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Co-Design with Children to Create a Sustainable Learning Space

by

Alisha Shrestha

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I hereby declare that the thesis entitled "**Co-Design with Children to Create a Sustainable Learning Space"** submitted to the Department of Architecture in partial fulfillment of the requirement for the degree of Master Science in Engineering in Energy for Sustainable Social Development, is a record of an original work done under the guidance of Prof. Dr. Martina Keitsch, Norwegian University of Science and Technology, Norway. This thesis contains only work completed by me except for the consulted material which has been duly referenced and acknowledged.

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074/MSESS/002

ABSTRACT

With the increasing population and limited natural resources, we, as individuals and societies need to learn to live together sustainably. We need to take action responsibly based on the understanding that what we do today can have implications on the lives of people and the planet in future. Until recently, education systems have mostly prepared students to perform certain social functions in a relatively predictable world. However, the world is changing and we can no longer expect the same old. Today's students will soon need to deal with complex sustainability challenges, which require totally new skills and attitudes to be developed. This paper aims to formulate the framework for sustainable learning space that will help empower students and build good social skills or the future. The research follows participatory design method in which in which various techniques of communication with children was conducted on the basis of literature review. Qualitative data were analyzed on the basis of the data collected during the period of two workshops. The findings revealed that children's perception of space is different to that of adult and it can influence their growth and knowledge. Thus including children as the design partner can be beneficial for the society in terms of sustainable development.

ACKNOWLEDGEMENT

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CHAPTER 1: INTRODUCTION

1.1 Background

Educators have been arranging and rearranging classroom spaces since the days of the single room schoolhouse. From shared seats and long benches to individual desks, from blackboards to whiteboards to smart boards, learning spaces have evolved over time in response to a changing world and students' changing needs. Research in participatory design with children shows that where students learn can make a huge difference in how well they learn (Wake, 2015). The shift from passive to active learning emphasizing student participation, as well as new educational initiatives of the modern time are challenging the educational institutions, from school to university level. The landscape of design and design research has moved closer to the user over the last couple of decades. As a result of this, the term co-design has emerged from the well-known participatory design movement that started in the early 1970s (Stalberg, Sandberg, Soderback, & Larsson, 2016). Co-designing with users indicates collective creativity applied across the span of a design process (Sanders & Stappers, 2008).

Most of the people think sustainability as related to concerns about the environment, while people, especially children are often neglected in discourses on sustainability. Needs of children are frequently ignored in an adult-centered society; most of the time adults making the majority of their decisions for them and choosing what is in their best interest (Hansen, 2017). Children as users and designers as adults who design products for children have distinct intellectual advancements as well as different ways of experiencing the world (Melanio & Gennari, 2013). Therefore, inviting children to the design process as partners is critical for developing an understanding about this special user group.

Co-designing with children can enhance design students' grasp of the design process, enable them to develop an understanding of children as users, and help them to overcome unique challenges of designing for children (Sila & Fatma, 2018). By educating citizens, especially young generations within the formal schooling system, the hope has been to effectively address the issue of sustainable development. Students represent the largest group of people on school (Pauw et al., 2015). A student is the definition of a person who is learning (Heistad, 2016). You study to learn something that you can use for further studies and work situation.

Author WAKE (2013) has argued that co-design with children is not just a worthy deal; it is an essential goal if we are to influence children positively about creating environmentally sustainable places and spaces. In the view of Emilia (2001), children have rights and not

simply needs, they therefore possess strength and competence to make decisions about their own education. So, Co-designing WITH children, FOR children, can empower them and be better equipped to hold an opinion in their everyday life in the future.

Co-design, or collaborative design, is rooted in the tradition of participatory design (PD); hence it typically refers to an activity in which potential users are empowered to bring their ideas into the design of new solutions.

Children see the world in a completely different way to adults. This is not just because they are small in size, but also because their cognitive, social and emotional intelligence is developed on a different level compared to adults. Through their curiosity and rich imagination, they are extremely creative and less restricted by reality. Designers can significantly benefit and learn from including children as expert users in cooperative design sessions. Children are honest and playful, and can broaden a designer´s product design horizon. By giving the children a voice in the process of designing child products, they may come up with unimaginable ideas, contribute in design decisions as well as discover physical limitations regarding the product.

1.1.1 Terminologies

Before proceeding, it is necessary to define some of the terms that will be repeatedly used throughout this thesis. While many of these terms seem common in their usage, different readers may have different perspectives and experiences, so we discuss each of these terms as they will be applied in this thesis.

Child

The age of the children of principal focus in this thesis are school aged children (11 to 16 years of age), and the methods and techniques discussed are primarily for children in this age range. Children have views and developmental needs that are different from those of adults. Techniques for working with children on design teams thus need to be specific to the needs of children. This concept will be expanded later in this thesis.

Framework

It literally refers to a basic structure supporting an object – when this object is a system or a concept the framework is considered as the combination of the principles and theory underlying it. Rogers and Muller (2006) talked about the use of 'frameworks' in HCI as going from more prescriptive ones, which mainly comprise a set of steps or principles to follow, towards more explanatory frameworks, presenting concepts or dimensions to consider

in designing experiences. The framework resulting from this research belongs in the explanatory end, as it defines the dimensions and related factors to consider in the co-design sessions with children.

Methods vs. Technique

It is important for the purposes of this thesis to distinguish between how we use the terms method and technique in regard to designing technology. A technique is defined as an activity that a design team participates in while creating a technology. The application of a technique can be very brief and may last in terms of duration a fraction of a single design session to two or more design sessions. Walsh et al. define a technique as "a creative endeavor that is meant to communicate design ideas and system requirements to a larger group" (Fails, Guha, Druin, 2013). Examples of techniques include brainstorming using art supplies, or critiquing technology using sticky notes.

Walsh et al. defines a method as "collection of techniques used in conjunction with a larger design philosophy" (Fails et al, 2013). Thus, a method includes the overall philosophy of a design team. It refers to the overall system that a team uses to design technology. A method can include one or many techniques, but it is more than a collection of techniques that makes up a method. It includes the attitude and values that the team brings to designing technology.

1.2 Rationale

Children view the world in a completely different way from adults. This is not just because they are small in size, but also because their cognitive, social and emotional intelligence is developed on a different level compared to adults. Through their curiosity and imagination, they are exceptionally creative and less restricted by reality. Designers can benefit and learn from including children as expert users in cooperative design sessions. Children are honest and playful, and can expand a designer's product design horizon.

Studies focused on exploring children's perspective have gained prominence since the late 1990's. In general, such studies have identified children as important contributors to the investigation of their own reality (Emilie Saure Hagen, 2012). Listening to children's opinions enables researchers to understand social phenomena with greater clarity and to access completely new world of meanings about the lives of children. Sustainable built environments for education are not only a necessity for sustainable development, but it also helps shape citizens and society more broadly (Aaraas, 2016).

1.3 Problem Statement

Students represent the largest group of people in school and they spend most of their time at school. The students are still not recognized as the design-partners. Their opinions are still not interrogated and incorporated. The classroom interior archetype – in which all the students have an appointed desk facing the teacher and the blackboard - embodies an educational philosophy that is modeled on the industrial principles of the early 20th century (Aaraas, 2016). While many schools in the world are adopting student-centered learning, the teacher's passing of knowledge is still a core activity in modern schools of Nepal.

The government has developed various plans and policies for the development of the education sector. The system is changing and moving forward from the traditional system. But, in spite of all the plans and policies, development and research, the students are still not recognized as the design-partners. Like mentioned in the beginning, students are the largest group of people in school and they spend most of their time at school. So, the design must be for them, co-designed with them.

The following sections try to respond to these questions. The analysis and findings are based on work with the first author's master thesis written in 2020 titled "Co-Design with Children to create a Sustainable Learning Space." The research purpose and studies refer to this master thesis.

1.4 Research Question:

1. Why aren't children being included as the design partners for their own learning environment?
2. Why isn't sustainability being integrated in the lives of the children as part of their regular learning experience?

1.5 Objective

Main Objective:

- To formulate the framework for sustainable learning space through co-design method.

Specific Objective:

- To gain perceptive on student's knowingness, attitudes and behavior of their learning space.
- To empower children.
- To impart knowledge about sustainability during the process.

1.6 Research methodology

To achieve the objectives of the research, a qualitative research method was used as this method was best for the research. Epistemologically, the study is follows Constructivism and Interpretivism. The constructive–interpretative methodology allows a nonlinear relation with the field of research and its participants. Data are not taken from the participants, but rather produced and interpreted considering reflections, dialogs, and an entire communication system that grants significance to those involved in the research.

