Sınıf Dışı Öğrenme Ortamının Öğrencilerin Başarıları, Fen Öğrenme Motivasyonları ve Fen Derslerine Yönelik Tutumları Üzerindeki Etkisi

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Öz

Bu çalışmada, sınıf dışı öğrenme (SDÖ) ortamının öğrencilerin fen bilimleri dersindeki akademik başarıları, fen öğrenmeye yönelik motivasyonları ve fen dersine yönelik tutumları üzerindeki etkileri incelenmiştir. Araştırma, Türkiye'nin Erzincan ilindeki bir ortaokulda öğrenim gören 8. sınıf öğrencilerinden oluşan 32 kişilik bir örneklem üzerinde yürütülmüştür. Çalışma, ön test-son test kontrol gruplu yarı deneysel bir desenle gerçekleştirilmiştir. MEB 2018 fen bilimleri öğretim programındaki basınç ünitesiyle ilgili etkinlikler deney grubuna okul bahçesinde uygulanırken, kontrol grubuna aynı etkinlikler sınıf ortamında 10 ders saati boyunca uygulanmıştır. Veriler, Basınç Başarı Testi (BBT), Fen Öğrenmeye Yönelik Motivasyon Ölçeği (FÖMÖ) ve Fen Dersine Yönelik Tutum Ölçeği (FDTÖ) ile toplanmıştır. Veri analizi için bağımsız örneklem t-testi kullanılmıştır. Bulgular, SDÖ ortamının öğrencilerin akademik başarı ve fen dersine yönelik tutumları üzerinde istatistiksel olarak anlamlı bir etkiye sahip olmadığını, ancak fen öğrenmeye yönelik motivasyonlarında deney grubu lehine anlamlı bir artış sağladığını göstermektedir. Sonuçlar, literatürde yer alan SDÖ ile ilgili çalışmalarla karşılaştırılarak tartışılmış ve SDÖ uygulamalarının daha uzun süreli planlanmasının etkili olabileceği vurgulanmıştır. Çalışma, özellikle okul bahçesi gibi SDÖ alanlarının eğitimde kullanımına dair özgün bir katkı sağlamaktadır.

***Anahtar Kelimeler**: Fen eğitimi, okul bahçesi, sınıf dışı öğrenme*

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GENİŞLETİLMİŞ ÖZET

Giriş

Fen eğitimi, öğrencilerin çevrelerini bilimsel bir mercekten gözlemlemelerini, incelemelerini ve anlamalarını sağlayan önemli bir alan olarak öne çıkmaktadır. Ancak, fen öğretiminin sadece sınıf ortamıyla sınırlı kalması, bu hedeflere ulaşmada sınırlılıklar yaratabilir. Sınıf dışı öğrenme (SDÖ) ortamları, öğrencilerin doğal ve sosyal çevreleriyle etkileşime girmelerine olanak sağlayarak fen eğitiminin amaçlarına daha etkin şekilde ulaşılmasını desteklemektedir. Bu bağlamda, okul bahçeleri gibi SDÖ ortamları, öğrencilerin bilimsel kavramları somut deneyimlerle ilişkilendirmelerine olanak tanıyan uygun öğrenme alanlarıdır. Literatürde, SDÖ ortamlarının motivasyon ve tutum üzerinde olumlu etkileri vurgulanmakta ancak akademik başarı üzerindeki etkileri konusunda karmaşık sonuçlar bulunmaktadır. Bu çalışma, SDÖ ortamlarının öğrencilerin akademik başarılarına, fen öğrenme motivasyonlarına ve fen dersine yönelik tutumlarına etkisini incelemeyi amaçlamaktadır.

Amaç

Bu araştırmanın amacı, bir SDÖ ortamı olan okul bahçesinin, fen bilimleri dersindeki "Basınç" ünitesi bağlamında öğrencilerin akademik başarılarına, fen öğrenme motivasyonlarına ve fen dersine yönelik tutumlarına etkisini incelemektir. Çalışma, SDÖ ortamının eğitimde nasıl etkili bir şekilde kullanılabileceğine dair yeni bilgiler sunmayı hedeflemektedir.

Yöntem

Araştırma, ön test-son test kontrol gruplu yarı deneysel bir desen kullanılarak gerçekleştirilmiştir. Çalışma grubunu, Erzincan ilindeki bir ortaokulda öğrenim gören 32 sekizinci sınıf öğrencisi oluşturmuştur. Deney grubuna "Basınç" ünitesi, okul bahçesinde SDÖ ortamında öğretilirken, kontrol grubu aynı içeriği sınıf ortamında almıştır. Veriler, Basınç Başarı Testi (BBT), Fen Öğrenmeye Yönelik Motivasyon Ölçeği (FÖMÖ) ve Fen Dersine Yönelik Tutum Ölçeği (FDTÖ) ile toplanmıştır. Verilerin analizi bağımsız örneklem t-testi kullanılarak yapılmıştır.

Bulgular

Araştırma bulgularına göre, SDÖ ortamında gerçekleştirilen öğretim, öğrencilerin akademik başarıları üzerinde istatistiksel olarak anlamlı bir etkiye sahip olmamıştır. Ancak, fen öğrenmeye yönelik motivasyon düzeylerinde deney grubu lehine anlamlı bir artış gözlemlenmiştir ($p < .05$). Bununla birlikte, fen dersine yönelik tutumlar açısından gruplar arasında istatistiksel olarak anlamlı bir fark bulunmamıştır.

