IASDR 2019
International Association of Societies of Design Research Conference 2019
DESIGN REVOLUTIONS
Manchester School of Art
Manchester Metropolitan University
02-05 September 2019

An Interdisciplinary Methodology for Facilitating Growth Mindsets of Creativity for College Students: Gameplay, Co-design and Group Dynamics

Yu, Shasha*[a]; Sanders, Elizabeth B.-N.[a]
[a] The Ohio State University, Columbus, US
* susanyue12@gmail.com

Collaborative creativity is crucial because we are facing increasingly complex challenges which no single discipline or skillset can solve. A growth mindset of creativity, in which people believe their creativity can be improved, plays a crucial role in collaborative creative performance. People with growth mindsets are more open to critique and conflict and more willing to engage in dialogue and negotiation, which are essential for fostering collaborative creativity. However, few studies focus on how to facilitate growth mindsets of creativity. This research integrates gameplay, co-design, and group dynamics to explore ways of facilitating growth mindsets of creativity. Four studies have been conducted. We measured participants' engagement, their perceived creative potential, and their perceived collaborative performance. We found that students were highly engaged in the process even when their strategies were evaluated with low scores. 57% of participants, felt more confident in their creativity and in their potential to improve their creativity after participating. Also, participants perceived the collaborative performance to be more creative than what they expected.

Keywords: growth mindset; creativity; adults, gameplay, co-design, group dynamics

1 Introduction

1.1 Background

Collaborative creativity*, which "can yield an outcome that is more creative than the sum of individual contributions" (Bishop, 2018),* is crucial because we are facing increasingly complex challenges which no single discipline or skillset can solve. Diverse groups are more creative because the input of multiple opinions, perspectives, and critique inspires more original and complex ideas (Sawyer, 2007; Pentland, 2014). However, building good collaborations among diverse people is not easy as not all group collaborations lead to more creative outcomes than those produced by individuals. For example, studies have shown that group brainstorming is usually a waste of time (Mullen et al., 1991). There are many reasons. Social inhibition, which is when people in a group hesitate to express ideas for fear of what the others will think, and social loafing, which is when people who are in a group don't feel as responsible for the outcome as they do when they're working alone, will impair the productivity of group creativity (Sawyer, 2012, p.66).

Mindset has been shown to have a huge influence on people's academic, social, and work achievements. Based on Carol Dweck's (2006) theory of growth mindset, students who have a *growth mindset*, which is the belief that an individual can improve their ability through their efforts, their strategies and help from others, outperformed those who have a *fixed mindset*, which is the belief that an individual's ability is set and cannot be changed. A *growth mindset of creativity*, which means an individual believes their creativity can be improved, and plays a

crucial role in individual and collaborative creative performance. Research showed that people with a *growth mindset of creativity* showed better insight problem-solving performance and are more confident in their creativity than those who had a *fixed mindset of creativity*. (Karwowski, 2014; Hass, 2016).

Also, a growth mindset makes people more open to critique and conflict, more willing to engage in dialogue and negotiation, and more likely to share their experiences and views, all of which are essential for fostering collaborative creativity (Sawyer, 2007). A growth mindset decreases a shy person's performance anxiety in a group (Valentiner et al., 2011), which empowers them to be more engaged in a group activity and better contribute to collaborative creativity. In addition, people with growth mindsets of creativity are more willing to take more complex challenges, which is essential for solving the complex challenges. However, in a survey of five thousand adults from US, UK, Germany, France and Japan, 59% of people didn't perceive themselves as creative and 65% reported their creativity has been stifled ("State of Creativity: 2016", 2016). In other words, these people didn't see the potential to improve their creativity. Therefore, how to develop a growth mindset of creativity for adults is a critical topic for our complex challenges.

1.2 Research Focus

The established methods used to develop a growth mindset are one-on-one interventions, such as asking participants to read a research paper about what growth mindset is and the benefits of having a growth mindset. However, these methods have been developed mainly to foster a growth mindset of intelligence. Creativity, unlike intelligence, is more about group work than individual work as many creative inventions came from collaboration. For example, the light bulb was not invented by Thomas Edison alone, but by the collaboration between him and his team members (Sawyer, 2007). Also, currently, no research is focused on the methods of facilitating a growth mindset of creativity. Therefore, a new methodology to develop a growth mindset of creativity at a group level is critical.

