

# Exploring the Preservice Teachers' Work to Label the Plants in the Faculty Garden

This descriptive qualitative case study aims to find out the pre service teachers' confidence about outdoor teaching, their knowledge about the plants and it explores the two research questions: To what extent do the preservice science teachers have confidence to teach in the outdoor settings? (1) and 'What are the pre service teachers' knowledge about the plants that they see on a daily basis? (2)'. To do this, it was reported the entire activity of two pre-service science teachers' work to label the plants at the faculty garden. The data collection encompassed rounds of semi-structured interviews, observations and a portfolio was prepared. The protocol addressed preparation for the connection to everyday life, their General Biology Course and for their collaboration. Preservice teachers labelled in total 124 plants from 14 species by focusing on mostly the trees. They reported that their main challenge is to label the family Pinaceae, although they have seen these plants almost daily for over two years. They reported that this practice-based work at the faculty garden enhances their knowledge and confidence to teach in the outdoor settings.

*Keywords:* Biology Education, Outdoor Learning Environments, Out-of-school teacher education, Pre-service Teacher Education, Science Education

## Introduction

Research reports the importance of biodiversity for ecological stability in many aspects (Arese Lucini, Morone, Tomassone & Makse, 2020; De Boeck, et al., 2018), just to name one of these, planting enhance the soil by improving the soil nutrient status, facilitating the enzyme activity and support the bacterial diversity which is important for the plants (Xu, et al., 2022). Unfortunately, contradictory to this, the sharp decline in biodiversity due to the environmental problems, climate change (Cardinale et al., 2012) and the human activities are reported as the related factors call forth the rapid extinction of species (Bowler et al., 2020; Shivanna, 2020). Adding to this, research also reports that nearly 80% of our planet's biodiversity remains to be discovered and named (Rao, 2022) while the term 'biodiversity' is still not precisely comprehended and not even heard by the majority of the population (Hooykaas et al., 2019).

Additionally, scholars report that the biodiversity and plant-based knowledge have serious effects in the conservation of species (Adeleye, Haberle, Gallagher, Andrew & Herbert, 2023), positively correlate with the conservation of biodiversity and understanding (Eylering, Neufeld, Kottmann, Holt & Fiebelkorn, 2023). So, in this vulnerable and intertwined balance learning about the species is essential for their preservation and ecological stability. Adversely, generally societies suffer from the lack of plant knowledge even in the very close by environment which is describe as plant blindness (Wandersee & Schussler, 1999) and even the (subject) teachers are not exceptional (Dikmenli, 2010; Mercan & Köseoğlu, 2022; Tekin & Aslan, 2022).

1 Along this line, to allocate more time on education (Thomas, Ougham &  
2 Sanders, 2021) for biodiversity and species knowledge in the school curriculums  
3 (Frisch, Unwin & Saunders, 2010) and strength the teacher education programs  
4 across the educational levels (Kaasinen, 2019) could be one possible way to  
5 improve the current level of species literacy in the societies. However, researchers  
6 emphasize that teacher education programs are highly focus on formal settings  
7 with limited outdoor education. As a matter of the fact that the outdoor learning is  
8 poorly understood (Fisher-Maltese, 2014) while the teacher education programs  
9 still mainly suffer from the gap between theory and practice (Douglas, 2016;  
10 Runesson-Kemper, 2019).