Tartışma ve Sonuç

Araştırma, SDÖ ortamlarının öğrencilerin fen öğrenme motivasyonlarını artırmada etkili olduğunu, ancak kısa süreli uygulamaların akademik başarı ve tutumlar üzerindeki etkisinin sınırlı olabileceğini göstermektedir. Literatürdeki benzer çalışmalarla karşılaştırıldığında bu bulgular, SDÖ uygulamalarının sürekliliğinin ve fiziksel altyapının önemine işaret etmektedir. Ayrıca, motivasyondaki artışın, uzun vadede akademik başarıya ve tutum değişikliğine yol açabileceği vurgulanmıştır. Sonuç olarak, SDÖ ortamlarının etkisini tam anlamıyla değerlendirmek için uzun süreli ve daha kapsamlı araştırmalara ihtiyaç vardır.

The Effect of Out-of-Class Learning Environment on Students' Achievement, Motivation, and Attitudes Toward Science Lessons

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Abstract

This study investigates the effects of out-of-class learning (OCL) environments on students' academic achievement, motivation to learn science, and attitudes toward science lessons. The research was conducted with a sample of 32 eighth-grade students from a middle school in Erzincan, Türkiye. The study employed a quasi-experimental design with a pre-test and post-test control group. Activities related to the pressure unit in the 2018 Ministry of Education (MoNE) science curriculum were implemented in the schoolyard for the experimental group, while the same activities were conducted in the classroom for the control group over 10 lesson hours. Data were collected using the Pressure Achievement Test (PAT), the Motivation Scale for Learning Science (MSLS), and the Attitude Towards Science Course Scale (ASTSC). Independent samples t-test was used for data analysis. The findings indicate that the OCL environment had no statistically significant effect on students' academic achievement or attitudes toward science lessons but resulted in a significant increase in their motivation to learn science in favor of the experimental group. The results were compared with existing literature on OCL and they emphasized the importance of planning OCL applications over longer durations for more effective outcomes. This study makes a unique contribution to the utilization of OCL environments, particularly schoolyards, in education.

Keywords: Out-of-class learning, science education, schoolyards

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1. Introduction

Science is the systematic effort to observe, investigate, and understand the universe, environment, and natural phenomena through planned and structured methodologies. It involves making inferences, predicting outcomes, and justifying observed phenomena (Kaptan & Korkmaz, 1999). In the contemporary educational landscape, the primary aim of science teaching is not merely the transmission of information but equipping learners with the ability to acquire, analyze, and connect information meaningfully. This aligns with the evolving demands of the 21st century, where students must solve real-world problems through critical thinking and application rather than rote memorization.

Science education plays a pivotal role in fostering these skills, as it encourages students to explore their environment and the universe through a scientific lens. Research suggests that science is inherently experiential, emphasizing hands-on learning and active engagement. However, restricting science teaching to classroom settings limits its potential to achieve these goals (Durel, 2018). Effective science education requires diverse learning environments, including out-of-class learning (OCL) settings, to fully integrate the natural and social worlds into the learning process. These environments, such as school gardens, science centers, and nature reserves, act as living laboratories, enhancing students' understanding by connecting abstract concepts to real-world experiences (Bowker&Tearle, 2007).

Active participation in the learning process has been consistently recognized as a critical factor for effective education (Aydede & Matyar, 2009). Constructivist learning theory emphasizes that learners actively construct their understanding and knowledge through experience and reflection (Wheatley, 1991). This theory underpins the pedagogical shift towards inquiry-based and experiential learning methods. Science education aligned with constructivist principles encourages students to explore, hypothesize, and test ideas, fostering skills such as critical thinking, problem-solving, and creativity (Gürsoy, 2018).

OCL environments uniquely address these pedagogical goals. By offering multisensory and hands-on learning opportunities, they enable students to engage directly with natural phenomena, fostering deeper understanding and retention (Eshach, 2007). These environments also align with students' developmental needs, particularly in primary and secondary education, where active and experiential learning is critical (Kaptan & Korkmaz, 1999). Studies consistently show that outdoor learning programs enhance motivation, attitudes toward science, and academic achievement (Mann et al., 2022).

Despite the recognized benefits of OCL environments, their integration into mainstream education remains limited. Traditional classroom practices often emphasize passive learning methods, which do not adequately support the development of scientific literacy. Outdoor learning environments, such as school gardens, provide opportunities for students to observe, experiment, and interact with real-world contexts, enhancing the relevance and applicability of scientific concepts (Khan et al., 2020).

Creating active and engaging learning environments is a cornerstone of modern science education. Schools, as structured institutions, are often constrained by time, resources, and traditional practices, which limit the incorporation of innovative learning strategies. However, the potential of OCL environments to complement and enhance in-class learning cannot be understated. These spaces not only support academic goals but also contribute to the holistic development of students, fostering environmental awareness, collaboration, and curiosity (Bowker & Tearle, 2007).

This study contributes to the growing body of literature by exploring the impact of OCL environments on students' academic achievement, motivation, and attitudes toward science. By focusing on school gardens, it addresses a gap in the existing research, which has predominantly examined more formalized OCL settings, such as science centers. Through this lens, the study aims to provide practical insights for educators, policymakers, and researchers to better integrate OCL environments into science curricula.