1.7 Methods adopted

Based on the ways in which researchers gain information from children, these methods and techniques can be grouped into five as observation-based methods, narrative-based methods, documentation-based methods, art-based methods, and game-based methods.

Observation-based methods aimed at obtaining an understanding of users' actual work environment and their needs by observing and interviewing them while they are doing their regular everyday activities (Nousiainen,2009)

Narrative- based methods aimed to facilitate expression and verbalization of the views and ideas of children.

Documentation-based method aimed to discover different aspects of the topic area and to gain information about the context (Nousiainen,2009).

Art-based methods intended to enable children to materialize their ideas and generate solutions based on hands-on activities.

1.7.1 Techniques for Co-design with Children

Techniques are design activities that are used at varying points in a design process to address certain sub-design goals.

Frictional Inquiry

In Fictional Inquiry, children are asked to participate in a make-believe scenario through which a narrative is set up to gather many requirements from children (Nousiainen,2009). The primary design goal is to research the problem and gather requirements that may help later in creating and evaluating solutions that are created further on in the design process.

Mixing Ideas

The Mixing Ideas technique grew out of Cooperative Inquiry work with young children. The primary design goals in mixing ideas are to create and refine multiple solutions.

Layered Elaboration

By its very nature, the elaboration process involves changing, extending, adding to, and subtracting from the ideas of others. The primary design goal is to create multiple solutions.

Sticky Notes

The goal of the technique is to evaluate prototypes and provide feedback and direction for future improvements of a given technology.

CHAPTER 2: LITERATURE REVIEW

2.1 Co-design definition

The Auckland co-designing lab has introduced this method for complex problems, and this approach has been deployed in big social projects (Auckland Co-design Lab, 2015). "Rethinking" and "re-designing" are terms that have been used to explain co-designing in some fields that need to be updated with the users' experiences. "Co-creation" and "participatory-design" are other terms for this approach, which emphasizes the users' role in the process. All the terms are a subset of the human-centered design process which is intertwined with the term "improving", that refers to improving the users' experience in a public space (Boyd, 2014). Co-designing, which is a subcategory of HCD projects, there are lots of definitions. The central common aspect of this description is that the clients are invited into the heart of the design process and they design directly with each other to improve the experience of clients and staff.

This section reviews the definitions and design steps of some famous and successful co-design projects. It is necessary to consider the point that in co-design projects, because of the different target groups, the steps are not always tidy and may not occur in the same way, so a general theme needs to be established from previous projects.

a. In Bradwell and Maar's (2008) research on co-designing, co-design has been defined as having an emphasis on:

•Collaboration

•Clear methodology, input, output, goals and current state of the process for the participants

•Exchange of information and expertise in the developmental process

•Equality of value and validity in inputs from all the participants, whether their ideas relate to large or small scale changes

In considering these points, co-design has been defined as an answer to the need for meetings or any productive communication between the different stakeholders and designers.

b. "Joined up design for schools" is a famous project that was carried out in more than sixty primary and secondary schools by the Sorrell Foundation. It aimed to inspire creativity in young people to improve the quality of their experiences in school through suitable design (Sorrell & Sorrell, 2005).

In this project, users took on the role of the designer within a certain category such as art, landscape, or furniture. They were asked to express their own design ideas, although the contribution was not directly to design their school's building. In other words, this collaboration was used to identify key themes for the designers. As has been stated in this project, the development of the client/consultant relationship is at the heart of the project. Two factors influence their objectives:

1. Investigation of the potential through an effective collaboration between the design team and the school to show that a suitable design can improve the quality of the experience of school.

2. Focusing on the educational value of this nurturing relationship and how it can provoke the student's creativity.

c. In the Cruickshank project (Cruickshank, 2014), the designer defined co-design in the "Beyond the Castle" study. He compared the results with different types of co-design as a process in which they employed the designers to be constructive by provoking the non-designers to be creative. In many other projects, co-design is closer to a user-centered design process in that the designers come up with the design ideas with the target group, then report it back to the stake holders.

d. Solaymantash (2013, p. 21) has expressed the philosophy of co-design from the point of view of an interviewee, Francoise Vos (2014), as "Co-design involves all stakeholders and starts from the beginning of the process. No direction to follow and no elitist behavior."

It is clear that co-design really depends on the target group that is involved and with the design subject. In this project for a primary school classroom with the pupils as the target group, the issue is whether or not co-design can be undertaken without a certain direction from the outset.

e. Co-design is where users and designers work directly and collaboratively with each other, rather than indirectly, with the users providing information to be considered by the designers or by working on sub-projects (e.g. landscape) (Wake & Eames, 2013).

2.2 Participatory Design

Participatory Design (PD) — as its name implies — allows end users to have a voice in the design process. It began decades ago in Europe, primarily in Scandinavian countries. Trade unions in Sweden were strong enough to demand that worker' voices be heard in shaping

their work environments and the technologies that were a part of those workplaces. While in PD the voice of the people is heard in a somewhat democratic fashion, the goal is compromise, not consensus. PD focuses on developing cooperative strategies for system design. It gives workers in the environment (i.e., system end users) a voice in the design process. PD encompasses a large field of research and is the basis for many of the co-design methods employed for adults and children. Muller and Kuhn suggest PD can be viewed as being mapped onto two dimensions: first a dimension of "Who Participates with Whom in What"; and second, "Position of Activity in the Development Cycle or Iteration" (Fails et al, 2013). The first dimension ranges from designers participating in the user's world to users directly participating in design activities. The second dimension ranges from early to late in the design process. While PD had very specific beginnings, the techniques of PD have been built upon and expanded in other methods, including those intended to include children in the design process, such as Bonded Design, and Cooperative Inquiry. These methods have the focus of giving users a voice in the design process — not just as users, but in some cases as co-designers. This is the case with many of the more recently developed methods for designing technologies with and for children.

2.3 Contextual Inquiry and Design

Contextual Design consists of a set of steps or processes which inform and direct the design team (Fails et al, 2013). These steps include: collecting data (Contextual Inquiry), interpretation of the data, data consolidation, visioning, storyboarding, user environment design, and prototyping. In Contextual Inquiry, the user is involved in collecting the data and prototyping steps. During the data-collection step designers observe and gather information while workers go about their routine processes. The workers or users are observed within the natural context of the process that is to be re-designed. Not only do the designers observe workers, but they can also engage them and follow up their observations with interviews. Thus Contextual Inquiry is a form of UCD where design team members gather interview information from users of the system while the users are in the context of their work tasks while using the current system. The gathered information is then analyzed by the designers in the interpretation phase to discover user routines or processes. Designers use the gathered information to create and describe the different work models: flow, sequence, cultural, artifact, and physical. In the data consolidation phase, individual user data is grouped and combined in a hierarchy that further describes the full process to facilitate the creation of representative personas of the new system. Through visioning and storyboarding the team

captures the user work practice and creates scenarios of how users will work with the new system. This enables system requirements to be established.

2.4 Designing for Children and Adult

Many of the current methods and techniques for designing with children grew out of or built on ideas from Participatory Design and Contextual Inquiry and Design as developed for use with adults. As discussed earlier, Participatory Design and Contextual Inquiry and Design are two forms of UCD focused on adult technology users becoming involved in technology design. While there are many similarities in co-design involving only adults and co-design for adults and children, there are also some considerations for modifications when children become a part of a co-design process as is discussed later when we address methods and techniques for designing with and for children.

2.4.1 Similarities in Adult and Child Participatory Design

While all adult designers were once children, our memories fail us and we cannot possibly hope to remember all of the nuances of what it means to be a child. Additionally, even if we could entirely recall our childhood experiences, we are not children in today's world. We do not know what it means to grow up knowing that mom always has a phone in her pocket, or assuming that every screen is a touch screen. Childhood has changed and will continue to change. The only way that we can keep up with it as designers is to include children in our design processes.

2.4.2 Modifications Needed for Children to Participate in Co-Design

Developmental differences between children and adults necessitate different methods of design when working with children rather than working with adult users. Due to developmental differences, children need different supports and scaffolds in order to accomplish design activities than adults do. Many of the changes that need to be made to adult-centered participatory design methods in order for them to work with children stem from the very different developmental abilities that children have from adults.

Children have different cognitive, motor, social, emotional, and communication abilities than adults. The difference in each of these domains must be considered when undertaking participatory design with children. The cognitive level of a child may mean that she needs abstract concepts to be explained in a more concrete manner.

