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Challenges of Biology Education in Yemeni Schools: a Preliminary Work

Yemen Okullarında Biyoloji Eğitiminin Zorlukları: Ön Çalışma

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Abstract

The main purpose of this study is to identify the major challenges that hinder effective biology education in Yemeni secondary schools from the perspective of students and recent graduates. Due to the limited number of empirical studies addressing biology education in Yemen, this research aims to contribute preliminary data that may guide future improvements. A qualitative research design was employed, and data were collected through an online questionnaire consisting of 14 items (11 closed-ended and 3 open-ended questions). A convenience sample of 30 participants from the science track responded to the survey. Descriptive statistics and thematic analysis were used to examine the data. The results revealed that students face significant obstacles in learning biology, including a lack of security and school infrastructure due to ongoing conflict, insufficient laboratory facilities and technological resources, limited access to learning materials, and a curriculum that emphasizes memorization over conceptual understanding. Participants also reported that teachers rely heavily on lecture-based instruction with minimal practical activities. These findings align with previous research indicating systemic weaknesses in teacher qualifications, curriculum development, and resource provision. Overall, the study highlights the urgent need for enhanced laboratory opportunities, curriculum revision aligned with contemporary scientific advances, teacher professional development, and strengthened school infrastructure. It is expected that this preliminary work will raise awareness among policymakers, educators, and

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stakeholders and encourage further research to improve biology education in Yemen.

Keywords: Biology education, Science education, Yemen, Educational challenges

Öz

Bu çalışmanın temel amacı, Yemen'deki ortaöğretim kurumlarında biyoloji öğretimini olumsuz etkileyen başlıca güçlükleri, öğrenci ve yeni mezunların görüşlerine dayalı olarak belirlemektir. Yemen'de biyoloji eğitimine yönelik ampirik araştırmaların sınırlı olması nedeniyle, bu çalışma gelecekte yapılacak geliştirme çalışmalarına ışık tutacak ön veriler sunmayı amaçlamaktadır. Araştırmada nitel araştırma deseni kullanılmış ve veri toplama aracı olarak 14 maddeden oluşan (11 kapalı uçlu, 3 açık uçlu) çevrim içi bir anket uygulanmıştır. Bilim alanından toplam 30 gönüllü katılımcı kolayda örnekleme yöntemiyle araştırmaya dahil edilmiştir. Elde edilen veriler betimsel istatistikler ve tematik analiz tekniği ile incelenmiştir. Araştırma sonuçları; devam eden çatışma ortamı nedeniyle güvenlik ve okul altyapısının yetersizliği, laboratuvar olanakları ve teknolojik kaynakların eksikliği, öğrenme materyallerine erişimde zorluklar ve ezbere dayalı müfredatın kavramsal öğrenmeyi sınırlaması gibi önemli engellerin bulunduğunu ortaya koymuştur. Katılımcılar ayrıca, öğretmenlerin çoğunlukla ders kitabına dayalı ve teorik ağırlıklı öğretim yaptığını, uygulamalara ise çok sınırlı düzeyde yer verildiğini ifade etmiştir. Bu bulgular, müfredat geliştirme, öğretmen niteliği ve kaynak sağlama konularında sistemsel eksikliklere işaret eden önceki araştırmalarla da uyumludur. Genel olarak çalışma, biyoloji eğitiminde laboratuvar fırsatlarının artırılması, bilimsel gelişmelerle uyumlu müfredat düzenlemeleri yapılması, öğretmenlerin mesleki gelişiminin desteklenmesi ve okul altyapısının güçlendirilmesi gerekliliğinin aciliyetini vurgulamaktadır. Bu öncül çalışmanın politika yapıcılar, eğitimciler ve paydaşlar arasında farkındalık yaratması ve Yemen'de biyoloji eğitimini geliştirmeye yönelik ileri araştırmaları teşvik etmesi beklenmektedir.