1.1. The Theoretical Framework of the Study

The development of diverse learning-teaching methods and techniques has transformed education, emphasizing the importance of creating engaging and inclusive learning experiences (Mann et al., 2022). As Karakaya (2016) noted, effective teaching increasingly requires the use of various approaches and environments to accommodate diverse learning needs. With the expansion of learning resources, keeping students confined solely to classroom-based instruction has proven insufficient. Consequently, utilizing every possible educational opportunity, including out-of-class environments, has gained prominence (Mann et al., 2022; Khan et al., 2020).

The concept of Out-of-Class Learning (OCL) has emerged in response to these challenges, broadening the definition of learning spaces to encompass both classroom and external environments (Mann et al., 2022). While initially considered risky by some parents and educators, the growing body of research has established OCL as a vital component of holistic education. Wagner (2000) argued that the term “learning outside” could eventually become as universally accepted as “learning in the classroom,” emphasizing the integration of diverse environments into education. For a truly inclusive educational approach, it is essential to design programs that treat classroom and out-of-class environments as complementary components of a cohesive learning strategy. These programs should focus on creating opportunities for active, experiential, and contextually relevant learning (Demirdirek, 2019).

1.1.1. Out-of-Classroom Learning Environments

Out-of-classroom environments are spaces that enable students to engage actively with their surroundings, offering inclusive, multisensory, and first-hand learning experiences. These environments allow students to explore living elements, such as plants and animals, and non-living elements, such as sound, sunlight, soil, and air, in ways that traditional classrooms cannot (Civelek & Özyılmaz-Akamca, 2018).

School gardens, in particular, serve as ideal OCL settings. They are accessible, controllable environments that can mitigate potential risks while fostering hands-on learning opportunities. These spaces facilitate the transition from abstract concepts to real-world applications, enriching students’ understanding and engagement with scientific phenomena. As Bowker and Tearle (2007) emphasized, school gardens are not only cost-effective and manageable but also invaluable resources for integrating formal education content into meaningful, experiential activities.

1.1.2. Out-of-Class Learning (OCL) in Context

Out-of-Class Learning (OCL) encompasses any educational activity conducted outside the traditional classroom setting (Beames et al., 2023). While terms such as "out-of-school activity," "outdoor learning," and "outdoor education" are often used interchangeably, this study adopts "Out-of-Class Learning" to highlight its integration within formal education systems, particularly in school gardens.

Unlike informal education, OCL is structured, planned, and curriculum-based, adhering to specific learning objectives (Beames et al., 2023; Ertaş et al., 2011). It combines the flexibility of external environments with the rigor of formal education, creating opportunities for active engagement and deeper learning (Okur-Berberoğlu & Uygun, 2013). Karademir (2013) further underscores that OCL activities are designed to complement classroom instruction, ensuring alignment with curricular goals and enhancing the overall learning experience.

1.1.3. Why Use "Out-of-Class" Instead of "Out-of-School"?

The decision to use "Out-of-Class Learning" rather than "Out-of-School Learning" in this study reflects a conceptual distinction grounded in both linguistic precision and educational practice. While "out-of-school" often implies informal, extracurricular, or unsupervised activities, "out-of-class" explicitly denotes structured, teacher-led, and curriculum-integrated learning experiences. This distinction aligns with the study's focus on utilizing school gardens as formal learning environments, bridging classroom and outdoor experiences within the boundaries of formal education. International research supports this distinction, as OCL environments are increasingly recognized for their ability to provide complementary, context-rich learning opportunities within existing educational frameworks (Beames et al., 2023).

1.2. Related Studies

1.2.1.Out-of-Class Learning (OCL) in Educational Contexts

Out-of-class learning (OCL) encompasses educational activities conducted beyond traditional classroom walls. Such environments include school gardens, science centers, museums, nature trails, and various community sites. OCL often fosters experiential, student-centered learning linked to real-world contexts, allowing students to apply theoretical knowledge to tangible experiences. Studies indicate that OCL can elevate student engagement, motivation, and overall learning quality (Beames et al., 2023; Cliffe & Cherrington, 2021; Dillon et al., 2016; Mygind et al., 2021). Curriculum-based outdoor learning has been shown to improve students' connection to subject matter, enhance engagement, and encourage positive perceptions of learning. Similarly, learning in outdoor environments provides authentic contexts for developing a range of cognitive and affective skills (Beames et al., 2023; Cliffe & Cherrington, 2021; Dillon et al, 2016).

1.2.2. Common OCL Environments in Science Education

Within science education, science centers and structured informal learning environments have historically been the focal points of OCL research. Systematic reviews of postgraduate theses in Turkey indicate that science centers are the most frequently studied OCL environments in science education (Gürsoy & Yıldırım Polat, 2023; Şahin & Asal Özkan, 2023). Such settings offer abundant experimental setups and materials that support inquiry-based learning and long-term knowledge retention. Although museums, nature sites, and botanical gardens also provide rich learning contexts, they have received comparatively less attention. Notably, school gardens remain underrepresented, suggesting untapped potential for easily accessible, low-cost OCL environments that can be integrated into the regular school schedule (Cliffe & Cherrington, 2021; Passy, 2014).