A child's motor development may mean that he needs to work with an adult design partner in order to complete the fine detail on a low-tech prototype. Socially, children may require help adjusting to working in small, ever-changing teams. Emotionally, children may need support in understanding that although their individual ideas are not immediately apparent in a final product, they nonetheless contributed to the design of that product and can feel pride in their contribution. Children may need support in communication — whether from an adult who helps them remember what to say when presenting an idea, or from an adult who helps them to write design ideas in a journal.

2.5 The Roles and Dimensions of Children in Design Processes

In her article "The role of children in the design of new technology", Druin outlines many ways in which children can participate in the technology design process and sets forth a continuum from least to most involvement from users to testers to informants to design partners (Druin, 2002). As indicated in the figure, as one moves along the continuum, the roles encompass those at a less involved level. Thus, a tester can perform the roles of both tester and user, where a design partner can perform all the roles. While a design partner can migrate among the different roles throughout the design process, when a technology is created, any validation evaluation should be conducted with a different group of users — in this case child.

User

Child users are the least involved in the technology design process, but they are most long-standing in history and it is the most common role that children play in the technology design process. Children participating as users interact with technology only after it is completed and marketed. Children who are users are helping to understand how a technology that

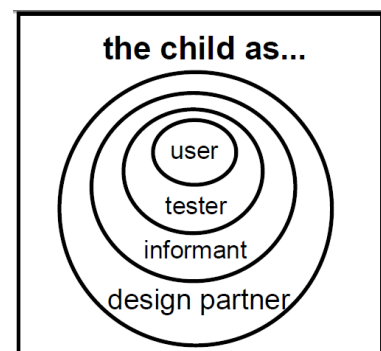**Figure 1: Roles of Children by Druin**

exists today is being used. Adult researchers typically observe child users to look for patterns of activity and general use. Adults then abstract from their observations what they believe should be changed in the technology. A child user is typically not asked for an opinion of a technology, rather the adult user interprets what that might be from observations.

Tester

Next along the continuum are testers, who also have limited input in the design process, but are allowed to interact with technology before its completion. When working with children as testers, adult designers, upon observation, will make changes to the technology before its final inception. The role of tester is the first role in which children are brought into an iterative process.

Informant

As informants, children are much more involved in offering opinions on the design of technology. They are no longer called on solely at the end of the process, but rather are involved in the design process at various points, when researchers feel they will be informative. Thus, the informant role goes beyond a simple interview of a child. It includes not only having a dialogue about a product, but also the child actively participating in design activities. The power of informant design is that the adult designers can determine when in the process they feel that the input of children is most needed. This is also the first role in which children are more directly asked for input on technology, rather than simply observed in their interaction with it.

Design Partner

The most involved in the design process are children as design partners. These children are active participants and equal stakeholders in the design process throughout the process, differing from informants in the amount that they are involved and the ways in which they interact with adults on the team. Design partnering refers to a specific level and type of involvement that children can have in the technology design process. It is a kind of involvement where children become equal team members and stakeholders with adults in the design of new technologies. Typical power structures between adults and children are broken down as adults and children work as teammates in technology design.

A child design partner participates in the entire design process.

2.6 Why Co-Design with Children?

The reasons to co-design with children are twofold: first, by co-designing with children, more varied ideas and technologies can be achieved; and second, by giving power to marginalized groups, which children often are, it will empower them. The children offer honest feedback, as well as ideas and technology directions that could not have come up with as adults

working without children. Additionally, as with the original movement in PD that was intended to empower workers in Scandanavia, we believe that co-design with children empowers children. That PD movement supported the inherent right to have a say in the design of the environment in which one lives. Co-design with children extends this notion to children. Seymour Papert supported the notion that empowering children politically and intellectually has existed for quite some time, even before computers existed. By allowing them a voice in the design of their technology, we are continuing to support this empowerment. Empowerment as an experience of co-design has been supported in literature.

2.7 Understanding the children co-design practice

All co-design approaches, from informants to design partnership, require different degrees of effort to engage the children in a meaningful manner and transfer their contribution to design inputs. Similarly to co-design with adults, typical drawbacks for co-design practice with children are the costs in terms of time and resources in arranging, running and analyzing the design sessions. When children are involved the following extra efforts are to be accounted for:

- gaining access to children – it requires making arrangements with parents, teachers and care-givers, dealing with strict ethical clearances, and fitting sessions into the children's school and extracurricular activities (Rode et al., 2003; Read and Mazzone, 2008);
- Running the design session – whether in a school or in a lab space, it requires recruiting more than one researcher to facilitate the activities and guarantee a reasonable minimum adult/children ratio;
- After the session – after the session is completed, children's contributions are not easy to interpret and need to be filtered and analysed from different disciplines and perspectives before they can be considered inputs for the design (Ruland et al., 2008; Sluis-Thiescheffer et al., 2009; Mazzone et al., 2008a).

2.8 Methods for Co-designing with Children

Various methods and techniques have been developed for integrating children into the design process. Based on the ways in which researchers gain information from children, these methods and techniques can be grouped into five as observation-based methods, narrative-based methods, documentation-based methods, art-based methods, and game based methods (Nousiainen, 2008). Observation-based methods aim at gaining an understanding of users'

actual work environment and their needs by observing and interviewing them while they are doing everyday activities. Contextual inquiry (Druin, 1999) is the most used and mentioned method in this group. The aim of narrative- based methods is to facilitate expression and verbalization of the views and ideas of children, and they include Embodied Narratives (Giaccardi, Paredes, Diaz & Alvarado, 2012) and Mission from Mars (Dindler et al., 2005). Documentation-based methods aim to discover different aspects of the topic area and to gain information about the context by utilizing documentation techniques, and they include Kid Reporter (Bekker, Beusmans, Keyson & Lloyd, 2003) and Networking News (Nørregaard et al., 2003). Art-based methods intend to enable children to materialize their ideas and generate solutions based on hands-on activities including mock-up and low-tech prototypes; this group includes Comicboarding (Morajevi, Li, Ding, O'Kelly & Woolf, 2007), Mixing Ideas (Guha et al., 2004) and Layered Elaboration (Walsh et al., 2010) methods, each of which was derived from cooperative inquiry (Druin, 1999).

2.9 Techniques for Co-designing with Children

Techniques are design activities that are used at varying points in a design process to address certain sub-design goals. In general, methods — such as those mentioned above — involve design activities or techniques during multiple design stages in order to accomplish varying processes and goals. Within the various methods described above, several techniques are used. We define a technique as one activity that a design team participates in while creating a technology.

2.9.1 Frictional Inquiry

One brainstorming technique that can be quite motivational to children is Fictional Inquiry (Fails et al, 2013). In Fictional Inquiry, children are asked to participate in a make-believe scenario through which a narrative is set up to gather many requirements from children. Two well-known and proven Fictional Inquiry techniques for brainstorming are Mission to Mars and KidReporter. As with other brainstorming techniques, these are best used early in the design process and child design partners should not be limited in their thinking. The primary design goal is to research the problem and gather requirements that may help later in creating and evaluating solutions that are created further on in the design process.

2.9.2 Mixing Ideas

The Mixing Ideas technique grew out of Cooperative Inquiry work with young children. Younger design partners (aged 4 to 6) may need more support in order to combine their ideas during the ideation or brainstorming phase of the design process. They are relatively good at coming up with individual ideas; however, they are often reticent to combine their ideas with others'. Thus, the Mixing Ideas technique grew out of a need to combine the ideas of many individuals into one idea. The primary design goals in mixing ideas are to create and refine multiple solutions. In order to do Mixing Ideas, teams need: paper, large and small; drawing and writing implements such as crayons and/or markers; and tape and scissors. As with low-tech prototyping, these materials are typically relatively inexpensive. Mixing Ideas works best when each activity is done during a different design session. Thus, designers considering this technique need to consider if multiple sessions are a possibility for their design team.

2.9.3 Layered Elaboration

A brainstorming technique developed for use in the Cooperative Inquiry method with children aged 7 to 11 is called Layered Elaboration. Layered Elaboration is best used for brainstorming when designing screen-based media, when combining the ideas of distinct groups, and when expense, time, and space are limited. The primary design goal is to create multiple solutions. By its very nature, the elaboration process involves changing, extending, adding to, and subtracting from the ideas of others. Layered Elaboration allows designers the ability to elaborate on others' ideas without "ruining" the initial idea.

