Participatory Design through a Learning Science Lens

Betsy DiSalvo
Georgia Institute of Technology
Atlanta, USA
bdisalvo@cc.gatech.edu

ABSTRACT

Participatory design is a growing practice in the field of Human Computer Interaction (HCI). This note is a review of how participatory design activities are a form of learning. The premise of this exploration is that participatory design is more than asking participants for their help in design. Instead, participatory design is a set of methods and practices used to scaffold the design experience, increasing participants' reflection of their own knowledge and accounting for their previous knowledge so they can more fully engage in the design process. This active reflection and considerations of pervious experiences are closely tied to metacognition and a number of learning theories. Exploring previous studies provides examples of how learning theories are enacted through participatory design and how a greater awareness of these theories can inform the practice of participatory design.

Author Keywords

Participatory Design; Learning; Active Learning; Learning Science; Collaboration; Metacognition

ACM Classification Keywords

H.5.m. Information interfaces and presentation: Miscellaneous

INTRODUCTION

In the *Human-computer Interaction Handbook*, Muller and Druin's introduce participatory design with the question, "Participatory Design: just add users and stir?" The challenge this question points out is that in order to engage users or participants in design, we cannot simply ask participants how to design something. Instead, we need to use methods that situate participants in a setting where they can partner with professional designers and developers [14].

In this paper, I address the challenge of creating those partnerships by identifying learning theories as critical considerations in successful participatory design practices.

Through exploring previous studies, I identify three constructs of learning practices used to enable participants to become a full participant in the design practice.

Participatory design in the Scandinavian tradition has gained a favorable following in the Human Computer Interaction (HCI) field on an international scale. A search of the SIGCHI conferences' proceedings finds 160 papers, extended abstracts, or posters that use the key phrase 'participatory design'. Participatory design first appeared as a key phrase in the 1992 SIGCHI proceeding; however, 68% (109 out of the 160 results) have been published in the last decade. As these SIGCHI studies have emerged, they catalog a wide variety of design activities that incorporate the methods, practices, and democratic ethos of participatory design.

After an analysis of these studies, and others in related publication venues, a correlation emerged between successful participatory design activities and the theories of the learning sciences. Similarly, when breakdowns occur in participatory design activities, there is a correlation between those breakdowns and a disruption in successful learning practices. This suggests that using learning theory can inform the development of participatory design methods, making them more effective and productive for designers as well as participants.

The following section will outline the background of participatory design and learning theory from the perspective of the learning sciences. Through an analysis I identified patterns of how learning theory can explain and inform successful participatory design practice and explore case studies that highlight how learning is an integral part of participatory design process. Finally, I discuss implications of incorporating more learning theory into the development of participatory design practices.

BACKGROUND AND MOTIVATION

Participatory design, which follows a Scandinavian tradition, seeks to include key stakeholders in the design process. Though still a niche area within design, participatory design has established itself as a rich domain of research and practice. Workplace environments were the central location of much of the early participatory design work [12]. However, as information and communication technologies have changed, the field sites for participatory design have expanded [9][2]. Because of this expansion, the end goal of participatory design is not just the design of an

operational system. It is about creating an experience or event that develops the agency of participants [11].

Most designers who use participatory design approaches would agree that learning is a significant goal of the process [20]. However, this perspective is focused on what designers can learn from participants, and how that insight can inform their designs. In exploring participatory design through a learning lens, it comes to light that all of the stakeholders are partners in a learning process, which creates shared understanding and collaboratively constructs new knowledge.

Arias et. al. identified the role of learning in a collaborative design process. In particular, their research calls out the need for reflection in collaborative design. Calling on the work of Schön's "reflection-in-action" [19], Arias and colleagues identify that as breakdowns occur, individuals can reflect on them [1]. This articulation of breakdowns, or successes, allows participants to see their own process in a new way, helps them theorize why things work they way they do, and lets them creatively collaborate on new ways to design their interactions.

