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

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This descriptive qualitative case study aims to find out the pre-service science teachers (PST)' confidence about instructional practice in outdoor setting, 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 preservice teachers' knowledge about the plants that they see on a daily basis? (2). To do this, it was reported the entire activity of two voluntary pre-service science teachers (PST)' 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 science 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 instructional 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 most 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

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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).

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

Largely Research reports that, the teacher identity and role develop throughout their profession, not surprisingly, the beginning teachers are not feeling self-confident and need support (Sabina, Touchton, Shankar-Brown & Sabina, 2023). Thus, for them taking their students outside the classrooms is a challenge. The teachers needs to be supported (Kisiel 2005) for the teaching in the informal learning environments (Cetin, 2020; Olson, Cox-Petersen & McComas 2001), specifically the beginning teachers (Ateşkan & Lane, 2016; Cooke-Nieves, Wallace, Gupta & Howes, 2022). As for example, Ordon, Bartelheimer & Asshoff, (2021), in their recent research with the biology preservice teachers reported that their high level of interest for outdoor teaching but a lower level of self-efficacy before their course that focuses on field trips. After the field trip course, preservice teachers showed improvement in their self-efficiency in the post test and the follow-up test revealed that this was a sustained and long-lasting effect. Additionally, based on the analysis of fourth to ninth grade (ages 10–14) students' self-reported outcomes on 28 field trips to natural environments, researchers showed that the students self-reported the higher learning outcomes on field trips to natural environments as long as their teachers are more involved in the tour (Alon & Tal, 2017).

These research findings suggest enhancing the teachers competency on conducting field trips and outdoor education both for their professional activities and to boost their students' educational gains. Hence, it is a necessity for the teacher education programs to support the teachers' practice as early as possible in their professional trajectory (Blaat & Patrick, 2024). Considering the mentioned (contextual) challenges related with the field trips and outdoor education in the teacher education program in Türkiye (Akar, 2014; Demir, 2022, Karbeyaz & Kurt, 2022; Lane, Ateşkan & Dulun, 2018), as a center of daily activities the school gardens might have a significant role to be able to connect the learning environments as an instructional strategy (Van Dijk-Wesselius, Van den Berg, Maas & Hovinga, 2020). Following on Stigler and Hiebert's (1999), schools at primary and secondary level should be restructured as places where teachers can learn. This recalls the literature that mentions the schoolyards have potential to combine out-of-school learning environments for student learning

as well as for the pre-service (science) teachers' education (Telli, 2022; Kaasinen, 2019). In this frame, Garden-Based Learning (GBL) contributes many areas of education as for example nutrition, health, students' engagement, connectedness with nature, especially important in metropolitan big cities and support the emotional physical and intellectual development of the school students (Earl & Thomson, 2020; Mansuroğlu & Sabanci, 2010; Ürey, 2018).

As it is well documented in the literature, the teachers and how they structure their teaching is important for their students and the educational outcomes in all educational context so as in the outdoor education (Cox-Petersen & Pfaffinger 1998; Lewalter, Gegenfurtner & Renninger, 2021). Eventually, we still need to know more about how to incorporate the school garden at different level of education into the pedagogy and the didactical knowledge effectively (Bergan, Nylund, Midtbø, & Paulsen, 2023; Jorgenson, 2013, Yahampath, 2023) to support the preservice teacher education programs with the practice based research.

This paper addresses this gap through its investigation of two voluntary 2nd grade preservice science teachers' activities that focus on the faculty garden where participants of this study have daily access during the academic year and in their leisure time.

Building upon this, this study explores the below two research questions:

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

Materials and Methods

Participants and Procedure

In this descriptive case study (Yin, 2014) with phenomenological approach (Moran, 2000), the entire activity of two voluntary 2nd grade pre-service science teachers' work to label the plants at the 2014-2015 academic year spring term was reported. At the time of the study, their subject topic in the General Biology course was biodiversity and only two preservice science teachers were interested in this task from the group. In connection with this, the assignments were suggested to the preservice teacher who had interest in teaching outdoor learning environments (purposive sampling, Cohen, Manion & Morrison, 2017, p. 219).