11 Largely, the teacher identity and role develop throughout the profession, not  
12 surprisingly, the beginning teachers are not feeling self-confident and needs  
13 support (Sabina, Touchton, Shankar-Brown & Sabina, 2023). Thus, for them  
14 taking their students outside the classrooms is a challenge. The teachers needs to  
15 be supported (Kisiel 2005) for the teaching in the informal learning environments  
16 (Cetin, 2020; Olson, Cox-Petersen & McComas 2001), specifically the beginning  
17 teachers (Ateşkan & Lane, 2016; Cooke-Nieves, Wallace, Gupta & Howes, 2022).  
18 As for example, Ordon, Bartelheimer & Asshoff, (2021), in their recent research  
19 with the biology preservice teachers reported that their high level of interest for  
20 outdoor teaching but a lower level of self-efficacy before their course that focuses  
21 on field trips. After the field trip course, preservice teachers showed improvement  
22 in their self-efficiency in the post test and the follow-up test revealed that this was  
23 a sustained and long-lasting effect. Additionally, based on the analysis of students'  
24 self-reported outcomes, research also showed that the students self-reported the  
25 higher learning outcomes on field trips to natural environments as long as their  
26 teachers are more involved in the tour (Alon & Tal, 2017).

27 These research findings suggest to skill the teachers on conducting field trips  
28 and outdoor education both for their professional activities and to enhance their  
29 students' educational gains. Hence, it is a necessity for the teacher education  
30 programs to support the teachers' practice as early as possible in their professional  
31 trajectory (Blaat & Patrick, 2024). Considering the mentioned (contextual)  
32 challenges related with the field trips and outdoor education (Akar, 2014; Demir,  
33 2022, Karbeyaz & Kurt, 2022; Lane, Ateşkan & Dulun, 2018), as a center of daily  
34 activities the school gardens has a significant role to be able to connect the  
35 learning environments as an instructional strategy (Van Dijk-Wesselius, Van den  
36 Berg, Maas & Hovinga, 2020). Following on Stigler and Hiebert's (1999), schools  
37 should be restructured as places where teachers can learn. This coheres with the  
38 literature that mentions the schoolyards have potential to combine out-of-school  
39 learning environments for student learning as well as for the pre-service (science)  
40 teachers' education (Author, 2022; Kaasinen, 2019). In this frame, Garden-Based  
41 Learning (GBL) contributes many areas of education as for example nutrition,  
42 health, students' engagement, connectedness with nature, especially important in  
43 metropolitan big cities and support the emotional physical and intellectual  
44 development of students (Earl & Thomson, 2020; Mansuroğlu & Sabanci, 2010;  
45 Ürey, 2018).

46 As it is well documented in the literature, the teachers and how they structure

1 their teaching is important for their students and the educational outcomes in all  
2 educational context so as in the outdoor education (Cox-Petersen & Pfaffinger  
3 1998; Lewalter, Gegenfurtner & Renninger, 2021). Eventually, we still need to  
4 know more about how to incorporate the school garden into the pedagogy and the  
5 didactical knowledge effectively (Bergan, Nylund, Midtbø, & Paulsen, 2023;  
6 Jorgenson, 2013, Yahampath, 2023) to support the teacher education programs  
7 with practice based research.

8 This paper addresses this gap through its investigation of two preservice  
9 science teachers activities that focus on the faculty garden where participants of  
10 this study have daily access. Building upon this, this study explore the below two  
11 research questions:

- 13 1. To what extent do the preservice science teachers have confidence to teach  
14 in the outdoor settings?
- 15 2. What are the pre service teachers' knowledge about the plants that they  
16 saw on a daily basis?

## 18 **Materials and Methods**

### 20 **Participants and Procedure**

21 In this descriptive case study (Yin, 2014) with phenomenological approach  
22 (Moran, 2000), the entire activity of two voluntary 2<sup>nd</sup> grade pre-service science  
23 teachers' work to label the plants at the 2014-2015 academic year spring term was  
24 reported. At the time of the study, their subject topic in the General Biology course  
25 was biodiversity. In connection with this, the assignments were suggested to the  
26 students who had interest in teaching outdoor learning environments (purposive  
27 sampling, Cohen, Manion & Morrison, 2017, pg.219).

