University of British Columbia

Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Children Engaging in the Design Process of Melfa Road is Crucial for Providing the Most Benefits

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Prepared for:

Course Code: UFOR 401

University of British Columbia

Date: 15 April 2022

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UFOR 401 Integrated Urban Forestry Capstone Studio

University of British Columbia

April 15, 2022

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Executive Summary

Neighborhoods have been trying to develop ways of engaging children with nature because of the potential health benefits. By also including children in the design process of outdoor spaces, their needs and desires can be incorporated. Our goals were to examine approaches for engaging children in design activities and encouraging nature-children interaction, and learn how children have been engaged specifically in the design of outdoor spaces. We used qualitative site analysis to make visual observations of the study site, then conducted a literature review. We found that interviews, workshops, and behavior mapping are the most effective ways of engaging children in the design process. We also found that spaces where children can interact with nature provide educational opportunities, sensory experiences, opportunities for exploration, and increased social cohesion and behavior. Finally, we found that when children were involved in the redesign of outdoor spaces, workshops with a drawing component were the most common engagement strategy. Involving children in the design process of outdoor spaces also allows children to feel heard, empowered, and create a sense of ownership over the space. Based on our literature review, we recommend first performing behavior mapping on Melfa Road to observe how children are currently using the space and interact with the natural environment. We then recommend hosting a workshop with different activities with parents present because they are the most accommodating strategy, especially for children with special needs. Finally, we recommend some potential ways to improve child-nature interaction at Melfa Road using existing green spaces. The next steps would be to create an engagement plan and execute these recommendations.

Introduction

The journey from home to school has the potential to provide children and their caregivers passive access to nature which has been shown to support cognitive and mental health (Mutz et al., 2019). Some neighborhoods have developed innovative approaches to actively engage children with nature, but we have not found any that have purposefully integrated them into a child's walk to school. Research has also shown that in order for new designs to reach their full benefit it can be helpful for end users to be engaged in their design (Derr, 2015). However, it is not clear how designers and community groups should engage children to support the design of new projects that will encourage interactions with nature in daily routines.

Research has shown that nature based environments provide students with environmental education opportunities to enrich student attitudes, behaviors, and learning skills. (Hussein, 2012). Literature also demonstrates that consistent nature/ biodiversity interaction (e.g. weekly) can provide sustained benefits in children lasting a full academic year (Harvey et al., 2020). Comparatively, students who do not partake in weekly outdoor nature/ biodiversity interactions show no increase or even a decrease in their wellbeing during the same time period. Additionally, nature based solutions and interaction can be a highly cost effective way to improve children's wellbeing compared to other methods involving built infrastructure or indoor activities (Harvey et al., 2020).

Figure 1. Site photo showing Melfa Road next to the Kids Club on the right.

Figure 2. Site photo of Melfa Road facing the Kids Club Day Care. Current signage shows shared space between pedestrians and cyclists.

Melfa Road is a shared non-vehicular use road adjacent to The Kids Club daycare and close to Norma Rose Point Elementary School. The site's main users are residents of the area and their children. This section of the road is vehicle restricted, but is still shared by pedestrians and cyclists causing safety concerns.

Currently, the road suffers from the absence of an interactive, child-friendly environment. By allowing children to be an integral part of the engagement process, their needs and desires will be incorporated into the redesign of the road (Parnell et al., 2008). Therefore, the health benefits, along with the essential need to involve users in design, supports the necessity in implementing innovative nature-based solutions that will actively engage all Melfa Road users with nature.

Goal

Our goal is to examine methods and approaches for engaging children in design activities, as well as encouraging nature-children interaction. Through a comparative analysis of strategies and methods used in other locations we will include how some neighborhoods have engaged children in the design of outdoor public spaces and activities, and how children have benefited from those interactions.

Methods

Site Context

Figure 3. Location of Melfa Road on University Endowment Lands marked by a gold star.

Our site is located on the east side UBC Vancouver campus on the University Endowment Lands, seen in Figure 3. It is in a residential area consisting largely of apartments and townhomes with minimal single family homes throughout. Many daycares are nearby, including the Berwick Child Development Centre, which specializes in helping children with disabilities. Norma Rose Point Elementary School, seen in the top right corner of Figure 4, is also very close to the site. It is clear that there are many young children, including some with special needs, that frequent the site.

Because the main users of the site are children with their parents, they should involved in the redesign of Melfa Road. Any added space to Melfa Road will also need to be inclusive of all children, regardless of their disabilities. Children, the primary users of this site, should be able to express their feelings and opinions on any changes made to the area.

