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Application of a Participatory Methodology for Investigating Personal Fall Arrest System (PFAS) Usage in the Construction Industry

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The participatory workshop is a new concept of design in which developers, end users, and researchers work together to design a product or service. This approach is still in its experimental stage as applied to studying jobs in the construction industry. In the current study, a participatory workshop was conducted to generate ideas for an improved Personal Fall Arrest System (PFAS) design and another workshop was held to generate ideas on fall protection training. In addition to generating ideas about PFAS design and fall protection training, the data collected through the workshop process was used to create three personas that served, at the end of the project, as vehicles for summarizing the research results. The workshop method is more commonly used by designers, but can provide useful information that can complement data from surveys or laboratory investigations conducted by human factors professionals and others interested in user-centered design.

1. INTRODUCTION

Personal Fall Arrest Systems (PFAS) are required by the Occupational Safety and Health Administration for construction employees who work at heights above six feet. However, the literature indicates that current levels of usage of PFAS are not adequate to reduce the number of fall-related injuries. Therefore, survey, interviews and participatory workshops were applied in this study to supplement the published literature in assisting us in analyzing current usage of PFAS among construction workers and views of PFAS from construction workers and other stakeholders in the construction industry. This paper describes one phase of this study – the use of participatory workshops to investigate PFAS design and fall protection training from the viewpoints of different stakeholders.

2. BACKGROUND

Participatory workshops are a form of small group interview that include a portion of time spent imagining, designing and redesigning the topic of the interview, to meet the participants' needs, wants, and desires. Participatory workshops first started in Europe, during the Scandinavian workplace democracy movement and were considered to be "a set of theories, practices, and studies related to end users as full participants in activities" (Muller, 1993). Schuler (1993) further defined "participation" as "users and other stakeholders participated in the design process to ensure that the design outcomes fit the way people will actually use the product in their own lives". Sanders (2002) described the participatory methodology as "a belief that all people have something to contribute to the design process and that they can be both articulate and creative when given appropriate tools with which to express themselves".

Several studies have applied a participatory methodology in the construction industry to address safety and health issues in the workplace. Although most of these studies did not evaluate the effectiveness of the improvements suggested from the workshops, or encountered low response rate during the evaluation, a participatory approach is still considered a useful tool for exploring ideas and insights from a target population. No published studies were found that had attempted to use participatory workshops to investigate PFAS design or fall protection training.

3. PROCEDURES

In the current study, two participatory workshops were conducted in Spring 2008. The objectives of the workshops were to generate ideas for improving PFAS usage, but with different focuses. Since the results from the first two phases of this study indicated that PFAS design and fall protection training are two strong factors affecting PFAS usage, the first workshop was specifically aimed at generating ideas for improvements in PFAS design, while the second was focused on fall protection training programs in the construction industry. Both workshops were planned to be approximately two-hours long, consisting of three session elements: sensitization, individual work, and group work. Participatory toolkits were developed specifically for these workshops, and were pilot tested in advance of the workshops. Toolkits are sets of ambiguous objects, fabric, and other items that workshop participants use in the "make" phase of the workshop (Sanders and Williams, 2001).

A total of fifteen participants attended the two workshops, including ten construction workers, three superintendents, and two safety personnel from three different contractors. The average age of the participants was 35 years

old, and their years of experience in the construction industry varied from 3 months to 23 yr, with an average of 11.7 yr.

3.1. Sensitization

The sensitization phase of each of the two participatory workshops involved the completion of a "workbook" tool, by each workshop participant. Sleeswijk Visser et al. (2005) defined a workbook as "a booklet with open-ended, fun, friendly questions to answer and things to draw". A week before the workshops, each participant was asked to complete a workbook and the completed workbook was to be submitted to the researchers at the beginning of the workshop. The purpose of sensitization is to assist participants in recalling their experiences and feelings in order to help idea generation. If submitted prior to the workshop, the workbooks can also help researchers prepare for the workshops.

