Review Article

Using the water pollution of Lake Pamvotis for science education in high school and college

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ARTICLE INFO	ABSTRACT
Received: 18 Feb. 2024 Accepted: 17 May 2024	This study examines the potential use of Lake Pamvotis water pollution as a teaching tool in science education. Teachers can develop engaging and informative lessons addressing critical environmental issues by analyzing the water quality data and identifying the pollutants in the lake. This approach allows students to understand the impact of pollution on aquatic ecosystems and encourages them to find solutions to mitigate the pollution effects. Further, using real-world examples such as Lake Pamvotis allows students to apply their scientific knowledge and critical thinking skills to address environmental challenges. The study begins with an introduction that provides an overview of using Lake Pamvotis water pollution in the context of science teaching in education. The introduction follows a literature review describing relevant research and related studies. Then, it discusses the methodology used in the study. The study concludes with a discussion of the implications of the results and suggestions for further research.

INTRODUCTION

Lake Pamvotis, also known as Lake Ioannina, is a large lake in northwest Greece. It covers a surface area of about 23. 9 km^2 and has a depth of 8 m. Lake Pamvotis is a vital water resource for Ioannina and its surrounding areas. It provides water and supports various economic activities such as agriculture and tourism. Nevertheless, due to urban and industrial activities, the lake has recently faced significant water pollution in its catchment area. The primary sources of pollution include agricultural and domestic wastewater and industrial waste. These pollutants have led to water quality degradation, biodiversity loss, and the growth of harmful algae blooms in the lake (Perrakis-Kollias, 2023).

Environmental and water pollution issues are essential topics in science education because they provide students with valuable knowledge about the impact of human activities on the environment and the importance of water conservation. Students can develop critical thinking skills and an understanding of ecological systems by studying the sources and consequences of water pollution. Furthermore, teaching water pollution as an important part of science education allows students to recognize the connection between scientific concepts and real-world issues, fostering a sense of environmental responsibility.

One of the leading causes of water pollution in Lake Pamvotis is the discharge of untreated or partially treated sewage. The lake receives effluents from domestic households, industries, and agriculture in the surrounding area. The lack of adequate wastewater treatment facilities and inadequate management of the sewage systems contribute to the release of pollutants into the lake.

Also, illegal sewage system connections add to the problem. These discharges introduce high levels of nutrients, organic matter, and pathogens into the lake, which causes eutrophication (Kapsalis & Kalavrouziotis, 2021) and decreased water quality (Moschos et al., 2021). The accumulation of pollutants in the lake can harm aquatic life and pose harmful health effects (Kagalou et al., 2002). Effective sewage management and implementing correct treatment plants are critical to addressing this issue and improving the water quality in Lake Pamvotis (Papastergiadou et al., 2010).

Lake Pamvotis is subject to various types of pollution. One of the primary pollutants in the lake is waste from nearby settlements and industries. This wastewater contains high nutrients such as nitrogen and phosphorus, which can cause eutrophication and harmful algae blooms (Peppa et al., 2020). Another important pollutant is sediment runoff from agriculture and construction activities, which can contribute to increased turbidity and reduced water quality. Additionally,

the lake is affected by a vast amount of solid waste, including plastics and other non-biodegradable materials, which leads to environmental degradation. Heavy metals such as lead and mercury are another problem, mainly due to industrial activities in the region (Ioannides et al., 2015). These pollutants pose significant challenges to the ecological balance and water quality of Lake Pamvotis (Schmidtke, 1988).

Pollution in the water significantly impacts the lake ecosystem, affecting aquatic organisms and the overall ecological balance. One of the immediate effects of water pollution is the depletion of oxygen levels in the lake, leading to hypoxia and damaging many aquatic species. In polluted water, excess nitrogen and phosphorus actively support harmful algae blooms, increasing oxygen depletion and resulting in the death of fish and other organisms. The presence of toxic chemicals and heavy metals in the water can bioaccumulate in the tissues of organisms (Stalikas et al., 1994), causing long-term health issues and disrupting the food network. These pollutants also impact human health as they can contaminate the water supply and pose a risk to individuals eating contaminated fish or water (Ovcharuk et al., 2022). Water pollution has long-lasting consequences for the lake ecosystem, requiring urgent attention and effective measures to prevent further degradation.