28 The faculty garden was proposed for the convenience of students due to the  
29 variety of plants that was suitable for a small-scale practice based student work. At  
30 the time of this study, the faculty garden had mainly two green areas one was  
31 named as the front garden where the main entrance (see Figure 1, removed for the  
32 blind review) is and second was the back garden (see the area in front of x , Figure  
33 1). The work in the front garden was reported previously (Author, 2022) and this  
34 study focuses on the back garden of the faculty. To note, the education faculty  
35 campus was renovated and reopened in 2019. This work was completed before the  
36 construction started (Anonymous, 2019).

37 In this study, pre-service science teachers determined their workload and time  
38 according to their schedule as well as the part of the campus garden for their work  
39 (see Figure 1). They were free to choose and use the information sources to label  
40 and document the plants. Researcher gave them full responsibility to plan and  
41 structurally supported throughout their work, such as providing connection with  
42 the plant taxonomy experts for their questions to finalize their labelling and  
43 equipping them with the digital and hard copy taxonomic keys.  
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1 To start with, first, the two preservice teachers made a round tour of the whole  
2 faculty garden (see Figure 1) before deciding the part they prefer to work on. The  
3 researcher joined their second round tour in which they briefed their plans and  
4 gave their reasoning for the choices. Meanwhile, researcher interviewed the  
5 students' teachers to figure out the reasoning why they wanted to work in the back  
6 garden. Afterwards, researcher explained the objectives and goals, shared guiding  
7 questions to support their thinking process and invited them to share their  
8 perspective. This was the first progress meeting.

9 Second, the student teachers prepared a draft working plan, task divisions and  
10 a timeline by responding to the given guiding questions. They shared their  
11 preparations with the researcher at the second progress meeting, revised the plan  
12 based on the feedback and discussion. In these meetings, the student teachers  
13 expected to take the initiative, formulate their work, exchange their ideas with  
14 each other and discuss with the researcher to finalize the schedule for this work.  
15 After finalizing their schedule and deciding their workload, they photographed the  
16 plants that they wanted to work with.

17 Third, the protocol addressed the frame of the study, their collaboration and  
18 task division, ethics in general and plants ethics in specific, guiding questions to  
19 connect their work to everyday life (e.g. "How many plants have you noticed in  
20 the faculty back garden? , Do you know them with taxonomical information  
21 and/or distinguish?), and their General Biology Course (e.g. Is it sufficient time to  
22 reserve for the topic? How does the theoretical knowledge in the course support  
23 your practical study at the faculty garden?) was finalized subsequently. The  
24 students' teachers were asked for their consent to participate in the study  
25 anonymously.

26 They worked one month in the spring term and reported they spend 3 or 4  
27 hours weekly in total 15 hours to complete their work. At the end of one month's  
28 work, the final report was prepared as a portfolio. Lastly, they prepared a lesson  
29 plan and organized a teaching demonstration (1 class hour=45 min.) for their  
30 classmates (45 students) at the faculty back garden where they completed their  
31 work. During this presentation, they shared their experience and gains from this  
32 work with their classmates. In the end, they discussed the use of school gardens in  
33 biology and science teaching with their classmates and had feedback for their  
34 work.

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**Figure 1a and 1b**, Author, 2015, google map and photos, (removed for the blind review)  
**Figure1a** The location of Anonymous Faculty, Anonymous Campus (removed for the blind review)

<b>Figure 1b</b> The photos from the Anonymous faculty back garden ((removed for the blind review)			
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**Data Collection Tools**

The data collection encompassed by rounds of semi-structured interviews, observations and a portfolio was prepared.

The semi structured interview questions firstly, addressed general aspects of their previous experience in the field trips and their existing plant knowledge with the questions: Which school subject you were taken out for out - door activities, how do you summarize your function in those field trips? What do you think about the particular gain from those trips as a student? Secondly, their current work was addressed with the questions: what is your biggest struggle while working at the faculty garden to label the plants now? How do you find the plant that you chose for this study? What time of the day do you notice this plant? What is the first characteristic of the plant that you notice? These two folds of questions were not asked in a predetermined order and were posed naturally as the conversation developed.