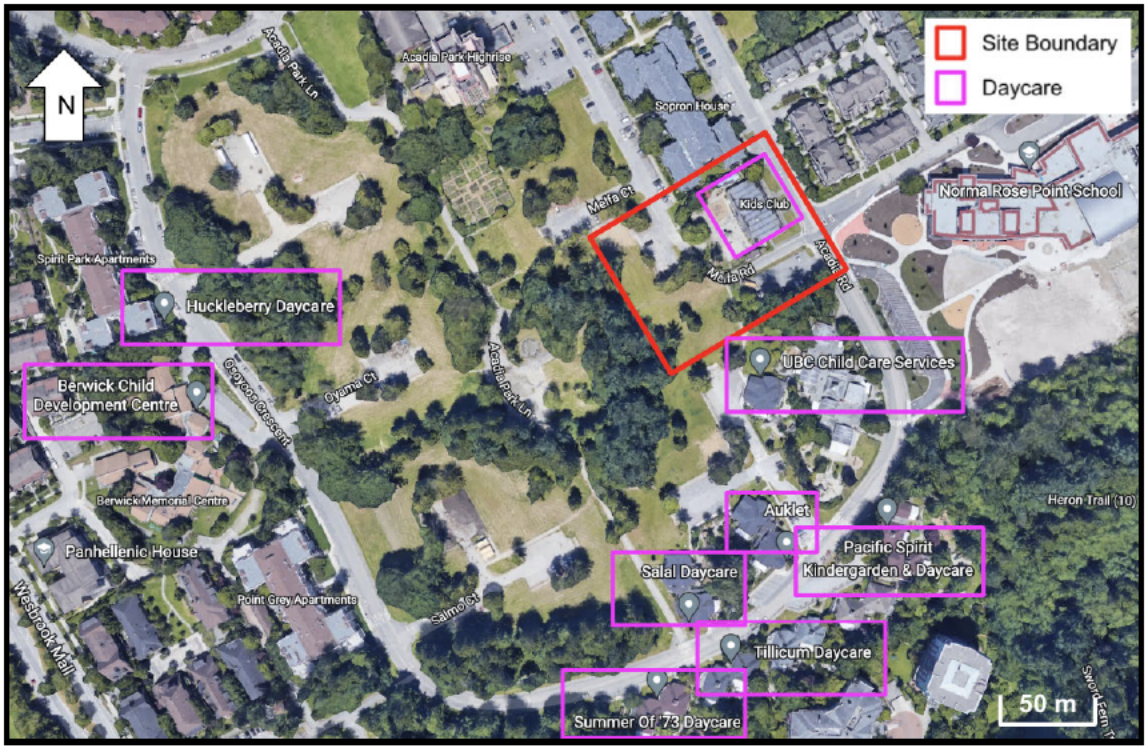

Figure 4. Closer view of site context. Site boundary outlined in red and eight daycares outlined in pink.

Qualitative Site Analysis

In order to frame our research with an understanding of existing conditions at Melfa road, we began our project with a site visit. During this process, we made visual observations of the site such as main user groups, site conditions, biodiversity composition, and general locations of significant site features. This process also involved documenting our findings through photography. These observations and photographs were utilized to inform our recommendations for the site.

Literature review

In order to find different ways in which children (including those with disabilities) have been involved in the design process, we conducted a literature review. Search words included ‘children in the design process,’ ‘involving children with disabilities in design,’ and ‘design process/engagement with children.’ We reviewed a total of 17 papers selected from Google scholar and the UBC library, then recorded information concerning how each method was conducted to compare and summarize findings. We organized the results regarding ways to involve all children in the design process as a table (Table A in Appendix I), portraying the feasibility in terms of time and cost of each method for Melfa Road.

To find studies that focus on child-nature interaction and benefits that arise from this, we used the following search phrases: ‘encouraging children-nature interaction,’ ‘children and sensory garden,’ ‘children and natural play.’ and ‘benefits of children interacting with nature’ using Google Scholar and the UBC Library. We selected, reviewed and analyzed 20 papers. We collected relevant information from the literature and divided it into categories such as the intervention, ecological elements used, intended impacts on children, intended ecological impacts, and evaluation of child-nature benefits. We then summarized and grouped the information from each category based on consistency and overlap resulting in 6 key themes emerging, seen in Table 2.

To find case studies regarding children participating in the design of natural spaces, we entered a combination of the search terms ‘children,’ ‘participatory design,’ ‘natural spaces,’ ‘nature,’ and ‘outdoor’ into Google Scholar. We examined a total of six case studies. After identifying common topics and overall findings, we then grouped the information into common themes and related them to the Melfa Road site.

Results and Discussion

Result 1: Children Participating in the Design Process

We evaluated different approaches to engaging children in the stakeholder process and found three main strategies that are most often implemented to obtain ideas from children: interviews, workshops with activities, and interactive environment/ behavior mapping (Table A). We found that interviews are the most used yet least interactive methods to ask children what they think. However, workshops with activities and behavior mapping are much more interactive and utilize active learning strategies.

Figure 5. Two game-play sessions from workshops (Gennari et al., 2019)

Several studies highlighted the importance of parental involvement during children's engagement (Parés et al., 2005). Engaging parents or guardians creates a comfortable environment in which children are able to feel safe to speak up for their desires (Derr et al., 2013; Parés et al., 2005). Involving adults will not only allow for adults to recognize the importance of involving kids in the design process and its benefits, but also will help spread the concept.

Figure 6. Gardens used to engage children in meaningful contact with nature (Nimmo & Hallett, 2008)

Figure 7. Parent chaperoning children during neighborhood walk activity (Slingerland et al., 2020)

Result 2: Child-Nature Interaction Benefits

To help the Melfa Road community understand the overall motivation and why it is important to engage children with nature, we assessed the benefits of child-nature interaction and discovered 6 consistent key themes in the literature (Table 1). Majority of the papers, while occurring in different geographical locations, had similar findings in that nature interaction fosters countless benefits.

Table 1. Benefits of children's interaction with nature discovered through review of literature (Visual representation found in Appendix II).

