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Small Change is Beautiful: Exploring Possibilities of Eco-san on School Garden for Transformative Pedagogy

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Abstract

This article explores the possibilities of the use of eco-san in the school garden in the Nepalese community school, focusing on transformative pedagogical impacts on the social learning environment of the school. In particular, the use of urine as a fertilizer in the school garden through eco-san and linking pedagogical alignment to provide a pleasant experience that has a positive impact on students' meaningful engagement, social connections, and developing confidence. The main finding for the research question came from qualitative data collected from students, parents, and teachers through in-depth interviews, focus group discussions, participant observations and informal conversations. This was supported by analyses of qualitative data on students' learning, collaborative inquiry, teachers' and parents' engagement and perceptions on the use of human urine as fertilizer from eco-san, and school gardening activities. Results showed that the gardening program attributes valued most highly by the parents and teachers included increased students' meaningful engagement, opportunities for experiential and integrated learning through dialogue conferences, collaborative inquiry, and building social skills like cooperation, sharing and argumentation. Future research should explore whether effects persist over time and if and how changes in students' positive attitude affect learning through school gardening activities applying human. Suggestions for applying results to future studies are provided.

Keywords: activity-based learning, eco-san, collaborative inquiry, school garden in community school

1. Background of the Study

Learning in community schools in Nepal is based on talk and chalk methods (Acharya, 2016). Students recite the words, formulas, and definitions in the name of learning. School science and health teachers promote the lecture method of teaching and learning. There is very little or no use of available local resources as instructional materials for teaching and learning purposes. Application of human urine as a fertilizer in the community school garden is beyond the concept of school teachers, parents, and students. Research shows that the school garden is a natural setting and a place where students and teachers can get sufficient instructional materials to study different subjects like science, health, environment, social studies and languages (Acharya, 2019; Klemmer, Waliczek, & Zajicek, 2005). Garden activities help to promote cooperation, collaboration, trust, argumentation and social qualities among the students and teachers (Acharya, 2019; Rawson, 2016). Policy level people in the education sector in Nepal realized the importance of the school garden as a learning tool and thus developed the draft education policy *Green School Guidelines*. Based on this guideline, *One Garden One School* policy is drafted and incorporated in the school curriculum. This program encompasses collaborative activities among the students, teachers, and parents by setting up the *Eco-club* and *Child-club* in each school throughout Nepal, where a school garden is a foundation for integrated learning. Research shows that school garden promotes disciplines, collaboration and critical mindset among students through active and meaningful engagement (Acharya, 2019; Situmorang, & Tarigan, 2018).

Reforming school education is the recent political agenda in Federal Nepal, has provided some hope for meaningful and contextually appropriate school education. Recently, the education system in Nepal is

decentralized from the federal state to the provinces and local bodies. Education now in Nepal is in the court of the local bodies. It was followed by the Eighth Amendment of the 1971 Education Act, [Government of Nepal (GoN, 2016)]. Its target was to follow a new constitutional directive, giving more rights to local bodies. The decentralized education system in Nepal is in favor of reforming the pedagogical system in all the community schools throughout Nepal. It is possible through the application of the locally available resources and setting a school garden in all the schools. Now, the first attempt at GoN has drafted the education policy related to *One Garden One School* to engage students in hands-on activities for learning science, health, and environment subjects.

As the PAR researchers, we (first and the second author) realized the use of human urine as a fertilizer supplied from the eco-san toilet on the school garden to ensure and restore the quality of garden soil to grow vegetables and flowers. Research is done by Viskari, Grobler, Karimäki, Gorbatova, Vilpas, & Lehtoranta, (2018) found that human urine can be used as a fertilizer to increase soil fertility that enhances productivity. Human urine consists inorganic ions such as sodium (Na^+), potassium (K^+), chloride (Cl^-), magnesium (Mg^{2+}), calcium (Ca^{2+}), ammonium (NH_4^+), sulfates (SO_4^{2-}), and phosphates (e.g., PO_4^{3-}). These all inorganic minerals help to restore the mineral depletion in the garden soil. Eco-san and school gardens are connected in-terms of hygiene, soil fertility, and preservation of the depletion of phosphorus from the soil.