Play, or "*engaging in activity for enjoyment and recreation without a practical purpose*", is a common approach to foster creativity in the arts, like free play or *improvisation* (Nachmanovitch, 1990). It is impressive to see a group of people spontaneously play together to create beautiful music or a fantastic acting performance. Maketools (visual materials for making that are composed of a carefully selected set of playful components) have been used in co-design, *a participatory design approach that involves all stakeholders in the process*, to inspire interdisciplinary groups in collaborative explorations of future opportunities (Sanders & Stappers, 2012). However, play alone is not enough to foster a growth mindset of creativity in a collaborative situation because group dynamics are essential. Therefore, in this research, we aim to enhance collaborative creativity by integrating play from co-design with a group interaction approach from social science to explore the development of growth mindsets of creativity.

1.3 Contributions

This research explores the integration of methods and practices spanning design and other fields, which sparks interdisciplinary collaboration and encourages innovation in methodology development in design. Also, the practice of the methodology will empower adults to discover their creative potential, increase their openness to constructive criticism, and embrace challenges to enhance collaborative creativity.

2 The Design Research

In this research, four studies were conducted to explore ways to facilitate a growth mindset of creativity for college students (Figure 1). The first study examined the fixed mindset triggers*, i.e., the elements that could impair people's confidence in their creative potential*. The second and the third studies examined whether gameplay in co-design was an appropriate approach to help adults facilitate growth mindsets of creativity when they encountered fixed mindset triggers. They also identified what principles were important for the methodology to facilitate a growth mindset of creativity. The fourth study explored whether this methodology would be applied to a daily life environment instead of a lab environment.

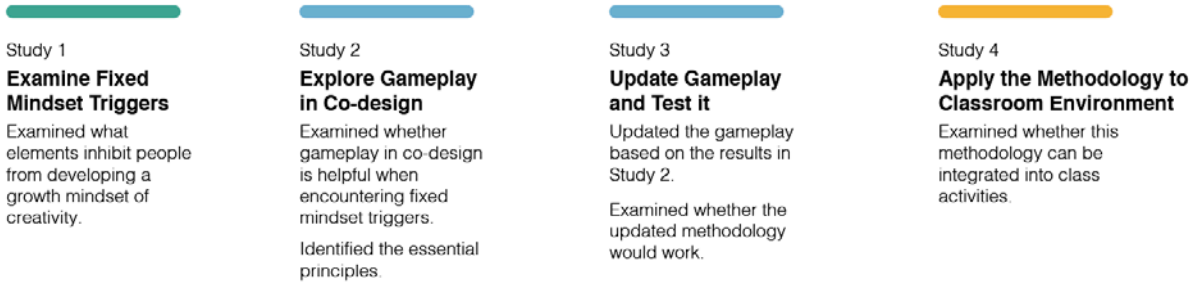

Figure 1. Research process

2.1 Examine the Fixed Mindset Triggers

The objective of *Study 1* was to examine *fixed mindset triggers, i.e., the elements that could impair students' confidence in their creative potential*. Seventeen students participated in the study and finished an online survey regarding their perceptions of creativity, e.g., "How creative do you think you are?" "Could you describe a moment in which you felt you were not creative?" The results from the survey show that five main elements can impair students' confidence in creativity: 1) Judgment 2) Comparison. 3) Failure. 4) No ideas. 5) Lack of Visualization skills

These results are consistent with previous studies (Kelley & Kelley, 2013; Dweck, 2015). Judgment or critique could impair students' confidence in their creative potential. However, judgment or critique is also important for fostering collaborative creativity (Sawyer, 2007). How to facilitate students' growth mindset of creativity even when they encounter those fixed mindset triggers? Research shows that games have the potential for promoting confidence for college students when they are struggling in STEM majors (Mayo, 2009; Kao, D. et al., 2015; Melcer, E. et al., 2017) and games also have been applied as an intervention to promote a growth mindset in children (O'Rourke, E. et al., 2016). Co-design is a *participatory design approach that involves all stakeholders in the process to meet users' needs*. Visual toolkits in co-design facilitate participants' creative explorations and enhance their creative confidence (Sanders & Stappers, 2012). Therefore, we integrated gameplay into co-design to examine whether it is helpful for facilitating the development of growth mindsets of creativity even when participants are encountering judgement or critique. We designed *a mindset change card* game based on the results of *Study 1.* The game was applied in the Co-design workshop in *Study 2.*

