AC 2010-1160: NOVICE STUDENTS' DIFFICULTIES AND REMEDIES WITH THE CONCEPTUALIZATION PHASE OF DESIGN

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Novice students' difficulties and remedies with the conceptualization phase of design

Introduction

Concept generation is an important phase in design[26], when designers start generating ideas and develop thoughts. Concept generation is closely related with creativity design as designers often come up with novel ideas in this stage[25].Unfortunately, previous studies reveal that student designers have a difficult time in the concept generation stage[6, 18]. It is found that students are struggling with coming up ideas and alternatives. However, as not much research is done on the detailed problems student designers meet in conceptualization stage, why concept generation is difficult for students is still not clear.

In this study, we try to fill this gap by exploring what specific difficulties students meet in concept generation stage and further probe what strategies students use to overcome these difficulties. The research questions guiding this study are:
1) What difficulties student designers meet in the concept generation stage
2 What strategies students use to cope with those difficulties, especially difficulty related with creativity?

Literature review

What is design?

A number of studies have been done on how designers design. In general, research shows that design activity is different from typical scientific and scholarly activities. A distinct "designerly" form separates design from other activities[7].

Lawson [23] compares the problem-solving strategies of designers with those of scientists and finds out that while scientists focus on "discovering the rules", architect designers are more concerned with "achieving the desired results". It is suggested that designers tend to be solution focused while scientists are problem focused. So the central feature of design activity is its "reliance on generating fairly quickly a satisfactory solution"[7] (Chap1, p7)

It is also recognized that design problems are ill defined or ill-structured[8, 33, 29] because design problems have underspecified or ambiguous goals, solutions and methods [29, 31]. These uncertainties, not only bring constraints to design but also make design an open problem. Jonassen[19] classifies design problem a unique type of problem and as the most complex and ill structured problem that encountered in practice. He points out that solving a design problem requires designers structure the problem by defining the nature of the artifact that will satisfy the ill-defined requirement.

Method of design

Research shows that design is a systematic process[11], in which designers have to generate, evaluate and specify the design concepts. The design process is consisted of distinct stages. For example, in the stage model used by Adams [1,2,3,4], engineering design is broken into eight stages: problem definition, gathering information, generating ideas, modeling, feasibility, evaluation, decision and communicating. This kind of systematic approach might help designers, especially student designers, as Radcliffe and Lee [30] find that the degrees to which students follow structured design process correlates positively with the quality or the effectiveness of design.

However, in practice, designers do not strictly follow this stage model. Fricke's[12, 13] research suggests that designers following a "flexible –methodical procedure"[9](p91) tend to produce better solutions. It is found that designers who follow a fairly logical procedure produce better solutions, compared with designers who rigidly follow the systematic approach. This kind of flexibility could be diverse and unique, depending on individual designer. For example, studies show that some designers may skip one phase and go directly to the next stage and the whole design process can be different for designers because of their preference, education background, etc [14].

This study integrates a framework of design process[17] and an existing operational model of a design process[24], which is also a staged process, including (1) task clarification, (2) concept generation, (3) elaboration /refinement, (4) detailed design/creation, and (5) communication of results. This model shares many similarities with Adams', as both of them agree that designers construct the problem first, generate ideas and then work on details.

Concept generation in design

Concept generation has been regarded as one of the most important phases in design[26, 35]. In conceptualization stage, designers have to generate a diversity of concepts and make evaluation and selection, which is regarded as a divergent – convergent approach[21]. As previous studies reveal student designers have a difficult time in the concept generation stage [6, 18], we are interested in what specific difficulties and problems students meet in the concept generation stages and their strategies to cope with those difficulties.

Creativity in design

Creativity is viewed as an essential element in design thinking[7]. Creativity design is closely related with concept generation as designers often come up with novel ideas in this stage[25]. However, designers often encounter fixation in design[20, 5]. Typically, when designers meet the fixation situation, they find it difficult to move away from the idea they have developed or examples they have seen[27], which prevent designers from being creative.

Research shows that using certain strategies may help designers get creative ideas. For example, Roseman and Gero[28] and Gero[15] proposed five procedures which could lead to creative design: combination, mutation, analogy, design from first principle and emergence. Cross[7] further discusses how these procedures are used in the design process to help designers generate ideas.

Methods

The study was conducted in a computer graphic program of a large Midwestern university in the US. The participants were recruited from two 2D commercial graphic design courses. CG01 is an introductory course for freshmen to acquire and implement basic design principles for visual communication; CG02 is an advanced course for students in the 2nd year or above, to design, create and prepare documents for commercial printing (see detailed information in Table 1).

