International Journal of Learning and Teaching
ISSN 1986-4558
Volume 18, Issue 1, (2026) 18-36
https://un-pub.eu/ojs/index.php/ijlt/index

Gardening and farming activities during COVID-19 to bridge informal and formal education

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Suggested Citation:
Appaji, N. & Janardhana, G.L. (2026). Gardening and farming activities during COVID-19 to bridge informal and formal education. *International Journal of Learning and Teaching, 18*(1), 18-36. https://doi.org/10.18844/ijlt.v18i1.9545

Received from July 2, 2025; revised from December 1, 2025; accepted from Janurary 12, 2026.
Selection and peer review under the responsibility of Prof. Dr. Jesus Garcia Laborda, Alcala University, Spain

Abstract

The COVID-19 pandemic, school closures, and resulting learning deficiencies created universal challenges for teachers, parents, and students. This study aimed to understand how garden activities connect to textbook concepts. We collected responses from 8,923 students (Lower Primary School, Higher Primary School, and High School) and 24,255 family members using a semi-structured questionnaire. Results showed that Lower Primary School students were more involved in the activities than those in Higher Primary or High School. Among parents, fathers provided more exposure to skills than mothers. High School students gained more skills and knowledge, and their grasp of textbook concepts was better than that of students in Lower or Higher Primary. Future research could examine how linking garden and farming modules to classroom learning affects formal education.

Keywords: Concept mapping; experiential learning; family involvement; formal education; gardening.

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1. INTRODUCTION

Students' learning life skills and their performance are related to schooling, and the absence of schooling during the pandemic was least known. However, parents were more concerned about their learning, and understanding the core concepts of subjects, we wanted to evaluate their time spent with their family members in the home garden, as well as farming activities, as they were a routine leisure time, and how gardening correlated with their subject learning. Ecology and ecosystems in the surroundings where we live, breathe, and enjoy our lives are least known in the present scenario. However, biology plays a major role in understanding the roles of humans and other living beings on this planet (Joda, 2019). According to Umar (2011), the study indicates that biological knowledge is not only about the collection of facts but also about human life and general theories. As they mentioned, teachers are not the source of knowledge in the innovative teaching and learning process; this may be due to an untimely syllabus or curriculum, or to their failure to adopt an action-oriented approach (Bedemo, 2020). Concept mapping promotes critical thinking, supports a greater number of learning outcomes (Hsu & Chang, 2011), and creates connections between two or more concepts (Jack, 2013). Most innovative research methodologies have successfully advanced learning science, especially in biology (Bedemo, 2020). Concept mapping is a descriptive and creative way of teaching a concept in an organized way to reflect the relationship among the content, where students' responses to the topic and contents are easy to recognize and understand (Novak & Canas, 2006), because of the graphical flow chart (Mutodi & Chigonga, 2016). Easy to link the relationship between the concept and content (Novak & Gowin, 1984). Knowledge gained from biology has helped solve human problems in agriculture, health, and animal husbandry; hence, biology is the most popular subject among students (Chu, 2008). On the contrary, many students find biology difficult to learn (Ogunkola & Samuel, 2011). The complexity stems from a failure to understand the concepts (Ziegler & Montplais). The intensity and frequency of home learning and parents' engagement during the pandemic were higher than before (Sonnenschein et al., 2021; Wheeler & Hill, 2021). The findings of Kristy et al. (2023) reinforce the important role of parents in their children's early reading development, particularly when the typical agents of instruction (i.e., teachers) have less time and fewer opportunities to interact with their students due to the pandemic. 1.1. Literature review

1.1. Types of learning

The home literacy environment refers to children's reading performance, parental attitudes, and the availability of study materials at home (Burgess et al., 2002; Roberts et al., 2005). The Covid-19 period and teachers' choice of online teaching methods are related to their computer skills, comfort, and familiarity with various software programs; teachers who felt more comfortable with online teaching had greater positive effects on their students' reading development (Dogan et al., 2021). Due to schools shutting down because of COVID-19, every academic institution was rethinking how to teach, as many felt the informal and formal modes of education were seriously affected. More assistance from families and teachers is needed for younger students. Indeed, parents of older children reported fewer negative experiences than those of younger children (Roy et al., 2022). Despite the strong efforts of schools and teachers, the different models may not have provided the same quality of education as instruction before the pandemic for several reasons. (Namkung et al., 2022.)

Evaluation of academic success during the pandemic was less focused on different student levels (Lower Primary School - LPS, Higher Primary School - HPS, and High School - HS) because most research on education during the pandemic found learning losses and difficulties in understanding core subject concepts.