Current efforts to address water pollution in Lake Pamvotis involve a combination of regulatory measures, research, and community involvement. The Greek Government has implemented several laws and regulations to reduce pollution in the lake. For example, treating domestic and industrial wastewater before it is discharged into the lake and establishing a wastewater treatment plant have significantly improved water quality (Latinopoulos et al., 2021).

The lake has also been investigated further by ongoing scientific research to understand the sources and impacts of pollution. This research provides valuable insights for developing effective strategies for preventing and mitigating pollution. Local communities and non-governmental organizations also actively raise awareness about water pollution and implement conservation practices (Potsikas et al., 2023). Educational programs and campaigns are organized to promote responsible behavior and sustainable resource use. These efforts aim to protect Lake Pamvotis and ensure its long-term ecological integrity.

INCORPORATING LAKE PAMVOTIS WATER POLLUTION IN SCIENCE CURRICULUM

Hands-on learning is crucial in science education as it improves students' understanding and retention of scientific concepts (Furtak & Penuel, 2018). Students can apply theoretical knowledge to real-world scenarios. Participating actively in experiments and investigations allows for a deeper understanding of scientific principles. This experiential learning also fosters critical thinking and problem-solving skills as students analyze data, draw conclusions, and make connections between different concepts. Hands-on activities promote student engagement and motivation, providing a

more enjoyable and interactive learning experience than traditional lecture-based approaches (Erickson et al., 2020). It is essential to develop scientific literacy and cultivate a curiosity-based mindset in science education (Ronchi, 1992)

For several reasons, studying water pollution in the local context is crucial. To address this problem, policymakers and stakeholders must first understand the specific sources and extent of water pollution in a local area. Studying water pollution in Lake Pamvotis, For example, can lead to strategies to reduce agricultural runoff or improve sewage treatment systems. Secondly, studying local water pollution allows the community to engage in a healthy environmental plan.

As citizens raise awareness about the impact of pollution on local water resources, they can be motivated to act and adopt sustainable behaviors to protect and preserve their environment (Dean et al., 2016). Lastly, studying local water pollution can contribute to scientific knowledge and understanding of ecological systems. By studying the effects of pollution on aquatic ecosystems and their associated biodiversity, researchers can generate valuable insights that can inform broader scientific studies and contribute to global efforts in water conservation (Rafols et al., 2019). Understanding the effects of pollution on the local environment is essential to addressing environmental issues, empowering communities, and advancing scientific knowledge.

Integrating topics on water pollution into science lessons is a crucial aspect of providing a comprehensive education about environmental issues. Students can develop a deeper understanding of the causes, effects, and solutions to the water pollution problem by incorporating lessons about water pollution. Science lessons can explore the various sources of water pollution, such as agricultural runoff, industrial waste, and sewage discharge, and their impact on ecosystems and human health. Students can also engage in hands-on activities such as water testing and analysis to gain practical skills in water quality monitoring (Sullivan et al., 2023).

Furthermore, by incorporating case studies such as Lake Pamvotis, teachers can provide real-world examples illustrating the consequences of neglecting water pollution. By addressing this problem in science lessons, students can develop a sense of responsibility toward environmental stewardship and be inspired to take action to protect our water resources (Uralovich et al., 2023).

Lake Pamvotis is an excellent case study for understanding the benefits of using water pollution in scientific teaching. The lake first experienced considerable pollution from human activities, making it a relevant and tangible example for students to study and analyze. Students can learn about the causes and consequences of water pollution and the potential solutions and mitigation strategies by examining Lake Pamvotis. The case study provides a further opportunity for interdisciplinary learning as students can explore the environmental, social, and economic consequences of water pollution in the region.

Ultimately, using Lake Pamvotis as a case study for water pollution enhances students' understanding of scientific concepts and empowers them to actively participate in addressing environmental issues.

DESIGNING TEACHING ACTIONS ON LAKE PAMVOTIS WATER POLLUTION

Environmental protection is crucial to a successful solution. Researchers must identify the key questions that will guide their research and help them understand the causes, consequences, and potential solutions for water pollution. What causes water pollution in Lake Pamvotis? How does water pollution affect wildlife? Can you list the health implications of drinking water? Can you list the best methods for water pollution control? Answering these research questions will provide valuable insights into the complex dynamics of water pollution, inform policy decisions, and contribute to protecting and restoring Lake Pamvotis and other polluted water bodies (Lemmen et al., 2023).