Courses	Participants in survey	Participants in interview	Production
CG01	46 (7 females; 39 males)	28 (6 females; 22 males)	Practice basic design elements, principles, composition and typology to communicate visually by solving exercise problems and designing projects like identity logo, flyer, calendar, and postcard. Program: In Design
CG02	19 (8 females; 11males)	17 (6 females; 11 males)	Design single and multiple- page documents for business, advertising such as identities, flyers, brochures, forms, catalogs, newsletters and booklets. Program: In Design
Total	65	45	

Table 1

We implemented a two-phase, mixed method study using a survey followed by in-depth interviews and observations.

The survey we designed consisted of 71items measuring various problems students may meet in five different stages of design (matched to the framework discussed above): Task Clarification, Concept Generation, Evaluation and Refinement; Detailed design of preferred concept and Communication of results. Another 17 items were general questions related to skills and preference, etc. All items were measured on a 7-point Likert scales, ranging from "very strongly disagree" to "very strongly agree". The semi-structured interviews following the survey allowed us a better understanding of problems students meet in the concept generation stage.

Quantitative data analysis

The descriptive statistics in figure 1 indicate that students find problems in stage 2 (Concept generation) are most difficult to cope with. The overall difficulty level of stage 2 is 4.12, based on the 7-point scale. Compared with the difficulty level of other four stages, all of which are under 3.5, this number is much greater. Besides, among the top five difficult problems students meet in the whole design process, three of them belong to stage 2(figure 2). The top two difficult problems are "generating a wide range of concepts" with difficulty level 5.03 and "coming up with creative or original ideas" with difficulty level 4.42, both of which are from stage 2. Therefore it is further demonstrated that students have a difficult time in generating ideas and concepts. This finding is also shared by Hokanson[18], whose study of student designers shows that "Getting the ideas and refining them is the hardest part" (p82).