Collaborative activities in the eco-san innovations in school garden are integrated into and enhance existing science, health and environment curriculum. Garden education linking with eco-san can support educational goals while addressing multiple, interrelated issues associated with learning, they are more likely to be adopted by teachers (Wheeler, Guevara, & Smith, 2018). Researches show that school gardens enhance a school's curricular, physical, and social learning environment (Acharya, 2016; Diaz, Warner, & Webb, 2018; Situmorang, & Tarigan, 2018). Gardening in the school promotes dynamic interaction between environmental, personal, and behavioral factors to explain people's behaviors (Bandura, 1986 as cited in Rubenstein, Ridgley, Callan, Karami, & Ehlinger, 2018). Also, eco-san and school gardens enhance a school's curricular learning environment by providing engaging hands-on education that reinforces teaching and learning (Bice et al., 2018). Gardens also alter the school's physical and social learning environments by increasing the availability and accessibility of fruits and vegetables to improve student's self-efficacy for consuming them, and by providing opportunities for adult and peer modeling of the preparation and consumption of fruits and vegetables (Morris, Briggs, & Zidenberg-Cherr, 2000).

A recent review of garden-based interventions suggests that these programs have the potential to improve students' willingness to learn, engage and promote argumentation skills (Robinson-O'Brien, Story, & Heim, 2009). *One Garden One School* education policy is increasingly popular that hopes to transfer the school education system from talk and chalk method of teaching and learning into activity-based instruction. Meanwhile, existing scenario and interest on the local, state, and national levels demonstrate an increase in and potential for funding and support of school gardens. There is a need for evidence-based studies to understand the impacts of school gardens and to inform the development of programs and policies. Policymakers, and the school teachers' support, need to better understand if and how school gardens improve children's well-being. This study explores the answer to the following research questions that have an impact on exploring the possibilities of school garden for transformative pedagogy in the community schools in Nepal.

(i) How do students, teachers, and parents perceive and meaningfully engage in the school garden to integrate learning in the living laboratory - the garden?
(ii) What role do parents and teachers play on the use of eco-san on school garden to transfer the existing pedagogical orientation into activity-based learning in science, health and environment subjects?

2. Materials and Method

2.1 Study Design

This study used a qualitative research design based on a participatory action research (PAR) approach, combining participant observation, in-depth interviews, focus group discussions and informal conversations. In order to gain a more complete and in-depth understanding of parents, teachers and students' perspectives and experiences, participant observation was chosen as the main data tool and data collection method. It allowed us to get alongside students in their *natural* environment to explore how they made sense of the gardening activities and how they shaped their activities through real field experience as part of learning. PAR aims to describe and understand dialogue conferencing, collaborative inquiry, mutual understanding, autonomy and ownership that occur within a group of people (Nury, Sarti, Dijkstra, Seidell, & Dedding, 2017). Over the years it has been recognized as a fundamental research method to explore and make sense of the social worlds of students (Tolley,

Ulin, Mack, Robinson, & Succop, 2016). This study is based on the PAR approach that focuses on the perspective of those being studied through the involvement in activities in a series of phases (plan-observe-act-reflect) to complete a cycle (Mirra, Garcia, & Morrell, 2015).

2.2 Ethics

Parental informed consent, headteacher and teacher consent have been taken to involve students, teachers, and parents for the study and it was expected that students would not be exposed to any significant risks. Furthermore, throughout the study, it was emphasized that research participation was voluntary and that any research participants were free to withdraw from the study at any moment without having to provide any reasons and without facing any consequences.

2.3 Research Participants

The enrollment procedure started by inviting students of grades five, six and seven of a community school, teachers teaching at the same level and parents. A total of 180 students, 10 parents, and 3 basic level teachers were decided to participate in this study. Purposive-convenient sampling was used to identify and select a school, census sampling to select students and simple-random sampling (lottery method) to select parents throughout the study period.

2.4 Data Collection Procedure

All research participants (students, teachers and parents) were engaged meaningfully in intervention activities and participating in garden-based learning sessions that were integrated into their regularly scheduled science, health and environment classes. The total session time was approximately 2 periods (one period equivalent to 45 minutes) of the total time of 1 hour 30 minutes in a week across 6 month time period, for a total dose of 30 hours. Every period (45 minutes) comprised of almost 10 minutes of instruction (5 minutes in the class and 5 minutes in the garden), followed by 25 minutes of hands-on activities in the garden (soil management, composting, seedling, watering, and caring) and 10 minutes for discussion based on the science, health, and environment subjects. Within 25 minutes of real field activities, parents were sharing, engaging and helping students in gardening activities. They were providing ideas about growing vegetables in the garden through the use of local community knowledge. The selection of intervention activities was informed by the teachers based on the science curriculum throughout the study period.