In contrast, the limitations of studies on learning subject concepts at home during the pandemic are significant, and data deficiencies highlight the need for an evaluation method to assess students' perceptions during the pandemic. In contrast, there appears to be a dearth of information regarding learning by action in the home kitchen, particularly experiential learning in some core subjects through practical experience (Janardhana & Nanda, 2023).3)

1.2. Online mode of education and its limitations

More than 1.6 billion students attended classes online during the pandemic (UNESCO, 2020). Most modes of education during the pandemic were online, distance, and virtual, with technology used to engage students (Moore-Adams et al., 2016). During COVID-19, the transition from traditional to online classrooms has affected both teachers and students with phobias like fear, stress, and lack of skill (Son et al., 2020). The major drawback of online learning is the lack of accessibility to the Internet and computers (Graves et al., 2021; Tadesse & Muluye, 2020). In online classes, students' and teachers' instructional and interaction time decreased (An et al., 2021). Providing online instruction to young students is challenging, as they have less experience with online learning and may have lower academic motivation than older students (Roy et al., 2022). Online education was the only way to meet educational demand during the COVID-19 pandemic (Martinez, 2020). To estimate the potential impact of the COVID-19 school closures on student learning (Dorn et al., 2020; Kuhfeld et al., 2020; Kaffenberger, 2021), not only the pandemic but also academic summer breaks have led to a decline in learning losses (von Hippel et al., 2018; Kuhfeld, 2019)).

1.3. Informal education

To support the education loss during the COVID-19 pandemic, the United Nations Educational, Scientific, and Cultural Organization (UNESCO, 2020) planned for equity during the school closures (UNESCO, 2020a), learning remained uninterrupted during the pandemic (UNESCO, 2020b), and the responses of schools to COVID-19 and disruption (UNESCO, 2020c). Learning and education in the garden and farming activities during the pandemic supported some basic findings and understanding. Online pedagogical virtual classes were the only way to replace the traditional method, but they were not easy for many because they lacked electricity, computer accessories, and a stable internet connection. Hence, we want to adopt a new, universal pedagogical approach in which every household activity serves a need. Apart from this, we wanted to explore the family members' gardening and farming skills to connect formal education concepts with informal skills. The gardening and farming activities to connect informal to formal learning and education, Garden as Lab for Formal Education (GLFE). 2. Purpose of study

Home gardens and farmland are miniature versions of nature, and gardening is experiential learning in the natural sciences that helps everyone develop life skills. Still, how students who are involved in gardening learn some skills being with family members and when enquired about their actions and school subjects (formal education) they recalled their actions and linked them with their subject concepts (informal learning) and our intervention made us connect the formal and informal learning life skills and if allowed to practice these in the future as their practical exposure will support the students to learn theories and concepts by their actions (doing) and enjoying the subject concepts and remember it as their life skills for the future sustainable living style. Most institutions, organizations, and universities have shown that their studies during COVID-19 were failures in learning and may have failed to understand where actual learning begins. Home is the first school of learning, acting, and independence. Hence, we wanted to address the following questions based on experiential learning in the present study. We addressed research questions to

understand our involvement and understanding, and to determine how best to make learning practices practical. We addressed the following research questions to fulfill this study's main objectives. How garden activities support recalling/remembering the core school subject concepts.

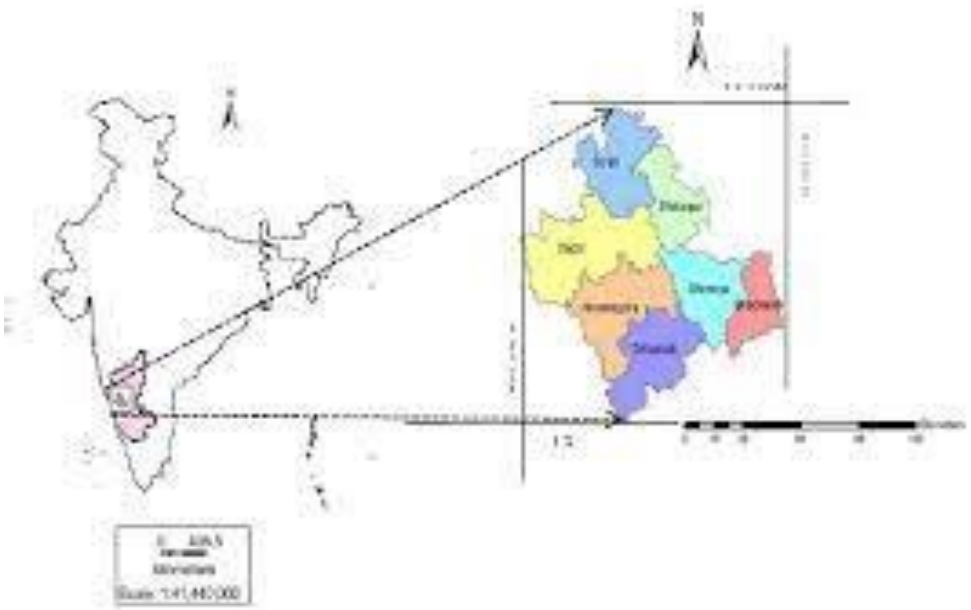
2. How does a family member's involvement support them in understanding the core concepts?
3. How home gardens and farming skills supported their experiential learning pre- and pandemic days
4. Do students' garden and farming skills vary before and during COVID-19?

2. METHOD AND MATERIALS

2.1. Study area

The present study was an attempt to engage children (students) and family members in overcoming the initial fear of school closure and to address what is next in their academic future. The latter phobia was COVID-19 symptoms; as a result, to connect people, families, and communities through pedagogical activities, we examined how informal learning skills actions meet the goals of formal education (2019-2021). We interacted with 7 taluks of Shivamogga district. Karnataka.