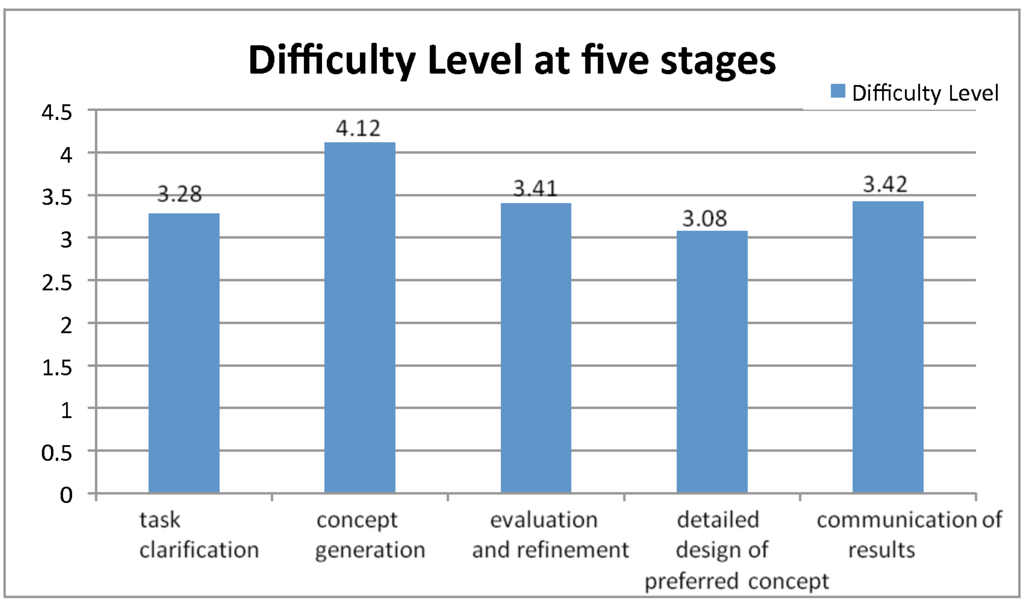

Figure 1

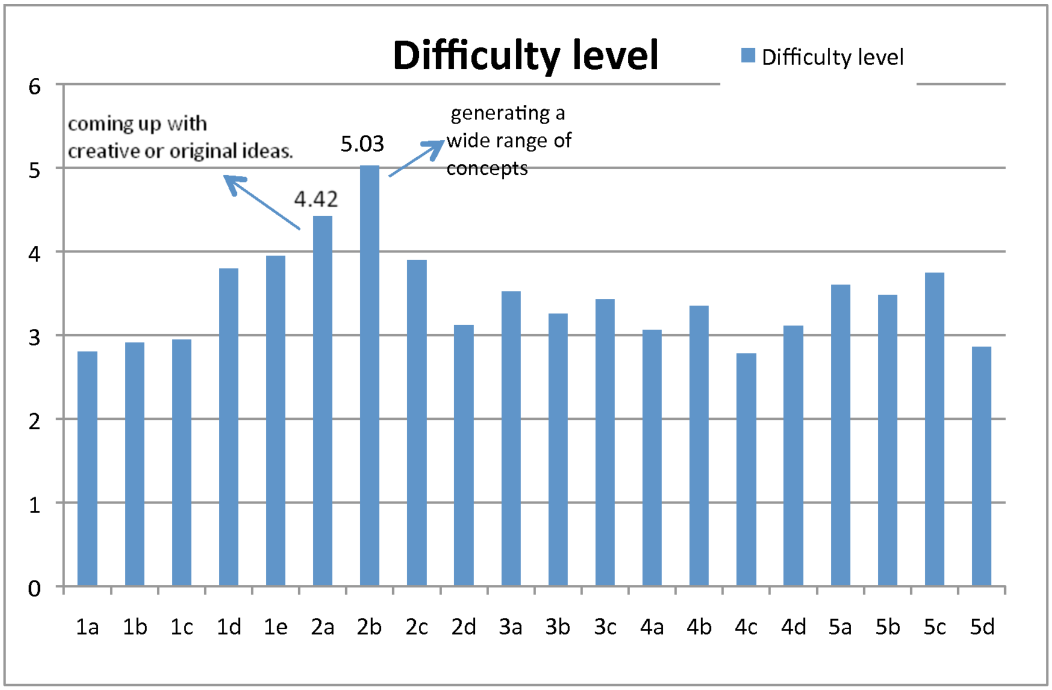

Figure 2

Qualitative data analysis

In the following section, we analyzed the interview with students.

Major findings

Students' difficulties - being creative/coming up with original ideas

The most difficult problem students facing in the conceptualization stage is to be creative and to generate original ideas. Many students talked about creativity and originality in design: "when doing a design, probably trying to be creative I think that's probably one of the hardest things to do"; "the hard part is that you don't want to make your idea too similar to their previous ideas, so it's, it's trying to come up with making something interesting and making something separate from what's already been done".

While lots of students emphasized that it was important to make design different from others, a great number of students were also struggling with how to jump out of box. One student described his difficulty as breaking out of his own style: "I have like a set style, and my problem is breaking from that style to try and come up with something new and different". Many student had similar problems: "the problems that I have the most when I'm designing is um when I tend to stick with the same design concept that I have for previous projects"; "Um it seems that I tend to come up with the same stuff like always like using a lot of circles and using a lot of lines I mean just kind of breaking out of the box". Students called these difficulties as "creative block" or "designer's block".

While students felt it was important to jump out of box, they also realized that they had to learn to play inside the box, like one student said: "first I look over the criteria the what we have to do um that's required for the project…. I think sometimes the problem can be that the requirement sort of um limit what you think you can do or what you would like to do and um …"

Students' difficulties - coming up with more ideas

Generating more ideas is also hard for students, like one student said: "(The biggest problem for me) is running out of ideas…sometimes I just have 1 and that's usually when you design you want to have multiple ideas and to just have 1 that's kind of difficult…".

Some students also felt it was difficult to pick up the best idea from a bunch of different ones. For example, one student commented: "probably my only problem is too many ideas rolling through my head hard to figure out which one I like". Another student talked about the project he worked on and complained: "there are so many different options for different animals and different pictures to pick um coming up with a good combo of them and the placement of them was pretty tough so that was probably my hardest one to do."

Students' strategies - getting inspiration by looking at examples or other's work

A large number of students mentioned that looking at different design examples would help them get inspiration. They will "go online and get a few ideas and see what other people have done", "go back to the notes and look at the different design examples or … use the examples that were given in class" or "look at other peoples like graphic design portfolios like um professional people".

Though students like to see other people' ideas, they do not borrow them directly, like one student said: "like to look at other peoples work too I mean its hard if you look at so many other peoples work you don't want to copy them but it is nice to get a few other examples and then like ok I could probably do that or find out how they did that and then use it to your advantage". Students tend to make changes and improvements based on the old examples and develop those ideas into their own design. For example, one students said: "I like looking at other people's ideas not to like do exactly what they have but it kind of gives you like if they forget something you can be like oh yea I can do a gradient or something on here something like that". Another students also mentioned: "(I willl) use the internet and look at what's been done and like see if you can change the idea a little bit". In sum, students feel that those design examples can "give you a starting point and you build off of that".