2.9.4 Sticky Notes

The sticky notes critiquing technique is a part of Cooperative Inquiry where children aged 7 to 11 and adults work together and critique an existing technology or prototype. The goal of the technique is to evaluate prototypes and provide feedback and direction for future improvements of a given technology. This could be a technology that has already been developed and deployed, or a prototype at any point of development. Sticky note critiquing can be done individually, but often more ideas will be shared if design partners work in pairs or small groups. While the above described technique is how sticky notes are employed in the Cooperative Inquiry method with children aged 7 to 11, sticky notes have been used by designers in many ways and sticky note techniques can be adapted for younger children (aged 4 to 6) as well as older children including teenagers.

2.9.5 Focus Groups

When conducting focus groups several factors need to be addressed (Fails et al, 2013). Some considerations include group composition, geographical location and scheduling, creating the right environment, moderator, introducing the group, conducting and recording the discussion, and rewards and recognition.

Group composition

All focus groups generally have some form of homogeneity whether it is in age or purpose. In terms of ideal group size, the literature provides varying advice, although marketing research group sizes tend to be larger than social science or design groups.

Geographic location and scheduling

New environments and strange adults can provoke anxiety, especially for young children. At the same time, a familiar location can evoke familiar responses such as a school may lead children to feel like they are in the traditional power structure of teacher–student where the adults have the answers and are looking for a specific response from the children. Therefore, one should be careful when selecting an appropriate location — one that is comfortable, but not too familiar, for the children.

Creating the right environment

When preparing focus groups, great attention must be given to creating an atmosphere of comfort and trust so that true feelings and opinions can be expressed. Part of this is room layout choice (a circular setting is often preferred), lighting, and even having a comfortable temperature level in the room. When working with children, it is important to address the traditional power structures that exist between adults and children — where children generally feel adults have the answers and their role is to figure out the "right" answer the adults already know.

Presented above is the history and current state of several methods and techniques that can be employed to design technology with and for children. It is of belief that children can and should be involved in the design of their own technology, not only because this empowers children, but also because children's involvement leads to a diversity of ideas that may not exist if they are not in the design teams. The importance of giving children the voice cannot

be overstated, and hope that researchers and designers of children's technology continue to listen to and design with children even more in the future.

2.9.6 Techniques used in design with children

The different dimensions of categorization of techniques considered the most relevant to designing with children is accompanied by and showed in table 1:

- a brief description and aim;
- its possible application according to the purpose, whether they are methods
- preferably used to explore the context (exploration), to generate concepts
- (generation) or to evaluate them (evaluation), although many techniques can
- be adopted in different phases with different objectives;
- examples and references of specific applications or variations;
- required skills of the children to use it;
- possible positive and negative aspects of its application.

Table 1: Techniques used in design with children

Technique	Description-Aim	Required skills	Advantages	Disadvantages
Brainstorming	Thought shower of ideas with more or less constraints	Linguistic, interpersonal	Quick way to generate many ideas	Need contextualizatio n
Contextual inquiry	Gather children's perception of the context	Linguistic, interpersonal	Experience of context of use from children's perspective	Need detailed explanation from children for interpretation
Drawing	Visualization of ideas and context	Spatial/visual	Familiar to the children; Easy way to communicate ideas; Keep some level of	Need detailed explanation from children to avoid mis-

			fantasy and imagination/ abstractness	interpretation
Focus group	Gathering children's collective opinions/ideas on specific topic	Spatial/visual, linguistic	Good for divergent phase of ideas generation	Abstract results
Interviews	Gathering children's individual opinions/ideas on topics	Linguistic, interpersonal	Explore details No need of children's literacy skills	Time consuming Needs interviewer skills to avoid biased answers
Scenarios	Stories describing use cases, including events, settings, actors, tools	Logic; linguistic; bodily kinesthetic (3d); spatial/visual (drawn);	Structured and contextualized information	Depend on children's narrative and linguistic skills
Role-play	Evaluate a concept by acting out use	Bodily kinesthetic; interpersonal	Engaging; encourages natural behavior; shows ideas in context of use	Ambiguous interpretation of resulting ideas
Presentation	Children	Linguistic;	Provide useful	May be

	present their idea, with or without props	interpersonal	information on children's explanation of their ideas	conditioned by social factors and children's linguistic skills
Prototype	Represent and explore ideas and concepts	Bodily kinesthetic; spatial/visual; interpersonal	Engaging; Allow role play; Allow thinking of practical constraints	Can be influenced by available material Time consuming in doing and analyzing

CHAPTER 3: CASE AREA

Kopila Valley School

Located on three acres of land, Kopila Valley School serves more than 400 students from nursery through 12th grade. The school was built to expand on the nonprofit's existing primary school and create a safe and nurturing

Figure 2: Kopila Valley School

environment that is not only a place of learning but also offers children nutritious meals, basic medical and dental care and after-school activities, such as sports and cooking classes. The school employs more than 100 Nepalese teachers and administrators. The campus also includes a Mental Health and Counseling Center, the Kopila Valley Health Clinic, a tutoring room, a computer lab, a stage and a small library.

Sustainability is at the center of the school design. Locally sourced rammed earth, chosen for better thermal mass and temperature control, was used to construct the thick walls reinforced with steel bars for stability and earthquake resilience and a small amount of PPC cement to protect against dampness.

Figure 3: Solar PV system in school building

Natural ventilation and lighting were also enhanced in the positioning of the buildings and windows, while covered terraces at southern-facing walls provide shade. The school is solar-powered with a solar PV system and an off-grid battery system.

The underground cistern stores rainwater harvested from the rooftops that is filtered for potable use. The landscaping and permeable paving ensure rainwater is also used to replenish the groundwater system. All waste-water is treated on site with constructed wetlands and then recycled. Gray water from sinks is used to flush the toilets; black water is filtered for plant irrigation; solids are converted in a pressurized tank into bio-gas fuel for cooking. Solar cookers are also used for cooking.

The students are at their best when their creative energies are encouraged. They thrive at science fairs and theater performances, art and poetry. They love dancing and moving, reading and learning. Kopila Valley School focuses on Montessori methods over teaching to a test. On helping students become doers and future leaders.

Figure 4: Bamboo structure for the school building

Most of the students in Kopila Valley School come from the rural part of the region and poor socio-economic backgrounds that are living in mud huts, abandoned or lacking access to basic needs such as food, shelter, health facilities and education. Kopila Valley School serves much more than just as a place to learn.

The methods by which this school has been constructed offer a compelling model for other schools looking to grow in responsible ways, and a lesson for all the students at Kopila Valley that environmental sustainability is something that they should take seriously. That principle is reflected throughout the school's curriculum. Students learn not just how their school operates with care for the environment, but how

Figure 5: Cow shed in the school premise

they interact with the food system by planting their own food that they consume each year.

CHAPTER 4: ANALYSIS AND DISCUSSION

The analysis is based on the drawings produced by the students of Kopila Valley School. The drawings are the result of their imagination and depiction of their own learning space. The drawings were then narrated by the students themselves, which has been used as the main source of analysis.

4.1 Co-design session with students

Two sessions were conducted for the completion of the thesis. While the first session was conducted on site, the second session was conducted online. For the first co-design session, the students were grouped in two groups. The first group was from grade 6 and 7, aged 11 to 13. The second group was from grade 8 and 9 aged from 14 to 16. Total eight students were selected for the first workshop. The selections of the students were totally independent of the researcher. The students were selected by the student coordinator who was representing the school.

Figure 6: Group 1 for the co-design session

The following are the ten main steps followed to process with the thesis:

1. Studying around the subject

2. Clarifying and filtering the co-design purposes

3. Getting familiar with similar design or research groups with the children and the details of communication with the children

Figure 7: Group 2 for Co-design session

4. Planning for the session

5. Initial planning to select a case area, i.e Kopila Valley School

6. Exploration of the school and selection of the students for co-design sessions

7. Commencement of the first workshop on site

8. Commencement of second workshop online

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9. Analysis done based on the workshops.