The filed of the learning sciences seeks to understand the phenomena of learning, as well as impact current practices to enable more effective learning [3]. The work of the learning sciences frequently resonates in shared values with those practicing participatory design. In particularly is a shared value on democratic practices. For learning sciences, this means creating learning environments, activities, and ethos that value the previous knowledge, culture, and diverse methods of communicating [7].

In the learning sciences, successful learning is broadly identified as a type of learning that helps people take control of their own learning process, recognizing when they understand and when they need more information. The learning science literature focuses mainly on identifying the strategies of how to help people actively take part in their own learning. The use of metacognition is critical in all of these strategies. Metacognitive knowledge is what one knows or believes about themselves and their knowledge [13]. Three key constructs related to metacognition can be seen in a number of successful participatory design practices: 1) reflection, 2) pre-existing knowledge, and 3) the zones of proximal development. Each of these constructs will be briefly described in line with participatory design examples from the HCI literature.

METHODS
I conducted searches of SIGCHI conferences' proceedings and found 160 papers, extended abstracts, or posters that use the key phrase 'participatory design'. Each of the abstracts and methods for these papers were read and identified as examples of *participatory design*, where participants were lead through active engagement, or *co-design*, where participants were simply asked to design or improve a current design without scaffolding activities.

Those papers that were examples of participatory design (approximately two-thirds) were then read and identified with codes that noted a correlation between successful participatory design activities and learning theories. Through these reviews there were several learning theories identified but those that occurred most frequent and had the broadest application were *reflection*, *pre-existing knowledge and misconception*, and *Zones of Proximal Development.* In addition, papers from related ACM venues were read to find examples that would best represent the learning theories identified. Approximately 200 ACM publications were reviewed in total.

The goal was to find case studies that would best represent the tie between participants as active learners and participatory design. Papers were selected because of their high quality use of participatory design practices, facility for explaining the learning theory connected to them and to represent a variety of cases from different domains and different types of participatory design activities.

CASES OF LEARNING THEORY IN PARTICIPATORY DESIGN

Reflection
Frequently, educators try to engage students in metacognitive processes through reflection by asking them to predict their ability to perform on various tasks, measure their mastery, and track what they need to learn to gain mastery, etc. [3]. Reflection can be a solitary effort; but, it is generally accepted that reflection is best done in collaborative efforts and best achieved through articulation in those collaborations [18].

The goal of participatory design is not about the participants' learning. Instead, the goal is usually about drawing out the tactic or procedural knowledge the participant's have [17]. This is a similar challenge experts face when trying to teach. They are so fluent in their basic knowledge that they forget about what needs be learned for novices to understand more complex problems [23]. The difference is that participants, while experts in their own experience, often do not recognize their own expertise. Instead, they need to be engaged in a reflection exercise that helps them better understand what knowledge they have and then effectively communicate it.

Effective participatory design activities encourage participants to engage in reflective practices so they understand what they know and what they do not know. For example, Chin, Kuchar, and Wolf investigated the analytical process of intelligence analysts [4]. The activity had participants role-play through different scenarios that modeled real-world security threats. The task of collecting and organizing intelligence data to try and understand the security threat aligned with their normal job duties. However, the public performance and the reflective interviews that took place after the scenario was performed were used to, "encourage and engage users in the analysis

and design of their own work." From the lens of learning sciences, the participants' public performance of their job was a reflective practice that helped them better understand and articulate their own procedural knowledge.

In another example, the author, DiSalvo and Khanipour Roshan developed a design probe method to help better understand communication technology among low-income parents [8]. Prior to the study, participants were dismissive of technology conversations because they assumed they were not technologically savvy. The method, called a medium probe, required participants to answer parenting questions everyday for a week, using a different medium each day. Then, the parents were asked to participate in a focus group where they compared and contrasted the technology they used. In the group discussions, the participants reflected on their experience with the media, noted that they knew more about the technology than they realized, and provided design input on the technology.

