Creativity in co-Design for Physical Education

Comparing Contributions of Children and Professionals

Mast, Danića; Schipper, Sylvia; van Doorn, Fenne; Schut, Alice; Gielen, Mathieu; de Vries, Sanne

DOI
10.1007/978-3-319-76908-0_45

Publication date
2018

Document Version
Accepted author manuscript

Published in
Interactivity, Game Creation, Design, Learning, and Innovation. ArtsIT 2017, DLI 2017.

Creativity in co-Design for Physical Education: Comparing Contributions of Children and Professionals

Danića Mast[1,2*], Sylvia Schipper[1,3], Fenne van Doorn[2,4], Alice Schut[5], Mathieu Gielen[4], Sanne de Vries[1]

The Hague University of Applied Sciences

[1] Faculty for Health, Nutrition & Sports,
Research Group Healthy Lifestyle in a Supporting Environment

[2] Faculty for IT & Design, Communication & Multimedia Design, User Experience Design

[3] Faculty Technology, Innovation & Society, Industrial Design Engineering

Johanna Westerdijkplein 75, 2521 EN, The Hague, the Netherlands

{d.mast, s.j.schipper, s.i.devries, f.a.p.vandoorn}@hhs.nl

Delft University of Technology

[4] Faculty of Industrial Design Engineering
Landbergstraat 15, 2628 CE, Delft, the Netherlands

[5] Faculty of Applied Sciences,
Department of Science Education and Communication,
Lorentzweg 1, 2628 CJ Delft, the Netherlands

{a.schut, m.a.gielen}@tudelft.nl

Abstract. This study is carried out within the context of a research and innovation project *Co-design with Kids* that aims to support teaching of broad so-called '21st century' skills. In this project, design toolboxes for use within primary education are developed and studied, with real life clients and assignments. In the case described in this paper, the assignment was to create new concepts for physical education (PE). To be able to assess the value of design outcomes created in a co-design trajectory by children, we compared their design outcomes to those created in a similar design process by professionals. Six teams of children (n=21, 11-12 years old) and three teams of professionals (n=10, with a background in design, sports or physical education) developed concepts in separate co-creation sessions. We present a first assessment of the differences and similarities in creativity of the design outcomes of the two groups. This assessment of textual summaries shows no remarkable differences between design outcomes of children and those of professionals in terms of elaboration, originality and relevance. This indicates that children could be involved as design partners. Further research is needed to gain insight into the specific value of involving children as design partners.

Keywords: Co-design, Physical Education, Children, Professionals, Co-creation

1 Introduction

In this study, we involved teams of professionals with a background in design, sport or physical education and teams of children as designers to invent new concepts for exercises in physical education. This paper describes the differences and similarities between the design outcomes of these two groups.

1.1 Involving Children in Physical Education Development

Children generally like to move and be physically active, but for physical education (PE) to be more effective, PE exercises should match their perceptual world [13, 20]. There are many efforts to make PE more motivating, better targeted and more effective. However, children are often participants in studies on PE, but they are rarely involved in the development of its content. Involving children in the development of PE can make children more motivated to participate, leading to increased effectiveness of physical education.

1.2 Context of the research

The study is carried out within the context of a research and innovation project *Co-design with Kids* that aims to support teaching of broad so-called '21st century' skills. These skills are hard to train by themselves; they need a coherent setting and content to train them. As many of the 21st century skills are also addressed within design processes and professional design education has a large array of tools and techniques to train design skills, a project is carried out to develop and study design toolboxes for use within primary education.

This project is carried out with real clients (companies and public organizations), to ensure a realistic and motivating setting for the children. In the case described in this paper, the client asked for ideas for a 'Gym of the Future'. As part of this research project, the question is addressed what the creative quality of the design outcomes from children is, and thus the value of such projects for the clients.

1.3 Research Questions/Goal

To be able to assess the value of design outcomes created in a co-design trajectory by children, we will compare their design outcomes to the design outcomes of a similar design process by professionals. With this approach, we aim to gain insights that can contribute to answering the following questions:

- What are the differences and similarities of (physical education game-) design outcomes created in co-design sessions by professionals vs. Children in terms of creativity?
- What is the value of children as design partners and what is the quality of their design outcomes?

