about 15 % were labeled with male identity like he/his, 6% (mostly girls) labeled them with both male and female identities like his/her while only 1 student (a female) labeled a designer with a female identity.

Can animals design?
Of the 289 (85%) students who responded to this question, 47% stated that animals design while 53% felt that animals did not design. The total number of justifications (322) was more than the number of students (242) providing them since some students gave more than one justification for their answer. The justifications in support of animal designing (152, 47%) were as follows.

Thus, as seen from Table 4, the justifications provided most often in support of animal designing was based on the

shelters that animals make for themselves. Birds were most often cited by students to strengthen their idea followed by other animals like rodents, ants, spiders and termites. Some students (15%) considered footprints marks left by animals as design. A few students stated that by leaving footprints on the ground, animals design albeit unconsciously. Students also ascribed creativity, imaginative skills and feelings and emotions to animals. These they considered were required for designing.

About 7% of the justifications were based on the different patterns found on the bodies of animals like cheetah, tiger, zebra etc. A few students assigned designing abilities to animals on the basis of continuity on evolution. They believed that since humans have evolved from apes and ancient humans designed, so animals too have designing abilities. One student reported in the interview, '*in future animals can design because man has also evolved from them and they can design, so animals can also evolve and design things*'.

Students' justifications were further probed in the interview, to get their understanding of the nature of design and the design process. For example, in the interviews those students who stated that animals design, were asked whether animal designing was different from human designing. Students said that human designing was more advanced than animal designing and one student said '*the shelters built by animals were small, temporary and not long lasting while the shelters by humans were very strong and can survive for a longer period of time*'. A few students also asserted that animals used limited materials

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Justifications for why animals do not design	From Boys	From Girls	Total valid %
- have no hands/have four legs/cannot hold a tool	23	19	42 (25)
- have no thinking ability/common sense	23	13	36 (21)
- have no knowledge of design/no capability of design	18	15	33 (19)
- have no creativity skills/imagination/drawing skills	14	14	28 (17)
- have small brains/no brains	10	9	19 (11)
- don't use objects/have no materials/technology	7	5	12 (07)
Total	95	75	170 (100)

Table 5. Students justifications for why animals cannot design

available in nature while humans used a variety of materials to make their homes. Interestingly, a few students also noted that animals design and make on their own while humans have a specialized group of people who design while others make. One student responded that '*animals design to satisfy their basic needs whereas humans design to satisfy their luxurious desire*'.

In the interview as well as in the survey, students did not seem to consider originality of design as an important element in animal designing. That all animals of the same species make similar kinds of homes was not considered relevant for animals. For example, when students who supported animal designing, was presented with the examples of weaver birds' nests which look the same for all the weaver birds, a few of these students said, '*...but they design in their own way*', or '*...it can be same and made with the same kind of twigs, still it is design*.'

Table 5 provides students' justifications for why animals do not design, and the main reason stated was the lack of hands or the presence of 4 legs (25%). Students suggested that the lack of hands limited animals from manipulating and holding tools like humans do. It also limited them from developing drawing and writing skills. About 21% of the reasons were based on the limited thinking ability of animals, which students felt were necessary for designing. Other skills which students considered missing among animals were creativity, imagination or '*having many ideas*' (17%). Though some students acknowledged the presence of brains in animals, they suggested that '*big brains*' like humans were lacking in animals and this constrained them from designing. During interview, the students who stated that animals do not design were presented with examples of animals that make their shelters. A few students tended to change the response from 'no' to 'yes'. They tended to agree that '*some animals but not all*' like birds had limited capacity to

design but their design were imperfect or '*not proper*'.

Attitude and interest towards design

A list of 10 statements was used to probe students' general interest and attitude towards design. Table 6 shows that about 70% of all students considered that girls could be better designers than boys. However, more girls (62%) than boys (38%) agreed with this statement and this difference was found to be significant [$\chi 2$ (1) = 40.35, p = .000]. A related statement was whether more girls choose design professions. About 69% of all the students who responded to this statement (47% boys, 53% girls), agreed that more girls choose design professions.