1.2.3. Impact of OCL on Academic Achievement

A substantial body of literature demonstrates that OCL can positively influence academic achievement, particularly in science. Various review studies and empirical findings support the notion that OCL activities enhance students' academic performance (Bodur & Yıldırım, 2018; Gürsoy & Yıldırım Polat, 2023; Khan et al., 2020; Mann et al., 2022; Sözer, 2015; Şahin & Asal Özkan, 2023). For example, Çakmak and Bozdoğan (2022) showed that garden-based OCL activities improved fifth graders' science achievement and reduced anxiety. Similarly, Bodur and Yıldırım (2018) found that OCL designed for a "Space Riddle" unit boosted seventh graders' academic achievement and scientific process skills. Additional studies focusing on topics such as "Force and Motion" (Bozdoğan & Kavcı, 2016) and "Electricity and Magnetism" (Anderson et al., 2000) reinforce the positive impact of OCL on learning outcomes.

However, not all research reports significant academic gains. Kazaklı (2020) found no statistically significant difference in academic achievement related to OCL on the "Transmission of Electricity" unit, though motivational factors improved. Similarly, Çağlar (2019) noted that combining formal and non-formal learning approaches did not yield significant changes in fifth graders' achievement, even though attitudes improved. These mixed results highlight that while OCL often supports academic performance, various factors such as the duration of the intervention, the infrastructural quality of the learning environment, and the pedagogical approaches adopted can influence outcomes (Beames et al., 2023; Quibell et al., 2017).

1.2.4. Effects of OCL on Motivation and Attitude

Motivation and attitude are critical for sustained engagement and effective learning. OCL environments commonly enhance intrinsic motivation and cultivate positive attitudes, as they expose learners to hands-on, authentic experiences (Beames et al., 2023; Cliffe & Cherrington, 2021). Studies indicate that OCL can foster curiosity, enjoyment, and a willingness to engage deeply with academic content, which may indirectly support achievement over time (Khan et al., 2020; Mann et al., 2022).

Meta-analytic research by Sayed, Karakuş, and Kanadlı (2023) revealed that OCL activities moderately improve students' motivation and attitudes toward learning. At the preschool level, Civelek and Özyılmaz-Akamca (2018) reported that outdoor activities bolstered children's fundamental scientific process skills, suggesting that positive motivational and attitudinal effects can begin early in a student's educational journey. Similarly, Zeren Özer and Güngör (2019) found that while science center-based OCL did not significantly enhance academic achievement, it did increase students' motivation—highlighting the possibility that motivational gains may precede or facilitate later academic improvements.

1.2.5. OCL Across Disciplines and Skills

Although OCL research frequently centers on science education, evidence suggests its benefits are not domain-specific. Karakaş-Özür and Şahin (2017) documented improved student achievement in social studies through OCL, while Demirdirek (2019) demonstrated that OCL activities focused on environmental education bolstered environmental literacy, scientific process skills, and creativity. Furthermore, research indicates that OCL can encourage interdisciplinary thinking and develop a range of cognitive, affective, and psychomotor skills, supporting broader curriculum goals (Beames et al., 2023; Cliffe & Cherrington, 2021)

1.2.6. The Understudied Potential of School Gardens as OCL Environments

Despite evidence of OCL's overall effectiveness, school gardens remain an underexplored setting. School gardens offer a unique, accessible venue for experiential learning, allowing students to directly observe natural processes, conduct experiments, and apply classroom knowledge to real-life scenarios (Hagger & Hamilton, 2018; Passy, 2014). Although some studies (e.g., Çakmak & Bozdoğan, 2022) highlight positive outcomes of garden-based OCL on achievement and anxiety reduction, further research is needed to understand how garden-based lessons influence motivation, attitudes, and long-term academic growth across different grade levels.

1.3. Purpose and importance of the study

This study aims to determine the direct influence of an out-of-class learning (OCL) environment on students' academic achievement, motivation to learn science, and attitudes toward science courses, specifically addressing the "Pressure" unit of the 8^{th}-grade science curriculum. Increasing learners' curiosity, engagement, and willingness to learn are fundamental objectives in education. While traditional classroom-based instruction can be effective, it may limit opportunities to foster these essential motivational factors. Research indicates that students often become more engaged and motivated when exposed to varied learning environments that allow them to explore and interact with content in authentic, real-world contexts.

Despite growing interest in OCL, the literature has primarily focused on highly specialized venues—such as science centers, museums, and nature-based settings—or on the effects of carefully designed activities within these spaces (Gürsoy & Yıldırım Polat, 2023; Şahin & Asal Özkan, 2023). However, school gardens, which are easily accessible and potentially cost-effective OCL spaces, remain underexamined. Current research tends to conflate the influence of the OCL environment with the specific teaching methods or activities implemented there, making it difficult to discern the environment's direct effect on key educational outcomes like achievement, motivation, and attitudes.

To address this gap, the present study uniquely isolates the role of the OCL environment itself. By employing the same curricular content, methods, and activities across both traditional indoor settings and outdoor garden settings, this research enables a more accurate assessment of how simply moving beyond the conventional classroom may impact students' learning experiences. This approach differs from prior investigations, which often attribute observed benefits to OCL-based interventions without distinguishing the contribution of the physical learning environment.

1.4. Research Questions

R1) Does exposure to a school garden-based out-of-class learning environment significantly impact 8th-grade students' academic achievement in the "Pressure" unit of their science course?