Key Themes Across Reviewed Literature
1. *Nature fosters learning and educational opportunities for children* [Almers et al., 2020; Askerland & Almers, 2016; Beery & Jorgensen, 2016; Cooper, 2015; Hussein, 2012; Hussein 2017; Moore, 2014; Nimmo & Hallett, 2008; White & Stoecklin, 1998.]
2. *Nature-children interaction leads to sensory experiences* [Acar, 2013; Askerland & Almers, 2016; Beery & Jorgensen, 2016; Fjortoft, 2001; Moore, 2014; Nimmo & Hallett, 2008.]
3. *Children prefer spaces with landscape diversity that afford opportunities for play, exploration, and creativity.* [Fjortoft, 2001; Moore, 2014; Mustapa et al., 2015; Nikravesh & Tabaeian, 2016; Rantala & Puhakka, 2019; Skar et al., 2016; White & Stoecklin 1998; Zamani, 2017.
4. *Nature interaction leads to cognitive and motor skill development in children* [Askerland & Almers, 2016; Fjortoft, 2001; Hussein, 2012; Kopeva et al., 2020; Mustapa et al., 2015; Sell, 2021; Zamani, 2017]
5. *Interacting with natural spaces and landscape could provide opportunities to create outdoor activities for children.* [Almers et al., 2020; Cengiz & Boz, 2019; Moore, 2014; Mustapa et al., 2015; Nimmo & Hallett, 2008; Sell, 2021; White & Stoecklin, 1998.]
6. *Interaction with nature increased children's prosocial behavior, self-regulation, confidence, and problem-solving skills.* [Acar, 2013; Brussoni et al., 2017; Heerwagen & Orians, 2002;White & Stoecklin, 1998.]

Elements in the design of outdoor public spaces can benefit children in many ways. First of all, providing outdoor play spaces creates outdoor learning environments for children (Cooper, 2015). In addition, it is important to ensure that all five senses are being stimulated when designing spaces for children (Acar, 2013). Sensory gardens provide a place for children to become aware of nature, encouraging mental development and social integration (Hussein, 2012). Sensory gardens can also allow children with autism to seek sensory stimulation from the environment making them inclusive green interventions (Hussein, 2009). Plants, animals, and water elements that provide habitat for a particular species can also be a source of inspiration for play while improving child physical and creative development (Acar, 2013; Wang et al., 2018). Interestingly, open spaces provide more opportunity than closed spaces and can help children become more social and allow them to gain contact with their environment (Acar, 2013; Heerwagen & Orians, 2002).

Result 3: Children Designing Natural Spaces and Outdoor Activities

Finally, we delved into case studies of children participating in the design of natural spaces and outdoor activities because they are the most applicable to the redesign of Melfa Road. Throughout the six case studies, we found that workshops were the most commonly used engagement strategy. This is likely because workshops are interactive and allow researchers to get the ideas and opinions of many children all at once. We also found drawing was the most popular activity performed during workshops, possibly because even young children can participate, allowing an exploration of creativity with minimal materials necessary. Some examples of drawings are seen in Figure 9.

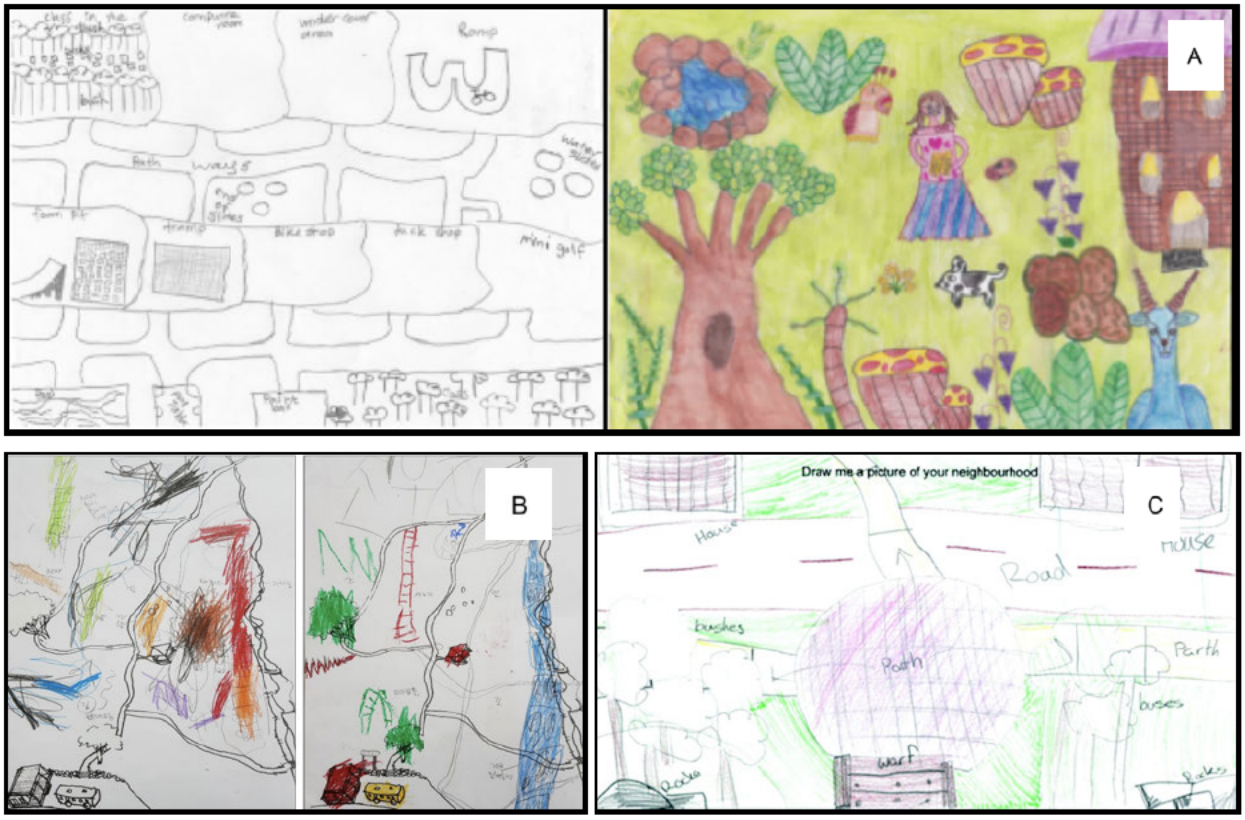

Figure 9. Drawings during workshops completed by **(A)** 10-11 year olds of imaginary ideal school yard (Sharma-Brymer & Bland, 2016), **(B)** 6-7 year olds of ideal forest play spaces (Kang & Cho, 2021), and **(C)** 9-10 year olds of ideal community (Malone, 2013).