Learning objectives were linked by science teachers on garden-based learning constructed on the lesson objectives for 5^{th}, 6^{th} and 7th-grade science and health subjects. Garden activities were chosen to maximize students' engagement in activities with plants, insects, soil, and the nature for seedling, tending, and harvesting. School garden had a space of approximately 700 square feet located in the southern part of the eco-san toilet and a half-minute walking distance from the main school building. During the plot preparation, students, teachers, and parents were fully engaged and they divided the land mass for separate plots to their activities. But the purpose of separating the garden plots by the teachers and students were to motivate students for activity-based learning.

Qualitative data were collected over six months from in-depth interviews, participant observation, focus group discussions, and informal conversations. Focus group discussions were conducted at the end of the sixth months' time period after the intervention of the first phase of the participatory action research cycle is completed. Parents were invited to attend focus group discussions (FGDs) through notices, phone calls, and students' oral messages.

A basic level of science and health subject teachers were asked to select students who already had parental consent to participate in the school gardening activities. But, it was obligatory for all students from grade 5-7 because gardening activities were linked with the practical activities of the teaching lessons and tied on regular school routine and periods. A total of 3 teachers, 10 parents (6 females and 4 males), and we PAR researchers (first and second author) participated in a series of 2 focus group discussions (1 before the intervention and another after the garden-based intervention). School headteacher, four parents, two teachers, and five students were interviewed when the first cycle of PAR is completed after six months. These semi-structured FGDs and in-depth interviews (IDIs) focused on participants' experiences of the school gardening activities with application of human urine as fertilizer, changes in the teaching and learning environment of the school.

2.5 Data Analysis

Data analysis was started from the first meeting at the school garden, i.e., when raw field notes were expanded into narratives, elaborating on initial observations, and when interviews were transcribed. Transcribed and translated interviews and expanded field notes were analyzed using thematic content analysis. i.e., themes

emerge from the data through a process of open coding and theme refinement, without restricting the analysis by predefined codes and themes (Mason, Mirza, & Webb, 2018). This process took place in three steps: open coding, categorization, and abstraction (Kyngäs, 2020). The content analysis started by coding in-depth interviews and write-ups of participant observation and focus group discussions.

Open coding involved reading, re-reading and reviewing the transcripts several times, while writing notes and headings, i.e., codes, in the manuscript to describe all content. Recurring patterns and apparent inconsistencies between participants' saying and their meanings were identified and coded. After repeated reviewing, all codes were transcribed into a coding sheet, forming categories. Relationships between different data segments were explored and both recurring categories and categories describing similar thoughts were grouped into broader higher-order categories to reduce the number of required categories. Finally, thematic content analysis was performed in which data were coded to identify emerging themes and patterns that were then categorized and interpreted according to their relationship to research questions and theoretical perspectives. Also, participant observation and informal conversation were conducted in all long gardening activities from the time of land management to the harvesting the vegetables over six months. Detailed field notes consisted of observations and descriptions of students', teachers' and parents' attitudes, behaviors, interactions, conversations, and changes to all these over time were recorded. The analysis included the co-researchers'(Note 1) reflections on the meanings and explanations.

Since all data were collected in the Nepali language, the data analysis was performed in Nepali. During data analysis and write up of the manuscript, the original Nepali quotes were used for as long as possible to prevent losing meaning as a result of translation. The quotes in the final manuscript were translated by the authors and checked by an expert.