2.2 Examine Gameplay in Co-design When Encountering Judgment or Critique

In *Study 2*, we applied the *mindset change* card game to co-design to examine whether gameplay in co-design has the potential to facilitate growth mindsets of creativity. Sixteen participants were grouped in teams of four people. We gave each group one persona who

had a fixed mindset, *e.g., Susan, a freshman in design major, doesn't think she is creative and is thinking to change her major*. One student acted as the persona, and the others tried to help her/him to develop a growth mindset of creativity. If the persona's mind was changed successfully, he/she would lose the game. Students played this game for 15 mins, then they worked together to come up with a solution to facilitate the persona to develop a growth mindset (Figure 2). Also, we identified the principles that are essential to facilitate growth mindsets of creativity by examining the gameplay elements and group interaction dynamics. Data from observations, participants' self-reports, and their game playing strategies were collected. The results showed that gameplay has many benefits to develop the growth mindset of creativity. For example, judgment-behaviour-feedback loops (Garris, 2002) in the game motivated people to engage in problem-solving without impairing their confidence in their creativity when being evaluated by others. Based on the data, four important principles for facilitating growth mindsets for adults emerged: *Support (collaborate)*, *Challenge (problem-solving), Intrinsic Rewards, and a Safe Environment.* Also, we examined the interaction dynamics. The results showed that the current interaction dynamics were not stable, and not everyone was engaged in the process and there are some defensive behaviours at the beginning of the game which could destroy the smooth conversation within the group. Based on the data, three elements of interaction dynamics, *i.e., equality of conversation, feedback, and evaluation* are essential for facilitating growth mindsets of creativity.

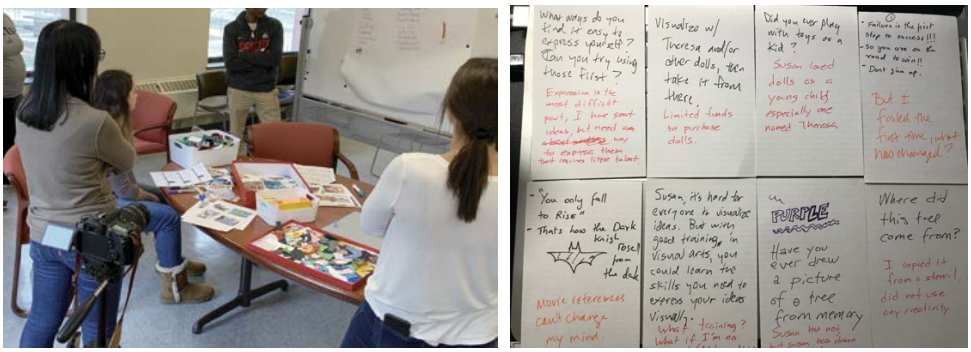

Figure 2. Gameplay in co-design

In *Study 3 (Figure 3.1)*, we designed a new game based on the results of *Study 2*. For example, students had teammates to work together to solve the problem. Random images were available to inspire them regarding strategies. The problem that they were trying to solve was challenging but not too hard. We asked participants to write each strategy on one card and evaluate it before they gave it to another person. That person evaluated it based on how helpful the strategy was to him/her and then provided feedback. This time, we set the goals for the two roles (problem solvers and a person who had a fixed mindset on his/her creativity) in a collaborative way instead of a competitive way to make the interaction smoother. Also, everyone in the group had the opportunity to share ideas. Twenty-three college-age participants from different backgrounds participated in the study. We measured participants' mindsets on the potential to improve their creativity before the study and after the study, their perceptions on their creative outcomes and their engagement when their strategies are evaluated with low scores. They played the game for 15 minutes and then they switched roles and played the game for 15 minutes again. After that, they worked together to come up with strategies to help the fixed mindset person develop a growth mindset. The visual materials (such as photos and paper shapes) were available to inspire students to come up with strategies. The results showed that participants were highly engaged in the process and continued to improve their strategies to solve the posed

problems when their strategies were critiqued. They didn't view the critiques as threats but rather as constructive feedback to help them improve their strategies. Fifty-seven percent of the participants, who initially believed their creativity could not be improved, felt more confident in their creativity and in their potential to improve their creativity after participating in the workshop (Figure 3.2, 3.3). Also, they perceived the collaborative outcomes were more creative than they expected (Figure 3.4)