The case studies did not mention what was implemented in the sites after children were involved in the design process. However, almost all of them stated benefits children gain even just by participating in the design process of a natural space or outdoor activity, no matter the engagement strategy used (Figure 10). For some children, it was the first time they felt their voice completely heard by adults. Children also felt empowered knowing they could truly make a difference in their neighborhood. Being a part of the design process also fostered place-making and children gained a sense of ownership over the spaces after learning more about the site, possibly spending extended time there, and having a say in its design.

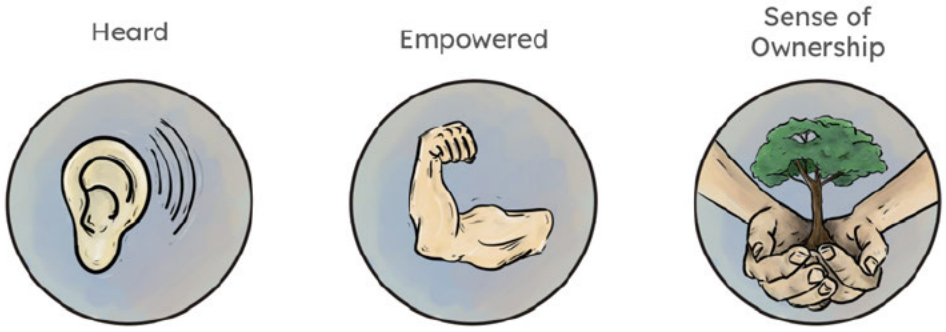

Figure 10. Visual representation of the benefits children gained by being a part of the design process of a natural space or outdoor activity.

Recommendations

Recommendation 1: Perform behavior mapping on Melfa Road to observe how children currently use the space and interact with the natural environment.

We recommend to first perform behavior mapping to learn how children are currently using Melfa Road. By observing their natural movements, it will be possible to know how children move about the area, what features they currently interact with, and any issues in sharing the space with cyclists.

Behavior mapping cost can be relatively high, as it involves researchers who specialize in this area to conduct observations of children, and several observations are needed to minimize errors. Even though the cost is high, this step is necessary, as it would form the baseline of what parts of Melfa Road to focus on to redesign when executing our second recommendation.

Recommendation 2: Execute a workshop with different activities with parents present.

Based on our literature review, we recommend the best way to engage children in the redesign of Melfa road is to execute a workshop with different activities with the presence of parents. We recommend workshops because they are the most accommodating method, especially for children with special needs because they are composed of different activities; based on their strengths and abilities, children may be more comfortable participating in one activity over the other. The presence of parents helps children perform better during workshops since children are often easily anxious and uncomfortable without company from people they are familiar with (Masi, 2001). Thus, during these workshops creative opinions from all children can be gathered throughout the day.

Incorporating ideas seen in our literature review, some examples of activities that could be performed during the workshops include: drawing ideally what the children would like to see on Melfa Road (Derr et al., 2013; Kang & Cho, 2021; Malone, 2013; Sharma-Brymer & Bland, 2016), playing games designed specifically to learn the children's ideas (Derr et al., 2013; Gennari et al., 2019), taking photographs of things they like outside (Derr et al., 2015), or showing them pictures of nature-play interventions such as a sensory garden then asking the children if they would like them on Melfa Road (Sell, 2021; Hussein, 2012; Nikravesh et al, 2016). Even if children come up with wild ideas of what they would like to see on Melfa Road, the goal of the workshops would be to allow children to be creative and learn what aspects of their ideas they like the most to be able to incorporate them into Melfa Road's redesign.

Time and cost associated with conducting a workshop is highly variable, as they are purely dependent on the chosen materials, the amount of effort in planning, the number of participants involved, and if participation incentives such as gift cards are used. Overall, the costs would range from low to medium because even though it may take more time to plan than other engagement strategies, specialized researchers are not necessary and there is high flexibility in material expenses.

Recommendation 3: Incorporating six key children-nature interaction benefit themes by improving existing green spaces on Melfa Road.

Based on our findings of the importance of children and nature interaction, we propose potential ways that SEEDS and UBC can improve child-nature interaction at Melfa Road using existing green spaces (Figure 11). Nearby green spaces with easy access, such as the adjacent forest could be used for adding landscape preference or enriching site biodiversity. Further, this space could also be used to create outdoor natural play spaces for children while affording opportunity for activity creation. Taking advantage of existing green environments can help children improve their cognitive and motor skills, as well as help children to develop or enhance social cohesion and behavior.

Across from the Kids Club is an empty greenspace where a portion could be converted into a small sensory garden, community garden, or an outdoor space for children's educational activity. Use of safe plants that yield a sensory experience to children is fundamental for providing intended benefits in the proposed garden space. In addition, some educational activities such as teaching children to identify vegetation, planting methods, or how to care for biodiversity could be developed here.