3. Findings

The results of this study are shown under the students, teachers and parents' meaningful engagement in the garden, their understandings, and insights of garden-based pedagogy. Basic level students' meaningful engagement in the school was described as an outcome of this study by all groups of focus group discussions, participant observations, in-depth interviews, and informal conversations. Students have described the importance of a school garden as a part of learning and how the learning environment had changed since we have started the garden program in the school. When we asked what they like in the garden, all of them replied, "We like this program and this type of learning!" When we (Note 1) asked what they liked about it, representative replies included "We love it!" "Fun!" "Overwhelming!," "Stimulating!," "We don't bunk classes and school days. Our school is not boring"! Students were arguing how the program had increased their confidence at school. *Learning by doing* is fun for us. They further said, "Science and healthy subjects were boring for us before gardening activities ….but now, it is really exciting and easy". Observation data showed that all the students have increased the habit of more dialogue, sharing, collaboration and asking whenever they have doubts either in the classroom or in the garden and playground. This data also revealed to us that *Small Change is Beautiful* as the students increase the self-confidence, self-pride, and self-esteem with which they referred to their new skills, knowledge, and accomplishments in the school garden. This finding is consistent with that of Swank and Shin (2015) who reported that participants involved in activities feeling calm and happy and learning to work together through the group experience. Also, a similar result was found by Becker, Lauterbach, Spengler, Dettweiler, & Mess, (2017) that students' learning was excellent when they are in outdoor activities. This study resulted that the students developed the habit of hardworking and confidence after exposing them to school garden activities in collaboration with the parents and science teachers.

Furthermore, we observed that the self-confidence of students was developed. It was shown by their garden activities like self-directive activities, continuous engagement in the activities, helping fellow students without the teachers' supervision and guidance. Similarly, students showed enthusiasm to learn science and health lessons by completing an assignment before time. Observing the students' activities, one of the teachers stated that: "*Students are empowered and they develop the self-learning skills. Also, they like to engage in the garden and link gardening activities with the curriculum materials. Gardening activities widened the thinking horizon of our students (e.g., sharing what they know and understand, rely on friends' argumentation and asking with the teachers if they have doubt)".*

Parents noticed that students developed a positive relationship between textbook matter and activities. One parent observed his granddaughter activities in the garden and stated like this: "*I am happy to see the activities of my granddaughter as she is playing with garden soil for learning. She never involved in manual work with us in the field. Now, I feel and realize that we (parents) have to provide such opportunities to our children. I am happy*

because she (pointing her granddaughter) understands the importance of fieldwork. Learning is possible for these activities. I am so much thankful to teachers for this".

This understanding of the teachers and parents was supported by the students in focus group discussion arguing that the varied skills are developed by them from the school garden activities. Two students were sharing their experiences like this: *"Now we can guide juniors (students below 5th grade) for gardening and learning. ... students from grades 8 and 9 are also watching our activities from windows. They are also interested to work with us".* They shared the importance of garden works and activities in the focus group discussion sessions. We have grown onion and garlic green leaves (pointing towards the garden). We can collect and eat green vegetables or supply in the school canteen. It was our idea to grow green spinach leaves in between the garlic plants. See (pointing towards the spinach in the garden), this place becomes beautiful. These words of students clearly show that they have changed a lot from the school gardening activities and developing academic as well as social qualities. This is one of the proofs of *"Small but Beautiful Change"*. These thematic findings discussed here were consisted with the study undertaken by Nury, Sarti, Dijkstra, Seidell, & Dedding, (2017) arguing that gaining insight into student's perspectives allow matching school gardening programs more to student's wishes and expectations, thereby potentially enhancing their intrinsic motivation for gardening and vegetable consumption. This study further elaborates as parental engagement is necessary to empower students in academic excellence and progress.

In-depth interviews and participants' observation clearly showed us that the impacts of gardening activities lead a constructive impression on engagement and confidence among students. Gardening activities decreased absenteeism and reported with their parents that they enjoyed in the schools. The headteacher reported that students' social behavior in this school is good. They cooperate, discuss, and share their feelings with the class teachers and subject teachers. While doing activities in the garden, students have a lot of conversation and sharing. A short conversation among the students and the science teachers is shown as:

Student 1: *Sir, I understood the venation in the leaves to identify monocot and dicot plants.*

Student 2*: See, the venation in these leaves (showing the leaves of long bean and onion in his hand) is different.*

Science teacher*: Show us. How the venations of the leaves are different?*

Student 3: *She picked both the leaves from the palm of student 2 and torn one by one. She said, "The onion leaf is torn from tip to its bottom but the leaf of bean does not".*

Student 1*: It is because the onion leaf has parallel venation whereas the leaf of a bean has reticulate venation.*

Science teacher: *Smiles (looked to my face). Yes, you are correct!*

This short but genuine conversation among the students and the teacher was fantastic and correct. Students from their activities learned real and the correct concept of the types of venation in leaves in biology lessons and curriculum. By listening to this conversation, parents were surprisingly asked me a question:

Parent 1*: Do they share the knowledge of science learning, sir (she said to me 'sir'- the first author)?*