2 Related Research

2.1 Co-creation: Involving Children in Design Assignments

In co-design (also known as participatory design), stakeholders are involved in a design process [3, 5, 8], often during several stages. Previous research shows many benefits from involving children in the co-design of technology [7, 8]. Innovations often originate in the user domain (instead of the manufacturer) [16] and children can come up with great, creative, outside the box solutions for problems [4], being experts on their own user experiences.

Though co-design with children (CDC) is widely acknowledged and applied, especially in the Interaction Design community, views on its value vary widely. Van Doorn [6] argues for a co-research approach in which the value of children's contributions lies in mapping the context of their current lives as an inspiration ground for design. Van Mechelen et al. [15] argue that CDC outcomes can be analyzed to uncover children's underlying values. Iversen et al. [9] see CDC as a form of child emancipation and emphasize that "the objective of design is not only technological products, but for participants to develop new insights, design abilities, and a critical and reflective stance toward technology through their engagement in design work.", thus assigning the merit of CDC to children's development rather than to a direct design outcome.

Criticism on co-design with children focuses primarily on the proper inclusion of children in all stages of the design process [17]. Van Mechelen et al. [14] have analyzed forms of group dynamics that challenge the co-design process with children. A critical reflection of design solutions stemming from children's participation is harder to come by.

Given that the current academic debate points at such different merits of CDC as emancipation, uncovering underlying values, or mapping a context, the basic question rises why the design outcome itself is no longer a central theme. It may be time to once again evaluate if design solutions of CDC have a better or different quality from those of professionals.

2.2 Comparing design outcomes of different types of designers

Little research has been done into the comparison of designs by children vs. adults or professionals. Related research does compare the outcomes of design trajectories using different types of design tools and with different age groups.

In a study by Thang et al. [21] outcomes of brainstorming vs. prototyping by children have been compared and assessed by an expert jury on creativity, novelty, non-obviousness, workability, relevance and thoroughness of ideas. The ideas were judged on transcripts of the explanation of the outcomes. Brainstorming outcomes were considered more creative, novel and surprising and prototyping outcomes were more relevant and workable.

A comparison of design outcomes by young children vs. teenagers by Chimbo et al. [5] showed that young children focused on decoration and graphical content, while

teenagers emphasized on textual content and usability. This shows that when designing technology for different age groups it would be important to involve different groups of children and not consider all children (of different ages) as one homogenous group.

Druin [7] argues for inter-generational design teams, suggesting that the contributions from children and adults are different and complementary.

2.3 Assessing Creativity

To be able to assess the value of design outcomes we will assess and compare their level of creativity to be able to give a first indication of similarities and differences.

Creativity is the creation, innovation, expression, production and discovery [19] of ideas. It is about bringing something into being. This can be done through generating something novel or through transforming the existent [10].

Assessing creativity is considered complex and difficult [12]. Nonetheless multiple research approaches generally identify similar componential factors: originality/novelty, usefulness/appropriateness/relevance and fluency/quantity, elaboration/variation [16, 18, 22].

The Consensual Assessment Technique (CAT) [2] is an approach where multiple expert judges assess the actual creativity of things that have been produced as a whole. Instead of assessing predefined criteria. However, correlations have been found with other judgements such as 'novel use of materials' and 'complexity' [1] corresponding with aspects defined by other researchers.

3 Method/Execution

3.1 Co-design with kids

In the first part of this study, 21 children (11-12 years old), were divided in 6 teams of 3 or 4 children. Each team chose one out of four assignments based upon problems they experience in PE lessons: 'Making explanation more fun', 2 teams; 'Making Balancing more fun', 2 teams; 'Game that allows cheating', 1 team; 'Fair teams', 1 team. In six weekly one-hour sessions they developed a concept using various design tools for divergent thinking (sensitizing, mind maps, brainstorming, prototyping), convergent thinking (dots-method [11], C-box, user-testing) and reflection (process wall). The sessions took place in the classroom and in the school gymnasium. During these sessions children were guided by their own classroom teacher. The assignment was introduced by a external PE teacher, to whom the children also presented interim results on which they received feedback. The final concepts were presented in the school gymnasium and were recorded on film.

3.2 Co-design with professionals

In the second part of this study, 10 professionals, of which 3 had a background in design and 7 in sports/physical education were invited to a 4-hour design session on one evening. The design session took place in a class room. The professionals were divided in three groups, with an as much as possible even distribution of people with different backgrounds. Each group had one member with a design background that could guide the design process. They had the freedom to choose their own method for their creative process, as they would in a real design context. Each group received one assignment (based on the assignments that were chosen most by the children): 'Fair teams'; 'Making explanations more fun'; 'Making Balancing more fun'. The final presentations were recorded on film.