R2) Does exposure to a school garden-based out-of-class learning environment significantly impact 8th-grade students' motivation to learn science?

R3) Does exposure to a school garden-based out-of-class learning environment significantly impact 8th-grade students' attitudes toward science?

2. Method

2.1. Research Design

This study employed a quasi-experimental design featuring a pre-test and post-test with a control group. In experimental research, comparisons can be made within a single group over time or between different groups exposed to various conditions (Karasar, 2016). For this investigation, two groups were formed—an experimental group and a control group—using non-random assignment. Both groups completed pre-tests and post-tests related to academic achievement, motivation to learn science, and attitudes toward science. The experimental group received instruction in a school garden, serving as the OCL environment, while the control group continued learning in a traditional classroom setting. Through this design, the study aimed to isolate and assess the direct impact of the OCL environment on key learning outcomes.

2.2. Working Group

This study was conducted at a public middle school in Erzincan located in Türkiye. The population of the study consisted of 8th-grade students from the school, and a convenience sampling method was employed to select the participants. Convenience sampling allows the researcher to access a readily available and easily accessible group of participants; however, it can reduce objectivity since the researcher exercises discretion in selecting the sample (Kılıç, 2013).

A total of 32 eighth-grade students (18 female and 14 male) participated in the study. To form the experimental and control groups, these 32 students were first identified using convenience sampling and then randomly assigned to either the experimental or the control group. As a result, 16 students comprised the control group and 16 students comprised the experimental group. This random assignment aimed to ensure that neither group would have a pre-existing advantage, thereby allowing a more accurate assessment of the effect of the out-of-class learning environment on academic achievement, motivation, and attitudes toward science.

2.3. Data Collection Tools

Data were collected using three instruments: the Pressure Achievement Test (PAT), the Motivation Scale for Learning Science (MSLS), and the Attitude Towards Science Course Scale (ASTSC). Permissions for these measures were obtained from their respective authors.

2.3.1. Pressure Achievement Test (PAT)

The PAT (Özcan, Koca & Söğüt, 2019) is a 20-item multiple-choice test designed to assess student achievement in the "Pressure" unit. The original test showed satisfactory reliability (KR-20 = .73), and re-analysis for this study yielded an internal consistency coefficient of .847, indicating high reliability.

2.3.2. Motivation Scale for Learning Science (MSLS)

The MSLS (Dede & Yaman, 2008) is a 23-item, 5-point Likert-type scale measuring students' motivation to learn science. Previous studies reported a reliability coefficient (Cronbach's Alpha) of .80. In this study, reliability was .806, confirming its suitability for the sample.

2.3.3. Attitude Scale Towards Science Course (ASTSC)

The ASTSC (Taşkın & Aksoy, 2019) is a Likert-type scale that measures students' attitudes toward science courses. Previous validations demonstrated acceptable reliability across its factors (α ranging from .64 to .78). In this study, the overall reliability coefficient was .747, indicating a reliable measure.

2.4. Implementation of the Study

The study took place at a public middle school during the instruction of the "Pressure" unit in the 8th-grade science curriculum. The unit spanned 10 lesson hours, following guidelines set by the Ministry of National Education (MoNE, 2018). Both the experimental and control groups received the same lesson plans and worksheets, all aligned with the specified unit outcomes. These materials were developed according to the 5E instructional model and reviewed by two academic experts and two experienced science teachers to ensure their appropriateness.

The core learning objectives, as outlined by the MoNE (2018) Science Curriculum, included enabling students to:

- Discover variables affecting solid pressure through experimentation,
- Predict variables affecting liquid pressure and test their predictions,
- Identify real-life and technological applications of the pressure properties of solids, liquids, and gases.

The topic of pressure provides an ideal context for comparing the effects of indoor and outdoor learning environments on students' academic achievement, motivation to learn science, and attitudes toward the subject. By having both groups perform the same experiments, the variable being examined is not the content or method of the experiments, but the learning environment itself. This approach ensures that any differences in outcomes between the two groups can be attributed to the environment in which the experiments were conducted. For instance, experiments such as measuring water pressure at different depths or examining the relationship between surface area and pressure are addressed at a more abstract level in the classroom, while in an outdoor setting, students have the opportunity to conduct these experiments in a real-world context. This allows the outdoor group to directly observe and relate their experiences to nature, potentially fostering a deeper understanding of the concept.

By keeping the experimental procedures identical for both groups, the study isolates the learning environment as the key variable, providing an objective comparison of the advantages of outdoor learning environments. This comparison offers valuable insights into how outdoor learning can enhance traditional classroom instruction, demonstrating its potential to bridge the gap between theoretical knowledge and practical, real-life applications.

Both groups worked with identical activities and worksheets during the lessons. The key difference was the learning environment: the experimental group conducted the same activities outdoors in the school garden, while the control group remained indoors in a conventional classroom setting. After completing the 10-lesson sequence, both groups were assessed using the Pressure Achievement Test (PAT), the Motivation Scale for Learning Science (MSLS), and the Attitude Towards Science Course Scale (ASTSC).

The “Pressure” unit was taught over a total of 10 lesson hours. Both the experimental and control groups followed the same lesson plans aligned with the Ministry of National Education (MoNE, 2018) Science Curriculum outcomes, using the 5E model (Engage, Explore, Explain, Elaborate, Evaluate). The key difference was the learning environment:

- **Experimental Group:** Conducted lessons and activities in the school garden, serving as the out-of-class learning environment.
- **Control Group:** Conducted the same lessons and activities in the traditional classroom.