The first author*: Yes, students are linking gardening activities with science content based on the curriculum. This is the part of learning science, health and environment subjects.*

Parent 2*: My granddaughter shared with me at home as she found out the pH of garden soil. She said that the pH of the school garden soil was found 6.5. I don't know what is pH and its role for vegetable production. But, now I know my little granddaughter learned a new thing from the activities. She also recommended me to measure the pH of our kitchen garden.*

First author*: The concept she (granddaughter-student) attained from the garden activities is correct. She learned science concepts by play way method.*

Parent 1, 2, 6, 9, 10 and Teacher: *Change is seen among students (e.g. actively engaging in activities, sharing the day to day activities of the school, talking lesson of science in the dining table and in the playground and happy to go in the garden) due to school gardening activities. They further said that "Small Change is Beautiful". We are happy!*

This conversation between the parents and co-researcher clearly show that students develop the skills and knowledge of basic scientific concepts from gardening activities. Similarly, in the sense of agriculture fields, today rely on fertilizers derived from inorganic minerals, such as phosphate destroy the fertile power of soil (Guedes et al., 2019). To minimize the depletion phosphorus and relative nutrients application of human urine in the school garden is one of the best solutions (Simha, & Ganesapillai, 2017). Regarding the use of eco-san toilet and application of human urine in the school garden, the dialogue conferencing between the teacher (second author) and the students, teachers, and parents is quoted like this:

Health teacher*:* "*The students of grade 7 felt privileged and excited to be a part of this*

pilot project (Note 3) like this one. Most of them did not realize and were amazed by the Eco-san system installing in school and the application of human urine as fertilizer in the school garden. They had an opportunity to use such a toilet which they had not used before. Justified human waste as a resource gives the soil more fertile and produces organic vegetables/crops from the school garden. Teaching the project was easy as all the procedures were provided and easy to follow." "*Initially the students were unsure of what they would find. Once they had experienced seeing the eco-san technology, their interest was generated. All sorts of ideas of how we should proceed in our investigation were suggested. We pursued one particular avenue: a comparison between conventional and eco-san toilets. There was lots of discussion about possible further work. It was an excellent opportunity to conduct open-ended investigative work, which helps students understand the nature of eco-san innovation and urine application as fertilizer."*

Student participant: *"Sir, eco-san is not toilet only, it is the source of agricultural nutrients.*

It's also the permanent solution of sanitation in school".

Parents: "P*eople's behavior towards eco-san and in utilizing human urine as fertilizer is guided*

by school education. In a resource-poor community, it is often acceptable to use human

excreta for food production.

As Fleer, (2019) found that play-way pedagogy in science is the best method to develop and understand science concepts. Many other researcher (Clague, Harrison, Stewart, & Atkinson, 2018; Rogers, Livstrom, Roiger, & Smith, 2019; Williams, Brule, Kelley, & Skinner, 2018) found that garden-based activities show promise for supporting students' engagement and learning in science classes and in fostering students' interest in pursuing science long-term impacts on basic scientific concepts to upgrade knowledge.

Learning from the garden-based activities show as potential as meaningful, real-life, helpful for encouraging teachers and students' meaningful engagement to learn. Gardening activities also help in uplifting the academic outcomes of students (Williams & Dixon, 2013). Hands-on learning is the main feature of school gardens; hence, they serve as *living laboratori*es in which students can see what they are learning and in turn, apply that knowledge to real-world situations. Students learn soil chemistry, plant taxonomy, plant parts, flower dissection, water properties, seed germination and variety of seeds, insects, ecology and environmental balance, and insects and their life cycles from the gardening activities.

Furthermore, findings showed that collaborative gardening applied human urine activities with the parents and teachers to develop learning habits and prepare students as action-oriented that benefitting academic outcomes in science, health, and environment subjects. In this connection, Williams, Brule, Kelley, & Skinner, (2018) found that the integration of garden-based activities may likely be not only an important ingredient for science learning but may also shape students' engagement and enthusiasm for science in the regular classroom. Meaningful engagement in the school gardens is a part of learning science that serves as a mechanism of personal transformation in a student's academic identity (Acharya, 2017; Saxton et al., 2014).