As for observations, their work at the faculty garden was observed in several cycles by researcher as field trips notes to find out their plant knowledge, how they handle the challenges and how they structured their work afterwards. In these observations, the structure of the work and their cooperation were observed according to their plans at the protocol. The preservice student teachers observed each other’s work as well and gave peer feedback and self-reflected on these.

Portfolio was organized in line with the protocol and included the students’ self-reflection to the peer feedback and researcher’s feedback, their own teaching in the teaching demonstration and the material that they prepared. Moreover, the students included their answers to the three knowledge questions (I know the plant before, I noticed the plant at the campus yard, I have the taxonomic knowledge for this plant) in response format yes/ no. The portfolio checklist were shared for the complete final version of the portfolio.

## 1 Analysis

2  
3 To answer the first research question, the preservice teachers' responses to the  
4 interview questions, the preservice teacher reflection in the portfolio, and  
5 observations notes were analyzed. To answer the second research question, their  
6 labeling work, their response to the three knowledge questions were investigated.  
7 Based on the contiguity (Maxwell & Miller, 2008), their answers were  
8 summarized and quotations from preservice teachers were shared.

9 The portfolio was analyzed in the line with the protocol from the content  
10 point of view. A checklist used for this purpose.

## 13 Results and Discussion

14  
15 This descriptive case study with the phenomenological approach investigated  
16 the practice based experience of two preservice science teachers to label the self-  
17 selected plants at the faculty back garden.

18 As for the first research question, *"to what extend the preservice science*  
19 *teachers have confidence to teach in the outdoor settings?"*

20 To sum up, for the first round of semi structured interview questions,  
21 preservice teachers pointed to their very limited experience at the outdoor  
22 environment in their student life which was generally bound to the daily visit  
23 towards the natural and historical environments which is similar to Demir (2022)  
24 findings but different then Blatt & Patrick (2014). They agreed about their role in  
25 these activities and were observers most of the time. They pointed out that they did  
26 not make any subject related preparations and/or report neither before nor after  
27 these trips. They viewed this as the main source for the challenges to plan their  
28 own schedule at the current study. They found these field trips were one of the  
29 days they look for at the school and a nice day in their memory from their students'  
30 time, especially traveling and being with their classmates outside the classroom.  
31 These finding are in line with previously reported research findings with DeWitt &  
32 Storksdieck (2008)

33  
34 *Preservice teacher-1:*

35 *I could not always hear what the teacher said. Sometimes we were too busy with*  
36 *photographing ourselves and looking around ...hii not focus on what the teacher was*  
37 *saying. I remember clearly, after the breaks and before we started to walk out, the*  
38 *teacher specially paid attention if there were any of us missing. I am now not sure we*  
39 *could follow any subject topic even if it were there.*

40 *We were so happy and enjoyed it!.*

41 *Preservice teacher- 2*

42 *I enjoyed the work, Yipp, truly to say more than I expected. I want to take my student*  
43 *out of the classroom and use the opportunities for this. But I am still feeling this will*  
44 *cost too much time to teach and too much organization. If the classroom is big for*  
45 *sure I do not want to do it.*

46 *With this work, I noticed the importance of gardens for education and to teach the*  
47 *plants. We can learn here! I have more attention now to the plants, specially family*  
48 *Pinaceae*

1  
2 To summarize the student teachers answers to the second fold of the  
3 interview questions that addressed their current work: It took two weeks for the  
4 student teachers to structure their work which was half of the time devoted for the  
5 study. Most of the time they viewed this as one of the main challenges to plan their  
6 own schedule. They found taking their own initiative as a complexity for them but  
7 they appreciated the guiding questions to structure their work. They found the  
8 feedback and guiding questions helpful to understand and structure their current  
9 work which seems at first place a kind of chaos for them. They said that they  
10 chose the back garden since they spent most of their time here for their studies and  
11 group work previously. That's why, they thought they were familiar with the plants  
12 since some of the plants they noticed previously, for example the walnut tree and  
13 other fruit trees especially when they have fruits on (Mercan & Köseoğlu, 2022).  
14 Yet, they have the difficulty to label the trees they saw daily (Ozturk-Akar,  
15 2023). They could not give any specific time of the day to notice the plant for the  
16 first time. They said they were too busy with their studies. What they appreciated  
17 in this part of the garden was a peaceful nice place to study and/or spend time with  
18 their friends.