Selecting appropriate sampling methods for water analysis is crucial in ensuring accurate results. Depending on the specific parameters being measured and the study's objectives, different sampling techniques may be employed. For example, grab sampling, where a single water sample is collected at a specific location and time, helps assess instantaneous water quality conditions. Other methods, such as composite sampling, include collecting multiple samples at regular intervals and mixing them to obtain an average representative sample (Levy & Lemeshow, 2013). This method is especially useful in analyzing water pollution trends over time. Furthermore, stratified sampling, which involves dividing the water body into different zones and collecting samples from each zone, can provide valuable information about spatial variations in water quality. Proper sample preservation and handling techniques, such as using appropriate containers and minimizing contaminants, are also essential to maintain sample integrity throughout the analysis process (Dittmann et al., 2022). Therefore, understanding the specific sampling methods and their appropriate application is vital for accurate water analysis results.

Conducting experiments to measure water pollution levels is essential to assessing the sustainability of aquatic ecosystems. These experiments provide valuable data to help researchers make better-informed decisions about managing water resources and conservation efforts. Various methods and technologies are employed to measure water pollution, including physical, chemical, and biological assessments. Physical assessments may include measurement of turbidity temperature and dissolved oxygen levels. In contrast, chemical assessments focus on the concentration of pollutants such as heavy metals (Papagiannis et al., 2004), nutrients, and organic compounds. Biological assessments involve the evaluation of the presence and abundance of indicators, such as benthic macroinvertebrates, which can provide valuable insights into the ecosystem's overall health (Joudah & Fahad, 2023). Researchers can comprehensively understand each system's water pollution levels using these approaches. This provides a basis for effective environmental monitoring.

Analyzing and interpreting data collected from Lake Pamvotis provides valuable insights into water pollution and can help teachers improve their science knowledge. Studying nutrient levels, microbial populations, and pollutant concentrations will help researchers identify patterns and trends that help understand the lake's ecological health. A simple data analysis could reveal increased nitrogen and phosphorous levels, indicating excessive nutrient inputs from agriculture or urban runoff. Identifying contamination sources by microbial information or the presence of harmful pathogens can provide information about potential sources of contamination. Studying pollutant concentrations can further help identify the specific contaminants and assess their impact on the lake's ecosystem (Harahap & Absah, 2022). Analyzing and interpreting data from Lake Pamvotis allows scientists and educators to raise awareness about water pollution, develop informed conservation strategies, and promote scientific literacy among students.

ENGAGING STUDENTS IN FIELDWORK AT LAKE PAMVOTIS

Fieldwork is a key component of science education, providing students with hands-on experience and enhancing their understanding of scientific concepts. Students can observe natural phenomena in their environment, collect data, and make meaningful connections between theoretical knowledge and real-world applications by engaging in fieldwork. For instance, conducting fieldwork allows students in water pollution research to analyze water samples from a polluted lake like Lake Pamvotis, assess the levels of pollutants, and examine the impact of pollution on aquatic life. Students develop critical thinking skills, learn to apply scientific methods and gain a deeper appreciation for the scientific process through this process. The fieldwork further fosters a sense of curiosity and allows students to develop hypotheses, ask questions, and engage in problem-solving activities (Molefe & Aubin, 2023). Fieldwork is critical in science education by providing students with practical experiences that enrich their learning and foster a deeper understanding of scientific concepts.

Planning and organizing field trips to Lake PamvotisIt is essential to incorporate practical applications of water pollution in science education. These field trips permit students to observe the lake ecosystem firsthand, conduct water quality tests, and analyze the impact of pollution on aquatic life. The teacher must prepare a detailed itinerary outlining the excursion's objectives, activities, and safety protocols before the trip. A student should be provided with all the necessary materials and equipment for conducting experiments and collecting data. Coordinating with local environmental organizations and experts can provide valuable insights and enhance learning experiences. By carefully planning and organizing these field trips, educators can create meaningful learning opportunities that encourage students to understand water pollution and its environmental implications.

