Early Design with Children: Optimizing Brainstorming Methods

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RUNNING HEAD: Brainstorming Methods

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Abstract

This is the first study to empirically evaluate the effectiveness of two design methods that elicit ideas from children during the brainstorming process. Experience prototyping and mixing ideas methods were compared. Experience prototyping allows users to use a product, prototype, or program to experience the interaction themselves before brainstorming. The mixing ideas method goes beyond traditional brainstorming by allowing children to collaborate on their ideas by combining ideas together within a group. We measured the average number of ideas generated per child in each group to explore which method, or combination of methods, elicits the most ideas from the children. We found that neither method elicited more ideas than the control group. Interestingly, it was found that the group experiencing a combination of both methods produced more ideas than the other groups.

Early Design with Children: Optimizing Brainstorming Methods

Researchers following user-centered design practices focus on the needs and capabilities of their users to ensure the product is effective [20]. The most commonly studied user is an adult. We believe children vary enough from adults in their needs and capabilities that they deserve unique consideration. Since the 1990s a considerable amount of research calls for the incorporation of children in the design process of software [4, 5, 6, 8, 9, 12, 15, 17, 18, 21, 23]. It is also critically important to consider a child's role within a design team beyond simply that of a participant.

According to Druin (2002), a child can play four different roles during the design process: user, tester, informant, and design partner. When a child is a design partner, they are an integrated member of the design team, with more input and control than the others [8]. Therefore, when integrated into the team children have the same creative power and influence as the adult team members. Choosing to work with children as design partners not only benefits the technology created, but also can provide positive social and cognitive experiences for the children involved [10]. Guha et al. (2011) suggests that the future of designing with children will go beyond technology into informal and formal educational setting allowing children to design their own future [13].

However, it can be difficult to include children in design studies for many practical reasons. They are unable to provide their own transportation and are busy attending class during normal business hours. In addition, only a fraction of computer software users are children so some see designing with children as an unneeded expense. Nevertheless, Druin (1996) demonstrates one clear advantage to including children in the design process; they help designers avoid common adult misconceptions. For example, she points out that many designers believe children love bright colors, loud sounds and have no attention span [16]. By including children in the design of software, misconceptions can be minimized and researchers can begin to understand the children's wants, needs, limitations, and potential.

Numerous researchers have recommended alternative methods for eliciting ideas from child users. These methods stem from the concept of participatory design, a process that includes users in the design so that they are actively and directly involved [2, 7, 14, 16, 22]. Interestingly, empirical comparisons between these methods have not been conducted to determine which one evokes the most ideas. In this study, we adapt two such collaborative methods: experience prototyping and mixing ideas.

Experience prototyping allows users and clients to gain first-hand experience of an existing or future product through personal engagement with prototypes [3]. Beuchenau and Suri (2000) define an experience prototype as "any kind of representation, in any medium, that is designed to understand, explore or communicate what it might be like to engage with the product, space or system we are designing" (p. 425). The goal of using this method is to understand user experiences and context, explore and evaluate design ideas, and communicate ideas to the target user audience. The mixing ideas method emerged to elicit ideas from children during brainstorming with the intention that all ideas would have an effect on the end design. According to Guha et al. (1999), the mixing ideas method has three main stages: observation/individual documentation, mixing ideas with a small group, and mixing ideas with the larger group. The mixing ideas stages occur when a group of children take their written or drawn individual ideas and combine them with others in the group. The actual mixing of ideas can be a group discussion or the physical mixing of ideas by cutting ideas apart and taping them together [11]. The outcome of this method is one final idea that is the result of all the combined ideas.

These methods are used to aid the researcher in discovering what the user (usually a child) will want or need. Both methods give children a chance for traditional brainstorming in the sense that users think critically to come up with new ideas or solutions and get the chance to communicate ideas in a new way. The experience prototyping method provided inspiration, confirmation, or rejection of original ideas along with feedback about proposed solutions. In the mixing ideas study, researchers found the children to be more productive in coming up with ideas in incremental steps, rather than one long session. Because these two techniques had not been empirically tested, we first have to determine whether either method performed better than a control group. These comparisons would indicate whether or not the methods are effective brainstorming strategies. We then compared the two groups to see if one outperforms the other. It is also possible that combining both methods would lead to the best outcome, so a fourth group was included and utilized both methods. Therefore, this empirical study compares the following groups: control, experience prototyping, mixing ideas, and a combination of both methods.

Method

Participants

A third grade elementary class of sixteen was chosen for the study. Written parental consent was obtained for fifteen of the children. The children were then randomly assigned without replacement to one of the four groups; one group had three children, the rest had four. Small toys and candy were used to thank the children for their participation.

Procedure

Before the design session, two identical, grade appropriate, educational, board games were created through collaboration with the teacher. The information in the game was presented in the form of sets of trivia cards for science, math, and social studies. Basic instructions were as follows. When the child rolls the die, they move to a colored square and must answer a corresponding color question (each subject had a corresponding color). By answering a question correctly, the player moves one free space. The objective of the game was to reach the finish first. The board game is representative of a low-fidelity software prototype in early stages of development.