3.3 Creativity Assessment Criteria

Based on Torrance Test of Creative Thinking [22], a toolkit for idea competitions by Piller & Walcher [16] and work by Reinartz & Saffer [18] we identified three criteria to assess the creativity of the concepts of children and professionals:

- *Elaboration:* The degree in which concepts are complete and detailed. To which extent the ideas are thought through [16].
- *Originality:* The extent in which results are novel and not a derivative of existing concepts [18].
- *Relevance:* The degree in which a solution is useful for a given problem [16].

3.4 Summary & Assessment of Design Concepts

Each design outcome from both children and professionals was summarized in text by a researcher based on the videos of the final presentations and checked by a second, independent researcher who compared the summaries to the presentation videos ensuring a truthful explanation of all concepts and to make sure that the summarizer didn't fill in any blanks. This ensured a similar representation of children's and professional's ideas.

The summaries were assessed based on the previously drafted criteria (elaboration, originality, relevance) by a third independent designer/researcher who described noticeable substantive differences and similarities between concepts. This designer/researcher has a background in design education and is experienced in objectively assessing design outcomes. In this study, due to practical constraints, this researcher was aware which group (children or professionals) had created each concept.

4 Results

4.1 Elaboration

Differences
Children seemed more specific in identifying physical devices and physical actions. They describe them and the rules of the game in a clear and specific manner. Furthermore, they describe the giving of instruction to players and the type of penalties within a game more often. Additions (such as projections or augmented reality) are to situations or surroundings that are familiar to the children. Their ideas are mostly based on existing situations and play forms. They combine different, existing gym and sports equipment and materials (such as using a stick while standing on a Pedalo balancing board), tasks (such as different angles of computer questions) and actions (such as ball throwing). They don't mention adjusting difficulty to the skill levels of individuals or offering help, in contrast to professionals.

The concepts of professionals are all rather complex, with various phases in game play. They add complexity to exercises by adding different phases or levels (such as the help of a virtual Messi in a higher level). Because they are less specific in describing the rules and actions, they just give an impression of the game play, these concepts seemed more abstract.

Another noticeable difference between concepts of children and professionals is that professionals gave their concepts a title, adding more context and explanation to their concepts.

Similarities
Professionals added complexity through phases which often makes the game play too complex and incomprehensive. In the 'three-stage rocket' concept ('Making balancing more fun' assignment) there is an accumulation of many activities (Mastermind, traditional exercises) that have no good coherence and are not well thought out in why and in which way they succeed each other.

The concepts of children are more simple, but when they do add complexity (which happened in a concept where goals that function as 'free zones' were introduced), their concepts also seem somewhat incoherent.

Conclusion
Both groups seem to elaborate in their concepts by either adding objects (children) or phases (professionals), but often this made the concepts more complex instead of adding value.

For this criterion, it is not possible to conclude if children executed the assignment better or worse compared to professionals in terms of elaborateness, at most in a different way, more explicitly and at a lower level of abstraction than the professionals.

4.2 Originality

Differences

The design outcomes of children are variations on existing concepts, to which they add more freedom and surprising elements. That does seem to make the concepts more motivating to play, but only slightly more original than existing concepts.

Professionals invent new elements, such as a Teacher in a control room (in the 'Escape Room' concept) or AR-characters and a sorting hat (in the 'Sorting Hat' concept). These are novel elements to PE, but often already existing concepts outside PE. Through combining with and adding these new aspects from other areas to more known PE practices, the originality of their design outcomes increases.

Similarities

The children's and professionals' solutions are novel and not similar to existing concepts. Allocating freedom (such as a play situation/environment that adjusts to a child's preferences) makes instruction more fun in concepts created by both groups.

Conclusion

Overall, professionals perform slightly better than children on originality. The difference between both groups is caused by the slightly higher novelty and richer context of the concepts described by professionals.

4.3 Relevance

Differences

The differences for this criterion are not so much found between the groups but much more between the assignments. Both children and professionals created relevant ideas for the 'Making explanation more fun' and 'Making balancing more fun' assignments. Neither managed to create a solution for 'Fair teams' that will last longer than just one game play. This might be because this assignment has a more psychological aspect than just a physical setting with straightforward rules for game play; we suspect the rules designed by both children and professionals can be manipulated once someone is familiar with the game. For example, in the 'without talking' concept, where teams are made based on questionnaire answers, players can discuss beforehand what preferences they fill in in the questionnaire.