As human urine is one of the major fertilizers to supply nitrogen (N), phosphorus (P) and potassium (K) as the major nutrients in the garden soil. Understanding the primary and secondary nutrients is part of chemistry learning for students. Urine will be supplied in the school garden from the eco-san toilet for the cultivation of vegetables. It was discussed well in the workshop of teachers, students and parents with dialogue conferences. Application of urine was a great interest among the parents, teachers, and students while discussing in informal conversations and FGDs. In an informal conversation, one of the parents who is the farmer in the local community said like this: "*I was not aware before six months but now I understand the importance and application of human urine for vegetable production. There appeared to be a great need for readily available nitrogen (N) fertilizer in organic farming, so if the use of human urine is supplied in the soil, the demand for organic vegetable would increase*".

This opinion of the parent is consistent with the researchers (Acharya, 2017; Kassa, Ali, & Zewdie, 2018; Sene, Hijikata, Ushijima, & Funamizu, 2019) who found that an improvement in soil phosphate chemical properties was noticed with increasing addition of urine; however, there was no significant increase in the ammonium nitrogen content and pH. The chemical composition of urine is in ionic form and its plant availability compares with chemical fertilizer (Getnet, 2018). Urine is best utilized if the nitrogen concentration is known, as it is variable from different sources, and if the plant nitrogen demand and soil nature is known (Pandorf, Hochmuth, & Boyer, 2018).

One of the purposes of participatory action research was to the development of collaborative trust within the key stakeholders (teachers and parents). It was found that parents were busy in gardening activities from the very beginning of the management of the land for the garden, soil preparation, composting, seeding and taking care of vegetables in the garden. Similarly, teachers were busy in the preparation of curriculum, facilitating students for activity-based learning and sharing the experiences with the students and parents. These activities win the trust within them that help to fulfill the personal responsibilities and tasks. Parents and teachers shared personal information that develops patience and kindness. Sharing personal information and fulfilling responsibilities develop collaborative trust through play-way pedagogy. Parents were slowly opened with the teachers and their children and grandchildren while working together in the school garden. Positive interaction and relationships eventually developed so teachers began their stories of difficulties while teaching based on textbooks without any activities. Sharing culture was developed among the teachers and parents within six months of intervention activities. Developing collaborative trust is consistent with previous research (Kochanek, 2005; Tschannen-Moran, 2001). Additionally, it was found out that trust was developed among the research participants that increase the reliability of the participatory action research.

Most of the parents and all the teacher participants recognized that the main aim of school garden activities was to grow vegetables and flowers by utilizing practical activities in science, health and environment lessons and reinforce students to engage in activities for learning. One of the parent participants shared with the first author in informal conversation like this: *"I realize and understand that the purpose of engaging students in the school garden is to cultivate an interest in work and develop the habit of collaboration and trust among friends, teachers and the family members"*. Most parents believed that engagement in school gardening could, indeed, have a positive effect on student's learning, understanding the purpose of growing vegetables and motivating in real field experiences. A majority of the parents desired supplementary actions at the school gardens to proliferate fun and diversity. During informal conversations in the school garden, parents mentioned that it would be more fun to have contests on who has the tallest plants and most beautiful vegetables. I think it would also be very fun to decide, for example, who has the most beautiful vegetables and to also discuss that in class. Furthermore, parents desire to manage prize to the students who are involving in the gardening activities and growing more vegetables. Finally, all the research participants would like to see bigger gardens so that more vegetables could be planted.

4. Discussion

This study aimed to explore the possibilities of the use of eco-san in the school garden in Nepalese community schools, focusing on transformative pedagogical impacts on the social and learning environment of the school. Results showed that the gardening program attributes valued most highly by the parents and teachers included increased students' meaningful engagement, opportunities for experiential and integrated learning through collaborative inquiry, and building social skills like cooperation, sharing and argumentation. School garden filled knowledge gaps concerning students' garden experiences in collaboration with the parents and teachers. Students' excitement and lively engagement in the gardening activities in science and health lesson was good as they were overwhelming and stimulating. Students' motivation and behavior showed that '*Small Change is Beautiful'* as the students increase the self-confidence, self-pride, and self-esteem through school gardening activities. Consistent with previous qualitative studies on students' gardening experiences (Burt, Koch, & Contento, 2017; Ohly, Gentry, Wigglesworth, Bethel, Lovell, & Garside, 2016; Rawson, 2016), this study shows that all the research participants were enthusiastic about school gardening and generally enjoyed it. Similar to findings of the researched by Rees-Punia, Holloway, Knauft, & Schmidt, (2017) found that the positive outcomes of school-gardening initiatives in the areas of science achievement but they did not demonstrate that children's environmental attitude or social behavior consistently improve with gardening. However, Green, & Somerville, (2015) found that the opportunities for teaching and learning on green school grounds can be more fully maximized through the involvement of all the stakeholders.