19  
20 Preservice student 1

21 *Learn on my own and search for the answer!.. puffff I did not expect that it would be*  
22 *that difficult, first I was scared then I enjoyed it.*

23 *I am still back to the idea about giving me the full freedom to plan the work. Truly to*  
24 *say, I do not know what to do for the first meeting but happy with deciding the part of*  
25 *a garden we planned to work on. It was at least something in our hands to come to*  
26 *the meeting.*

27 *When you shared the guiding questions all became meaningful even my almost empty*  
28 *look to the plants in the back garden. It would be helpful to start with these guiding*  
29 *questions or maybe share some previous assignments.*

30 *I learned a lot about the plants but of course not all, it is impossible there are so*  
31 *many. But now I know how*

32  
33 Preservice teacher-2:

34 *I really looked for a ready plan that was given by you and just go and do with this*  
35 *one. Step by step... Off it was not a possibility.*

36 *I feel I have to take initiative otherwise the work is not going, time is running. After*  
37 *all I understood this is the point, I should be active and take the initiative.*

38 *I focused on the guiding questions and read them carefully in the protocol. Slowly, I*  
39 *got used to it and started to work with my classmate.*

40 *I learned a lot about the plants but what I learned the most, Nature need real good*  
41 *eye to see the detail and differences”*

42  
43 To conclude, the analysis of interviews with two pre-service science teachers  
44 indicate that they were not confident at the beginning. Through the work they  
45 developed their self-confidence and the plant knowledge which is in line with  
46 Ordon et al. (2021) findings and the importance of training for pre-service teachers  
47 in the outdoor environments for their confidence and professional development  
48 (Alon & Tal, 2016).

1  
2 As for the second research question “*What are the pre service teachers’ knowledge*  
3 *about the plants that they see on a daily basis?*”  
4

5 *Table 1.* Sum of the labeling work at the faculty back garden and the student  
6 teachers’ answers to the three knowledge questions

	Species	English	Turkish	Number of labelled plants	Knowledge Questions					
					I know the plant before.*		I noticed the plant at the campus garden.*		I had taxonomic knowledge	
					S1	S2	S1	S2	S1	S2
1.	<i>Prunus avium</i>	Cherry	Kiraz	1	+	+	-	-	-	+
2.	<i>Pirus communis</i>	Pear	Armut	5	+	+	-	+	+	+
3.	<i>Cydonia oblonga</i>	Quince	Ayva	1	+	+	-	-	+	+
4.	<i>Rosa L.,</i>	Rose	Gül	1	+	+	+	+	-	-
5.	<i>Juglans regia</i>	Walnut	Ceviz	1	-	+	-	+	+	-
6.	<i>Ficus carica</i>	Fig	Incir	1	+	+	-	+	-	+
7.	<i>Malus domestica</i>	Apple	Elma	1	+	+	-	-	+	-
8.	<i>Malva Vulgaris</i>	Mallow	Ebegümeçi	1	+	-	-	-	-	-
9.	<i>Pinus sylvestris</i>	Scots pine (UK), Scotch pine (US) or Baltic pine	Sarıçam	46	-	-	+	+	-	-
10.	<i>Cupressus sempervirens</i>	Cypress tree	Selvi - Servi	34	-	-	+	+	-	-
11.	<i>Pinus pinea</i>	Stone pine	Fistik Cami	4	-	-	+	+	-	-
12.	<i>Thuja occidentalis</i>	Thuja	Mazi	1	-	-	+	+	-	-
13.	<i>Populus alba</i>	Populus	Kavak	1	+	+	+	+	+	-
14.	<i>Buxus sp.</i>	Buxus	Simsir	26	-	-	-	-	-	-
				<i>Total number of plants</i>	124					
				<i>Total Yes</i>	8	8	6	9	5	4
				<i>Total No</i>	6	6	8	5	9	10