Out-of-Class Learning (OCL) Stages: In accordance with OCL best practices, the activities were structured in three main stages for the experimental group:

1. Pre-Visit (Preparation) Stage: Students were introduced to key concepts, objectives, and safety rules in the classroom before going outside.
2. On-Site (Implementation) Stage: Students engaged in hands-on learning activities in the school garden, using simple tools, real objects, and natural surroundings to understand pressure concepts.
3. Post-Visit (Follow-Up) Stage: Students returned to the classroom to reflect on their experiences, analyze data, and connect observations to scientific principles, reinforcing learning through discussion and evaluation.

2.5. Data Analysis

Before conducting further statistical analyses, the pre-test scores on the Pressure Achievement Test (PAT), the Motivation Scale for Learning Science (MSLS), and the Attitude Towards Science Course Scale (ASTAC) for both the experimental and control groups were examined. Descriptive statistics for each measure are presented in Table 1. To assess the normality of the data, skewness and kurtosis values were evaluated. According to George and Mallery (2010), skewness and kurtosis coefficients within the range of ±2 indicate that the data can be considered normally distributed.

Table 1.

Descriptive Statistics of the Scales Used in the Study

Scale	Group	N	$\bar{x}$	SD	Min	Max	SC	KC
PAT	Control	16	8.94	3.39	2	14	.348	.404
	Experimental	16	8.19	2.76	3	13	.201	.545
MSLS	Control	16	95.69	8.37	83	113	.608	.096
	Experimental G	16	93.62	11.72	72	110	.743	.407
ASTSC	Control	16	49.00	5.03	40	59	.298	.56

Experimental	16	45.93	5.65	36	55	.023	.983

Evaluations of the skewness and kurtosis coefficients for the experimental and control groups' pre-test data confirmed that the distributions were normal. Because the sample size in each group was 16, the Shapiro-Wilk test was also employed to assess normality (Shapiro & Wilk, 1965; Büyüköztürk, 2013). A p-value greater than .05 from the Shapiro-Wilk test indicates no significant deviation from normality, thus confirming that the data are normally distributed (Mertler & Vannatta, 2005). The results of the Shapiro-Wilk test for pre-tests are presented in Table 2.

Table 2.

Normality Test Results of the Scales Used in the Study

		Shapiro- Wilk		
Scale	Group	W	df	p
PAT	Control	.963	16	.721
	Experimental	.969	16	.819
MSLS	Control	.959	16	.648
	Experimental	.911	16	.123
ASTSC	Control	.966	16	.769
	Experimental	.971	16	.859

As Table 2 shows, the p-values for all tests and scales in both groups exceed .05, confirming that the distributions are normal. Moreover, there were no significant differences between the groups' pre-test scores, indicating that the experimental and control groups were homogeneously distributed prior to the intervention. Since all conditions for normality were met, the independent samples t-test, a parametric statistical technique, was chosen for subsequent analyses.

3. Findings

3.1. Findings Related to PAT

Descriptive and normality analyses were performed for the PAT post-test to determine whether the sample was normally distributed. Then, an independent t-test was conducted to determine whether the difference in post-test mean scores was significant. The results of the independent groups t-test analysis are given in Table 3.

Table 3.

Independent t-test Results for Pressure Achievement Test Post-Test Scores

Group	N	$\bar{x}$	SD	t	p
Control	16	16.19	2.56	-0.414	.681
Experimental	16	16.50	1.59		

In Table 3, according to the PAT post-test scores of the students after the teaching activities, it is seen that the average of the group that taught in the classroom was X = 16.19 and the average of the group that taught in the garden was $\bar{X}$ = 16.50. There is a difference of 0.31 points between the posttest mean scores of the control and experimental groups in favor of the experimental group. The difference between the post-test scores of the groups after the teaching activities was not statistically significant ($t_{0.05}$=0.681). Based on this statistic, it can be said that there was no difference in terms of students' academic achievement after the implementation.

3.2. Findings Related to MSLS

For the MSLS post-test, descriptive and normality analyses were conducted to determine whether the sample was normally distributed. Then, an independent t-test was conducted to determine whether the difference between the post-test mean scores was significant. The results of the independent samples t-test analysis of whether the difference between the post-test mean scores was significant are given in Table 4.

Table 4.

Independent t-test Results Regarding Motivation Scale Scores for Learning Science

Group	N	$\bar{x}$	SD	t	p
Control	16	98.37	5.58	-3.517	.001
Experimental	16	104.12	3.40		

According to the results of the analysis obtained from the motivation scale applied after the teaching activities in Table 4, it is seen that the group that taught in the classroom had an average of $\bar{X}$ = 98.37, while the group that taught in the school garden had an average of $\bar{X}$ = 104.12. There is a difference of 5.75 points between the post-test mean scores of the control and experimental groups in favor of the experimental group. There was a statistically significant difference between the post-test scores of the groups ($t_{0.05}$=0.001). Based on this statistic, student motivation significantly differed after the implementation.