Currently, steps are being taken to study the pollution from the lake (Nikolopoulou et al., 2023; Spiliotis et al., 2020). Scientists can analyze the concentration and types of pollution present by collecting water samples from different locations within the lake (Kagalou et al., 2008). These samples can also measure water quality parameters such as pH, dissolved oxygen, and turbidity. On-site experiments can be conducted

to simulate different scenarios and observe the effects of pollution on the lake ecosystem. For example, mesocosms can be established to examine the effects of nutrient pollution on the growth of algae and aquatic plants (Peppa et al., 2020). On-site experiments combined with field sampling researchers can gather valuable data on the extent of water pollution in Lake Pamvotis and its ecological consequences (Grønlund et al., 2023).

Reflecting on the fieldwork experience and its educational value, it becomes clear that the work-in-learning component of science education is essential. Students gain a deeper understanding of scientific concepts and processes through immersion in the environment, actively observing and collecting data. Fieldwork allows students to develop critical thinking and problem-solving skills. Fieldwork also promotes curiosity and excitement about science that cannot be fully replicated in a traditional classroom setting. It allows students to engage with the natural world and appreciate its complexities, fostering a lifelong passion for science (McDaniels, 2014). In general, the educational value of fieldwork must be balanced and incorporated into science teaching to enhance student learning and engagement.

USING TECHNOLOGY TO STUDY LAKE PAMVOTIS WATER POLLUTION

Technology is important in science education as it enhances learning experiences and allows students to explore and discover. Students can engage in interactive simulations, virtual experiments, and scientific investigations that otherwise would be impossible or dangerous in a traditional classroom setting. For example, the teachers can use technology to create an online platform, where students can collect and analyze water samples from Lake Pamvotis to study water pollution. This technology-based approach enhanced interactive learning for students and provided them with real-world applications of scientific concepts. Moreover, technology allows for personal learning experiences by providing students access to various resources and tools tailored to their needs and interests (Faig, 2023). Integrating technology into science education can change how students learn and understand scientific concepts.

Water quality monitoring devices and sensors are necessary to assess and control the pollution from Lake Pamvotis. These technologies provide accurate and real-time data on water parameters such as pH levels, dissolved oxygen temperature, and nutrient concentrations. Scientists can pinpoint the sources of pollution and their impact on the lake's ecosystem by monitoring these parameters continuously. Using water quality monitoring devices enables the early detection of potential hazards and the implementation of appropriate mitigation measures, such as the adjustment of wastewater treatment plants or the establishment of buffer zones (McGarrity & Zhao, 2023). This proactive approach is critical to prevent further degradation of the lake's water quality and ensure its long-term sustainability.

Analyzing data using computer software and apps has become a key instrument in diverse scientific fields. These tools allow researchers to process large amounts of data quickly and efficiently, allowing for more accurate and reliable results. In addition, computer software and apps offer advanced data visualization capabilities, which allow researchers to identify patterns, trends, and relationships quickly and easily in data. In studying water pollution in Lake Pamvotis, computer software and apps can be used to analyze water quality indicators such as pH levels of dissolved oxygen and nutrient concentrations. Researchers can generate graphs, charts, and statistical analyses that comprehensively understand the water pollution situation by inputting the collected data into the software. This information can then be used in education to inform science teaching, allowing students to explore real-world data and develop their data analysis skills (Aljrees, 2024).

Incorporating virtual field trips and online resources is useful for increasing school science teaching (Klippel, 2020). Virtual field trips allow students to explore places and phenomena that would otherwise be impossible in a traditional classroom setting. Students can visit different ecosystems, conduct experiments, and interact with simulations. Virtual reality technology provides a more immersive learning experience (Mulders et al., 2020). On the other hand, online resources offer a wide range of multimedia materials, such as videos, interactive simulations, and virtual labs, which can complement classroom lectures and readings. These resources allow students to explore scientific concepts, conduct experiments, and apply their knowledge to real-world situations.