Our proposals aim to address the future planning and design of Melfa Road where opportunities for enhancing the space focus on maximizing children's benefits through nature engagement.

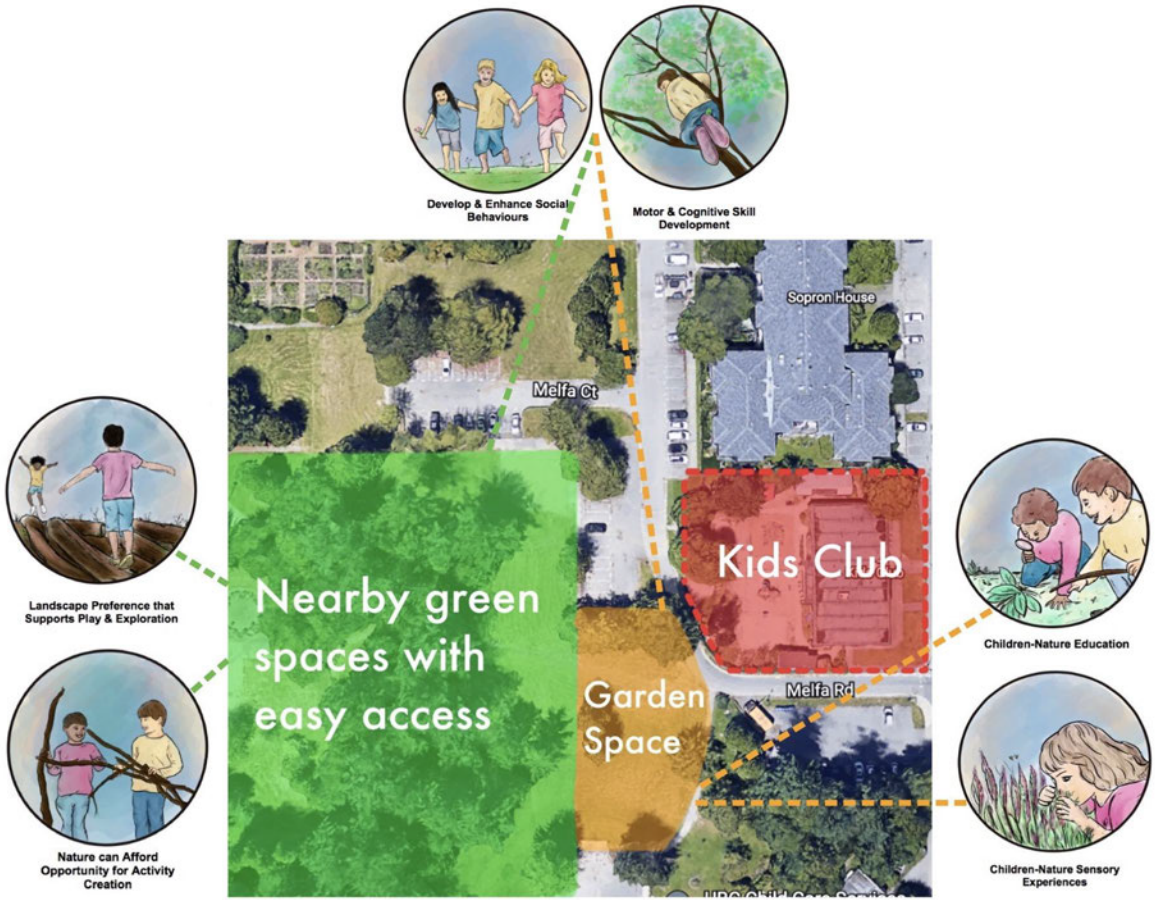

Figure 11. Potential of existing green spaces at Melfa Road to provide opportunities for incorporating our six key themes to benefit children (Larger image found in Appendix II).

Future Considerations

Next steps would be to evaluate the true cost of the engagement methods such as implementing workshops or collaborating with professionals to perform behavior mapping. Following which, creation of an engagement plan for the surrounding community of Melfa Road would need to occur. Although we have indicated areas on Melfa Road that have potential to engage children with nature to provide benefits, learning what children and the community desire from the space would lead to specific design recommendations.

Conclusion

Through extensive research, we found ways to involve children in the design process and benefits associated with child-nature interaction. We found interviews are the most used engagement strategy to assess children's perspectives due to its cost and time efficiency. However, behavior mapping and workshops have been found to be the most inclusive methods of engaging all children, regardless of their disabilities, in the design process. Interaction between nature and children can provide numerous benefits to a child's health, education, and development. Even by just participating in the design process of a natural space children reap benefits, such as feeling empowered and gaining a sense of ownership over the space. Based on these findings, we recommend first performing behavior mapping, then execute a workshop with parents present. We also provide recommendations of ways that SEEDS and UBC can enhance the existing green spaces along Melfa Road such that the benefits children receive from the space are maximized. Our recommendations could and should be applied to other neighborhoods where many children are present because of the numerous health benefits children receive interacting with nature and being a part of the design process.

Acknowledgements

Special thanks to Dr. Almas, Dr. McHale, Dr. Rout, Kaitlyn Pike, Yaying Zhou, and Emily Tu for all their work, guidance, and assistance during the course of this year and this project!

Thank you to our stakeholders, Ben and Gabby from SEEDS for meeting with us and assisting us!