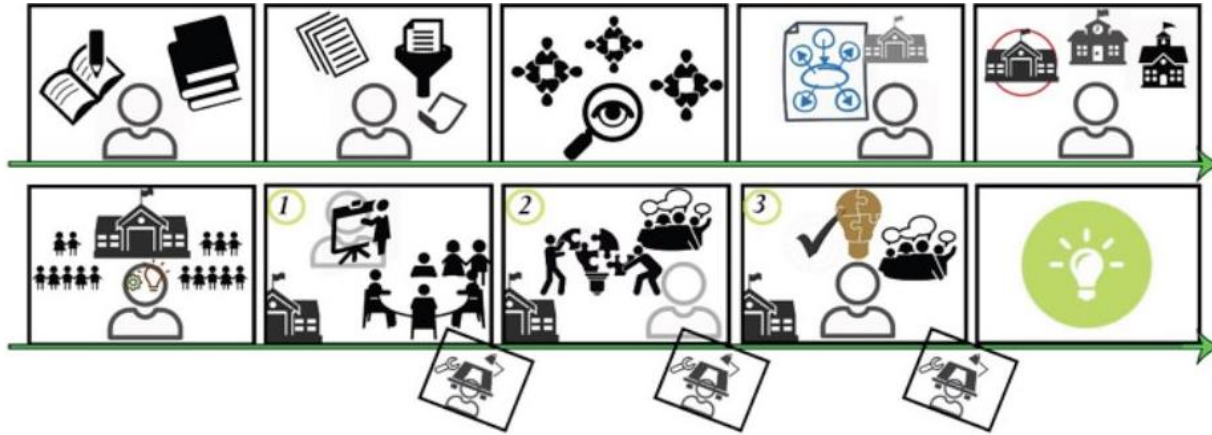10. Results finalized based on analysis

Figure 8: Steps for conducting research

4.1.1 First workshop

Each session lasted for about 2 hours and took place in the co-coordinator's office space in the Kopila Valley School hostel. The students were first asked to talk about their schools and explain the interesting things about their school. After the conversation, the students were asked to draw a school of their own kind and mind with all the elements that they think is required for a school environment.

Figure 9: Students during 1st workshop

The first group session was with the students of grade 6 and 7.

In the Figure 10, we can see the great distant between the main building and the toilet. When asked, the result was due to the foul smell. This was the very common concern among the students. Within the main building, the cafeteria is the biggest suggesting want for more social space. The river is flowing besides the school main building suggesting the connection with nature and requirement of the water body. The main
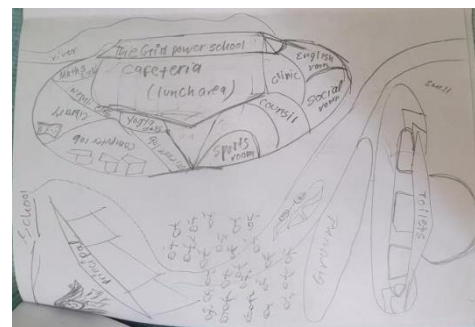

Figure 10: Drawing 1

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significance of this drawing is the mention of "The Girl Power School" and the portrayal of the principal as female even when in reality the principal was male suggesting the women empowerment.

The Figure 11 is very simple and highlights the elements that is required for the school, a cycle lane because the student wanted to visit school in a cycle, the chess room and computer lab which the student wanted to be accessible at any hours for the need of
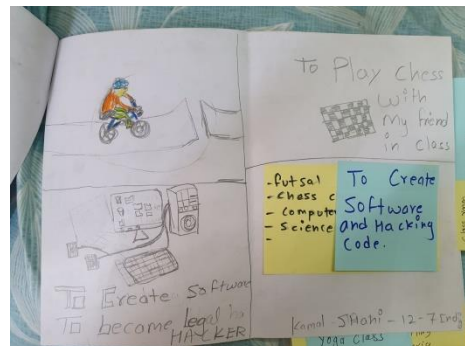

Figure 11: Drawing 2

research.

The Figure 12 also expresses the need of computers in the classroom with the beds for resting suggesting the need for the quiet and private space.

As, for the design of the school, the students were asked to create the school design in collaboration combining their previous drawing and ideas. This was very interesting to watch because the students were seen more active and involved than with the individual

work. Their minds were more creative and ideas were

Figure 12: Drawing 3

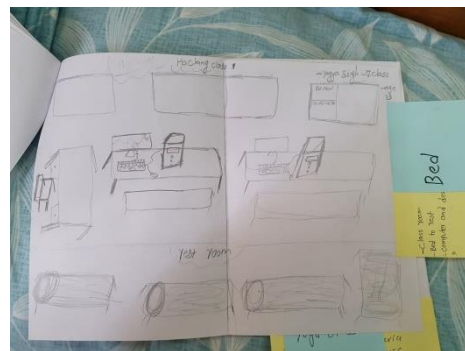flowing as they were suggesting various ideas to the artist, which was selected by the group themselves.

The most important point in the Figure 13 is the location of the school in the natural environment. The presence of the hills with the river along with the trees surrounding the school premise is significant in the drawing. Other student's drawings show the similar location characteristics. The emphasis in this drawing

is more on the creative spaces such as the playground,

Figure 13: Drawing 4

pool, computer lab, and canteen. The classrooms are clustered in the single space. The presence of the neighborhood is also viewed as important.

The second group session was with the students of grade 8 and 9.

The students of this group were as expected more matured and forward. Their designs also reflected the same and were detailed.

Similarly in the Figure 14, the emphasis on the main school building is less in relation to the creative spaces such as meditation space, playground, vocational site, garden area and hangout space for students.

Figure 14: Drawing 5

The big emphasis in the swimming pool is visible along with the view tower and the separate grounds allocated for different sports. The part of the flower garden as in other drawing is also mentioned in Figure 15.

The drawings suggest the necessity of the quiet place. When conversing, these age group students were reported to be stressed for their exams and thus require a meditation spot or someplace peaceful.

Figure 15: Drawing 6

The separation of the building blocks for the primary and secondary to reduce the noise and lessen the disturbance are also seen in the drawings. The presence of the exciting environment can also be seen present as for examples, swimming pool, gazebo, view tower etc.

The different view on the Figure 16 was found to be the presence of the view tower with big garden space and gazebo. The separation of the playgrounds for the senior and junior students was stated to be for more flexibility and safety. The classroom arrangement of the juniors and seniors is also mentioned. This is also mentioned in the other student's drawing. The reason stated was due to noise produced by the juniors.

Figure 16: Drawing 7

Figure 17 also displays the separation of the classrooms for the junior and seniors. The placement of the drinking water taps in various places was also viewed as an important factor.

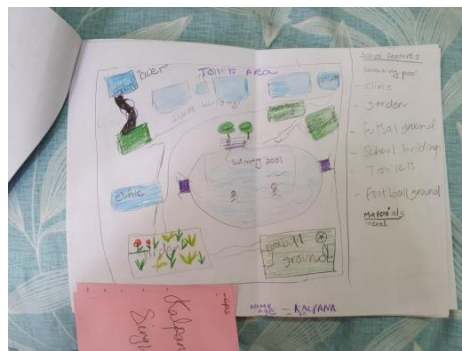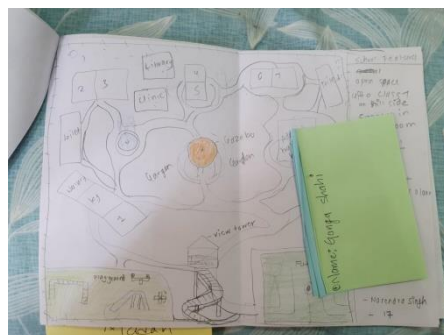The road networks are also intricate. The presence of accessible water tap, futsal ground is seen in almost all drawings. Similar to the previous group, the toilet block can be seen a little further from the classroom due to the smell as explained by the students.
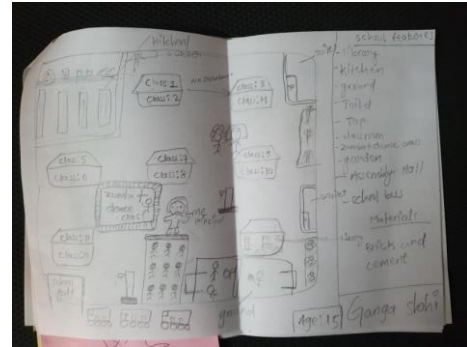

Figure 17: Drawing 8

4.1.2 Second workshop

The second workshop was done to gain detail perspective of the children's relation to space. In this workshop, the children were provided with the collages of important objects that were listed out based on their own drawings and conversation.

They were asked to place the collages as desired and interpret the relation and the purpose of the placements.

Figure 18: Students during their 2nd workshop

Figure 19 is the typical classroom with the twist of interior design. The group wanted the classroom to be beautiful with bamboo-designed window, flower arrangements and stone wall. The row sitting was selected for the greater concentration on studies and flexible movement. The group's emphasis on Figure
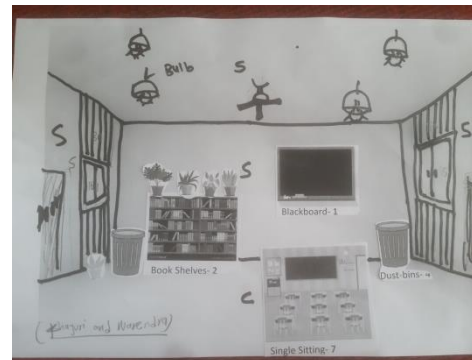
Figure 19: Drawing 9a

20 was the outdoor sitting under the tree-shade. This location was allocated for multipurpose use such as outdoor study, yoga and simply hangout space for students. The big open cafeteria surrounded by trees and flowers can also be seen in the drawing.