Anahtar Kelimeler: *Biyoloji eğitimi, Fen eğitimi, Yemen, Eğitim sorunları*

Introduction

The system of education in Yemen started in the south of Yemen before independence. It started with a few schools exclusively in Aden city, which was the capital city of South Yemen. Those schools were for only certain classes of people, not for every class of Yemeni people. Then, the system of education started in the north of Yemen after 1962. However, education in Yemen has impressively expanded and improved since 1970, leading the illiteracy rate to be reduced from 90% to less than 45%. This has had a remarkable positive impact on the socioeconomic status of Yemenis who suffer various challenges demographically, geographically, and economically (Saif, 1999; World bank, 2010). Meanwhile, teaching science for basic education and biological, chemical, and physical sciences became a part of the governmental and private school curriculum. The textbooks and teaching policies were based on Egyptian educational experiences. Furthermore, most of the teachers were brought from some Arab countries, including Egypt, Iraq, Sudan, and Syria. Given that paying attention to the improving education system in Yemen, the faculty of education was the first faculty that was founded in Sana'a University, which is the first university established in Yemen in response to presidential Decree No. 42 issued on June 16, 1970 (Saif, 1999).

For teaching science in Yemeni schools, Ministry of Education in North Yemen, early 1980s, designed nine different textbooks titled "General Science" to be taught within the elementary and middle schools, stages of the basic education, grades from one to nine. However, for secondary schools, three textbooks were developed: biology and earth science, physics, and chemistry for each grade of the three years of the secondary school. Then, during the unification of South and North Yemen in 1990, those textbooks were updated for each grade with the same name, except for the textbook of biology and earth science renamed biology (Saif, 1999; Muthanna et al., 2022).

This work is important because it addresses the key problems facing biology education in Yemeni schools, from the perspective of secondary school science-track students and graduates. Currently, very few documents discuss the issues surrounding biology education in Yemen, despite the fact that significant challenges exist. The curriculum of biology education has important aims that have to be achieved, but due to the different obstacles hindering biology education, Yemeni

schools have not achieved the goals that have been set for them. Thus, this work attempts to provide a preliminary work to explore these challenges and suggest recommendations that may aid in breaking down such problems.

Literature Review

Importance of Biology Education

Scientific advancement is the most principal factor in empowering non-industrial countries to enter the basic stream of modern innovation and commerce (Gödek, 2004; Oloruntegbe, 2010). Science is divided into many disciplines, and biology is one of them. Biology is defined as a branch of science that studies living organisms, whether microorganisms or macroorganisms. Biology has been connected to human beings since the origin of humans. To transfer biological knowledge and skills across generations, biology education has been established. Biology education is considered a unique field and requires special teaching and learning contexts (Reiss, 2018). Appropriate education in biological sciences makes a difference in shaping the minds of any nation, and improving scientific skills such as observation, perception, classification, hypothesis formation, inquiry, measurement, assessment, discussion, and communication. A proper teaching of biological sciences to individuals has been consistently recognized as a tool for advancing economic improvement, eradicating poverty, and improving social well-being (Özcan, 2003; Okenyi, 2012). Also, to make biology education sophisticated, a new area is allocated, which is biology education research. This area aims to develop easy tools for teaching and learning of biology and its relevant domains. Indeed, science education is considered a tool to encounter various dilemmas, which are diagnosed through the lens of their consequences. However, Biology education has been developed as a specific area because it needs unique teaching and learning techniques, as well as focused study, to bring understandable knowledge of it to individuals (McComas et al., 2018).

As biology is the true tool for seeking knowledge and illustrating phenomena in any environment, using this tool requires understanding and serious use of verified scientific methods. Therefore, systematic ways and fundamental methods have been established and developed. Those have effectively helped developed countries in making science being practice in their societies daily. These fundamental methods are industry innovation, motivating environment, data exchange, morals, and social duty on a daily basis in a systematic way, in order to be efficient for the process of learning and teaching has been established under the term of science education (Özcan, 2003; Okenyi, 2012).