References

Acar, H. (2013). Landscape design for children and their environments in urban context. In Ozyavuz, M. (Ed.), *Advances of Landscape Architecture,* 291-324. DOI:10.5772/55751

Almers, E., Askerlund, P., Samuelsson, T., & Waite, S. (2020). Children's preference for schoolyard features and understanding of ecosystem service innovations - a study in five Swedish preschools. *Journal of Adventure Education and Outdoor Learning, 21*(3), 230-246.https://doi.org/10.1080/14729679.2020.1773879

Askerland, P. & Almers, E. (2016). Forest gardens - new opportunities for urban children to understand and develop relationships with other organisms. *Urban Forestry & Urban Greening, 20*(1), 187-197.https://doi.org/10.1016/j.ufug.2016.08.007

Beery, T. & Jorgensen, K. A. (2016). Children in nature: sensory engagement and the experience of biodiversity. *Environmental Education Research, 24*(1), 13-25. https://doi.org/10.1080/13504622.2016.1250149

Brussoni, M., Ishikawa, T., Brunelle, S., & Herrington, S. (2017). Landscapes for play: Effects of an intervention to promote nature-based risky play in early childhood centers. *Journal of Environmental Psychology, 54*, 139-150.https://psycnet.apa.org/doi/10.1016/j.jenvp.2017.11.001

Cengiz, C., & Boz, A. O. (2019). Biophilic playgrounds as playscapes in child-nature interaction. *International Journal of Scientific and Technological Research, 5*(12), 216-226. https://doi.org/10.7176/jstr%2F5-12-23

Cooper, A. (2015). Nature and the outdoor learning environment: the forgotten resource in early childhood education. *International Journal of Early Childhood Environmental Education, 3*(1), 85-97. https://eric.ed.gov/?id=EJ1108430

Derr, V. (2015). Integrating community engagement and children's voices into design and planning education. *Codesign,11*(2), 119-133. https://doi.org/10.1080/15710882.2015.1054842

Derr, V., Chawla, L., Mintzer, M., Cushing, D., & Van Vliet, W. (2013). A city for all citizens: Integrating children and youth from marginalized populations into city planning. *Buildings, 3*(3), 482-505. https://doi.org/10.3390/buildings3030482

Fjortoft, I. (2001). The natural environment as a playground for children: the impact of outdoor play activities in pre-primary school children. *Early Childhood Education Journal, 29*(2), 111-117. http://dx.doi.org/10.1023/A:1012576913074

Fjørtoft, I., & Sageie, J. (2000). The natural environment as a playground for children: Landscape description and analyses of a natural playscape. *Landscape and urban planning, 48*(1-2), 83-97. http://dx.doi.org/10.1016/S0169-2046(00)00045-1

Gennari, R., Matera, M., Melonio, A., & Roumelioti, E. (2019). A board-game for co-designing smart nature environments in workshops with children. In: Malizia, A., Valtolina, S., Morch, A., Serrano, A., Stratton, A. (eds) End-User Development. IS-EUD 2019. Lecture Notes in Computer Science, vol 11553. Springer, Cham. https://link.springer.com/chapter/10.1007/978-3-030-24781-2_9

Harvey, D. J., Montgomery, L. N., Harvey, H., Hall, F., Gange, A. C., & Watling, D. (2020). Psychological Benefits of Biodiversity-Focused Outdoor Learning Program for Primary School Children. *Journal of Environmental Psychology, 67,* 1-8. https://doi.org/10.1016/j.jenvp.2019.101381

Heerwagen, J. H. & Orians, G. H. (2002). The ecological world of children. In P. H. Kahn, Jr. & S. R. Kellert (Eds.), *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations,* 29-63. MIT Press. http://playspaces.ru/wp-content/uploads/2016/08/Kahn__Kellert_Children_and_nature.pdf

Hussein, H. (2012). The influence of sensory gardens on the behavior of children with special educational needs. *Procedia-Social and Behavioral Sciences, 38*, 343-354 .https://doi.org/10.1016/j.sbspro.2012.03.356

Hussein, H. (2017) Sensory affordances in outdoor play environment towards well-being of special schooled children. *Intelligent Buildings International, 9*(3),148-163. https://doi.org/10.1080/17508975.2015.1015945

Kang, T. S., & Cho, S. M. (2021). Effects of participatory design on the development of space concept in young children. *International Journal of Advanced Culture Technology, 9*(2), 64-71. https://www.koreascience.or.kr/article/JAKO202119559800511.pdf

Kopeva, A., Khrapko, O., & Ivanova, O. (2020). Landscape organization of a sensory garden for children with disabilities. *IOP Conference Series: Materials Science and Engineering, 753*(2), 1-7. http://dx.doi.org/10.1088/1757-899X/753/2/022028

Kreutz, A., Derr, V., & Chawla, L. (2018). Fluid or fixed? Processes that facilitate or constrain a sense of inclusion in participatory schoolyard and park design. *Landscape Journal, 37*(1), 39-54. https://doi.org/10.3368/lj.37.1.39

Lozanovska, M., & Xu, L. (2013). Children and university architecture students working together: A pedagogical model of children's participation in architectural design. *Codesign, 9*(4), 209-229. https://doi.org/10.1080/15710882.2012.693187

Malone, K. (2013). "The future lies in our hands": Children as researchers and environmental change agents in designing a child-friendly neighborhood. *Local Environment, 18*(3), 372-395. https://doi.org/10.1080/13549839.2012.719020

Masi, G., Mucci, M., & Millepiedi, S. (2001). Separation anxiety disorder in children and adolescents. *CNS drugs, 15*(2), 93-104. https://doi.org/10.2165/00023210-200115020-00002