Figure 1
Map of Shivamogga, Karnataka, India, showing all the taluks of the study areas



2.2. Participants

The students involved in the study vary across Lower primary school (Lps – standards 1 to 4), 18.23%, Higher primary school (Hps – standards 5 to 8), 22.3%, and High school (Hs – standards 8 to 10), 59.2%. We interacted with 8923 students within the family members 24,255, including (mother, father, grandmother, grandfather, sisters, brothers, aunties, uncles, etc.), and found the interaction very informative. The involvement of high school students is the highest because family members can easily handle them in the garden for most activities, followed by HPS and LPS. LPS and HPS students have shown interest, but parents have minimized their participation in most activities due to preventive measures. (Figure 2). Whereas the sex ratio indicates that 68.55% of females and 31.44% of males show interest in learning, involvement, commitment, and observation to learn more, and in accepting failures, a learning attitude, time management, and the repetition of activities, girls in the garden have shown greater favoritism. (Figure 3).

Figure 2.
Different class-wise students from different study sites.

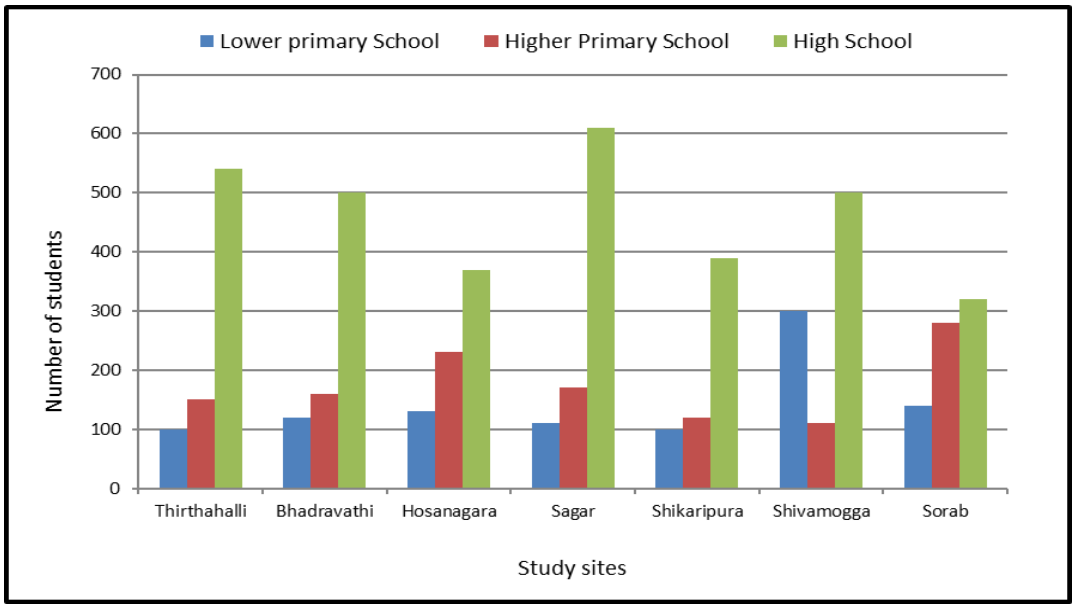
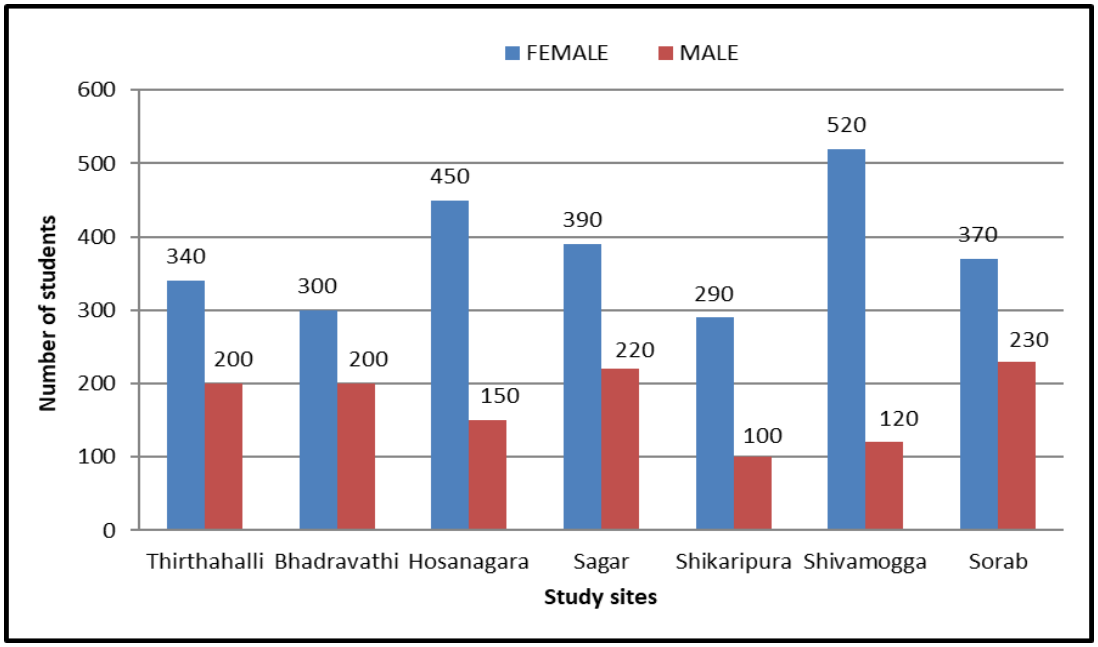


Figure 3.
Sex ratio and student involvement from the present study.