3.3. Findings Related to ASTSC

After it was confirmed that the populations from which the samples were selected for ASTSC pre-test scores were normally distributed and that there was no statistically significant difference, ASTSC post-test data of the experimental and control groups were analyzed. For the ASTSC post-test, descriptive and normality analyses were conducted to determine whether the sample was normally distributed. Then, an independent t-test was conducted to determine whether the difference between the post-test mean scores was statistically significant. The results of the independent samples t-test analysis for the statistical significance of the difference between the mean scores administered after the instructional activities are given in Table 5.

Table 5.

Independent t-test Results Regarding ASTSC

Group	N	$\bar{x}$	SD	t	p
Control	16	50.93	3.41	-1.773	.086
Experimental	16	53.00	3.16		

When the students' academic achievement post-test scores are analyzed in Table 5, it is seen that the control group's average was $\bar{X}$ = 50.93, and the average of the experimental group was $\bar{X}$ = 53.00. There is a difference of 2.07 points between the post-test mean scores of the control and experimental groups in favor of the experimental group. There was no statistically significant difference between the post-test scores of the control and experimental groups ($t_{0.05}$= 0.086). Based on this statistic, there is no difference in students' attitudes after the application.

4. Results, Discussion and Recomendations

4.1. Results and Discussion

This section presents the study's findings on academic achievement, motivation, and attitudes, integrating both the current study's results and previous research.

4.1.1. Results on Academic Achievement (PAT)

The independent samples t-test conducted on the PAT post-test scores indicated an increase in both the control and experimental groups' arithmetic means after the instructional period. However, there was no statistically significant difference favoring the group taught in the school garden as an out-of-class learning (OCL) environment. In other words, teaching the "Pressure" unit outdoors did not lead to higher academic achievement compared to the traditional classroom setting (R1). This finding contrasts with many studies suggesting that OCL positively affects students' achievement, interest, and problem-solving skills (Beames et al., 2023; Becker et al., 2017; Falk, 1997; Falk & Adelman, 2003; Falk & Storksdieck, 2010; Hagger & Hamilton, 2018; Khan et al., 2020; Mann et al., 2022; Olson, Cox-Petersen & McComas, 2001; Otte et al., 2019). However, these prior studies often integrated specialized teaching methods and activities (e.g., argumentation, predict-observe-explain, the 5E model) designed specifically for OCL contexts. Thus, their positive results may reflect the effect of these innovative instructional strategies rather than the environment itself.

Our findings align with studies that found no significant improvement in academic achievement when teaching was conducted in out-of-class environments. Zeren Özer and Güngör (2019) and Kazaklı (2020) similarly reported no increase in students' achievement after instruction in OCL settings. Kazaklı (2020) attributed the null effect to constraints such as limited time and inadequate physical conditions. Short instructional periods and insufficient infrastructure can diminish the potential benefits of OCL (Beames et al., 2023; Becker et al., 2017; Çağlar, 2019; Gürkan, 2019; Hagger & Hamilton, 2018; Karatekin & Çetinkaya, 2013).

4.1.2. Results and Discussion on Motivation (MSLS)

Analysis of the MSLS post-test scores revealed a statistically significant difference in favor of the experimental group taught in the school garden. This indicates that using the school garden as an OCL environment enhanced students' motivation to learn science (R2).

These findings resonate with meta-analytic results showing that OCL can positively influence students' motivation (Sayed, Karakuş & Kanadlı, 2022). Other studies have similarly demonstrated that OCL's authentic, real-world contexts spark curiosity, reduce anxiety, and foster greater interest in the subject (Beames et al., 2023; Bodur, 2015; Cliffe & Cherrington, 2021; Dillon et al., 2016; Hagger & Hamilton, 2018; Gürkan, 2019; Mann et al., 2022; Mygind et al., 2021). When learning moves beyond the confines of the classroom, students often find science more engaging and relevant, thus increasing their intrinsic motivation and potentially setting the stage for more sustained educational benefits.

4.1.3. Results and Discussion on Attitudes toward Science (ASTSC)

The post-test results for the ASTSC showed no significant difference between the experimental and control groups. Thus, integrating a school garden as the learning environment did not yield a statistically meaningful improvement in students' attitudes toward science (R3). Attitudes are often resistant to change over short periods. The 10-lesson intervention may have been too brief to influence such deeply rooted affective variables. Attitude formation and change generally require long-term exposure, multiple positive experiences, and reinforcement (Arslan, 2006; Mertler & Vannatta, 2005). Some studies (e.g., Ürey & Çepni, 2014) reported mixed results on attitude shifts after OCL interventions, and others (Yazkan, 2012) have shown that longer durations or more intensive OCL programs can influence attitudes. Thus, while this short-term study did not affect attitude, extended or repeated OCL experiences may yield more favorable attitudinal outcomes.

The interplay among academic achievement, motivation, and attitude is complex. While this short intervention did not improve academic achievement or attitudes, it did enhance motivation. Previous research indicates that motivation is a critical driver of academic performance and can influence attitude formation over time (Hagger & Hamilton, 2018; Gürkan, 2019; Mann et al., 2022; Mygind et al., 2021; Oliver & Simpson, 1988; Özdemir & Dindar, 2013; Turhan et al., 2008). With extended OCL implementations and improved resources, the initially enhanced motivation may eventually translate into higher academic achievement and more positive attitudes.