Both examples used the learning processes of performance and reflection that helped the participants become more aware of their own cognition. That awareness provided a number of advantages. It empowered participants to feel qualified to share their knowledge, and it provided them with a chance to reflect on breakdowns in their processes. It also allowed them to new ways to articulate their process and to communicate contributions to the design.

Keeping these goals of performance and reflection in mind can help in developing participatory design activities. While designers can simply watch someone perform an activity or look at an artifact participants made, using performance and reflection approaches might build in unusual moments to pause during and action, opportunities for comparison between activities, and group feedback that allows for new considerations to be brought forth. Getting an individual who is fluent in an activity to step outside of their expertise is difficult, but tools to facilitate this might include asking evocative questions, requesting they make something in the wrong order, or giving them an opposite goal from their normal activity; i.e. *What is the least effective way to do this task*.

Pre-existing Knowledge and Misconceptions

People come into any new situation with a range of prior knowledge, skills, goals, and beliefs. This pre-existing knowledge impacts how those people interpret, remember, reason, or problem solve in any given situation. Often, individuals come into a new concept with prior knowledge that may help them interact with the world or a problem correctly; yet, that interaction may be based upon fundamental misconceptions [10][16]. This means that while a person's existing knowledge functions to answer questions, or is correct in one context, it may actually divert them from understanding, given a new context.

A key feature in a participatory design session might be to elicit the preconceived notions that participants have about the service, process, or artifact they are engaged in designing. In some cases, an understanding of the preconceived notions might be what the designer is seeking to learn from the participants. However, if a designer seeks to design with participants, moving them past their pre-existing knowledge to a place where they can rethink their understanding is necessary.

An example of how pre-existing knowledge plays a role in the participatory design process can be found in Ogonowski et. al.'s study of a living lab that engages users in the life span of a home entertainment development project [15]. In the project, participants were originally assigned to attend workshops based upon their technology experience, to create homogenous groups so that those with greater technology experience would not stifle the non-experienced participants. However, due to scheduling issues, some of the non-experienced participants attended the workshop that was dominated by more experienced attendees. Rather than resulting in an imbalanced discussion, the non-experienced participants' lack of previous knowledge allowed them to approach the problem without a pre-conceived knowledge of what would or would not work.

"Especially during workshops, non-experienced users contributed many interesting and innovative ideas due precisely to their lack of knowledge about marketable technology." [15]

The novel approaches were more apparent in the group that contained fewer non-experienced participants. The authors of that study did not speculate on why the heterogeneous groups produced better insights. However, learning research suggests that the heterogeneous group may have provided better context for the ideas from the more experienced users and less limitations on the ideas from the non-users, resulting in a collaborative formation for novel ideas. Arias et al. suggests that the integration of various perspectives, "symmetry of ignorance", supports the reflective process, enhancing the creation of shared understanding [1].

Balancing group expertise is an approach one could take in creating participatory design groups. This could be undertaken in one group, such as the example above, or through a process of asking participants to design aspects of a product they are not familiar with, then explaining it to an expert or vice versa. Other methods might include design charrettes that specifically give roles to different members, agreeing with or in contrast to their expertise. Diverse perspective would allow for challenges to misconception that are accepted because they come from the expert perspective. Building in acknowledgement of diverse expertise may also build awareness of other perspective and increase innovation [5].

Zones of Proximal Development

Zones of Proximal Development (ZPD) is a concept originally developed by Vogotzgy, which explains the access learners have to new knowledge. In Vogotzgy's

model, the learner can solve certain problems unaided, yet cannot solve other problems. The zone between these two situations is called the Zone of Proximal Development, a place where the learner can problem solve with some guidance. The use of ZPD concept is to theorize what are appropriate learning goals.

In the development of participatory design activities, it is important to keep a participant's ZPD in mind. If an activity is a problem that the participant knows the answer to, participatory design is not necessarily needed – one could simply ask the participant questions. On the other hand, if an activity is outside of a participant's ZPD, then that participant cannot effectively contribute because they would not be able to complete the activity as the designer intended.