The first section of the workbook in this study asked the participants to describe themselves using questions, such as "What is your favorite TV show", "What are your hobbies" and "For what reasons do you work in the construction industry". The second section requested participants to record a log of their daily work life for one day and in the last section they were asked to address their concerns about PFAS design or training (depending on the workshop in which they participated). In addition, participants were given the opportunity to list their favorite PFAS design and even draw a design that they would like to propose. Figure 1 shows a sample of a workbook page for the PFAS design workshop. On this page, a participant was asked to keep a log of a typical workday of his or her life.

a typical workday of my life

The next two pages are for you to keep a log of your activities on a typical workday of your life. Please keep the workbook with you through the day and fill out the table. Below is an example so that you can see how someone might fill it out.

day of week: Monday

type of day: X (please cross the face that represents your feelings the most during the day.)

Time	Activity	Location	Thoughts or feelings	Related to safety, for example, harness?	If yes, please explain
5:30 am	Got up, showered	Home	Feel well rested	no	
6:00 am	Ate breakfast	Home	The coffee tastes good	no	
7: 00 am	Drove to work	Work	Not too late	no	
7:30 am	Had a safety meeting	Work	First thing this morning, important	yes	Weekly safety meeting conducted by the supervisor
8:00 am	Started to work	Work	Lots to do today	yes	Went to get harness

Fig. 1. Sample page of a workbook for the participatory workshops.

3.2. Individual sessions

In the forty-minute individual sessions, each participant was asked to complete a project individually in the first twenty minutes, then present the project to all participants and comment on the other participants' projects in the next twenty minutes. The individual sessions for both workshops were designed similarly: participants were asked to make a timeline of their PFAS experiences, from their first day of using PFAS (or other fall protection equipment if PFAS was not applied in the industry when they started working) until the present. Each participant was given a large sheet of paper with a horizontal center-line across the middle. The center line was to be read as a timeline, from past till now. Above the line indicated "positive" perceptions and below the line indicated "negative" perceptions. The degree of "positive" and "negative" increased with the increase in distance from the center-line. Pictures and words were distributed to participants to assist their immersion into their experiences and express their emotions, memories, and opinions regarding PFAS usage. Figure 2 gives an example of the completed collages during the individual sessions. The time line is the line along the center of the paper.

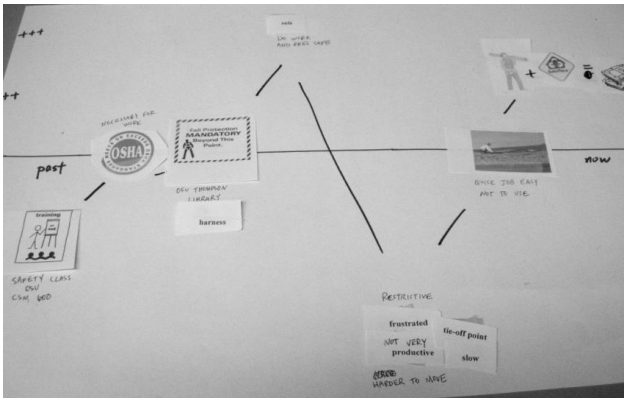

Fig. 2. An example of a completed collage from an individual session.

A total of 42 pictures and 60 words were selected and pilot tested to ensure the timeline toolkit was adequate and appropriate for participants to be able to express their PFAS experiences. The contents of the pictures and words covered their work tasks, job sites, accidents scenarios, fall protection equipment and some emotion-expressing pictures. The three-pages of pictures and words are shown as Figure 3.

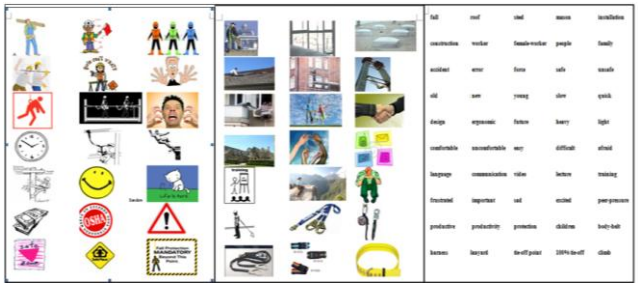

Fig. 3. Images and words for the individual sessions.

Participants were asked to choose pictures and words which they felt best described their thoughts and feelings, then cut, place and tape them on to the white paper. They were told they could use as many pictures and words as they felt made sense, but they did not have to use all of them (Figure 4).