4.2. Conclusion

This study contributes to the OCL literature by isolating the effect of the environment itself, rather than the methods or activities typically associated with OCL. Despite no immediate gains in academic achievement or attitude, the significant improvement in student motivation highlights the potential value of OCL environments. In the short term, teaching the "Pressure" unit in the school garden did not surpass traditional classroom instruction in terms of achievement or attitude. However, the increase in motivation suggests that OCL environments could be a stepping stone toward more meaningful and lasting educational improvements. Given that motivation correlates positively with both achievement and attitude (Dede & Yaman, 2008; Hagger & Hamilton, 2018; Gürkan, 2019; Mann et al., 2022; Mygind et al., 2021; Oliver & Simpson, 1988), extending the duration of OCL experiences and addressing infrastructural shortcomings may yield more pronounced benefits.

Ultimately, this study underscores the need for more comprehensive, long-term research, improved physical conditions in school gardens, and the integration of newer, more international references to better understand how OCL environments can enrich teaching and learning in science

4.3. Limitations and Recommendations

This study was limited by its short implementation period, the reliance on a single subject unit (Pressure), and the focus on a specific grade level. Additionally, infrastructural constraints in the school garden may have restricted the potential benefits of the out-of-class learning (OCL) environment. In light of these limitations, future research should consider extending the duration of OCL interventions, as the 10-hour implementation may have been too brief to influence academic achievement or alter deeply ingrained attitudes. Longer and more frequent exposures to OCL environments could allow the observed motivational increases to translate into enhanced cognitive outcomes over time. Improving the physical quality and educational resources of OCL settings, such as school gardens, may also yield stronger results. Adequate infrastructure, tools, and materials can support more engaging, hands-on learning experiences that go beyond what can be achieved indoors. Broadening the scope of the investigation would be beneficial. Studies comparing OCL with alternative teaching methods, integrating both formal and informal learning experiences, and examining a variety of subjects and grade levels could provide insights into the most effective contexts and instructional strategies. In addition, incorporating digital technologies, such as virtual field trips or augmented reality apps, may mitigate environmental limitations and offer diverse, interactive opportunities for learning.

Longitudinal and mixed-methods designs could deepen understanding of how motivation, attitude, and achievement evolve over time. Such approaches, complemented by qualitative data, would clarify why certain OCL interventions succeed or face challenges. Finally, engaging with newer, international literature can help situate findings within a broader educational landscape, informing globally relevant best practices for implementing OCL in diverse settings.

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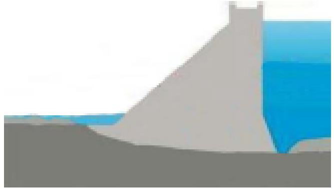
Appendix 1

EVENT 2



What is the reason why the dam walls thicken downwards? Explain.

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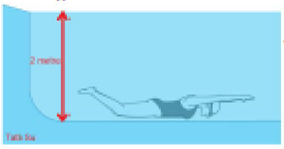
In two pools 2 meters deep, one filled with fresh water (drinking water) and the other with salt water (sea water), it is more difficult to swim in the bottom of the one filled with salt water? Explain why.



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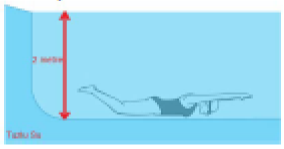
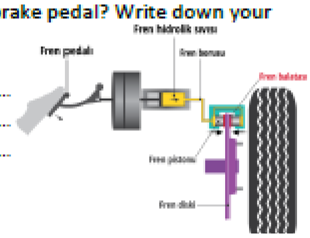


How can a truck carrying a load of tons of mass be stopped by pressing a brake pedal? Write down your guesses.



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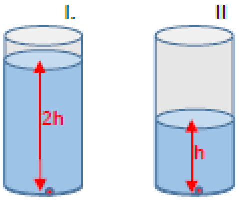
Let's explore

Pressure: The perpendicular force exerted by solid, liquid or gaseous substances on the object they are in contact with is called pressure.

The pressure that a liquid will exert on the point with which it is in contact;

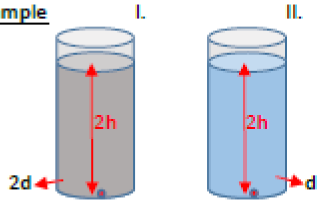
- Depth (height) of the liquid,
- The density (mass) of the liquid,
- It depends on the gravitational force of the point of measurement.

Example I. II



Liquid pressure at the point I > II

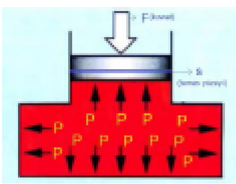
Example I. II.

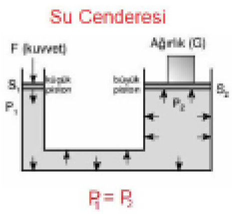


Liquid pressure at the point I > II

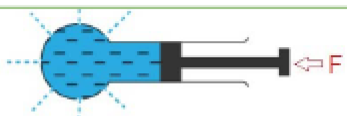
★ Liquid pressure increases with increasing depth and increases with increasing density.

★ In liquid pressure, the amount of liquid, the shape of the container and the size of the contact surface of the container with the ground are not important.





Liquids cannot be compressed. A liquid can be compressed by the contact surface of an applied force. As a result of the pressure on it, and this pressure is exactly the same in every direction. transmits. This fact is called Pascal's Principle. This property of liquids is important in daily life. Used in many fields.



Answers

- In liquids, the pressure increases as the depth increases, so the pressure is higher at the depth of the water