7 \*+ Yes, know, -, No, I do not know  
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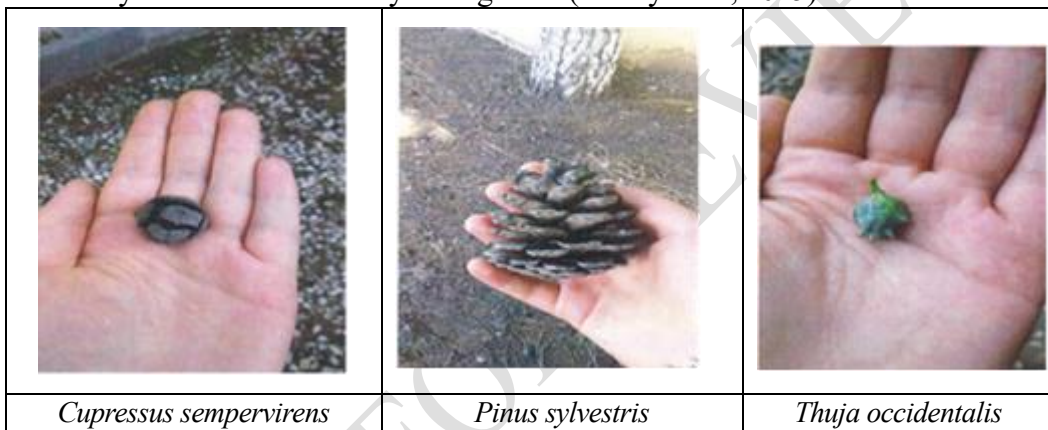
9 Preservice teachers prefer to use the electronic sources to label the plants, yet  
10 it was observed that the information they found was complicated for them in the  
11 first place. They emphasized the quick accessibility of e-sources which also  
12 provided them focusing on their work but they pointed out that they need more



1 knowledge to be able to progress with the taxonomy keys. In total, they labeled  
 2 124 plants from 14 species. The preservice teachers' answer to the knowledge  
 3 questions showed that they are familiar with most of the plants (8 yes for 14  
 4 different plant species) but their taxonomic knowledge about these plants needs to  
 5 be supported (Table 1).

6 The findings suggest that as long as the pre-service students have connection  
 7 with the plants such as fruit trees, they have relevance and recognition which  
 8 might also count as the plant awareness (Nates, Campos & Lindemann-Matthies,  
 9 2010; Staag & Dillon,2022). They reported their challenges to label, especially the  
 10 family Pinaceae. They said that they appreciated the contact with the expert  
 11 especially for these trees, at the beginning to compare the cones was a helpful tip  
 12 (Figure 2).

13  
 14 *Figure 2.* Photographs from the pre-service teachers portfolio, comparing the cons  
 15 of family Pinecea at the faculty back garden (Anonymous, 2015)



16  
 17 Analysis of students' self-reported outcomes showed that the pre-service  
 18 teacher students learn more about plants and increase their plant taxonomy  
 19 knowledge during this small scale practice work at the faculty back garden. They  
 20 reported that they noticed the importance of learning at the out class setting since  
 21 they experienced and learned a lot from their own work.

22 Current study's outcomes would lead an example for a preparation program  
 23 for pre service teachers to improve their outdoor learning experience. These  
 24 outcomes would contribute to the existing literature that points to the importance  
 25 of outdoor learning and its contribution to significant learning outcomes (DeWitt  
 26 and Osborne 2007; Falk and Dierking 2000).