3.3. Group sessions

The objectives of the group sessions were to generate ideas on how to improve PFAS usage within each workshop. Within each workshop, the participants were divided into two groups and each group was asked to complete a group project within thirty minutes. After the project was completed, one member of each group presented their results and shared them

with the other group. The group session fully utilized the experiences of participants and provided the participants a means to present their thoughts to the researchers, and to each other. A picture of the toolkit used in the PFAS design workshop is shown in Figure 5.

Fig. 4. Participants engaged in an individual session.

Fig. 5. Toolkit for the group session of the PFAS design participatory workshop.

Lastly, there was a ten-minute mini-session at the end of the PFAS design workshop to briefly address the topic of training. Participants were asked to respond to a poster with information and pictures of different training methods and discuss which methods they preferred. The purpose of this mini-session was to gather information on their opinions related to fall protection training and help the researchers prepare for the second workshop.

The objective of the group session in the second workshop was to propose ideas on how to conduct a successful and effective fall protection training program in the construction industry. These participants were also divided into two groups; each group was expected to design a future fall protection training session for construction workers. Posters were provided as a tool to aid participants considering various factors of a training session, such as length, content, methods and materials. Similar to the first workshop, these participants were asked to participate in a ten-minute group discussion session at the end of the workshop, this time on PFAS design.

4. RESULTS

4.1. Results from sensitization

In order to more succinctly represent the information from the fifteen participants' workbooks, three personas of characteristic workshop participants were created. Pruitt and Adlin (2006, P.11) defined personas as "fictitious, specific, concrete presentations of target users". Persona is often used as a tool to help designers and researchers place their focus on specific users of products or systems (Pruitt and Adlin, 2006). The purpose of developing personas in this study was to help analyze the relationship between one's personal attributes and PFAS usage behavior. Details for each persona included demographics, work history, type of PFAS used, PFAS training, and opinions and experiences with PFAS. At the conclusion of the entire study, the findings were expressed through the effect they were projected to have on the personas.

4.2. Results from individual sessions

The data generated from the individual collages presented a clear picture of participants' opinions and emotions towards PFAS, by recalling and expressing their own experiences of using PFAS. A total of 212 words and pictures were used by the fifteen participants, including 100 pictures and 112 words. It gave an average of 24 words and pictures per person. The top ten most frequently used pictures and words are shown on Figure 6.

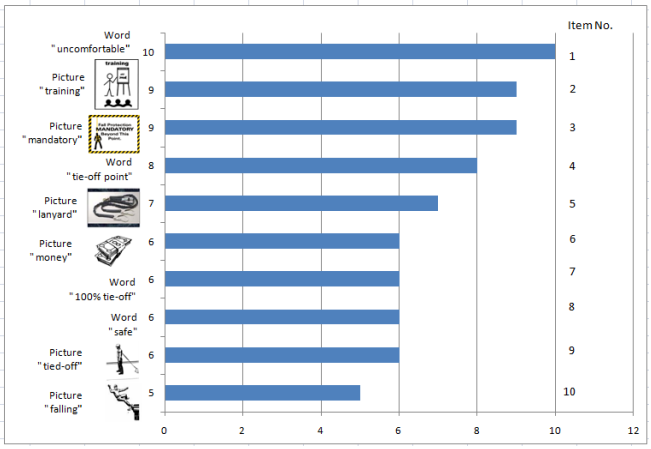

Fig. 6. Top ten most frequently used pictures and words.

The results corresponded with the data from the previous phases of this study that "comfort" of the harness, difficulty to find a tie-off point, and fall protection training were viewed as factors that influence PFAS use. Further, most of the participant construction workers used PFAS and tied-off because PFAS use was mandated on their jobs. In addition, lanyard and retractable lanyard were considered negative factors by some participants, because the lanyard could be a tripping hazard and the retractable lanyard can be too heavy to carry.

4.3. Results from group sessions

The group session in the first workshop focused on PFAS design. The harnesses designed by the two different groups both featured a spring-loaded D-ring, which would make the connection between lanyard and harness much quicker and easier. A worker can reach out with one hand and connect the lanyard to the D-ring. The new DBI/SALA Exofit harness already has this feature. However, because many workers use harnesses provided by their employers, some workers are unaware of the existence of these beneficial, but costlier features. Group 2 created a one-handed, easy-to-don, and adjustable buckle to make a harness easier to wear. Their design also integrated a body-belt to the harness to make the user feel safer. However, such features created by both groups already exist in some current harness models (DBI/SALA).