2.3. Data collection

A semi-structured questionnaire for student and family responses was collected. Based on the participants' and parents' responses, the analysis was performed to meet the desired basic objectives. The questionnaire served as the foundation for developing the open-ended questions presented in the Appendix.

2.4. Ethics Consideration

The research was executed in compliance with ethical requirements for studies involving human subjects. Informed consent was obtained from all participants and from parents or legal guardians of minor participants before their participation in the study. Participation was voluntary, and participants were informed of the study's goal and their right to withdraw at any time. All techniques conducted in this study adhered to the ethical norms established by the institutional and/or national research committee, as well as the 1964 Helsinki Declaration and its subsequent amendments. All data were collected anonymously and handled confidentially. No personally identifiable information was documented.

2.5. Data analysis

Descriptive statistics and Spearman’s rank correlation (Zar, 2007) were used to assess significance within the study's limits.

3. RESULTS

This section presents the results from the questionnaires and interactions, which aim to explore each participant's perception during the pandemic.

3.1 concept map and the core subjects

The major learning of the present study, as shown in the concept map (Figure 4) and in the connections among the subject concepts based on their education and understanding, is summarized in Table 2. According to the survey and questionnaires, students' involvement in the present study indicates that gardening and farming skills help them learn life skills and recall concepts from school subjects. A total of 8923 students from the 7 taluks of Shivamogga district were involved. Among them, some experienced the skills and found them useful (yes %), while others failed to remember the skills (no %), as shown in Figure 5. The different classes of students, such as the LPS involvement ratio, show greater significance than HPS and HS. LPS students' interest in participating in all activities has shown greater commitment than in other classes. Table 3.

Figure 4.
Home garden and farming skills with core subject concept mapping (source –author's elaboration).

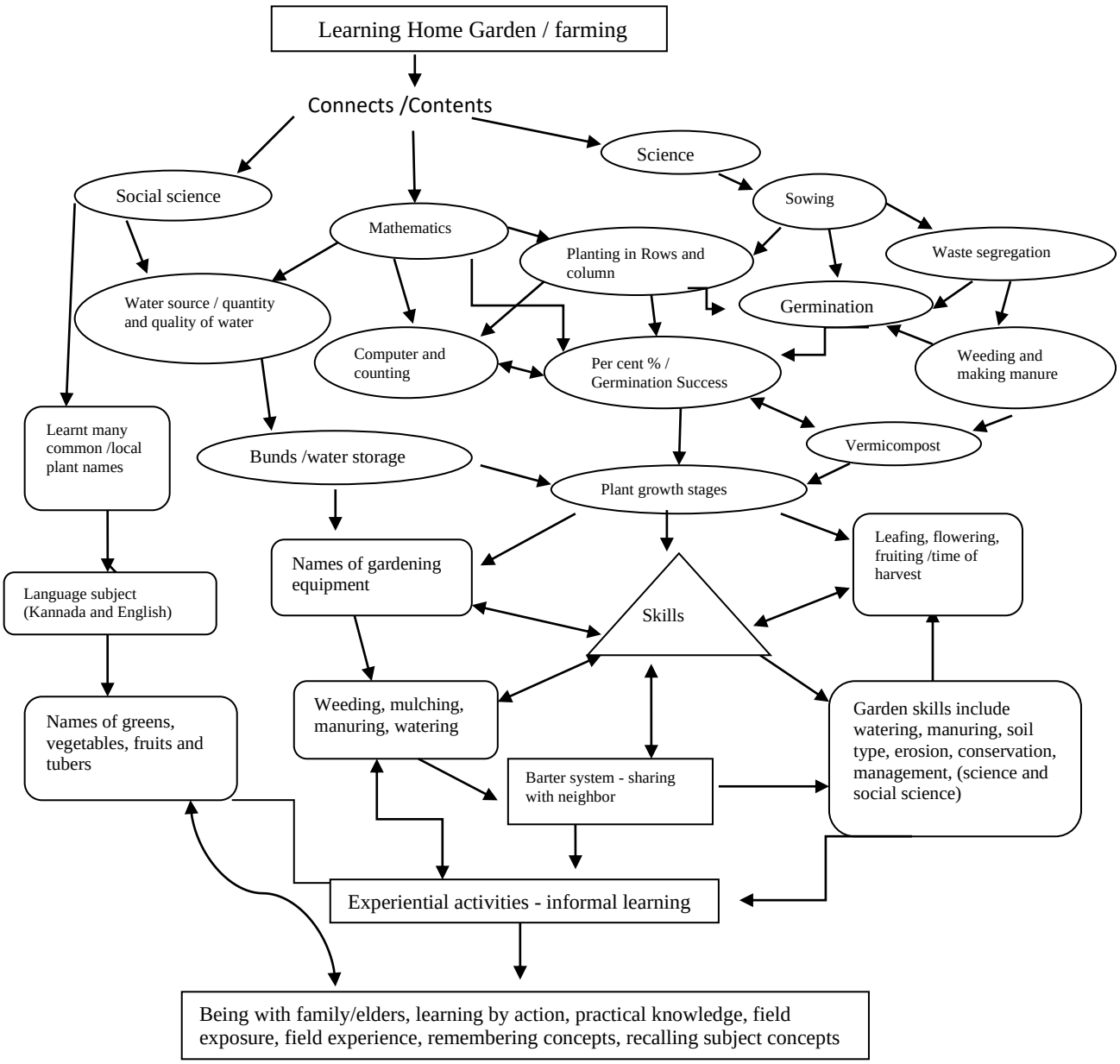
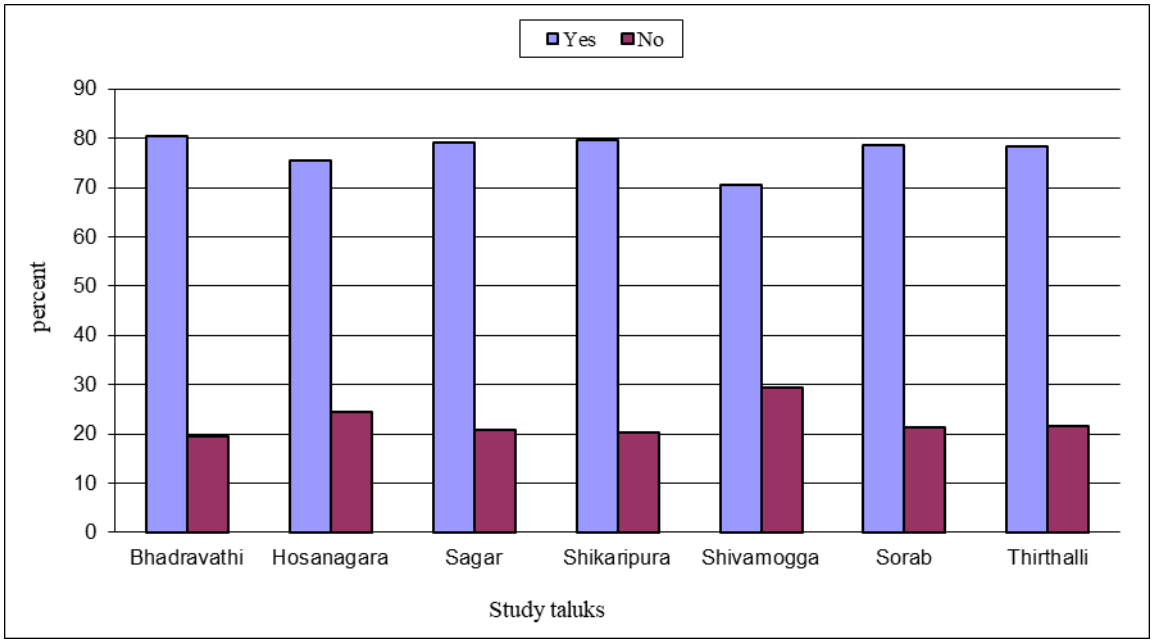