27 The student teachers prepared one portfolio (hard copy) for their joint work.  
 28 They included the literature list that they searched and used, the photos from the  
 29 garden and the plants (Figure 3), their plan with the drafts, the lecture plan for the  
 30 demo teaching with drafts and the relevant teaching materials. They added their  
 31 responses individually for the three knowledge questions, guiding questions and  
 32 the self-reflections to peer feedback, feedback from the researcher and classmates.  
 33 The final version of the portfolio evaluated in respect to its content based on the  
 34 checklist shared with the student teachers. The student teachers were asked for  
 35 their general opinion about their portfolio preparation process. Generally speaking

1 they were positive to the portfolio preparation process and portfolio assessment.  
 2 They suggested preparing such a portfolio only electronically since all their  
 3 materials were electronic (Hardy & Hardy, 2018). The portfolio and their work  
 4 were presented to their classmates and they shared their experiences in a  
 5 classroom discussion.

6  
 7 *Figure 3. Selected photos from the student teachers' portfolio (Anonymous, 2015)*



### 8 9 10 **Conclusions**

11  
 12 The teacher education programs need to skill and develop the teachers  
 13 competences with appropriate interdisciplinary, pedagogical and professional  
 14 competences to perform in the different learning environments. Following on  
 15 researchers recommend on the out-door learning process that emphasizing the  
 16 experience or confidence of preservice teachers, this study contributes to the  
 17 preservice teacher education with the aim to make them familiar with the  
 18 educational use of the school gardens, develop their subject teaching skills and  
 19 support their confidence to teach in the informal learning environments.

20 Taking from this point, this study give below suggestions

21 Based on the findings, first, this study draws the attention to the importance  
 22 of faculty gardens for the teachers' education and supporting teacher education  
 23 programs in this manner which is parallel with the previous studies. To do this,  
 24 potential contributions of the faculty gardens could be investigated and planned for  
 25 the academic year, and/or integrate across the curriculum in harmony with the  
 26 related subject teaching. While doing these (primary) schools' visits to the faculty  
 27 gardens may contribute to the faculty and schools collaborations and fulfill "a  
 28 class day out" in a feasible way. The structured teaching-learning activities and  
 29 (digital) teaching materials (Kali, Levy, Levin-Peled & Tal, 2018) would increase  
 30 the profit from the visits as it is highly suggested in the previous researches (Cox-

1 Petersen & Pfaffinger 1998; Lakin, 2006; Karbeyaz & Kurt, 2022). Notably, this  
 2 would provide a teaching practice for the preservice teacher and opportunity to  
 3 reflect on their own teaching (Ma & Green, 2021).

4 Second, the faculty gardens are viable places to leverage the urban green  
 5 areas and landscape, especially in the city campus. They have environmental and  
 6 aesthetic value and recreational functions (Akca & Zulfikar, 2019; Güneroğlu &  
 7 Pektaş, 2022 ). Their architecture should be considered for the sustainability of the  
 8 urban areas in harmony with their surroundings (Çalışkan, 2023). Their  
 9 renovations and construction plans should consider the effects on the acoustic and  
 10 traffic as well (Burns, 1979; Horoshenkov, Khan & Benkreira, 2013; Maleki,  
 11 Hosseini & Nasiri, 2010). This is especially important to protect the existing  
 12 sources (Saglik, Kartal, Şenkus & Temiz, 2021) in the cities with a potential to  
 13 develop.

14 As final, the potent value of green areas in the educational institution may be  
 15 supported with encouraging programs (Anthony, 2021, Ribeiro, et al. 2021) such  
 16 as UI GreenMetric World University Rankings. The institution's potential impact  
 17 for both sustainable societies and green campus could be placed among quality  
 18 indicators of the higher education institutions.

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