Students' strategies - keeping trying

In order to find a good idea, many students will keep thinking and try different ideas. There are comments like "just keep doing a bunch of them and eventually one of them will be good", "keep hitting it until it looks right", "sitting down and trying out different ideas until I come up with something nice". Since students desired to jump out of the box, they said they would "doing something that you don't necessarily feel comfortable with", "just start to just think outside the box just do stuff I normally wouldn't do like".

Some students like to use computer software to help them visualize the effect and find the idea. For example, one student said: "I do a lot of Photoshop work so I like to import my pictures into Photoshop and mess around with them, give them different colors and tints and levels and stuff like that so that usually helps me get the effect I want". Others prefer to use sketches, like one student said: "I just doodle a lot and I just keep drawing until I come up with three different sketches…" They feel that sketching will help them generating more ideas.

When students generate a bunch of different ideas, they will make a selection, like one student said: "first I'd like write down all of my different ideas. Then out of those ideas I can usually pick out a few that just wouldn't work whatsoever or were just completely off the wall. Then I'd narrow it down to like 5 or 6 maybe."

Minor findings:

Students' difficulties - how to get started

Several students mentioned that they found it was hard to start thinking about the initial ideas. For example, there were comments like: "have problems coming up with how to start like what to design first" "I think the biggest problem is um it's kind of just get a blank you have a blank sheet of paper and you have to like figure out how to fill that out to and look good"

Students' strategies - seeking for other people's advice

Students are concerned about other people's opinion. They would like "to have somebody else look at them and kind of give some input on what they think about it". One student said: "… I will talk to other people about this and get their feedback on it. And that helps to get different perspectives so that I'm not only looking at it from my perspective all the time." Another student even noticed that clients' preference is important in design: "if I know who I'm designing for, I can ask what they like."

Students' strategies - design under requirement

In the process of idea generation, students said they still kept into mind what the requirements are. There are comments like: “Generally I just kind of think about what they’re asking and uh just kind of brainstorm in my mind “; “I still try to remember like obviously the requirements”.

Students’ strategies - following certain procedures to get started

Student who had difficulties with starting thinking of ideas talked about his own way of generating ideas: “usually I just start by doing I usually just do like what I want first and then I go back and read the requirements and then I change it based on what it needs to be because if I do it the other way I can’t like get started it’s just hard to figure out how to start”

Discussion

Both the survey and interview results demonstrate that, in the conceptualization stage, students are mostly concerned with how to generate ideas, especially creative ones. They want to jump out of the box and make their design original and different from others’. However, as students mentioned, they were facing those “creative blocks” and “designer’s blocks”, which prevent them from being innovative. Many students complained that they were stick to one style or idea. This fixation effect has been reported by many researchers[20, 5].Typically, when designers meet the fixation situation, they find it difficult to move away from the idea they have developed or examples they have seen[27].

Roseman and Gero[28] and Gero[15] proposed five procedures which could lead to creative design: combination, mutation, analogy, design from first principle and emergence. In our interview with students, we find that some of these procedures or strategies are used by students. For example, the most popular strategy students prefer to use is to look at more design examples to get inspiration. One student said: “(I willl) use the internet and look at what’s been done and like see if you can change the idea a little bit”. This strategy could be categorized as mutation, which involves “modifying the form of some particular feature, or features, of an existing design”[7] (p53). Another student mentioned that : “I like looking at other people’s ideas not to like do exactly what they have but it kind of gives you like if they forget something you can be like oh yea I can do a gradient or something on here something like that”. This process can be viewed as emergence, in which “new, previously unrecognized properties are perceived as lying within an existing design”[7] (p55). Our qualitative data also shows that sketches and computers as design tools are widely used in the conceptualization stage, to help students generate ideas, which is supported by a large body of literature [32, 16, 10, 22, 34].

Conclusion

The biggest problem students facing in the concept generation stage is to get creative ideas. Students want to jump out of the box and make design different from others'. The widely used strategy is to look at design examples to get inspiration. Students tend to make changes and improvements based on the old examples and develop those ideas into their own design. They also use paper-based sketches and computer to help them visualize their design and generate ideas. Besides, students are willing to listen to other people's advice. For design educators, it would be better to provide more examples to students before starting design and show students how to identify creative elements and involve that into their own ideas.

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