Figure 21 suggests the classroom sitting arrangement to be according to the work. They wanted circular setting for the group work and individual sitting for the individual work.

Figure 20: Drawing 9b

26
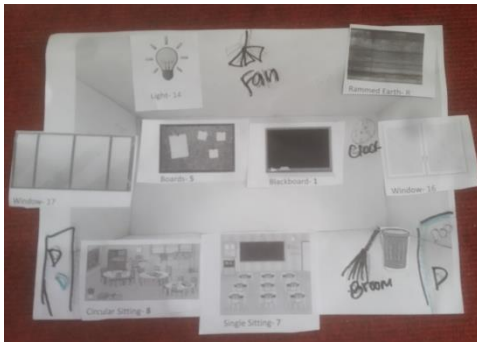
Figure 22: Figure 10a
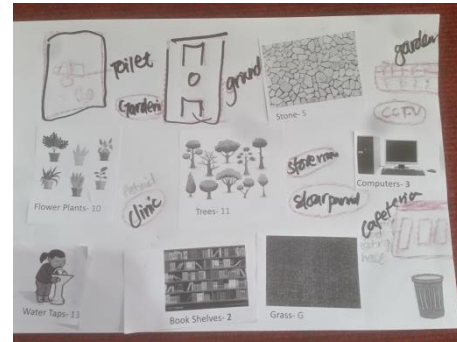
Figure 21: Drawing 10b

Figure 23 shows more focus on the presence of the individual computers on the classroom to perform their group projects and learn new things. The other focus was on the large window to get more natural light and row setting for the other studies for greater concentration. Futsal ground was common in all the drawings along with the natural vegetation of flower garden and shaded tree areas.
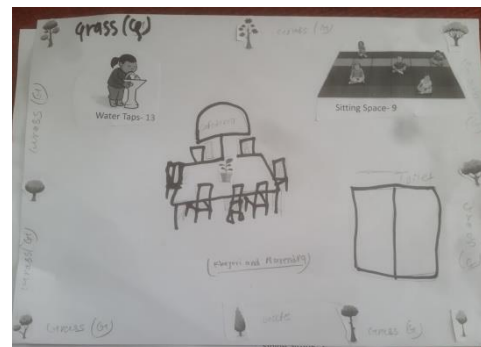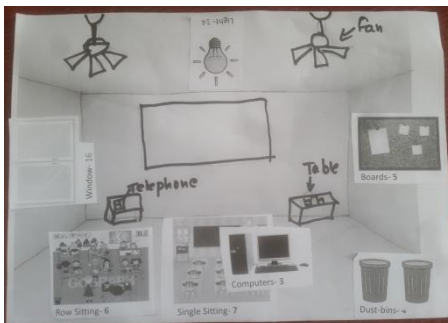

Figure 24: Drawing 11a
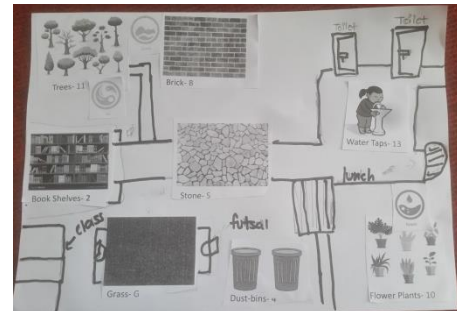
Figure 23: Drawing 11b

4.2 Discussion

Analyzing the data and information from the workshops, conversation and observation, the works could be divided into three sections and explained further on the basis of stakeholders who can contribute, how they can contribute and when is the possibility.

4.2.1 Safety and Comfort

Whether we are adult learners or only beginning our journey through academia, we look for learning environments that are safe and positive. If we are going to optimize interaction among our learners, which can have tremendous effects on learning, all learners must feel

that they can safely take those risks that are part of exploration and constructivism (Clapper, 2010).

The lists of objects are as follows:

a. Healthy choice: - Cycle lane, Meditation/Yoga space, Swimming pool

b. Flexible movement: - Separate playground for juniors, two doors, security camera

c. Health clinic

d. Toilets:-hygienic, clean, odorless

e. Classroom: - Noise reduction, concentration

WHO? School Administrator and Teachers

HOW? Be clear, reflective and explicit about the children's vision, needs and their requirements; and find structures, processes and operating systems for an ever-growing group of individuals for them to take responsibilities for sustainability practices.

WHEN? While the topics such as hygienic toilets and proper classrooms can be achieved in short span of time. The others such as cycle lane, meditation space, security cameras etc can be achieved with proper planning, degree of importance and within a certain period of time. Some mentioned such as swimming pool in schools can be difficult to manage in every school. The list is further managed in Figure 25.

4.2.2 Physical Space

A school's physical place includes the built environment, surrounding natural environment, and the resources that flow through the school. It provides both the context for an educational experience and a visible representation of school values. To best harness the power of physical place, it must be engaging and active, be progressively more efficient, and embody systems that enhance human, environmental, and economic health. Dul, Ceylan, and Jaspers reviewed recent studies in this field and summarized the features of space that are relevant to creativity, such as: any view from the window, furniture, privacy, lighting, plants, physical indoor climate (humidity, temperature), sounds (positive: music, absence of noise, silence), odors (positive: fresh air, absence of bad smell). McCoy and Evans identified a view of the natural environment, the presence of natural materials, the complexity of the space and the number of objects in the space as creative space characteristics. A school's built and natural

environment provides immense opportunities for students to learn about sustainability, science, technology, conservation, the history of their community, and more.

The lists of objects are as follows:

a. Beautiful Interior

b. Flower garden

c. Sports grounds:-Futsal, Football, Tennis etc.

d. Attractions: - View tower, Gazebo, Bridge

e. Location:-Natural surrounding

f. Large windows

g. Building Materials:-Familiar or unique

WHO? School Administration, Designers, Children and Parents

HOW? Create energy and enthusiasm for sustainability by inspiring each other; encourage children to learn sustainability from their environment; although it starts with one or two individuals, learn to find ways to involve more people and to grow, hence creating strength in numbers and ever-growing.

WHEN? Physical spaces when already in existence can be difficult to manage. Thus the mentioned lists may take time with proper planning and system. Thus to realize the possibilities, it is further explained in Figure 25

4.2.3 Social Skills

According to the psychologist Lev Vygotsky, the way children learn is by internalizing the activities, habits, vocabulary and ideas of the members of the community in which they grow up.

The lists of objects are as follows:

a. Multipurpose common space

b. Open cafeteria

c. Social Club

d. Vocational training space

e. Active engagement

f. Learning space:-Kitchen garden, water taps and rain water harvesting.

g. Mutual learning:-Sitting arrangement, display boards, computers

WHO? Parents, Teachers and children

HOW? Create a community of practice and sustain interest. Search for ways to support the integration and implementation of sustainability across the whole school system.

WHEN? Children learn and grow with each other. Providing them with space to grow is not difficult in the school environment. Thus in Figure 14, we can see the lists of possibilities to achieve within certain period of time.

The school is as an institution with excellent disposition of public space that could be offered to its neighborhood. The idea of the thesis to create a "sustainable learning space" for children can be helped by parents, pupils, neighbors, the local population, teachers, etc., through active participation and collaboration. This can help develop mutual community relations and improve local environment via active participation of the local population.

CHAPTER 5: FINDINGS

The variety of elements suggested provide evidence for the assumption that the children understand their learning as something that can happen everywhere in the school, in the material spaces available to them. Additionally, children referred to their learning experiences when using the various tools designed to create a child-friendly informative environment, such as playgrounds, display boards, or specific elements from the school infrastructure, such as windows and water taps in the toilet. The study showed that the children's perception of learning are intimately connected to how they explore objects and places, indicating that children create opportunities to freely construct knowledge based on their adoption and multiple uses of objects. It is noteworthy that the place for children's learning is mainly the space where everyone is together: the classroom, the playground. The results in this category reveal a co-learning environment and an understanding of learning experience in which children recognize peers as models worth observing either in free activities or in adult-driven situations.