Moore, R. C. (2014). Nature play & learning places. Creating and managing places where children engage with nature. *Raleigh, NC: Natural Learning Initiative and Reston, VA:*

National Wildlife Federation, 1(6), 1-55.http://tessaroselandscapes.com.au/wp-content/uploads/2016/06/Nature-Play-Learning-Places_storefront_preview_0.pdf

Mustapa, N. D., Maliki, N. Z., & Hamzah, A. (2015). Repositioning children's developmental needs in space planning: A review of connection to nature. *Procedia-Social and Behavioral Sciences*, *170*, 330-339. https://doi.org/10.1016/j.sbspro.2015.01.043

Mutz, M., Muller, J., & Goring, A. (2019). Outdoor adventures and adolescents' mental health: daily screen time as a moderator of changes. *Journal of Adventure Education and Outdoor Learning, 19*(1), 56-66. https://doi.org/10.1080/14729679.2018.1507830

Nikravesh, R., & Tabaeian, S. M. (2016). Sensory garden design solutions in child friendly environments (Case study: The children of the city of Isfahan, North West-District# 12, in pre-elementary and elementary schools). *Journal of Design and Built Environment*, 7-21. https://doi.org/10.22452/jdbe.sp2016no1.2

Nimmo, J., & Hallett, B. (2008). Childhood in the garden.: A place to encounter natural and social diversity. *Young Children, 63*(1), 32-38. https://eclkc.ohs.acf.hhs.gov/sites/default/files/pdf/childhood-garden.pdf

Nowicki, E. A., and Brown, J. D. (2013). “A kid way:” Strategies for including classmates with learning or intellectual disabilities. I*ntellectual and Developmental Disabilities, 51*(4), 253–262. https://doi.org/10.1352/1934-9556-51.4.253

Parés, N., Carreras, A., Durany, J., Ferrer, J., Frexia, P., Gomez, D., Kruglanski, O., Pares, R., Ignasi Ribas, J., Soler, M., & Sanjurjo, A. (2005). Promotion of creative activity in children with severe autism through visuals in an interactive multisensory environment. *Proceedings of the 2005 Conference on Interaction Design and Children*, 110-116. https://doi.org/10.1145/1109540.1109555

Parnell, R., Cave, V., & Torrington, J. (2008). School design: Opportunities through collaboration. *Codesign, 4*(4), 211-224. https://doi.org/10.1080/15710880802524904

Rantala, O. & Puhakka, R. (2019). Engaging with nature: nature affords well-being for families and young people in Finland. *Children’s Geographies, 18*(4), 490-503. https://doi.org/10.1080/14733285.2019.1685076

Rohde, C. & Kendle, D. (1994). Human well-being, natural landscapes and wildlife in urban areas, a review. *English Nature Science, 22.* http://publications.naturalengland.org.uk/publication/2320898

Schepers, S., Schoffelen, J., Zaman, B., & Dreessen, K. (2021). ‘I’m the boss of the Stiemerbeek valley!’ Reconsidering children’s empowerment in participatory design from the perspective of infrastructuring. *CoDesign*, 1-15. https://doi.org/10.1080/15710882.2021.1912775

Sell, A. (2021). Perception of nature play in children’s gardens: A survey of decision makers from North American public gardens (Doctoral dissertation).https://deepblue.lib.umich.edu/bitstream/handle/2027.42/168577/Sell%2c%20Andy_Thesis.pdf?sequence=1&isAllowed=y

Sharma-Brymer, V., & Bland, D. (2016). Bringing nature to schools to promote children's physical activity. *Sports Medicine, 46*(7), 955-962. https://link.springer.com/article/10.1007/s40279-016-0487-z?noAccess=true

Skar, M., Gundersen, V., & O'Brien, L. (2016). How to engage children with nature: why not just let them play? *Children's Geographies, 14*(5), 527-540. https://doi.org/10.1080/14733285.2015.1136734

Slingerland, G., Lukosch, S., & Brazier, F. (2020). Engaging children to co-create outdoor play activities for place-making. In Proceedings of the 16th Participatory Design Conference 2020-Participation(s) Otherwise-Volume 1, 44-54. https://doi.org/10.1145/3385010.3385017

White, R., & Stoecklin, V. (1998). Children's outdoor play & learning environments: Returning to nature. *Early Childhood News, 10*(2), 24-30. https://www.whitehutchinson.com/children/articles/outdoor.shtml

Wang, X., Woolley, H., Tang, Y., Liu, H. Y., & Luo, Y. (2018). Young children's and adults' perceptions of natural play spaces: A case study of Chengdu, southwestern China. Cities, 72, 173-180. https://doi.org/10.1016/j.cities.2017.08.011

Yantzi, N. M., Young, N. L., & Mckeever, P. (2010) The suitability of school playgrounds for physically disabled children. *Children's Geographies, 8*(1), 65-78. https://doi.org/10.1080/14733281003650984

Zamani, Z. (2017). Young children's preferences: What stimulates cognitive play in outdoor preschools? *Journal of Early Childhood Research,15*(3), 256-274. https://doi.org/10.1177%2F1476718X15616831

Appendix I

Table A. Summary of different methods for engaging children in the design process. In the literature there are four main ways in which researchers and organizations have engaged children in the design process.