COLLABORATING WITH LOCAL ORGANIZATIONS AND EXPERTS

Community partnerships are essential in science education, providing students with opportunities for hands-on learning experiences and real-world applications of scientific concepts. These partnerships allow educational institutions to collaborate with local businesses, government agencies, and nonprofit organizations to develop and implement science programs relevant to the community's needs and interests. Through these partnerships, students can participate in research projects, internships, and mentoring programs that expose them to different disciplines and career paths. Through a connection to the community, science education becomes more engaging and meaningful as students see firsthand how their knowledge can be applied to address local environmental and societal. Community partnerships also promote a sense of ownership and pride among students as they see the impact of their scientific contributions on their communities. Along with building bridges, these partnerships can help encourage collaboration and innovation in scientific research and development (Burston & Collier-Stewart, 2021). Community partnerships in science education inspire and prepare the next generation of scientists and problem-solvers.

Engaging with local environmental organizations offers college students unique opportunities to learn about environmental conservation in the community and contribute to them. Students can gain practical experience in environmental research monitoring and advocacy while

positively impacting local ecosystems through volunteering or internships with these organizations. Working alongside professionals in the field can further enhance students' networks and build important connections for future career opportunities. Local environmental organizations often offer educational programs and workshops, which can enhance students' understanding of environmental issues and the actions needed to address them (Odeyemi et al., 2023). Overall, interacting with local environmental organizations is a valuable way for college students to engage in environmental stewardship and apply their academic knowledge to real-world challenges.

Inviting experts to share their knowledge and experiences is a valuable practice for educational purposes in college. Experts bring expertise and real-world insights that can greatly enhance students' knowledge of a topic (Smith et al., 2022). Experts can bridge the gap between theory and practice, giving students a more holistic understanding of a topic By providing firsthand accounts and examples. However, experts can challenge students' preconceived notions and stimulate critical thinking by presenting alternative perspectives and new ideas. Experts can also be role models and inspire students to pursue their passion and expertise in a particular area. In general, bringing experts together to share their knowledge enriches the learning experience and cultivates a deeper appreciation of a subject.

Collaborating on research projects and initiatives allows students to engage in hands-on learning and develop essential skills for their future careers. Students can contribute their unique perspectives and expertise to solving complex research questions by working with their peers and faculty members. Collaborative research projects also allow students to deepen their understanding of the subject matter and delve into interdisciplinary fields. Further working together on research initiatives promotes critical thinking, problem-solving, and effective communication skills, all of which are valuable assets in the professional world. Participating in collaborative research projects enhances the educational experience and prepares students for future endeavors (Ahn et al., 2022).

ASSESSING STUDENT LEARNING ON LAKE PAMVOTIS WATER POLLUTION

Assessment plays a crucial role in science education, allowing students to demonstrate their understanding of scientific concepts and skills (Schildkamp et al., 2020). It gives teachers insights into students' learning progress and helps them make informed instructional decisions to support their learning. Assessments in science education can take several forms, including writing tests, laboratory reports, projects, and oral presentations. This assessment assesses students' knowledge and ability to apply scientific methods, think critically, and communicate effectively.

Using assessment in science education, educators can identify students' misconceptions, address their learning needs, and promote a deeper understanding of scientific concepts (Schneider & Plasman, 2011). Assessments also provide feedback to students, enabling them to engage actively in the learning process and foster their metacognitive skills.

Designing formative assessments for ongoing learning is an essential aspect of successful education. Formative assessment provides valuable feedback to students and teachers, allowing for adjustments and improvements in the learning process. These assessments are typically low-stakes and occur throughout the learning process, allowing students to demonstrate their understanding and identify areas, where they may benefit from additional support.

Educators can better monitor student progress and tailor instruction by designing formative assessments that align with learning objectives and promote active engagement. Formative assessments can also foster a sense of ownership and responsibility for the students as they actively monitor their learning (Kingston et al., 2023). Educators can gather a comprehensive picture of the student's understanding and make informed instructional decisions using various assessment techniques such as quizzes, projects, and observations.