This shows that children not only reproduce meanings but produce it; they do not just adapt to the modification and co-construction of social values and norms, but also influence them. This finding supports previous research that has shown how children are active co-constructers of culture. The study supports the argument that children must be featured as design partners in their learning processes. This study utilized the opportunity to listen to children's voices and given the results, the expectation is that teachers, experts in education, and other professionals involved in developing alternatives to potentiate learning may gather ideas to reflect upon their understanding of children's learning, as well as the role of peers and the various spaces within that learning.

The school's initiation of appointing sustainable ambassador is a very creative way of making students understand about the sustainability. But, it was also seen that only the ambassador was fully aware of the major issues and the details. Also, in terms of identifying the school's most valued element, while the student ambassador talked about the sustainable elements, the other students directed towards the extra items such as the bridge, the gazebo and futsal ground. It was also seen that in both the groups, the student ambassador was present who was very active at all times.

The implementation of sustainable habits outside the school area was limited. When asked, the students replied that it's difficult to apply and make the adults apply. Thus, the students

preferred to ignore and less enthusiastic to apply it at homes. They replied that they would utilize it completely when they will be fully grown adult and responsible.

But, this was not the case for the garden that they mend themselves. The vocational training in the school offers the classes for the gardening and growing plants themselves. The students were more intrigued and captivated by this. This was due to their sense of ownership. The outcome of garden was their own work and hence was proud and utilized the knowledge and talked about it with everybody.

The summarized form of the finding can be illustrated in the table below.

Table 2: Summarized finding

Methods	Key points
Drawing	- Playing Equipment - Comfortable spaces - Quiet spaces - Exciting Environment - Computers - Smell avoiding space
Conversation	- Use of local material - Curiosity - Quiet space - Smell avoiding space - Activity area - Community participation
Observation	- Interested in physical activity - Need of dynamic space with some changeable details - More energetic in a bigger space - Sunlight and nature is effective for their mood - Interested in stories and myths
	A friendly energetic communication with the students and understanding them was important

General Experience	• Creating and designing something is very exciting for the students

Relevance to SDG:

To achieve the change, we need new skills, values and attitudes that lead to more sustainable societies. Education systems must respond to this pressing need by defining relevant learning objectives and learning contents, introducing pedagogies that empower learners, and urging their institutions to include sustainability principles in their management structures. Education is both a goal in itself and a means for attaining all the other SDGs. It is not only an integral part of sustainable development, but also a key enabler for it. That is why education represents an essential strategy in the pursuit of the SDGs.

Figure 25: The whole-institution approach (UNESCO

- The learner is able to promote the empowerment of young people.

- The learner is able to use all opportunities for their own education throughout their life, and to apply the acquired knowledge in everyday situations to promote sustainable development.

The co-design method applied for the thesis helps in enlightening the perception of the children in defining their learning spaces and how it can be developed sustainably. The children learn in various ways. So, listening to the voices of the children is very important as they are the future citizens of the world.

There is a global dimension to every aspect of life and communities and sustainability isn't something that can be achieved in isolation. The decisions we make on a daily basis have a global impact. Children growing up today can look forward to spending their working lives

as citizens of an increasingly difficult world. Today's children are part of a global society and need to be aware of the global issues and to feel empowered to play a part in sustaining our world. Sustainability in schools can bring together a wide range of people and ideas that have a great opportunity to foster global perspectives. Students experience and act on sustainability issues in an individual and local way, while exploring the "ripple effect" through which local actions affect the wider world.

Education is essential to achieve all of the goals. "A fundamental change is needed in the way we think about education's role in global development, because it has a catalytic impact on the well-being of individuals and the future of our planet. Now, more than ever, education has a responsibility to be in gear with 21st century challenges and aspirations, and foster the right types of values and skills that will lead to sustainable and inclusive growth, and peaceful living together." Irina Bokova, Director-General of UNESCO. Moving forward on the path of sustainable development will require a profound transformation of how we think and act. To create a more sustainable world and to engage with sustainability-related issues as described in the SDGs, individuals must become sustainability change-makers (UNESCO, 2017). They require the knowledge, skills, values and attitudes that empower them to contribute to sustainable development. Education is therefore essential for the achievement of sustainable development. All educational institutions can and should consider it their responsibility to deal intensively with matters of sustainable development and to foster the development of sustainability competencies.

Based on the literature, analysis and findings, the research and analysis framework was developed which is as shown in the next page.
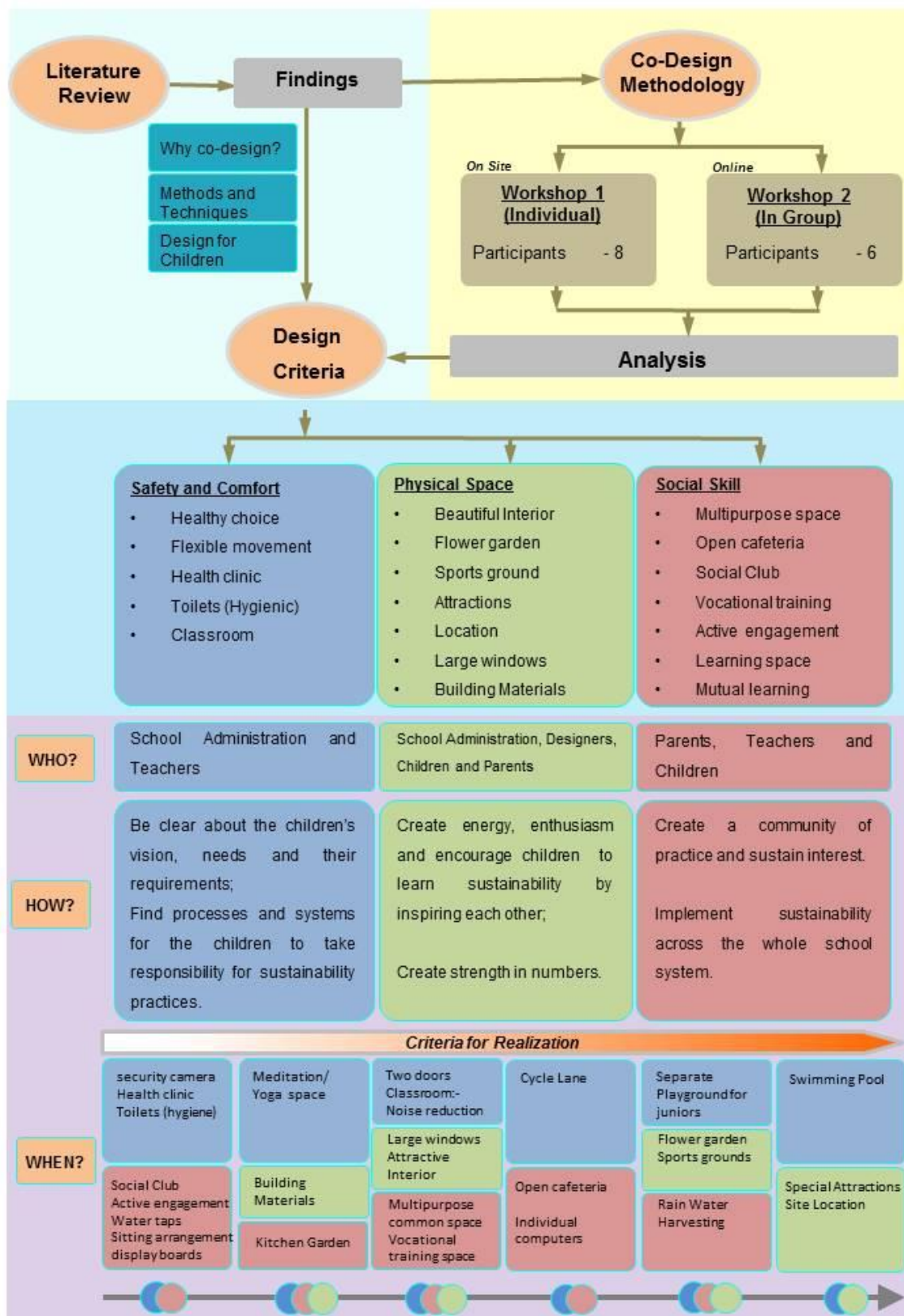
Figure 26: Research and Analysis Framework

CHAPTER 6: CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This research was undertaken to develop a framework for sustainable learning space with the help of co-design methodology. Findings can inform the school administrators, policy makers, parents and the wider education community of the current state of sustainable development in schools, indicating the skills and qualities required by school to move forward. Sustainability in schools can encourage new models of leadership. Early learning and experience of sustainability helps children to grow into better human for the future society. It can help them make their informed decisions regarding their ways of living and contribution to the sustainable development. The children's narratives showed how learning implies action, done something with an experience here and now. They contextualize in their immediate interest and experience. This is a very important aspect of how children in this study represented and constructed the meaning of their learning experiences as independent work or group work. The findings can relate to the possibility for children to be design partners and make material changes in their learning environments, as they recognized their own competence for learning, exploration of places, manipulation of objects, and transformation of their surroundings to potentiate new experiences. In doing so, the children feel empowered and motivated. The children are curious; they seek to learn new things and are fascinated when they come across new experiences.