The adults are better with 'The escape room' concept (where different rooms have different physical tasks that have to be accomplished before moving to the next room), making the implicit explanation more surprising and rewarding (such as Messi as a virtual guide when a higher level is reached) and therefore seems more 'fun', than the intertwined explanation of the children's ideas.

In "Making balancing more fun" implicit balancing is enhanced in different forms. In both concepts created by children, teams battle each other making the movement more complex (striking back a ball with a stick while crossing the floor on a Pedalo board), while the competition makes it fun. One of the professionals' concepts consisted of a virtual reality environment that makes the balancing exercise more complex and also more motivating and exciting.

Similarities

Both children and adults use implicit instruction for different elements to create interesting exercises. Both have difficulties designing a solution for a more psychological problem.

Conclusion

Children and professionals create relevant concepts that solve the given problem. They give different accents, but this has no effect on the value of the outcome relevancy.

5 Conclusion

This first assessment of differences and similarities of the design outcomes of children and professionals show that the design outcomes of both groups are more or less equivalent on the whole in terms of creativity, although there are some differences in details.

For Physical Education, our results show that input from children aged 11-12 years can be of equal value as input from professionals in the early ideation stage. In developing PE curricula, children could be valuable co-design partners and could be involved more.

Since our first findings demonstrate no remarkable differences between the design outcomes of children and professionals, this justifies follow-up research that looks in more detail at the aspects influencing the creative quality of design outcomes of children versus professionals.

Amidst the academic debate on the various reasons for CDC and the shift away from valuing the design outcomes as such, this study suggests that the quality of the design solutions is still a relevant focus.

6 Discussion & Further Work

This study has some strengths and limitations that should be taken into account when interpreting the results.

Spatial Context. The different contexts (gymnasium & classroom for the children; workshop room for the professionals) in which both groups carried out their assignment could have resulted in differences in focus. For example, the use of gym equipment by children because of their presence in the gym.

Personal Context. Some differences in the design outcomes can be explained by personal context, (such as the age difference between groups). The use of a title (and consequently increased context and explanation) for the concepts by professionals is something professionals would be more accustomed to. That children name penalties and instructions more often is likely because these are aspects that they come into contact with in their school context daily.

Background Professionals. Only three professionals had a professional design background (most had a PE background). Even though each team of professionals had one designer as a member, in a normal design setting a design team would consist of more designers. In future research, it would be interesting to see what the differences would be between groups of professionals with just a PE background or groups of professionals with just a design background and groups of children.

Trajectory. Both groups followed different design trajectories that might have been of influence on the design outcomes. Professionals spent less time on their assignment (4 hours) than children (6 hours, divided over 6 weeks). The difference in weeks over

which the design process was spread gave children more time to let their ideas settle. Nonetheless, we didn't see this in the results. In further research, more similar trajectories would be preferable to be better able to identify the cause of similarities and differences.

Tools & Instruction. The professionals had complete freedom in their approach while the children had a specified toolkit to work with and instructors to guide them. This could have had effect on the outcomes and therefore the judgment of the concepts. Further research is needed to explore what variables are of influence on the design outcomes for both children and professionals.

Concept Summaries. All concepts were summarized textually. A good addition would be to graphically summarize the concepts, all in the same manner. This allows objective evaluation solely based on design features although there will always be an element of interpretation in the translation of concepts into a 'neutral' format that cannot be attributed to either of the groups.

Anonymous & Objective Assessment. The assessing researcher knew which concepts were designed by which group. To be able to objectively assess the outcomes, in the next stage of this project an objective jury, consisting of multiple members, will assess anonymized concepts.

More Teams. We examined the design outcomes of one class of children. For further research, we should review the design outcomes of more classes from other schools to investigate the difference between different age groups, school types, and the contents of the toolkit that the children have worked with.

Creativity. The value of design outcomes doesn't solely rely on the level of creativity. Although it gives an indication and a way of comparing amongst results, in future research we should look into additional methods of assessing the value of design outcomes by children as design partners.

Acknowledgements

This project is funded by NWO-NRO under the 'Human Capital: 21st century skills' program. We would like to thank the professionals, the children and teacher of the participating school.