The faculty garden was proposed for the convenience of students due to the variety of plants that was suitable for a small-scale practice based preservice teachers' work. The faculty garden had the leisure facilities which was generally used for the relaxation purposes by the staff and the pre-service teachers but only occasionally used for the preservice teachers' teaching practice. This study reports one of these instructional practices by focusing on the subject teaching, namely biodiversity. At the time of this study, the faculty garden had mainly two green areas; one was named as the front garden where the main entrance (see Figure 1a) is and

second was the back garden (see Figure 1a). The work in the front garden was reported previously (Telli, 2022) and this study focuses on the faculty back garden. To note, the education faculty garden was renovated and reopened in 2019. This work was completed before the construction started (COMU, 2019, February 12).

In this study, pre-service science teachers determined their workload and time according to their schedule as well as the part of the faculty garden for their work (see Figure 1). They were free to choose and use the information sources to label and document the plants. Researcher gave them full responsibility to plan and structurally support throughout their work, such as providing connection with the plant taxonomy experts for their questions to finalize their labelling and equipping them with the digital and hard copy taxonomic keys.

To start with, first, the two preservice teachers made a round tour of the whole faculty garden (see Figure 1, Yıldız, 2012) before deciding the part they prefer to work on. The researcher joined their second round tour in which they briefed their plans and gave their reasoning for the choices. Meanwhile, the researcher interviewed the preservice science teachers to figure out the reasoning why they wanted to work in the faculty back garden. Afterwards, the researcher explained the objectives and goals, shared the guiding questions to support their thinking process and invited them to share their perspective. This was the first progress meeting.

Second, the pre-service science teachers (PST) prepared a draft working plan, their task divisions and a timeline by responding to the given guiding questions. They shared their preparations with the researcher at the second progress meeting, revised the plan based on the feedback and discussion. In these meetings, the pre-service science teachers (PST) expected to take the initiative, formulate their work, exchange their ideas with each other and discuss with the researcher to finalize the schedule for this work. After finalizing their schedule and deciding their workload, they photographed the plants that they wanted to work with.

Third, the protocol addressed the frame of the study, their collaboration and task division, moral right-wrong and moral good-bad (ethics) in general and in specific, the plants ethics that discusses the moral value of plants, and individual responsibilities toward them (Stroppa, 2023), the guiding questions to connect their work to everyday life (e.g., *How many plants have you noticed in the faculty back garden?, Do you know them with taxonomical information and/or distinguish?)*, and their General Biology Course (e.g., *Is it sufficient time to reserve for the topic? How does the theoretical knowledge in the course support your practical study at the faculty garden?)* was finalized subsequently. The pre-service science teachers were asked for their consent to participate in the study anonymously.