Students were curious and gained a sense of accomplishment and pride from seeing their vegetables, growing, and harvesting. These findings are consistent with other studies demonstrating that children experience feelings

of achievement, satisfaction, and pride from taking care of their crops and harvesting them (Acharya, Rajbhandary, & Acharya, 2019; Ohly, Gentry, Wigglesworth, Bethel, Lovell, & Garside, 2016; Rodriguez, Lamm, Odera, Owens, & Thompson, 2015).

In addition, school gardens proved to be excellent works to experience feelings of competence as students gained a sense of achievement and pride, resulting from a rigorous, but rewarding, gardening journey. After several gardening lessons, students were capable of gardening properly without the help of science teachers. Lastly, school gardening activities connect teachers and parents for the overall improvement of the overall academic environment of the school. This finding of the previous researchers like (Syriopoulou-Delli, Cassimos, & Polychronopoulou, 2016) found that working experience with children is seen to be the most important factor shaping the attitudes of teachers towards collaboration with parents. However, Bodvin, Verschueren, & Struyf, (2018) reported that the poor collaboration is mainly situated on the parents' side, such as parents that need more processing time to accept their child and that show distrust towards the school.

5. Conclusion and Future Research Directions

This study indicates that, for teachers to be enthusiastic to make the promise of time and vigor to school gardening, they must identify and trust that gardening is an important teaching technique that will enhance students learning. By genuinely understanding the value of learning through gardening, teachers may then effectively use it in the curriculum. To achieve this goal, teachers must first have opportunities to see gardening used successfully as a teaching tool. The school administration should provide opportunities that promote teachers' understanding of school gardening and its adaptation into the curriculum. Model school gardens need to be constructed by the local municipality and the province that can provide school gardening demonstrations through on-site exhibits and visitations. The mid-day meal program for the needy students needs to be supplied through the school garden. Exposures of teachers from the model school to the other community schools through presentations and sharing my short programs and sessions. Commitment to gardening as a teaching tool develops for teachers who need the educational tools to effectively implement a garden-based curriculum. The practical portion of science and environment subjects need to be transferred into the garden from the classrooms.

To develop the physical resources needed, the school landscape should be promoted as an extension of the indoor classroom. School grounds are an ideal teaching laboratory that can provide more learning space at a very low cost. To promote and support the use of school gardening by educators and educational institutions, it is imperative to research be conducted that quantifies the student learning that occurs when gardening is used in the curriculum. Universities and colleges, and the cooperative extension service all have potential roles in increasing the visibility of school gardening and helping teachers understand its value as a teaching tool within an interdisciplinary curriculum.

Furthermore, based on the authors' experience developing garden intervention activities with teachers for this study, there is also an important role for health advocates and educators in the promotion of garden-based education in schools. Because hands-on garden activities may enhance a variety of academic subjects, health promoters could partner with teachers from multiple disciplines to integrate garden activities throughout the school day (Canaris, 1995). This would reinforce nutrition education across the curriculum and increase physical activity opportunities for students during the school day. However, gardens are often viewed as an add-on activity that takes away from what is assumed to be more valuable instructional time. Yet a small but growing body of evidence suggests that garden-based education may be an effective method to improve students' test scores (Klemmer, Waliczek, & Zajicek, 2005). Yet, these outcomes necessitate an agenda that measures learning outcomes. Future research should explore whether effects persist over time and if and how changes in students' positive attitude affect learning through school gardening activities.

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Authors' Contributions

KPA and GPD collected data. KPA and GPD transcribed, translated and interpreted the data. KPA drafted the manuscript. KPD provided scholarly guidance and corrected the manuscript. All the authors read and approved the final version of the manuscript.

Ethical Statement

Consents were obtained from all the research participants.

Disclosure Statement

No potential conflict of interest was reported by the author.

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Notes

Note 1. Co-researchers here means researchers in participatory action research

Note 2. The first and the second authors

Note 3. Use of eco-san toilet and application of human urine in the school garden