When students were probed further in the interview, some students revealed that girls could be better designers than boys because they were more interested in the field or they were better at coordinating things like wearing accessories matched with their clothing, or '*keeping things in order*'. A few students also said that '*most of the time fashion designers are girls*' so they must be better designers than boys. When asked whether they were better in other design fields like architecture or car designing, these students agreed that they were better even in these fields since '*they were more creative*' or '*had more ideas than boys*'. One student also said that '*girls were better in designing but boys were better in making things*'. A few students considered girls as better designers because they thought girls were better in needlework and tailoring. Most students said that more girls than boys choose design profession because they were better in it. These two responses reflect students' belief that designing ability is present mostly among girls and that design professions are mostly suited to girls.

To the statement, whether designing needs a lot of mathematics, only about 24% students (64% boys, 36% girls) agreed, suggesting that most students feel that

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Statements	Students' agreement responses		
	Boys Nos. (%)	Girls Nos. (%)	Total Nos. (%)
I think designing requires creativity	141 (51)	136 (49)	277 (90)
I am interested in design	105 (44)	131 (56)	236 (75)*
If design is introduced as an optional school subject, I will choose to study it	103 (45)	136 (55)	229 (74)*
I think girls can be better designers than boys	85 (38)	137 (62)	222 (70)*
I think more girls than boys choose design professions	101 (47)	113 (53)	214 (69)
I like to read magazines about design and designers	80 (42)	112 (58)	192 (62)*
We can design only after taking up courses in design	57 (51)	54 (49)	111 (35)
Anyone who is not good at drawings should not take up design courses	44 (55)	36 (45)	80 (25)
I feel designing needs a lot of mathematics	48 (64)	27 (36)	75 (24)
Design work is boring	39 (59)	27 (41)	66 (21)

*Table 6. Students' responses to attitude towards design (*significant difference)*

design does not require mathematics. The low percentage of students who felt that mathematics is necessary for designing can be related to the attitude that designing is relatively easy. It also thus reflects the attitude that since it is easy, design is mostly pursued by girls.

About 75% of the students (44% boys, 56% girls) showed an interest in design ('*I am interested in design*'). Similarly, about 74% of the students (45% boys, 55% girls) showed an interest in taking up design as a school subject (*If design is introduced as an optional school subject, I will choose to study it*). In both these statements, the number of girls agreeing was significantly higher than the number of boys. In order to validate students' responses, negative statements were also included. So when asked whether design work was boring only about 21% (25% boys, 18% girls) of the students agreed, suggesting that most of them did find design interesting. These responses strengthen the need for D&T to be introduced in the curriculum.

It was found that about a third of all the students (51% boys, 49% girls) stated that for designing we do not require any special course. Most students in the interview agreed that people can design without taking up any courses in design since one needs to either have the 'talent', 'interest', 'good imagination' or 'experience' for designing.

Only a fourth of the students (55 % boys, 45% girls) agreed with the statement, '*anyone who is not good at drawings should not take up design courses*'. The biased nature of this statement led the researcher to probe it further in the interviews. All the students said that they understood the statement. Of those who disagreed, most suggested that drawing skill was not necessary for designing. For example one of the most typical responses justifying their stance was, '*they can do other jobs in designing which are different from drawings; for example they can do manual work.*' The '*other job*' suggested by students and which they thought did not require drawings were music, art, craft, cooking, software designing, pottery and weaving etc. When asked how designers would communicate their ideas to others most students suggested that they choose a design profession where drawing is not needed, or '*they can either make a rough sketch*' ('*but not* [necessarily] *be good in drawings*'), or '*describe it in words so that others might draw it*' for them.

Nature of design
In order to probe students' ideas about the nature of design and designing activity, a set of 18 statements was designed. Students had to indicate with a tick mark whether they *agreed, disagreed*, or were *unsure* about each of the statements. The categories below were created to analyse the responses.