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

Figure 1a. The Location of COMU Education Faculty, Anafartalar Campus

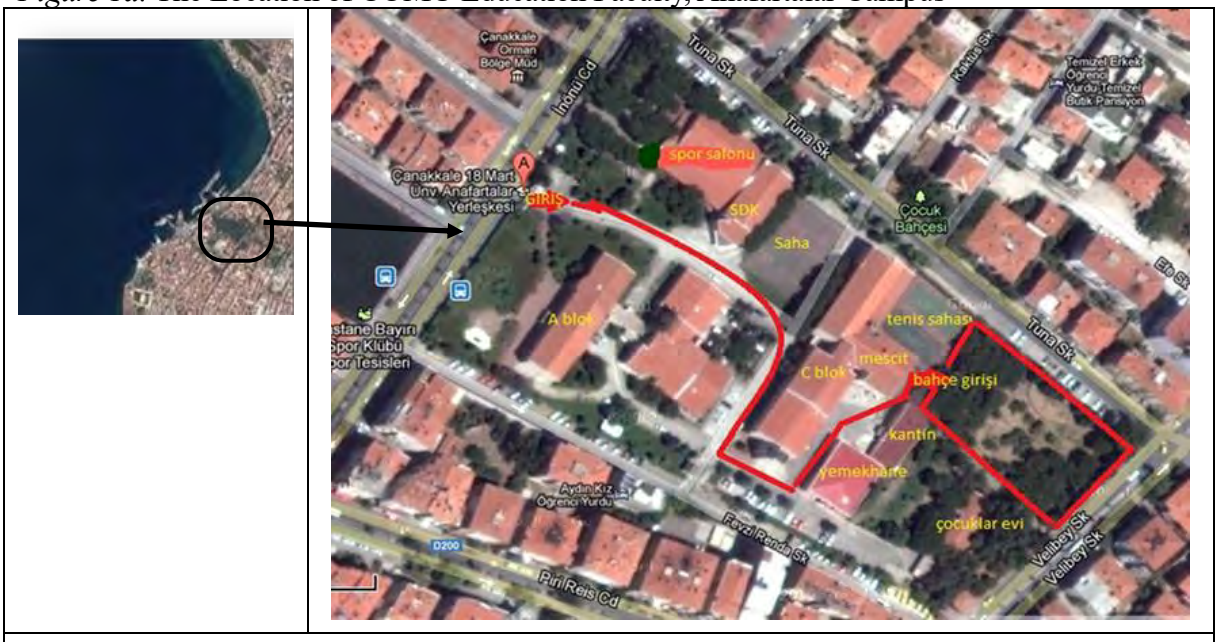


Figure 1b. The Photos from the Faculty Back Garden

Source: 2015: google map and photos.

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 the pre-service science teachers 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 groups of questions were not asked in a predetermined order and were posed naturally as the conversation developed.

As for the observations, the pre-service science teachers' work at the faculty garden was observed in several cycles by the researcher. These field trips were noted to find out the pre-service science teachers' 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 pre-service science teachers self-reflection to the peer feedback and the researcher's feedback, their own teaching in the teaching demonstration and the material that they prepared. Moreover, the pre-service science teachers 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 was shared for the complete final version of the portfolio.

Analysis

To answer the first research question, the preservice teachers (PST)' responses to the interview questions, the preservice teachers' reflection in the portfolio, and the observations notes were analyzed.

To answer the second research question, the preservice teachers (PST)' labeling work, their response to the three knowledge questions were investigated. Based on the contiguity (Maxwell & Miller, 2008), their answers were summarized and quotations from preservice teachers were shared.

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

Results and Discussion

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

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

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

The pre-service teachers (PST) responds to the questions which address the previous experience as a school student as below (semi structured interview questions, data collection tools, p. 7).

Preservice teacher 1:

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

To summarize the pre-service teachers (PST) answers to the second group of the interview questions that addressed their current work: It took two weeks for the pre-service teachers (PST) to structure their work which was half of the time devoted for the study. Most of the time they viewed this as one of the main challenges to plan their own schedule. They found taking their own initiative as a complexity for them. Regardless of this, they found the feedback and guiding questions helpful to understand and structure their current own work. They said that they chose the faculty back garden since they spent most of their time here for their studies and group work previously. That's why, they thought they were familiar with the plants since some of the plants they noticed beforehand, for example the walnut tree and other fruit trees especially when they have fruits on (Mercan & Köseoğlu, 2022). Yet, they have the difficulty to label the trees they saw daily (Ozturk-Akar, 2023). They could not give any specific time of the day to notice the plant for the first time. They said they were too busy with their studies. What they appreciated in this part of the faculty garden was a peaceful nice place to study and/or spend time with their friends.

The preservice teachers (PST)'student teachers answer to the second round of the interview questions that addressed their current work (semi structured interview questions, data collection tools, pg 7).

Preservice student 1:

> *Learn on my own and search for the answer! I did not expect that it would be that difficult, first I was scared then I enjoyed it.*
> *I am still back to the idea about giving me the full freedom to plan the work. Truly to say, I do not know what to do for the first meeting but happy with deciding the part of a garden we planned to work on. It was at least something in our hands to come to the meeting.*
> *When you shared the guiding questions, all became meaningful even my almost empty look to the plants in the back garden. It would be helpful to start with these guiding questions or maybe share some previous assignments.*
> *I learned a lot about the plants but of course not all, it is impossible there are so many. But now I know how.*

Preservice teacher 2:

> *I really looked for a ready plan that was given by you and just go and do with this one. Step by step… it was not a possibility.*
> *I feel I have to take initiative otherwise the work is not going, time is running. After all I understood this is the point, I should be active and take the initiative.*
> *I focused on the guiding questions and read them carefully in the protocol. Slowly, I got used to it and started to work with my classmate.*
> *I learned a lot about the plants but what I learned the most, Nature need real good eye to see the detail and differences"*