Approach	Citations	Estimated time	Estimated cost	Details about approach
Interviews	(Nowicki et al., 2013) (Lozanovska et al., 2013)	Approximately 1 week: Preparing interview questions, identifying participants, gathering interview answers, analyzing answers / visualizing results.	**Cost: Low** (Used for buying some snacks or toys to encourage children to do interviews) - Other resources that address inclusivity and would be essential during interviews is the presence of speech therapists, electronic aids, or sign language. These would be used for the sake of children with learning and communication disabilities.	Meeting with children either one on one or in a group setting, and asking them questions to learn their opinions. Parents are often present to make children more comfortable.
Workshops with activities	(Derr et al., 2013) (Malone, 2013) (Derr et al., 2015)	1-2 months: Preparing for each activity, seeking participants, forming working groups including both the youth and children, doing activities, organizing all information that are gathered from activities, analyzing information, presentation of results.	**Cost: Medium-low** (varies with the number of participants) (All money will be allocated into two sections: buying snacks or gift card to encourage participants, buying tools for each activities)	In the form of a series of workshops with three sequential stages to prepare, develop and evaluate the whole design. Specific workshop activities Include some activities such as modeling, storytelling, and drawing.
Interactive environment/ Behavior mapping	(Parés et al., 2005)	Approximately 1 week: Hiring researchers/ behavioral psychologists to take a couple hours a week and observe childrens' general landscapes preferences on Melfa road.	**Cost: Medium-high** (Hiring researchers/ behavioral psychologists make cost variable depending on amount of hours and varying rates of experts)	This approach is best for participants that are unable to communicate easily in interviews. Instead, children are observed in a given environment with this method by researchers.

Appendix II

Extra Visualizations

Figure 12. Visual representation of the key themes found in the literature regarding the benefits of children interacting with nature.

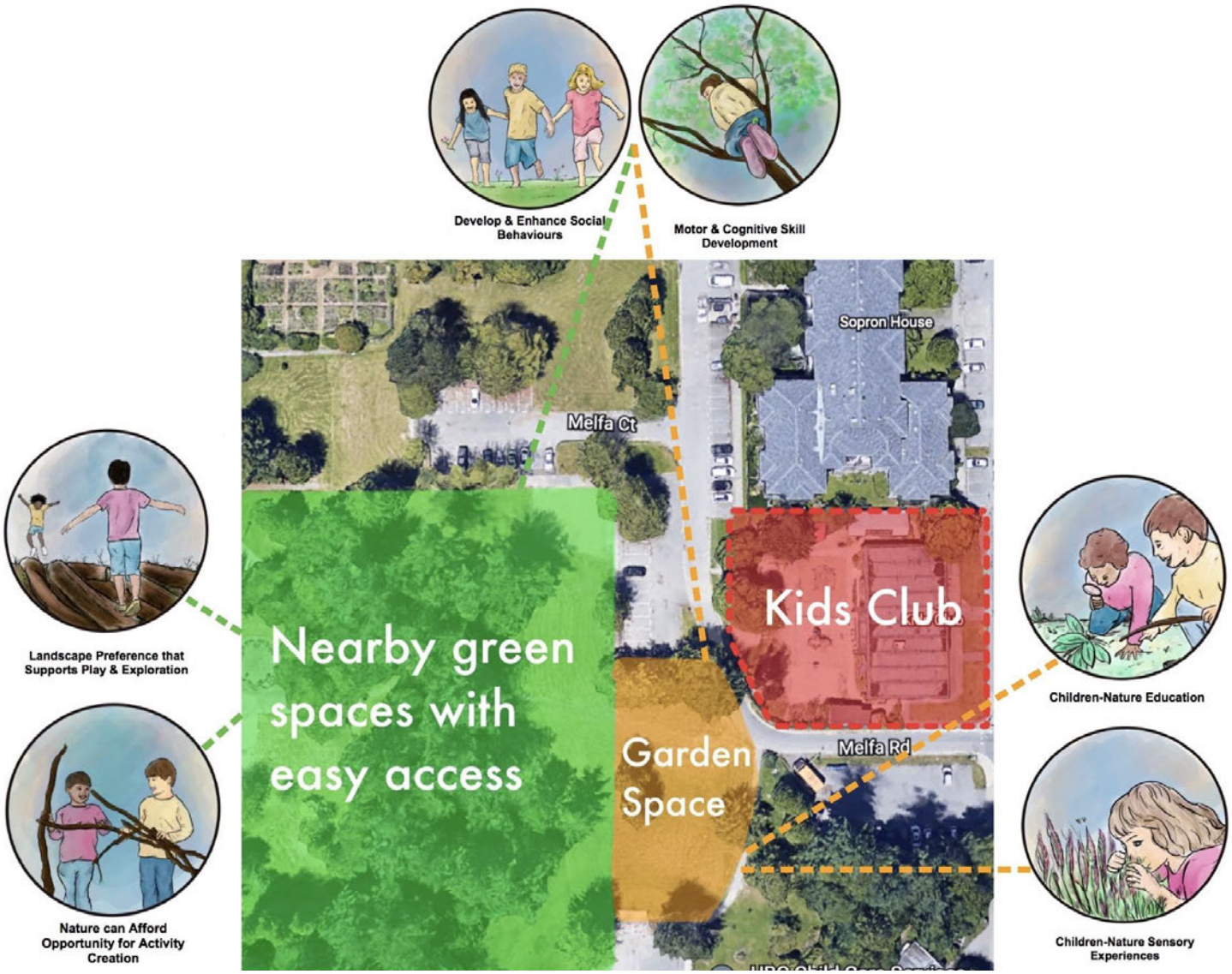

Figure 13. (Figure 11 Expanded) Potential of existing green spaces at Melfa Road to provide opportunities for incorporating our six key themes to benefit children.