Table 2.
The concepts and activities performed in the garden /farmland and their relation to core subjects.

Activities	Concepts	Subjects
Gardening	Discipline, segregation, manuring, mulching, waste management, planting, weeding, maintenance, and nurturing	Science, biology, value education, and environmental study
Soil making	Grading soil quality, soil layer, soil type, soil color, soil porosity, and soil management	Science, biology - microbes
Sowing	Seed health and handling, soaking, germination to sapling, handling sapling, and percentage of germination and sapling success, handling bunds (rows and columns).	Science, mathematics
Handling equipment	Different equipment names, handling and holding, and the purpose of the equipment.	Science, kannada, mathematics
Pruning	Quantity, size, shape, numbers, hygiene, health, and handling	Science, social science, and Mathematics
Cleaning equipment	Health, handling, water, maintenance, and removing soil and dust from machines	Science, Mathematics, and Physical Education
Art of making bunds	Water use, soil erosion, water conservation, and management.	Science, Mathematics, and Physical Education
The art of making a garden	Diversity of plants, birds, insects, wealth, and health of the garden, and the beauty of the garden	Science, Mathematics, and Physical Education
Machine handling	Timing sense, handling, standing posture, concentration, and health	Science, kannada, mathematics, physical education
Plant disease	Hygiene, health, and handling to minimize repellents, minimizing waste, and management	Science, biology - microbes
Multiple names of plants/greens	Common or local names of plants and their uses as food, medicine, and fodder	Languages, science, and social science
Garden/farm as a miniature	Activities performed repeatedly, getting chances to perform with a mentor and guidelines, participation, and repetition of	Core concepts of physics, chemistry, biology,

forest	experiments	mathematics, languages, and social sciences.
Area/space occupied	How to manage space within the garden (rows and columns)	Science, geography, history
Plant growth	Osmosis, diffusion, photosynthesis,	Science, biology
Seasons	leaf life span, flowering duration, fruit availability, manuring time, and duration	Science, geography
Role of mentor/family members and their commitment	Activities, involvement, mistakes, care, concentration, consciousness, repetition, reasoning the concept, questioning until the desired answer and satisfaction.	Remembering school subjects and teachers who taught different concepts and logic.

Figure 5.
The percentage of students who learnt/enjoyed garden and farming skills.