The game's general instructions were verbally presented to the entire class prior to the students moving into their groups. Each researcher was assigned to a group of children for the duration of the session. The groups are described in detail in the following sections (cf. Table 1).

Control (Traditional Brainstorming)

Children were asked to use their ideas to draw pictures or write about how to create the game including characters, additional rules, and other aspects of the board game. The children were also encouraged to think "outside the box" and come up with creative ideas that have not been introduced in board games before. After ten minutes of writing/drawing individually in their journals, the students played the game designed by the researcher for the rest of the time, which was approximately twenty minutes.

Experience Prototyping (EP)

Children began by playing the game for seven minutes after which they were asked to think of ways to improve the game they just played. The children completed a brainstorming session identical to the control condition. Following that, the group met with the researcher to discuss their journals and to clarify, elaborate, or add ideas. This component also lasted ten minutes.

Mixing Ideas (MI)

Children began by observing their peers playing at indoor play (also known as “stations” or “center time”). During the observation, the children were in pairs and were encouraged to document what they observed. Their goal was to discover what the other children like/do not like to play with. The children then had a brainstorming session identical to the control group. After brainstorming, the children combined their written or drawn ideas with a researcher by taping them together or cutting out taping pieces of different ideas together for another ten minutes.

Combined Methods (CM)

Children in this group participated in both the experience prototyping and mixing idea methods. First the children played the game for seven minutes, same as the EP group. Then the group brainstormed for ten minutes. After brainstorming the children were asked to elaborate on these ideas with the researcher. Next, the children observed other children in indoor play for five minutes and then had a brainstorming session, like the MI group. After brainstorming, the children combined their written or drawn ideas with a researcher by taping them together or cutting out taping pieces of different ideas together for another ten minutes.

		Group			
Task	**Time (min)**	**C**	**EP**	**MI**	**CM**
General Introduction/Sorting	10	1	1	1	1
Specialized Instructions	5	2	2	2	2
Brainstorm Individually	10	3	4	4	4&7*
Played Game (Experience Prototyping)	7		3		3
Observed Game	5			3	6
Free Time to Play Game	20	4			
Mix Ideas	10			5	8
Communicate/Elaborate with Researcher	10		5		5

*Session was split into two five minute sessions

Table 1. Tasks completed by students in the four brainstorming manipulations. Time was measured in minutes. The values under each group heading indicate the order in which a group completed their tasks. For example, the control group started with the introduction, then had specialized instruction, followed by individual brainstorming and free play.

Results

This study utilized a between-subjects experimental design. The independent variable was the brainstorming method employed by the group. The dependent measure was the average number of ideas generated per child. An idea is defined as any comment or picture that embodies a single concept. The number of ideas for each child were counted from their journals. Any ideas generated from a group discussion or mixing ideas cases in which children collaboratively came up with the idea were divided equally between the participants in that group. For example, if the group had eight new ideas during mixing ideas and there were four children in the group, two ideas are added to each children's totals. We do not compute an ANOVA and post-hoc tests as the findings are easy to interpret in their descriptive form. Table 2 displays the average number of ideas generated per child for each group. The headings show which method if any was used for that group.

	Experience Prototyping	
Mixing Ideas	Not Used	Used
Not Used	Control 4.5	EP 5.33
Used	MI 4.25	CM 10

Table 2. Average number of ideas generated per child for each group.

Conclusion

Our goal is to encourage future empirical comparisons of these collaborative methods. We believe that these results provide a starting point for an empirical exploration of these brainstorming methods involving children.

One surprising outcome of this study was the fact that neither the experience prototyping nor the mixing ideas method outperformed the control group in idea generation. This suggests that basic brainstorming may work as well as either method. Interestingly, combining both experience prototyping and mixing ideas, children were able to come up with more ideas about how to improve or change the game. This initial evidence suggests that the combination of the methods will yield the most ideas when collaborating with children.

Even with this strong evidence supporting the use of both methods in collaborations with children, there is at least one primary limitation. We had a small sample size. This is especially true given a between-subjects experimental design. However, small sample sizes are typical when participants' represent a population that is difficult to sample from.

In future research, a larger sample of children could be included and a within subjects design could be utilized. From a conceptual standpoint, one could manipulate time children spend brainstorming. The accuracy of the results may increase since the children would have more time to write down or elaborate their ideas. In addition, combined methods group separated the brainstorming session into two sessions. The separate brainstorming could have increased idea generation, since they were given two short opportunities rather just one.

In conclusion, we recommend combining experience prototyping [3] and mixing ideas [11] methods when attempting to facilitate idea generation during collaborative efforts. The combined method produced approximately twice as many ideas as any other condition. This appears to be a practical difference in idea generation. Involving children in the design process has come a long ways in the last 12 years. Children's products will continue to improve as long as we appreciate these end users' unique needs, wants, limitations, and expectations.

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