One example of the impact ZPD can have in the success or failure of a participatory design activity is the use of participatory design in the development of mobile systems by Svanæs and Seland [22]. In their study, participants were trained in drama techniques and then asked to use improvisational techniques to build scenarios for use in a mobile system. Svanæs and Seland discovered that enacting drama techniques and creating performances, as outlined by their facilitator, was too difficult and intimidating for the participants. They also found that if the participants were too entrenched in the field, (ie: the participants were primarily researchers/Ph.D. students working in the context they were designing for) then the results were repetitions of what was already known.

"Without real users, the workshop runs the danger of "spinning in the air" and simply iterating existing assumptions and prejudices about the context of use." [22]

In a study with teens from low-income neighborhoods, DiSalvo, Johnson and Bruckman developed a participatory design activity that asked the young people to design the packaging for their perfect video game [6]. The goal of the study was to learn what role video games played in the teens' lives and to gather inspiration and design implications for educational video games. Participants were also provided craft materials, templates, popular magazines, and jewel cases and instructed to slide their finished designs inside with the intention of making the activity feel more authentic. While all the participants completed a design and enjoyed talking about games during the activity, the resulting video game packages and dialogue were unimaginative. In contrast, one of the adult mentors for the group also participated. His design was inspirational, particularly because he articulated the complex reasons for the game design and explained how it could serve as a road map for overcoming poverty.

The request that the team was making in the activity was outside of the teens' ZPD. It wasn't that they didn't like doing the creative activity, it was simply too much of a reach for them, at that time, to create a novel game idea or

to think about games in a more representative way. After working with some of these same teens over the course of two years on other game related projects, we asked them again to design the packaging for the perfect video game. Perhaps because of the two years of maturity or the exposure to discussions around the video games, the final products were creative, unique, and reflected the personal experiences of these young people.

Anticipating participants ZPD is difficult. But by looking at the learning sciences literature, we can see how strategies that involve scaffolding the experience can both help identify where a participant is functioning and be adjustable, falling away when they are not needed [24][21]. One way to scaffold the experiences for participants is to have smaller activities that teach and build confidence in smaller aspects of a larger activity. For example, working on improving a favorite games, talking about what makes that game good and then working towards making a new game concept might have facilitated better design insights in our first try with students.

However, as designers we often do not have the luxury of testing the ZPD of participants before the walk in the door. One strategy to address this is to include a small task or question in our recruiting procedures targeted to give insights into the ZPD of a participant. But likely the most useful and effective tool is to remain flexible in our activities. If we see a group struggling to understand the task in front of them we should find out what is the cognitive or skill deficiency, or if the task is too easy, and adjust our activities accordingly. While it is difficult to change up a perfectly conceived activity, unless participants are operating in their ZPD there is little to be gained.

CONCLUSION

Many of the participatory design studies demonstrate learning theories. In many cases, the creative skill of the designers, in both developing activities and focusing on exposing and building upon the participants' pre-existing knowledge, resulted in exemplars of learning theories. However, despite these exemplars, as we seek to expand the use of participatory design practices, leveraging existing theory and literature can help us understand why some participatory design activities are successful and why others are not. These theories and practices can also help designers, who are new to participatory design, better conceptualize participatory design, thereby, increasing their understanding and helping them create more productive methods. Expanding upon this work could take the shape of a more extensive review of projects that use participatory design methods and map those to learning theory. Alternatively, one could explore this work further by developing participatory design methods that explicitly leverage learning and then investigating if learning occurs.

REFRENCES

1. Ernesto Arias, Hal Eden, Gerhard Fischer, Andrew Gorman, and Eric Scharff. 2000. Transcending the individual human mind—creating shared understanding through collaborative design. *ACM Transactions on Computer-Human Interaction (TOCHI)* 7, 1: 84–113.

2. Erling Björgvinsson, Pelle Ehn, and Per-Anders Hillgren. 2010. Participatory design and democratizing innovation. ACM, 41–50.