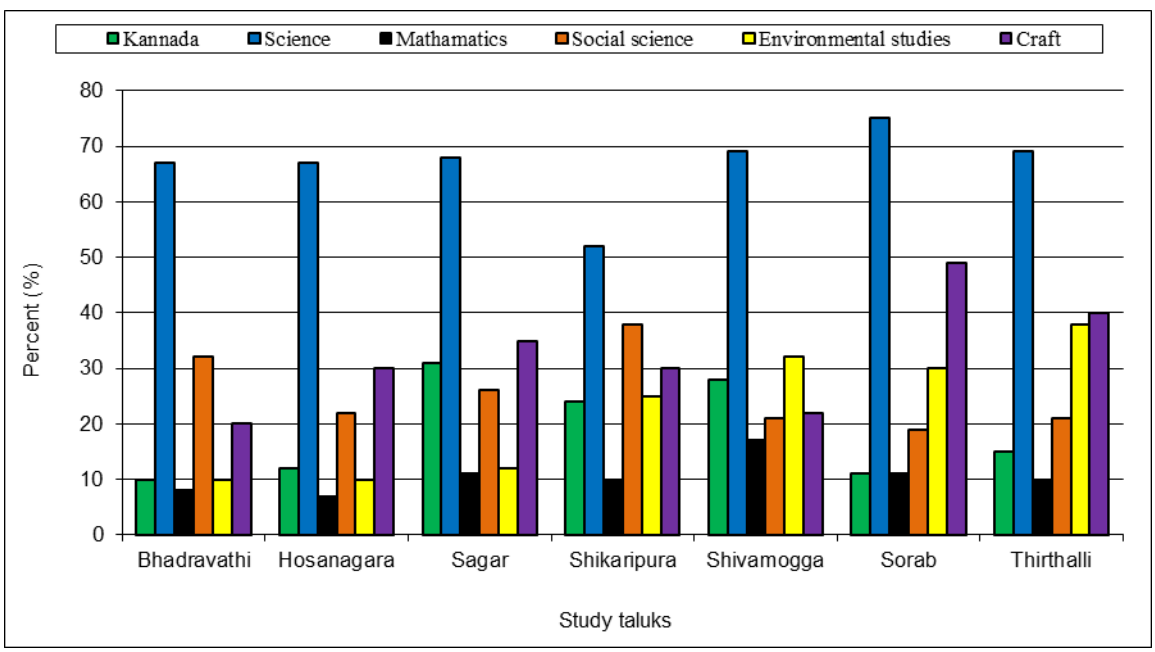
3.2. Parents' role in motivating informal teaching

Parents reported their attempts to teach and familiarize students with some core subjects, such as science education and concepts, which ranked first, followed by Horticulture skills, social studies, Kannada

(language), Mathematics, and Environmental studies. (Figure 6). Science education skills such as seed soaking, germination, watering, absorption (osmosis and diffusion), photosynthesis, leaf size, color change, and shape were all discussed with family members. Whereas in social studies, such as watering, excess water flow, soil erosion, bund making, soil and water conservation, and management skills, with activities. Water storage points, such as ponds, are used for utility and minimum use during different stages of plant growth. In Kannada, the different names of plants (many common/local names of plants and their use as food, fodder, medicine, and manure), equipment used, manure names, and the nature connection with the songs and adages. In mathematics, the number of seeds shown in rows and columns, germination success (%), sapling plant success (%), watering time, manuring time, counting of seeds, and watering period. In Environmental studies, segregation of waste, minimizing inputs, recycling, differences between degradable and biodegradable materials, renewable and non-renewable energy sources, and their significance in gardening and farming are discussed. Attempt to get exposed to the activities, HS students learned more subject concepts than HPS and LS (Tables 2 & 3). In gardening and farming activities, the father plays a major role, and other family members are involved in the present study, as shown in Figure 7: the mother, grandmother, elder brother, grandfather, elder sister, uncle, aunt, and teachers. As the teacher's role in gardening and farming skills is last emphasized in school, these activities receive minimal exposure, and the time spent on them is less than at home. The correlation for the father role is the highest, followed by mother, grandmother, elder brother, grandfather, elder sister, uncle, aunt, and teachers, as shown in Table 3.

Figure 7.

The percentage of parents' involvement in teaching the skills.



3.3. Informal learning before and during COVID -19

The time spent in the garden during the COVID period is greater than during the non-COVID period, and this exposure has a major impact on some of the skills students learned (Figure 8). The correlation study reveals that HS students are more educated, followed by HPS and LPS. (Table 3). Apart from the subjects, the value of education or moral education was evaluated in terms of gardening discipline, involvement, commitment, observations, time spent, interest, etc. The correlation study reveals that HS students are more educated, followed by HPS and LPS. (Table 3). The activities, the concept behind the activities, and the core subject recalled during gardening, as shown in Table 3, reveal the importance of informal education within the family and community and the pivotal role of learning in bridging the gap.

Figure 8.
The percentage of students learning and involvement in garden and farming skills.