Concept of Biology Education

Biology is one of the basic sciences that deal with study of varieties of life either in the wild or on the molecular level, so biology is simply defined as the field of science studying the different aspects that are related to all living organisms. It studies the taxonomy, heredity, function, structure, growth, spreading, and evolution of organisms including bacteria, protozoa, fungi, plants, and animals (Magna, 2002). In spite of the wide scope of this field, it has basic concepts that control all the studies and research, which strengthen it into a coherent and simple area of science. Biology acknowledges the basic unit of life is the cell, the basic unit of inheritance is the gene, and the evolution process is the engine that drives the keen mechanism of the synthesis and creation of new species. Biology is branched into many branches which can be called sub-disciplines. The branching is based on the types of organisms studied and the approaches to study them. For instance, microbiology is the study of microorganisms such as parasites and bacteria, cytology studies all the interactions and the cellular component of all living cells, biochemistry investigates primitive life's chemistry, and molecular biology is the study of the complicated interactions between molecules inside biological systems, botany is the

study of plants, physiology studies the functions of organisms' organs and tissue, evolutionary biology investigates the events that produced the diversity of life, ecology is also classified under biology and this science studies how organisms interact with around environment, zoology is the study of animals, pathology is focused on studying diseases that infect plants and animals, entomology studies insects and so forth.

For folk to be able to learn, teach, and understand the concepts of biology and its related materials, biology education is established and being educated as the specific area of science. Biology education can be defined as a process of learning and teaching by applying essential principles. As a result, people can have the ability to contribute beneficially to the advancement of society (Okenyi, 2012; Okenyi, 2013).

Yemen

Yemen, Republic of Yemen, was established in 1990 by unifying the South of Yemen and the North of Yemen. Yemen is located east of the Red Sea, North of the Indian Ocean, and Southwest of the Arabian Peninsula in Western Asia. Yemen has approximately 31,603,133 people on 555,000 km². Approximately 51.1 % of the population is female. Almost 62% of the population resides in rural areas; about 38% of Yemeni people are under the age of 15 years, and 63% are under 24 years. Geographically, Yemen has an important and distinct location due to its having many islands located in both Red Sea and Arabian Sea. Also, it has the largest and the most famous island, called Socotra Island, in Arabian Sea. In addition, Yemen has control over the strait of Bab Al- Mandab. Despite of that, Yemen is one of the low-income countries, and it is considered the poorest in the Middle East region where many people of old generation and rural areas cannot read and write (Shormani et al., 2018; United Nations, 2022).

Biology Education challenges in Yemeni Schools

As mentioned above, biology is an important subject that aid any society to thrive. Educationally and scientifically, biology is considered as an important domain of science that made the leaders of advanced society to give it a unique attention to its tool of learning and teaching. In Yemen, after unifying of south and north, the curriculum of biology education has been planned to be conducted and designed in a way that should meet the needs of Yemeni society; however, it was imported as it is from other countries (Saif, 1999).

Generally, biology education is designed to help people gain knowledge about ethics and critical thinking and make them intelligent in a way of tackling the problems around them in their environments, which leads to creating a strong society. The second aim is to prepare well-trained teachers able to work with scientific literacy tools during the process of teaching and learning. By this way, the teacher would be capable of teaching the students the virtue of technologies and techniques effectively, consequently, both the graduated students and teachers will be able to adapt to developments of science and then use it in benefit of improving their lives and their society (Zakhamn et al., 2020; National Research Council, 1990), however, due to the different problems that hanger biology education in Yemeni schools, biology education could not provide impact on Yemeni society. In the following paragraphs, more challenges of biology education in Yemeni schools will be explored.