3. John D. Bransford, Ann L. Brown, and Rodney R. Cocking. 1999. *How people learn: Brain, mind, experience, and school.* National Academy Press. Retrieved September 24, 2015 from http://doi.apa.org/psycinfo/1999-02807-000

4. George Chin Jr, Olga A. Kuchar, and Katherine E. Wolf. 2009. Exploring the analytical processes of intelligence analysts. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, 11–20. Retrieved September 24, 2015 from http://dl.acm.org/citation.cfm?id=1518704

5. Taylor H. Cox and Stacy Blake. 1991. Managing cultural diversity: Implications for organizational competitiveness. *The Executive* 5, 3: 45–56.

6. DiSalvo, Betsy. 2012. *Glitch game testers: the design and study of a learning environment for computational production with young African American males.* Retrieved September 2, 2015 from https://smartech.gatech.edu/handle/1853/43646

7. Betsy DiSalvo and Carl DiSalvo. 2014. Designing for Democracy in Education: Participatory Design and the Learning Sciences.

8. Betsy DiSalvo and Parisa Khanipour Roshan. 2014. Medium probes: exploring the medium not the message. ACM, 239–248.

9. Carl DiSalvo, Andrew Clement, and Volkmar Pipek. 2012. Participatory Design For, With, and By Communities. *International Handbook of Participatory Design. Simonsen, Jesper and Toni Robertson (Eds). Oxford: Routledge.(2012)*: 182–209.

10. Andrea A. DiSessa. 2006. *A History of Conceptual Change Research: Threads and Fault Lines.* Cambridge University Press. Retrieved September 23, 2015 from http://psycnet.apa.org/psycinfo/2006-07157-016

11. Pelle Ehn. 2008. Participation in design things. *Proceedings of the Tenth Anniversary Conference on Participatory Design 2008.* Indiana University, 2008.

12. Pelle Ehn. 1993. Scandinavian design: On participation and skill. *Participatory Design: Principles and Practices*: 41–77.

13. John H. Flavell. 1979. Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. *American Psychologist* 34, 10: 906.

14. Michael J. Muller. 2002. Participatory design: the third space in HCI. *Handbook of HCI, Lawrence Erlbaum, Hillsdale, NJ.*

15. Corinna Ogonowski, Benedikt Ley, Jan Hess, Lin Wan, and Volker Wulf. 2013. Designing for the living room: long-term user involvement in a living lab. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, 1539–1548. Retrieved September 23, 2015 from http://dl.acm.org/citation.cfm?id=2466205

16. Helga Pfundt and Reinders Duit. 1988. Bibliography. Students' alternative frameworks and science education. Retrieved September 23, 2015 from http://eric.ed.gov/?id=ED315266

17. Elizabeth B-N Sanders. 2002. From user-centered to participatory design approaches. *Design and the social sciences: Making connections*: 1–8.

18. R. Keith Sawyer. 2006. *The Cambridge handbook of the learning sciences*. Cambridge Univ Pr.

19. Donald A. Schön. 1983. *The reflective practitioner: How professionals think in action*. Basic books. Retrieved September 25, 2015 from

20. Jesper Simonsen and Toni Robertson. 2012. *Routledge handbook of participatory design*. Routledge.

21. Elliot Soloway, Mark Guzdial, and Kenneth E Hay. 1994. Learner-centered design: The challenge for HCI in the 21st century. *interactions* 1, 2: 36–48.

22. Dag Svanaes and Gry Seland. 2004. Putting the users center stage: role playing and low-fi prototyping enable end users to design mobile systems. *Proceedings of the SIGCHI conference on Human factors in computing systems*, ACM, 479–486. Retrieved September 23, 2015 from http://dl.acm.org/citation.cfm?id=985753

23. Technology Group at Vanderbilt. 1997. *The Jasper project: Lessons in curriculum, instruction, assessment, and professional development*. Psychology Press.

24. David Wood, Jerome S. Bruner, and Gail Ross. 1976. The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry* 17, 2: 89–100.