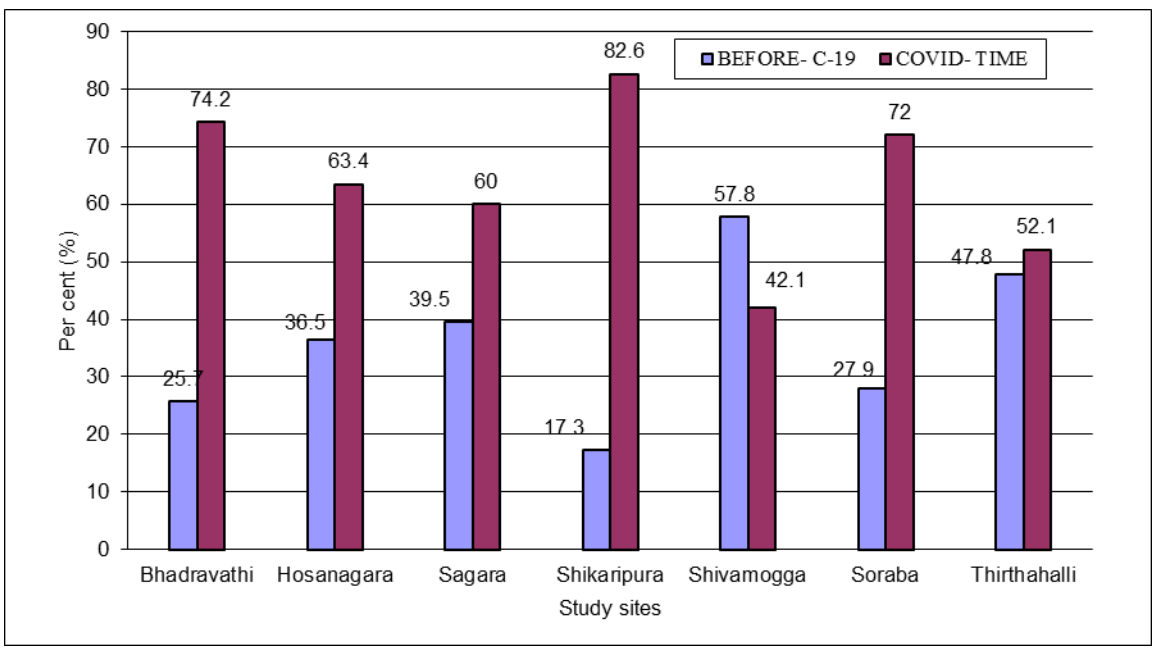


Table 3.
Results of Spearman's rank correlations performed in the study.

Concepts - (informal action/teaching and formal education and subjects learned)	Students	Correlation	p-vale
1. Involvement ratio (yes/no)	LPS	0.85	<0.003**
	HPS	0.72	<0.05*
	HS	0.65	<0.05*
2. Core concept of subjects learnt / experienced	LPS	0.52	<0.002**

	HPS	0.68	<0.003**
	HS	0.73	<0.001**
	Father	0.82	<0.0005**
	Mother	0.75	<0.0004**
	Grand mother	0.65	<0.003**
	Grand father	0.54	<0.004**
3. Parents involvement in exposing garden and farming skills	Elder brother	0.53	<0.003**
	Elder sister	0.45	<0.02*
	School teacher	0.32	<0.001**
4. Gardening and farming skills before and after	LPS	0.52	<0.03*
	HPS	0.65	<0.0002**
	HS	0.71	<0.0001**
5 Value education/Moral education	LPS	0.55	<0.03*
	HPS	0.64	<0.0002**
	HS	0.72	<0.0001**

P*<0.01, **<0.001

3.4. Experiential learning pre-pandemic days

However, primary educational activities and learning begin at home through experiential learning, including stories about moral and valued education, the reasons behind every action, and its outcomes. Table 2. Hence, we need a stronger understanding of how COVID-19 school disruptions have impacted student learning experience. To support this, we need more studies and research with the community, academicians, social scientists, and government and non-governmental organizations, along with area-specific case studies, to address these concepts in pedagogy to foster a skillful experience. Educational researchers consider the absence of school a loss of education and learning, but families and communities have begun teaching some life skills, and the research community needs to analyze the learning losses and skills students have experienced through informal learning.

4. DISCUSSION

The present study indicates how home activities have supported some students' learning during the pandemic. Based on current research, we proposed a relatively novel approach to study children's family experiences and perceptions, and their association with academic gaps. We found that the idea of garden activities and approaches for reaching the textbook content has facilitated its delivery to students. However, our study goes further to describe the compounding of differences and the consequences associated with long-term, sizable disparities in their experiences (GLFE). Our results also indicate that family and schooling experiences make a more balanced contribution to explaining certain simple skills and tools, as stated by our

research, while describing the importance of these experiences over the pandemic and subject contents, although children's overall levels of accumulated experiences did not fully explain gaps, but being with family and community during non-schooling time was balanced. In a few instances, they want to connect the school subject to day-to-day activities so they can experience the subject and content as much as possible. Previous research has documented that students learn during challenging times, including natural disasters (e.g., NAEP, 2022; Ward et al., 2008). Earlier studies during the pandemic appear to be negatively associated with young students' inference-making, as inference-making is a core general skill that can influence not only reading but also learning across different subject areas (Kendeou et al., 2020).