The variety of elements conveys that the children understand their learning as something that can happen everywhere in the school, in the material spaces available to them. Additionally, children referred to their learning experiences when using the various tools designed to create a child-friendly informative environment, such as playgrounds, display boards, or specific elements from the school infrastructure, such as windows and water taps in the toilet. The study showed that the children's perceptions of learning are intimately connected to how they explore objects and places, indicating that children create opportunities to freely construct knowledge based on their adoption and multiple uses of objects.

It is noteworthy that the place for children's learning is mainly the space where everyone is together: the classroom, the playground. The results in this category reveal a co-learning environment and an understanding of learning experience in which children recognize peers as models worth observing either in free activities or in adult-driven situations.

This shows that children not only reproduce meanings but produce it; they do not just adapt to the modification and co-construction of social values and norms, but also influence them. This finding supports previous research that has shown how children are active co-constructers of culture. The study supports the discussion that children must be featured as design partners in their learning processes. This study utilized the opportunity to listen to children's opinions and given the results, the expectation is that teachers, experts in education, and other professionals involved in developing alternatives to potentiate learning may gather ideas to reflect upon their understanding of children's learning, as well as the role of peers and the various spaces within that learning.

Students can identify issues in their own schools and homes, and predict the outcome if they were left unresolved. They can suggest ways to solve a range of problems, including recognizing who would help them achieve their goals and over what timescale. Not only does this support student inclusion in the school management process, but it allows brings to life the everyday solutions to a wide range of environmental issues. They can collaborate to agree goals and values, communicating these to their peers and agreeing ways to perform designated individual and group tasks. From recycling to reducing waste, learners can have a positive impact on their future planet, driving change in their schools' policies.

In the recently endorsed SDG framework, Education has been advocated as a largely untapped strategic resource for building re-salient and sustainable societies (K.C, 2016). It has been put forwarded as a stand-alone entity to improve human living standard with direct linkages to economic growth, employment, gender equity, healthy life and creation of peaceful and resilient societies (K.C, 2016).

It has been well explained that the overall aspect of education is fundamental to promote, peace, justice and equality in the work. Various lessons has been learnt from the last decade of MDGs (2000-2015); providing stronger and sustainable pathways for upcoming SDG (2015-30) period. The citizens with higher capabilities and skills can make better choices in their life regarding economic engagements and productivity as well as promoting social values like trust, tolerance, equity and global cooperation.

6.2 Recommendation

As for the recommendation, it has been done for the major stakeholders in terms of short term and long term activity Such as for Policy makers, in short term they can provide incentives for the school that includes and promotes sustainability and helps student to learn about it and

demonstrate the integrative and supportive nature of sustainability. Recommendations for the policy makers, school administration, parents, and teachers are listed as below:

6.2.1 Recommendation for Policy Makers
Short-Term

a. Provide incentives for the school that includes and promotes sustainability and helps student to learn about it.

b. A consistent and coherent approach to sustainability has to come from all parts of the education to reduce school leaders' initiatives burden and to demonstrate the integrative and supportive nature of sustainability in delivering other priorities.

Long-Term

a. Make policies to include school children in sustainability programs.

b. Develop the capacity of local authorities to support schools in developing sustainable schools.

6.2.2 Recommendation for Teachers
Short-Term

a. They can create a classroom environment that includes group work spaces where resources are shared.

b. Effective teachers can help students to grasp relationships and make connections. They can do so by providing a model or a scaffold that students can use as support in their efforts to improve their performance.

Long-Term

a. Increase the amount of time teachers spend on learning as sustainability can be new topic.

6.2.3 Recommendation for School Administration
Short-Term

a. Students must be provided with observations and experiments that have the potential of showing to them the importance of sustainability in daily lives.

b. Start to model sustainable practices, for example through energy savings, growing food and inclusive behavior.

c. Integrate sustainability across the curriculum.

d. Enable shared resources, contacts and practice by coming together around a focus of sustainability.

Long-Term

a. An important aspect of social learning is to link the school to the community. In this way, students' opportunities for social participation can be enlarged.

b. Create school policies and plans based on sustainability.

6.2.4 Recommendation for Parents

a. Be in contact with teachers so that they can learn to provide richer educational experiences for their children at home.

b. Parents along with teachers, community organizations, and volunteers can form a sustainability committee to report and make new recommendations to the school's decision-making committee.

6.2.5 Recommendation for Designers

a. Include children as the design partners.

b. The design team made the sustainable features visible for the school and provided ways for students to engage with or manipulate the features.

6.3 Integrating sustainability
Use the school as a laboratory:

One of the views of sustainability education is that students should practice doing as well as reading. By making learning practical, students' understanding of sustainability concepts becomes three dimensional, perceptible, and more memorable. The school environment can be a wonderful place to apply sustainability practices learned in the classroom. There are so many sustainability practices that can be done at a school that can also be applied in the home, a business, organization, or a municipality. To maximize student learning and the value of these projects to the school, staff and faculty must be committed to coaching and assisting students. A scope of work has to be defined that can be done by a few students that is not too urgent. It is also to be made sure that the work is documented and made available so that future students can learn easily and get inspired. Supervising student's projects may

be more time consuming than having staff complete the work, but done right, it is a great educational opportunity.

Set up an eco-rep program

The EcoRep Program aims to educate students on and off campus about sustainable behaviors that benefit our community and the environment. It is a great way to engage students on sustainability and spread outreach in the student population through peer-to-peer education (Fang, 2013). Sometimes students will have an interest in a subject not covered by the curriculum or have an idea that cannot be implemented in a class. It can be helpful in nurturing these students. Students can also conduct independent study in a group. The work might involve a school sustainability project, a reading list, a research inquiry, or a creative project. It can also be a good way to follow up on a vacation projects.

Go on field trips

Seeing is believing and students may remember a field trip to the related areas of the discussion long after they have forgotten the written material from the class. Facilities Managers, staff, and faculty can also benefit from field trips to learn about what other places are doing for sustainability or what is going on in the community. It may be the thing to convince people to take action to support sustainability at their own school.

Attend a conference

It's a terrific opportunity to take students out of the academic setting and into the real world where they can meet people who are doing work in real time. It is also a great way of having a faculty or staff member who is on the edge about sustainability to get them some education and inspiration.

Invite speakers

In addition to taking students out into the field, the practitioners can also be invited into the classroom. It is good to get range from speakers by arranging for them to speak at a public event at the schools as well as more intimately with just the class and keep it basic for the students to understand.

Develop faculty

Many faculties are interested in sustainability but don't know where to start with integrating them into their courses. So organizing a faculty development workshop, and inviting faculty

from other organizations who have experience teaching sustainability in their disciplines to come teach your faculty can be productive. These workshops can be a vital time for reflection and discussion about the curriculum.

The results of the thesis can benefit the policy makers, educators, future designers, school administration, parents and children themselves. The main discussion is that if the children should be involved as the design partners? Does involving children as design partners help promote sustainability and achieve SDG. As the result of the thesis, it is believed that children should be involved as the design partners and this can help in attaining sustainability and sustainable development goals. Thus, based on the research, the policies can be formed to create a healthy environmental, economic and socially responsible living and learning environment for all students and staff, establishing a division level commitment to sustainability along with guidelines on the range of plans and actions that could be adopted at the individual school level. The future designers can learn variety of new things from including children in the design process and making them the design partners in the development of the spaces. Thus, sustainability is the issue that is important for all groups of people in every aspect of life. Embedding sustainability in daily life is the easiest way of achieving sustainability. Thus, transferring knowledge to the future citizens from their early childhood can have a great impact and help in the process of sustainability.

Though the Ministry of Education hasn't made reflection of SDG on the education progress and plan of Nepal (still in progress) however it would be relevant to share SDG recommendation to make sustainable improvement in education sector (K.C, 2016). The SDG recommends investing and strengthening education system by integrating the education component to broad ranges of other development areas like economic growth and employment, gender and peace, infrastructure and health and agriculture. Along with the hardware aspects, there should be reform in the curriculum so as to promote civil and peace education, understanding of democratic norms and values like transparency, accountability etc.

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