Figure 3.1. Updated gameplay in co-design

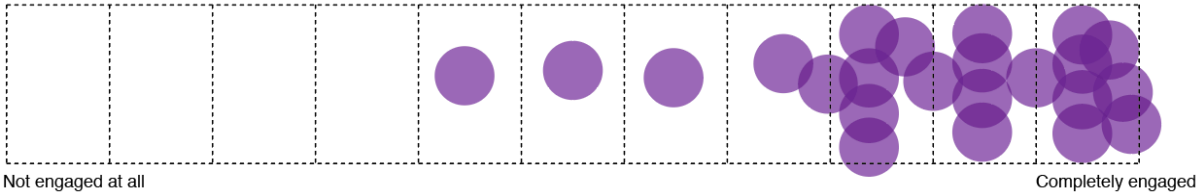

Figure 3.2. Participants were highly engaged in the process

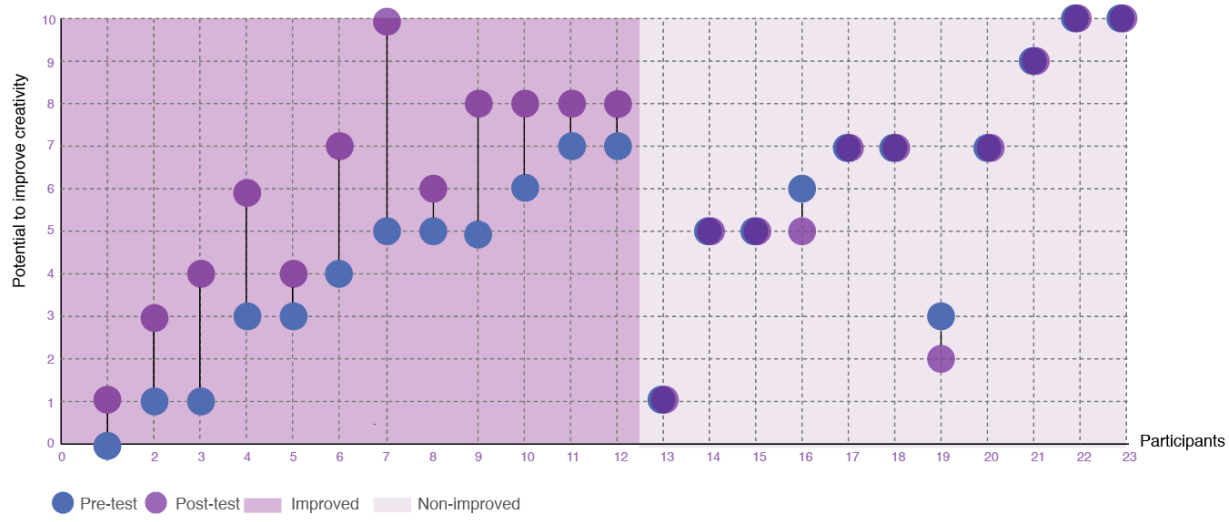

Figure 3.3. 57% (12 out of 21) of the participants were more confident in the potential to improve their creativity

Ps: No.22 and No.23 were not included because both before and after the test, the score was 10.

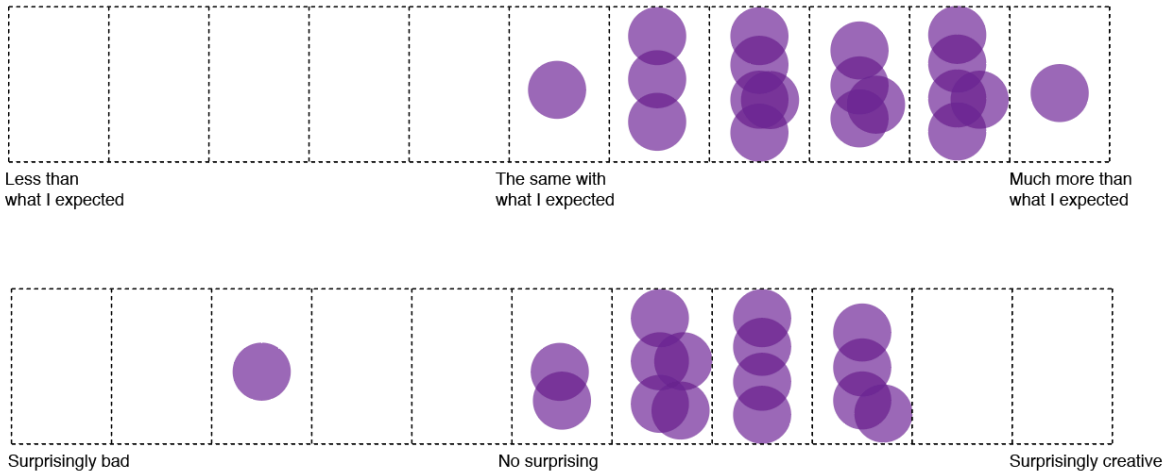

Figure 3.4. Students perceived collaborative performance as more creative than they expected