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Design as activities	Agree (%)	Unsure (%)	Disagree (%)
To design means to make patterns	46	33	21
Design is about the appearance of things	54	29	17
To design means to draw	40	29	31
In design you need to make plans	74	16	10
Knowledge and skills in design			
In design one has little opportunity to work with one's hands	35	29	36
Scientific knowledge is used in design	39	31	30
In design different kinds of knowledge and skills are used	79	15	6
Designers know about materials and their properties	61	29	10
Consequences of design			
Designing improves things	70	20	10
A well designed product must look attractive	58	25	17
What designers do			
Designers solve real world problems	35	40	25
Designers get their ideas by observing people	66	21	13
Is design modern or ancient?			
Design is a modern activity	48	22	30
Ancient people have designed things	66	23	11
Design and other disciplines			
Art is the same as design	52	28	20
Designing and engineering are the same	16	47	37
Specific talent in design			
Design is an activity that we all do	56	22	22
People can learn to design	77	15	8

Table 7. Student's responses to statements on design concepts

There was no significant difference between the responses of boys and girls in each of the statements. Table 7 indicates that about 46% of the students agreed that designing is about making patterns, as an unsure category was available, about 33% students chose this option. In the interview, students suggested that there were certain design fields like fashion designing or floral designing where making patterns were important but not all design fields required this. Interestingly, students who agreed with the statement mentioned that all design fields are involved in making patterns to some extent. For example, in architecture, the architect follows a certain pattern for all

the floors in the building, while an air conditioner (AC) designer has to put the different elements of the AC in a certain pattern.

Students considered design as being about appearance of things (54%) and suggested that a well-designed product must look attractive (58%). Majority of the students also agreed (74%) that in design one needs to make plans. About 79% of students agreed that designers depend on different kinds of knowledge and skills to design. When probed about the kinds of knowledge and skills that designers need to have, in the interviews, most students

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reported '*knowledge of art, knowledge of sketching/ drawing*' '*geometry*' and knowledge of '*how to make something*' and knowledge of '*how to make thing attractive*'.

About 61% of students also agreed that designers need to know about materials and their properties. When probed, students reflected a common understanding that '*without knowing about the materials and their properties, the designers would have to experiment a lot and there would be a lot of waste of materials*'. About 77% agreed that people can learn to design which reflects a positive attitude of students regarding design learning. About 56% agreed that all people engage with design in their daily activities. Students in the interview suggested that people engage in design through '*drawing*', '*painting*', '*cooking*', '*garnishing food*' '*keeping things in order*', '*tailoring*'.

More than half the students (52%) agreed that design and art were the same while a little less than half (47%) were unsure whether designing and engineering were the same. This reflects students' strong association of design with art and less association with engineering. A few students suggested that engineering had many different branches which involved different kinds of engineering while all fields of designing mostly involved making things attractive. A few students also revealed that though design and engineering involved giving shape to things, engineering was more '*concentrated in science*' while designing was more '*concentrated in our day-to-day activities*'. Two students held the idea that engineering '*did not involve creativity*' but '*making the same things again and again*' while '*designing involved more creativity*'.

Only about a third of students agreed that designers solved real world problems. However some of those who agreed with this statement in the interview gave interesting explanations. They gave examples of modern technological artefacts like air conditioners, heaters, computers and bridges that solve our problems. Students, who disagreed with this statement, usually thought of 'real world problems' as global, social or political problems (e.g. '*national calamities*', '*poverty*' or '*municipal*') which they thought could only be resolved by government authorities or politicians and not designers.

About 66% of students agreed that designers get their ideas by observing people. When probed further on how *designer* get ideas by observing people, students gave examples from fashion design. They suggested that fashion designers usually '*see the trend of what people like and then they design according to their need and requirements*'. Only a few students suggested that designers can look for problems of people and what they need and then design or improve things according to their needs.

Most students (66%) felt that ancient people did design. In the interview, students suggested examples like the wheels, stone tools, cave paintings, architectures, sculptures, utensils and handicrafts from the past. To the contrary statement regarding design as a modern activity, 48% students agreed. In the interview a few students who agreed with both the statements suggested that design was both modern and ancient since there are more and varied design professions today which were absent in ancient times, such as car designing or website designing.