Preservice teacher 2:

> *I enjoyed the work, truly to say more than I expected. I want to take my student out of the classroom and use the opportunities for this. But I am still feeling this will cost too much time to teach and too much organization. If the classroom is big for sure I do not want to do it.*
> *With this work, I noticed the importance of gardens for education and to teach the plants. We can learn here! I have more attention now to the plants, especially family Pinaceae*

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

As for the second research question *"What are the preservice teachers' knowledge about the plants that they see on a daily basis?"*

The preservice teachers (PST) prefer to use the electronic sources to label the plants, yet it was observed that the information they found was complicated for them in the first place. They emphasized the quick accessibility of e-sources which also provided them focusing on their work, but they pointed out that they need more knowledge to be able to progress with the taxonomy keys. In total, they labeled 124 plants from 14 species. The preservice teachers' answer to the knowledge questions showed that they are familiar with most of the plants (8 yes for 14 different plant species) but their taxonomic knowledge about these plants needs to be supported (Table 1).

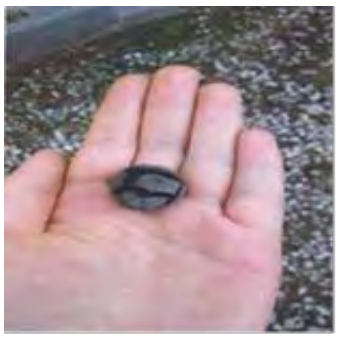
Table 1. Sum of the Labeling Work at the Faculty back Garden and the Student Teachers' Answers to the Three Knowledge Questions

	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.	*Prunus avium*	Cherry	Kiraz	1	+	+	-	-	-	+
2.	*Pirus communis*	Pear	Armut	5	+	+	-	+	+	+
3.	*Cydonia oblonga*	Quince	Ayva	1	+	+	-	-	+	+
4.	*Rosa L.,*	Rose	Gül	1	+	+	+	+	-	-
5.	*Juglans regia*	Walnut	Ceviz	1	-	+	-	+	+	-
6.	*Ficus carica*	Fig	Incir	1	+	+	-	+	-	+
7.	*Malus domestica*	Apple	Elma	1	+	+	-	-	+	-
8.	*Malva Vulgaris*	Mallow	Ebegümeci	1	+	-	-	-	-	-
9.	*Pinus sylvestris*	Scots pine (UK), Scotch pine (US) or Baltic pine	Saricam	46	-	-	+	+	-	-
10.	*Cupressus sempervirens*	Cypress tree	Selvi - Servi	34	-	-	+	+	-	-
11.	*Pinus pinea*	Stone pine	Fistik Cami	4	-	-	+	+	-	-
12.	*Thuja occidentalis*	Thuja	Mazi	1	-	-	+	+	-	-
13.	*Populus alba*	Populus	Kavak	1	+	+	+	+	+	-
14.	*Buxus sp.*	Buxus	Simsir	26	-	-	-	-	-	-
	Total number of plants			124						
				Total Yes	8	8	6	9	5	4
				Total No	6	6	8	5	9	10

**+ Yes, know, -, No, I do not know*

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

Figure 2. Photographs from the Pre-service Teachers (PST)' Portfolio, Comparing the Cones of Family Pinecea at the Faculty Back Garden (2015)