2.3 Apply this methodology to a classroom environment

The current results are promising. However, one remaining question is how to apply this methodology to daily life environments, such as classrooms? How would instructors integrate this methodology into class activities to facilitate the development of students' growth mindsets of creativity to enhance collaborative creativity? To explore how to make the methodology accessible to more people and empower them through daily life activities, we conducted *Study 4* in a classroom environment (Figure 4).

Figure 4: Classroom activities

The class workshop was an optional assignment in a design introduction course. Twelve students from different backgrounds took part in the workshop. They were grouped with four students and they didn't know each other before they attended this workshop. Each group was given a problem to solve. We intergrated the workshop to the course content. The instructor was available in the workshop to introduce some concepts, like brainstorming and iteration to the group. There were two sections with different activities in the workshop. In the first section, participants worked together to reframe the problem, generate the pain points of their target audience, and conduct brainstorming for the solutions. Then they played the same game as was used in Study 3. One person acted as the persona and others were the problem solvers. The problem solvers evaluated their strategies before they gave them to

the persona, then the persona evaluated the strategies and gave feedback to the problem solvers. After that, they worked together to come up with solutions to the posted problem. In the second section, participants played the same game and we gave them the same visual materials as were used in Study 3, i.e., paper shapes and images. We measured participants' mindsets on the potential to improve their creativity before the study and after the study, their perceptions on their creative outcomes and their engagement when their strategies are evaluated with low scores. Also, we compared participants' engagement between the first workshop and the second workshop to see whether there were differences.

The data from the classroom workshop showed a similar pattern to that in Study 3. 58%(7/12) of the participants who initially believed their creativity could not be improved, felt more confident in their creativity and in their potential to improve their creativity after participating in the workshop. Also, participants were engaged in the process and continued to improve their strategies to solve the posed problems when their strategies were critiqued. They didn't view the critiques as threats but rather as constructive feedback to motivate them to improve their strategies.

The visual materials (images and shapes) were helpful for them to get started. They liked the game in the first workshop, but they felt it was difficult and struggled to start to come up with strategies. The visual materials in the second workshop were helpful for them to get started quickly. In addition, this workshop also showed that the ideal length of the game should be less than 30 minutes, otherwise students would feel that the game is repetitive and boring. By comparing students' collaboration between those two workshops, we found that students in the gameplay section were more likely to share ideas and views especially for some students who were introverted. More classroom workshops in different courses will be conducted in the near future to see whether there is a similar pattern.

3 Discussion

Everyone is creative (Sanders & Stappers, 2012). Creativity is something you practice, not just a talent you are born with (Kelley & Kelley, 2013). Given gameplay in co-design has the potential to facilitate students' growth mindsets of creativity, it behooves us to study the methodology by which students perceive the fixed mindset triggers, *i.e., judgement and critique* as opportunities to growth. In this research, we examined students' fixed mindset triggers, whether this methodology would enhance students' confidence in their creativity, facilitate students to see their creative potential, or motive them to try new strategies to improve their creativity. Students perceived the game to be fun and easy which made it easier for them to get started. For example, when we told students they would play a game, they felt excited and looked forward to playing it instead of hesitating to try. The elements that we generated in this research, e.g., *Support (collaborate)*, *Challenge (problem-solving), Intrinsic Rewards, Equal Conversation, and Feedback,* are important for the success of the game*.* For example, when students were struggling with coming up with strategies, they could talk with their teammates and they could turn to the visual materials to get inspirations. The task in the game was challenging but not too hard which could motivate them to try but not make them feel too frustrated. The equal conversation gave everyone the opportunity to share ideas, which was important to foster collaborative creativity. Also, the feedback and evaluation from others were helpful for them to adjust and improve their ideas. In addition, we applied this methodology into a class environment to examine whether it works in a daily life environment in addition to a lab environment. Our findings suggest a provocative new relationship and interaction between adults' growth mindsets of creativity and gameplay, where students kept trying new strategies to improve themselves.