Conclusions and Discussions

The survey provides useful insights into Indian middle school students' ideas and attitudes towards design and designers. The study sought to reveal ideas about design and designers among students who had no D&T education in their school curriculum and hence provides students' preconceived ideas about design and designers.

Most of the ideas of students on design largely pertained to design as art, painting, decoration, and beautiful patterns or drawing. Very few ideas of design were related to design as planning before making. Students mostly cited examples of designed artefacts. Only a few students' ideas invoked two steps of the designing process (i.e., planning and making, or ideation and making). When asked to complete the sentence…'*Designers are people who…*', about one-fourth of all the ideas pertained to a tautological response, '*Designers are people who design*'. Besides, other activities assigned to designers, were making art (such as painting, decorating etc), planning, making things, and inventing. Few ideas were actually associated with planning or imagining. Skills such as creativity, imagination, hard work and expertise were mostly associated with designers. The most common artefacts that students thought designers designed were clothes and fashion designers were the most cited of all the design professionals.

Interestingly while considering designing by animals and ancient humans, students focused on their making activities. However while considering design in general, they mainly thought of design as some artistic rendering process and in most students' responses, a designer assumed the role of an artist. That a designer designs for a purpose, was evident only in a few of the students' responses and almost all of these purposes were related to employing aesthetic appeal. That an artist always enjoys the freedom of expression while, a designer works under constraints and for specific users, was almost absent from all students' responses.

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Students' responses to the structured questions on the nature of designing also suggest that they consider designing as an artistic rendering process. However when explicitly stated, a large number of students also agreed with design as planning and working with hands. They showed an awareness that designers need to depend on different knowledge and skills for designing and considered design as a modern activity (in terms of emerging new disciplines of design) on the one hand while also believing that ancient people had designed things for use.

Overall students showed a positive attitude towards designers and design learning. It was found that more girls than boys showed interest in learning design and also reflected the attitude that girls could be better designers than boys. However, it appears that their positive attitude was aligned more with their idea of design as an artistic rendering process than as a problem solving one.

It can be said that these students, despite not having a formal D&T education, did show a fair understanding of what design is and what designers do. Students reported that designers design (a tautology) but what this designing consisted of was not clear in their responses. Just about 10% of students spontaneously recognized that one of the central features of design is planning. Student's ideas about any profession and their practicing professionals are very important since students' perceptions of professions are closely related to the choice of their careers. Thus in this stage perceptions about different professions might play an important role in making appropriate decisions. If students believe that designers usually decorate or make things attractive then certain groups of students (such as technically oriented students) are less likely to consider design as important for their career. Educating these students that designing is not just about decoration may lead more students to consider design as an option of study for their careers. The aim of design education thus, should not be to negate any aspect of the range of activities that students understand by the term 'design' but to extend and broaden this range of what they understand by this term.

Although design is so much a part of our daily life, it has been transformed into something banal and inconsequential by the widespread media coverage (Heskett, 2002). Design today is assigned a lightweight and decorative role for fun and entertainment, and which is useful only in terms of making profits in economic sectors. This is just a small part of what design is all about. However, as Heskett points out, the part should not be mistaken for the whole.

Last but not the least, it is important for teachers and curriculum developers involved in developing technology education materials to know about students' perceptions about design and designers so that students' ideas, opinions could be integrated into the new curriculum materials. Students' existing knowledge of design can limit their learning of design concepts and processes. Even teachers' knowledge of design will directly influence the design classroom practices. Thus, it is necessary that curriculum developers recognize students' and teachers' prevailing knowledge of design and develop strategies to widen their concepts of what design is and what designers do.

Limitations

The grade wise differences are not reported in this paper due to space constraints. The structured questions in comparison to the open ended questions could have a few biases. But they were probed further and students' responses in the structured questionnaire were related with their responses in the open-ended ones and the interviews. However, students' responses to the open-ended questions could be considered more reliable than those in the close-ended ones.

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