Implementing summative assessments is a crucial aspect of assessing student understanding. These assessments usually come at the end of a unit or course, providing a comprehensive overview of a student's knowledge and skills in a specific subject. Unlike formative assessments used to monitor students' progress during instruction, summative assessments are a final measure of achievement. They help teachers monitor the effectiveness of their instructional methods and curriculum while providing students with a clear indication of their strengths and areas for improvement. Educators can obtain a well-rounded picture of student comprehension and make informed decisions about their instructional strategies by incorporating summative assessment tools such as exam projects and presentations. Summary assessments also encourage students to engage in deep learning and critical thinking as they must demonstrate their understanding and apply their knowledge to real-world scenarios (Vieira Braga et al., 2024). The summative assessment ultimately supports fostering a rich and meaningful learning experience for students.

Providing feedback and opportunities for improvement is a very important element in our education system. Feedback is a valuable tool for students to understand their strengths and weaknesses and identify areas for improvement (Sadler, 2014). It also motivates students by recognizing their achievements and encouraging them to pursue further success. Feedback allows educators to assess the effectiveness of their teaching strategies and make necessary adjustments to meet the needs of their students (de Kleijn, 2023). Educators can guide students towards developing their knowledge and understanding by providing specific and constructive feedback. This feedback should be tailored to each student's needs and abilities, ensuring they receive meaningful guidance. Opportunities for improvement should be designed to challenge and push students beyond their comfort zones, enabling them to explore and expand their abilities. Through feedback and opportunities for improvement, students can progress towards their education goals.

OVERCOMING CHALLENGES IN TEACHING LAKE PAMVOTIS WATER POLLUTION

Limited resources and funding for science education pose serious problems with teaching scientific concepts and skills. Schools and colleges cannot provide up-to-date laboratory equipment, materials, and resources necessary for engaging and hands-on science education without sufficient funding. Students are thus limited in their ability to develop critical thinking, problem-solving and inquiry skills. Limited resources may also lead to overcrowded classrooms and larger student-teacher ratios, reducing the individualized attention and support students receive (Baron-Polańczyk, 2023). These challenges demonstrate the need for increased investments in science education to ensure that all students have access to high-quality science instruction and opportunities for scientific exploration and discovery.

It addresses potential safety concerns during fieldwork to ensure the well-being of scientists and students. Before starting fieldwork, a good risk assessment is important. This assessment should identify hazards such as rough terrain, inclement weather, or dangerous wildlife (Kimani, 2023). Providing adequate participant training regarding safety protocols and emergency procedures is also important. Also, it is necessary to have access to communication devices or emergency contact information in case of an accident or injury.

The lack of real-world issues in the curriculum can significantly hinder effective education. Many traditionalists argue that education should focus more on academic knowledge and skills than real-world problems (Wheelahan, 2015). They might think that such issues should be left to other institutions or that the students are unprepared to handle them. However, this resistance fails to recognize the importance of preparing students for the complex and challenging realities of the real world. Students can develop critical thinking skills, problem-solving ability, and a deeper understanding of the world by incorporating real-life issues into the curriculum. Engaging with real-world problems can make education more meaningful and relevant, increasing motivation and engagement (Manuele, 1999). Overcoming resistance requires a shift in the mindset and recognizing the value of applied learning experiences.

Supporting teachers in developing their knowledge and skills ensures high-quality education. Teachers can stay up-to-date with the latest research and teaching practices by being provided with opportunities for professional development (Ingvarson et al., 2013). This can help them improve their instructional strategies, integrate innovative technologies into their lessons, and efficiently address the diverse needs of their students. Professional development programs can be tailored to meet the specific needs of teachers, whether in the subject-specific content areas of teaching methodologies or classroom management techniques. Mentorship programs and collaborative learning communities can also provide teachers with ongoing support and opportunities for reflection and growth.

BENEFITS & IMPACTS OF USING LAKE PAMVOTIS WATER POLLUTION IN SCIENCE TEACHING

Enhancing students' understanding of environmental issues is crucial to promoting the knowledge and practice of environmental education and sustainability. Educators can provide students with the knowledge and skills required to recognize and address environmental challenges by integrating environmental subjects into the curriculum. One effective approach is to use real-world examples, such as Lake Pamvotis water pollution, to bridge the gap between theory and application. This specific case study can provide students with a deeper understanding of the causes and consequences of water pollution and the potential solutions that can be implemented to mitigate its adverse effects (Simanjuntak, 2023). This hands-on approach enhances the student's understanding of environmental issues, fosters a sense of responsibility, and empowers students to participate actively in environmental conservation efforts.