4 Future Work

In this research, we measured participants' perceived collaborative performance. However, we didn't measure the collaborative performance from the views of creative experts outside of the group. In future studies, we will measure experts' views on the collaborative performance to examine whether this methodology can enhance collaborative creativity.

About 60% of the participants perceived their creative potential could be improved after participating in the study. However, 40% of them didn't perceive their creative potential could be changed at all. In future studies, we will examine the mechanisms of this methodology further to explore whether there are some principles which are essential for facilitating growth mindsets of creativity for all people.

In the current study, we examined whether students' perceptions changed immediately after the study. In the future, we will conduct a longer term study to evaluate whether this effect lasts longer.

5 Reference

Bishop, L. (2018). Collaborative musical creativity: How ensembles coordinate spontaneity. *Frontiers in Psychology*, *9*.

Dweck, C. S. (2006). Mindset: The new psychology of success, Random House. *New York, NY*.

Dweck, C. (2015). Carol Dweck revisits the growth mindset. *Education Week*, *35*(5), 20-24.

Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation & gaming*, *33*(4), 441-467.

Hass, R. W., Katz-Buonincontro, J., & Reiter-Palmon, R. (2016). Disentangling creative mindsets from creative self-efficacy and creative identity: Do people hold fixed and growth theories of creativity? *Psychology of Aesthetics, Creativity, and the Arts*, *10*(4), 436.

Kao, D. & Harrell, D. F. (2015). Mazzy: A STEM learning game. *Proceedings of the 10th International Conference on the Foundations of Digital Games (FDG 2015*), *June 22-25, 2015, Pacific Grove, CA, USA. ISBN 978-0-9913982-4-9.*

Karwowski, M. (2014). Creative mindsets: Measurement, correlates, consequences. *Psychology of Aesthetics, Creativity, and the Arts*, *8*(1), 62-70.

Kelly, D. & Kelly, T. (2013). *Creative confidence: Unleashing the creative potential within us all*. New York, NY: Crown Business.

Mayo, M. J. (2009). Video games: A route to large-scale STEM education? *Science*, *323* (5910), 79-82.

Melcer, F. E., Hollis, V., Isbister, K. (2017). Tangibles vs. mouse in educational programming games: influences on enjoyment and self-beliefs. *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems, Denver, CO, USA Denver, ACM 978-1-4503-4656-6/17/05.*

Mullen, B., Johnson, C., & Salas, E. (1991). Productivity loss in brainstorming groups: A meta-analytic integration. *Basic and Applied Social Psychology*, *12*(1), 3-24.

Nachmanovitch, S. (1990). *Free play: Improvisation in life and art*. Penguin.

O'Rourke, E., Haimovitz, K., Ballweber, C., Dweck, C., & Popović, Z. (2014). Brain points: A growth mindset incentive structure boosts persistence in an educational game. *In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. 3339-3348. ACM.*

Pentland, A. (2014). *Social physics: how good ideas spread-the lessons from a new science*. Penguin.

Premuzic C. T. (2015). Why group brainstorming is a waste of time. *https://hbr.org/2015/03/why-group-brainstorming-is-a-waste-of-time.*

Sanders, E. B.-N. & Stappers, P.J. (2012). *Convivial toolbox: Generative research for the front end of design*. Netherlands: BIS Publishers.

Sawyer, K. (2007). *Group genius: The creative power of collaboration*. Basic Books.

State of Create: *2016 https://www.adobe.com/content/dam/acom/en/max/pdfs/*

AdobeStateofCreate_2016_Report_Final.pdf

Valentiner, P. D., Mounts, S. N., Durik, M., A, Lonsway, L. S. (2011). Shyness mindset: Applying mindset theory to the domain of inhibited social behavior. *Personality and Individual Differences*, *8*,1174-1179.

About the Authors:

Shasha Yu: Shasha is a graduate student in the Department of Design at the Ohio State University. Prior to OSU to pursue her M.F.A. degree, she had a master's degree in Psychology and worked as a UX researcher in a global Game Design company for three years. Her expertise is in gameplay in education, co-designing, and information visualization.

Elizabeth B.-N. Sanders: Liz teaches design research and participatory design in the Design Department at The Ohio State University. As a practitioner, Liz introduced many of the methods being used today to drive design from a human-centered perspective.