Cupressus sempervirens

Pinus sylvestris

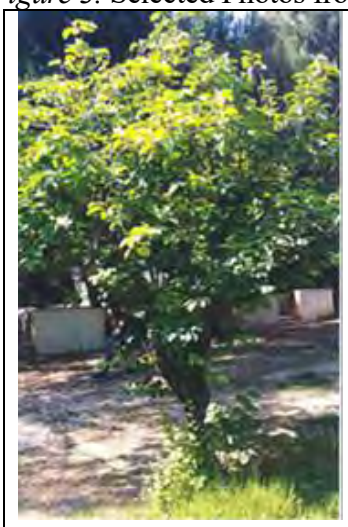
Thuja occidentalis

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

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

The pre-service teachers (PST) prepared one portfolio (hard copy) for their joint work. They included the literature list that they searched and used, the photos from the faculty back garden and the plants there (Figure 3), their plan with the drafts, their lecture plan for the demo teaching with drafts and the relevant teaching materials. They added their responses individually for the three knowledge questions, guiding questions and the self-reflections to the peer feedback, the feedback from the researcher and classmates. The final version of the portfolio evaluated in respect to its content based on the checklist shared with the preservice (PST) teachers. Meantime, the pre-service teachers (PST) were asked for their opinion about their portfolio preparation process. Generally speaking, they were positive to the portfolio preparation process and portfolio assessment. They suggested preparing such a portfolio only electronically since all their materials were electronic (Hardy & Hardy, 2018). The portfolio and their work were presented to their classmates, and they shared their experiences in a classroom discussion.

Figure 3. Selected Photos from the Student Teachers' Portfolio (2015)

		
Cydonia oblonga	*Juglans regia*	*Pinus sylvestris*

Conclusions

The teacher education programs need to develop the teachers' practical competences with appropriate interdisciplinary, pedagogical and professional competences to perform in the different learning environments. Following on researchers recommend on the out-door learning process that emphasizing the experience on the confidence of preservice teachers, this study contributes to the preservice teacher (PST) education with the aim to make them familiar with the educational use of the school gardens, develop their subject teaching skills and support their confidence to teach in the informal learning environments.

Given that this work is based on two voluntary pre-service teachers (PST) instructional practice in the faculty back garden and reported their self-efficacy and how they benefit from this practice. In essence, the two voluntary preservice teachers (PST) experienced an instructional approach that was different from their classmates. The researcher then assessed the students' experiences regarding their self-efficacy. They benefit from the extra instructional input obviously and had a better feeling about themselves. This methodological aspect compromises the research that is the main limitation of this study. This suggests that further studies might search the learning outcomes of the participants with the learning experience of the rest of the classmates. At any rate future study can benefit from the findings of current descriptive case study, as such additional information about the preservice teacher (PST) instructional practice.

Taking the point of the preservice teacher education, a step forward, this study gives below suggestions to conserve the in-city faculty gardens to support the pre-service teacher (PST) instructional practice on subject teaching and develop their self-efficacy at different educational settings.

Based on this first, this study draws the attention to the importance of faculty gardens for the pre-service teachers' teacher education programs in this manner

which is parallel with the previous studies. To do this, start with the potential contributions of the faculty gardens that could be investigated and planned for the academic year, and/or integrate across the curriculum in harmony with the related subject teaching. While doing these school students' visits to the faculty gardens may contribute to the faculty and schools' collaborations and fulfill "a class day out" in a feasible way. The structured teaching-learning activities and (digital) teaching materials (Kali, Levy, Levin-Peled & Tal, 2018) would increase the benefit from the schools' visits as it is highly suggested in the previous research (Cox-Petersen & Pfaffinger 1998; Lakin, 2006; Karbeyaz & Kurt, 2022). Notably, this would provide an instructional practice for the preservice teacher and opportunity to reflect on their own teaching (Ma & Green, 2021).

Second, the faculty garden in this study is located in a city center. To address as a green area, these gardens are viable places to leverage the urban green areas and landscape, especially in the city. Besides being educational institutions, they have environmental, aesthetic value and recreational functions (Akca & Zulfikar, 2019; Güneroğlu & Pektaş, 2022). That's why, their architecture should be considered for the sustainability of the urban areas in harmony with their surroundings (Çalışkan, 2023). Their renovations and construction plans should rethink the effects on the acoustic and traffic as well (Burns, 1979; Horoshenkov, Khan & Benkreira, 2013; Maleki, Hosseini & Nasiri, 2010). This is especially important to protect the existing sources (Saglik, Kartal, Şenkus & Temiz, 2021) in the cities with a potential to develop. The pre-service teacher education (subject teaching) would profit from such a conservation plan for the practice based instructional education in the preservice teacher education.

As final, the potent value of green areas in the educational institution may be supported with encouraging programs (Anthony, 2021, Ribeiro, et al. 2021) such as UI GreenMetric World University Rankings. The institution's potential impact for both sustainable societies and green campus could be placed among quality indicators of the higher education institutions. Hence, the faculty garden at the city center has the potential participation in such a ranking while supporting the awareness of the green areas and function in the instructional practice of the preservice teachers (PST).

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