The second workshop had a short group discussion on PFAS design at the end of the session. One welder commented that sometimes he had to perform welding work while wearing a harness and the current harness he had was not spark-resistant. He suggested a harness should be designed for different trades instead of generalized. Half of the participants in the second workshop had their own harness. They believed one would be more motivated to use a harness and take better care of it if it was personalized.

The main group session of the second workshop was intended to generate ideas on fall protection training. Both groups in that workshop preferred hands-on training or demonstration of fall protection equipment, rather than lecturing or PowerPoint training. They believe lecture should integrate with some hands-on experiences to motivate attendees. Safety videos have also been a popular training method in the construction industry, with trainers. However, many participants complained that most safety videos they have watched appear dated. The repetitive use of the same training materials makes trainees less interested in topics and reduces the effectiveness of the materials. All types of safety games, including computer games, video games and board games, were not selected as training methods by the participants. They believe safety is a serious topic and that games would not convey the gravity of safety. The ten-minute mini-session on training methods at the end of the first workshop also produced strong negative feedback regarding use of computer "games" to train workers on the use of PFAS. When further asked about their opinions of receiving training and achieving a certificate online, all participants opposed the idea because they were not that familiar with computer use.

5. DISCUSSION & CONCLUSIONS

Two participatory workshops were conducted to collect information on construction workers' perspectives on how to improve PFAS usage. This was done as part of a multi-phase study that investigated the use of PFAS by construction workers. Fifteen construction workers and supervisors participated in the workshops and successfully completed three projects during each workshop, which included the projects from a sensitization, an individual, and a group session. In comparison with other methods applied in the first two phases of the study, which included a preliminary survey of construction workers and interviews with other construction industry stakeholders, the participatory workshops focused more on encouraging participants to generate ideas by expressing their experiences and opinions in the workshop. Most findings from the workshops were consistent with results from the first two phases of the study. The results reinforced the notion that comfortableness of PFAS, safety training, and a company's enforcement are considered important in affecting PFAS usage, based on the perceptions of construction workers and supervisors.

In addition, there were some unique findings discovered exclusively through the participatory workshops. For example, construction workers' perception of risk was studied in this phase of the research. It was also discovered in the workshops that the construction workers believed that personalized PFAS and PFAS specially designed for their tasks or trade would be expected to increase usage. Personas were also used for the first time as a tool to study how personal characteristics contribute to PFAS usage behavior.

There were some limitations in this study. First, participants were all commercial construction workers who worked on projects on our university's main campus. However, their work experiences were substantial and were not limited to work on this single college campus. Second, none of the participants chose to complete the workbook prior to the workshops. As a result, time had to be allotted for this activity at the beginning of the workshop, thereby extending the overall length of the workshops. The participants' failure to complete the workbooks ahead of time might have reduced the effectiveness of workbooks in that participants were not preparing for the workshop and thinking in advance about their experiences with PFAS. Further, because the workshops went longer, participants may have been tired by the time the creative group session began, and were possibly less productive than they may have been otherwise. Additionally, it was the researcher's first time conducting a participatory workshop among the construction workers and the researcher was inexperienced (author DL). In spite of this, the workshops were conducted in a professional manner.

Although the two designs created during the PFAS design workshop already existed in the market, which was not expected by the researcher, the participants were able to express their thoughts and emotions regarding PFAS use during both workshops. More importantly, the participants displayed a high level of engagement and interaction amongst themselves and with the researcher, throughout both workshops. This is an important factor for a successful participatory workshop.

As the first generative toolkit used among construction workers, the toolkit in this study was exploratory. In addition, it confirmed Sanders' (2006) recommendations that a sufficient toolkit, an experienced facilitator, well-planned directions and cooperative participants are prerequisites for a successful participatory workshop.

These two participatory workshops successfully fulfilled their objectives: to allow us to explore factors (that were not addressed in the survey and one-on-one interview stages of the study) through creative engagement with workers and managers. Both PFAS design and training were consistently viewed as important by various construction industry stakeholders who participated in the study. Data from all of these stages of investigation contributed to the development of a theoretical model of PFAS usage, which was explored in a subsequent phase of the study (Liu, 2008).

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