Fostering critical thinking and problem-solving skills for students' cognitive development is incredibly important. These skills enable individuals to handle complex issues, analyze information, evaluate evidence, and make informed decisions. In the context of science education, by engaging students In hands-on activities and inquiry-based learning (National Research Council, 2012), critical thinking and problem-solving skills can be achieved. Unlike passive information-receiving students, such an approach allows students to participate actively in constructing their knowledge. Educators can encourage students to ask questions, identify problems, and seek innovative solutions, creating an environment that promotes critical thinking and problem-solving skills (Yanti et al., 2024). The students develop a deeper understanding of scientific concepts through this process and improve their ability to apply them to real-world situations (Nilyani et al., 2023).

Promoting environmental awareness and stewardship in our society and natural resources is extremely important to protect and preserve them for future generations. Individuals need to be educated about the impact of their actions on the environment and make informed choices in their everyday lives. By raising awareness, people can become more conscious of their energy consumption, waste generation, and carbon footprint and take steps towards reducing their negative impact on the environment. To promote environmental stewardship, individuals are encouraged to actively participate in conservation efforts, such as volunteering for environmental organizations, engaging in sustainable practices, and advocating for environmental policies and regulations. Promoting environmental awareness and stewardship is essential for creating a sustainable future and the good of our planet (Reutotar, 2023).

Contributing to the scientific knowledge of Lake Pamvotisis is necessary to understand the lake's ecological health and environmental impacts. Numerous studies have explored various aspects of the lake, including water pollution, biodiversity and sedimentation rates (Karaouzas et al., 2021).

These studies provide valuable insights into the lake's current state and the factors affecting its ecological balance. Smith et al. (2010) researched this topic and examined the levels of heavy metal contamination in the lake water. They evaluated the impacts of human activities on the lake's biodiversity.

CONCLUSIONS

Several main points are discussed in this study. The study first explains the importance of incorporating real-life environmental problems into science education. Students can gain a practical understanding of water pollution and its impact on aquatic ecosystems by using Lake Pamvotis as a case study. The second highlights are the various science concepts, which can be explored through this case study, such as water quality testing, biodiversity assessment, and ecological restoration. Third, the study emphasizes the benefits of fieldwork and hands-on experiments in science education as they promote inquiry-based learning and critical thinking skills. The study argues that using Lake Pamvotis water pollution as a teaching tool can enhance science education by providing students with a meaningful and engaging learning experience.

For science teachers, examining the water pollution in Lake Pamvotis is of great importance in college education. The pollution of Lake Pamvotis provides an excellent real-life example for studying various scientific concepts and their implications. Students can analyze the sources and types of pollutants in the lake, explore the impacts of pollution on aquatic ecosystems and human health, and explore the effectiveness of different remediation strategies. This hands-on approach improves students' understanding of scientific concepts and fosters critical thinking, problem-solving, and environmental awareness. As a tool, teachers can bridge the gap between theory and practice. Using Lake Pamvotis water pollution as a teaching tool enables students to gain valuable skills and knowledge that can be applied in real-world situations.

Educators must include real-world issues in the curriculum to better prepare students for the future challenges they face. Teachers can create an engaging and relevant learning experience for students By integrating environmental pollution, social justice, and technological advancements. Real-world issues promote a deeper understanding of the subject matter and encourage critical thinking, problem-solving, and collaboration skills essential for success beyond the classroom. A real-world perspective in the curriculum also helps foster a sense of purpose and empowers students to become active global citizens. Thus, educators must actively integrate real-world issues into their teaching practices (Meyers et al., 2009).

The potential impact of utilizing Lake Pamvotis water pollution for science teaching In education is important. This approach allows students to engage in real-life, hands-on experiences that promote a deeper understanding of scientific concepts and principles. The students can develop critical thinking skills and gain practical knowledge By observing and analyzing the effects of water pollution on the lake ecosystem. This approach also promotes a sense of environmental responsibility and sustainable practices among the students (Hodson, 2009). By participating actively in the cleanup and restoration efforts of Lake Pamvotis, students can become agents of change in their communities and beyond. Integrating this approach into science education can produce a generation of scientifically literate individuals with the knowledge and skills to address and solve complex environmental challenges.

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