However, in the present study, the LPS students' interest was comparatively higher than that of their counterparts. One study on modeling students' reading during the pandemic suggested that having parents read to their children every day would help mitigate potential loss of reading ability (Bao et al., 2020). The present study also reveals that children's experiences are more accurate when they are with their parents during field activities. The present study revealed benefits for students in their experiential learning, which supported them in understanding subject core concepts with repeated actions every day with family members as their teachers, as we have some consistent studies (Spitzer & Musslick, 2021), providing some clarification as to why some students' academic outcomes may have increased rather than decreased during the pandemic. Not all students are experiencing learning loss. However, some students are experiencing some level of learning loss; there were also instances where this was not the case. For example, Maldonado and De Witte (2020) and Kuhfeld et al. (2020) found learning losses in certain subjects but no significant effects in others. This is related to their grade level and exposure to content and modules. Engzell et al., (2021) determined that losses were up to 60 percent larger amongst students from uneducated homes, but we found the reverse is true from the present study because farmer's families had a better experience than non-farming families but the parents failed to connect the concepts of the subject based on their field experience with a module due to lack of textbook subject concepts for them (Fig. 4).

As Coleman et al. (1966) report, parents play a major role in education, and today it is well established that parental effort matters for educational outcomes and child well-being. Indeed, most studies have predicted academic success when parents are actively involved in their children's educational process, either through their relationship with teachers and the school or their support of learning at home (Dearing et al., 2006; Flouri & Buchanan, 2004; Katz et al., 2011; Walsh, 2010). Our research quantified some of the garden skills in (Table 3), activities, and some concepts connected with their actions (Fig 4), which is reciprocal to Balli's (1998) study, which reveals that students feel confident when they perform some exercises at home with their families, they do better in school. The study (Janardhana & Nanda, 2023) found that kitchen activities had a greater impact on experiential learning during the COVID-19 holidays and revealed the kitchen as a laboratory for a deeper understanding of subject concepts while spending time with family members. The present garden experiment exposure aligns with their study on experiential learning, focusing on being with family and community. Educational research is very limited in understanding the impact of COVID-19 on students and on family involvement in gardening skills to connect with subjects, as quality and quantity differ across cultural and socio-economic backgrounds, education, and geography, and student learning progress is limited in many areas. But in the present attempt, the children learned the maximum skills while with family members, based on the duration of exposure and its significance. (Tables 2 & 3).

5. CONCLUSION

We have some highlights of our study based on family commitment and involvement. We have some highlights of our study based on family commitment and involvement. The higher the elderly family member's parental involvement, the more gradually children are exposed to the same questions, and they improve their skills, hopefully more than the minimum number of family members. Second, we noticed that parents with children acquire more gardening and farming skills than less skilled parents. The third space for gardening and farming is directly linked to more activities, more skills, repetition, and more exposure. Finally, we found that the pandemic and school closure opened new avenues for learning, recalling, and remembering core subject concepts through practical exposure. Students saw the garden as a laboratory and a miniature of nature, which triggered their motivation to replicate the same in school for practical, skill-based exposure.

Conflict of Interest: The authors declare no conflict of interest in the present study.

Acknowledgments (when appropriate): This research was supported by the parent organizations, Kodachadri Integrated Development Society® and Jana Sagara Nave Trust®, under the COVID-19 to 20 program. During School closures, when the community was scared about what was next in learning and education. The labs of Elder's Life Exhilaration Center and Biodiversity Education and Research Lab, Environmental Study Center, Shivamogga, Karnataka, India. The authors thank all the parents, family members, children/students, and teachers in this research. Thanks to S. Chandrasekhar, Dinesh Hosanagara, Pavithra Dinesh, Mamatha, Srikanth, and Radha for helping with data collection and entry in the analysis. Our special thanks to the KIDS® and JSNT® board members for their moral support. We are grateful to the education department, DIET, and SSA of Shivamogga, Karnataka, for their support.nd B designed the study. Author A managed literature searches performed the statistical analysis, and wrote the first draft of the manuscript. Both Authors A and B performed the corrections. Both authors read and approved the final manuscript.

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Appendix

Table 1. A semi-structured questionnaire for the present study.

Sl. No	Activities	Subjects recalled during the activities (Kannada, Mathematics, Science, Social, kannada, English, Hindi, computer etc.)	Family members (mother/ father/ aunty/ sister/ uncle /grandmother/ grandfather) assistance	Before COVID - 19 days	During COVID - 19 days
1	Basic principles of gardening and farming				
2	I learnt names of Instruments of garden and farm land				
3	I learnt how to sow seeds				
4	I learnt about germination and its success				
5	I learnt how to plant saplings				
6	I learnt how to give required water for plant				
7	I learnt how to give required manure for plant				
8	I learnt how to make support sticks for vegetable plant				
9	I learnt how to segregate waste and management for plant				
10	I learnt how to make compost				
11	I learnt how to make vermi-compost				
12	I learnt how to make				

	bunds
13	I learnt how to identify the disease symptoms in plants
14	I learnt how to spray to plants
15	I learnt different seasonal crops, vegetable and fruits information
16	I leant about minimum skills in farm
17	I learnt about maximum skills in farm
18	I learnt barter system with our neighbors
19	I learnt about domestic market and its importance
20	I learnt how to keep agricultural equipments
21	I learnt how to use kitchen and garden waste to compost
22	I learnt about the local other multiple names of greens and vegetables
23	I learnt about the weeds as greens
24	I learnt about pruning, cutting and cleaning
25	I learnt about harvesting methods
26	Seasons of garden and farming work
27	Judicious use of water for planting