References

1. Amabile, T. M. (1983). The social psychology of creativity: A componential conceptualization. Journal of personality and social psychology, 45(2), 357.
2. Baer, J., & McKool, S. S. (2009). Assessing creativity using the consensual assessment technique. In Handbook of research on assessment technologies, methods, and applications in higher education (pp. 65-77). IGI Global.
3. Benton, L., Johnson, H., Ashwin, E., Brosnan, M., & Growemeyer, B. (2012). Developing IDEAS: Supporting children with autism within a participatory design team. Proceedings of CHI 2012, 1759-1764
4. De Bono, E. "Children Solve Problems." (1972).

5. Chimbo, B., & Gelderblom, J. H. (2014, November). Comparing young children and teenagers as partners in co-design of an educational technology solution. In Proceedings of the ISI e-Skills for Knowledge Production and Innovation Conference (pp. 17-21).
6. Van Doorn, F., Gielen, M., & Stappers, P. J. (2014). Children as co-researchers: More than just a role-play. In Proceedings of IDC 2014, 237-240. https://doi.org/10.1145/2593968.2610461
7. Druin, A. (1999). The design of children's technology. San Francisco: Morgan Kaufmann Publishers.
8. Druin, A. (2002). The role of children in the design of new technology. Behaviour and Information Technology, 21(1), 1-25.
9. Iversen, O., Smith, R., Dindler, C. (2017). Child as Protagonist: Expanding the Role of Children in Participatory Design. Proceedings of IDC 2017, 27-37.
10. Kaufman, J. C. and Sternberg, R. J., *The Cambridge Handbook of Creativity*. Cambridge University Press 2010, 2010.
11. Klapwijk, R. (2011, October 26). De kunst van het kiezen: to stip or not to stip. Retrieved July 07, 2017, from https://www.wetenschapsknooppuntzh.nl/blog/de-kunst-van-het-kiezen-to-stip-or-not-to-stip/
12. Klapwijk, R. M. (2017). Formative Assessment of Creativity. Handbook of Technology Education, 1-20.
13. KVLO Topic Beleven in bewegen (BO) number 1 31 january 2014 https://www.kennisbanksportenbewegen.nl/?file=6298&m=1459423514&action=file.download)
14. Mechelen, M. van, Gielen, M., vanden Abeele, V., Laenen, A., & Zaman, B. (2014). Exploring Challenging Group Dynamics in Participatory Design with Children. In 13th international conference on Interaction Design & Children (pp. 269–272). https://doi.org/10.1145/2593968.2610469
15. Mechelen, M. van, Derboven, J., Laenen, A., Willems, B., Geerts, D., vanden Abeele, V. (2017). The GLID method: Moving from design features to underlying values in co-design. Int. J. Human-Computer Studies, v97 p116-128. http://dx.doi.org/10.1016/j.ijhcs.2016.09.005
16. Piller, F. T., & Walcher, D. (2006). Toolkits for idea competitions: a novel method to integrate users in new product development. R&d Management, 36(3), 307-318. http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9310.2006.00432.x/epdf
17. Read, J.C., Fitton, D., Sim, G., and Horton, M.. 2016. How Ideas make it through to Designs: Process and Practice. In Proceedings of the 9th Nordic Conference on Human–Computer Interaction (Nordi- CHI '16). ACM, New York, NY, USA, Article 16, 10 pages. https://doi.org/10.1145/2971485.2971560
18. Reinartz, W., & Saffert, P. (2013). Creativity in advertising: When it works and when it doesn't. *Harvard Business Review*, *91*(6), 106-111.
19. Schasfoort, B.. Beeldonderwijs en didactiek. Wolters-Noordhoff, 2007.
20. Slot-Heijs, J., Lucassen, J., Collard, D. (2017). Effecten van bewegingsonderwijs op sport- en beweeggedrag op latere leeftijd. Mulier Instituut
21. Thang, B., Sluis-Thiescheffer, W., Bekker, T., Eggen, B., Vermeeren, A., & de Ridder, H. (2008, June). Comparing the creativity of children's design solutions based on expert assessment. In Proceedings of the 7th international conference on Interaction design and children (pp. 266-273). ACM.
22. Torrance, P.. "Verbal Tests. Forms A and B-Figural Tests, Forms A and B.". The Torrance Tests of Creative Thinking-Norms-Technical Manual Research Edition. Princeton, New Jersey: Personnel Press. p. 6.