The security in Yemen

The security issue in Yemen has been big worrisome due to continuous political crises, and the country has been torn apart by an interlinked series of conflicts. Currently, the conflict is between Houthi (officially called Ansar Allah) and the government, which is called Alshra'ia, due to different motivations. People in north Yemen live in fear of death from bomb explosions by Saudi military aviation and the military confrontations between Houthi and resistance, and people

in South Yemen are afraid of armed groups who spread in different areas. By early 2019, 43% of school-aged children did not attend school (Yemen Education Crisis, 2020; Coppi, 2018; UNESCO IBE, 2010). This percentage (43%) is a high percentage, and it is gradually increasing because some schools are predicted by Saudi military aviation as places to store weapons and then they are bombed. This has led the children's families to keep their children at home. Basically, biology education improvement in Yemen started later in 2002 by creating schools, which are located in the main cities. It was provided with basic facilities and some important infrastructures with financial support given by Yemen's friends and the international community. Currently, many schools have crippled these infrastructures by ongoing conflicts with which biology laboratories were also destroyed. Meanwhile, electricity and water supply are vandalized completely from public schools. Likewise, the consuming chemical materials such as chemical solutions were finished and no re-supplying is promised. Furthermore, a lot of fathers and mothers have become without jobs or working without salaries. This made their children unable to stay in their classes. eventually, those children became unable to complete their education, and they dropped out of school. Those children themselves are the next generation who will be the society of strong Yemen.

Lack of proper curriculum development

An appropriate position for biology education has not been given in the Yemeni school curriculum. The quantity of materials that is taught and learned in schools is imported from other countries and the curriculum structure has not changed since the unification in 1990 of Yemen. It still focused on theoretical bulk and unspecific topics such as morphology, animal kingdom divisions, and so on, ignoring all the advancements in scientific knowledge and educational hypotheses. It covers a high number of topics, unavailable time allocated to the biology practical part, as well as insufficient economic conditions, make barriers in front of biology curriculum development (BSCS, 2003; Saif, 1999).

Teachers

In any nation, when talking about the improvement of biology education, teachers are mentioned as key factors to be considered. However, Yemeni schools lack qualified teachers in biology. Biology teachers are not professionally qualified. They have the knowledge of the subject, but they lack the learning and teaching methods. These teachers, for many years, have not been trained by going for in-service training. The science teachers face difficulties in comprehension of biology concepts like cell division, sporogenesis, segmentation, scurvy, anemia, and asexual reproduction, etc., and this affects their output of biology education. Atilla (2012) in his research has viewed that the difficulty of biology teaching is made by teachers resulting from using unsophisticated ways of biology teaching. Most schools, either private or public, especially schools that are located in rural areas, do not have biology laboratories at all, and students study biology just theoretically. Indeed, this also creates barriers in front of teachers who plan to use practica lessons during their teaching. They then consume class time sketching figures on the blackboard and lecturing in the context of books (Yemen Education Crisis, 2020; Saif, 1999; Atilla,2012; Raja, 2020; Mahyoub, 1996).

Education System and Biology Literacy

The education system was two educational systems before the unification of Yemen in 1990, and then, since 2015, the time when the current conflict started, the education system came back to be into two systems. The presence of two systems in Yemen with different administrations poses a challenge to mounting a harmonized countrywide response. Regarding biological literacy in Yemen is still delivered by using the traditional approach of teaching, which is lecturing. This was before 1990, the time of the unification of Yemen, and after 1990, between 1991 and 2014, and until now through the current conflict. Even though the updated textbook includes a section

specified for the simple experiments to be done by students in order to acquire the basic skills of biology, such as observations and interpretation, the context of the book is only given by the teacher as a lecture. The practical works or laboratory investigations are very limited. The material taught relies on memorization, which kills the passion and the curiosity of students toward the biological sciences. Furthermore, the assessment consists of monthly quizzes, midterms, and comprehensive final examinations. These examinations and quizzes represent only the methods of evaluating students besides the homework (Saif, 1999; Abu-Asba et al., 2012).

Inadequate Fund

Yemen is considered the Arab world's poorest country, and Yemen is dependent on oil exports and international help for most of its services. Achieving biology education requirements, sufficient fund is needed, but there is no satisfactory support for an empowering environment to encourage the successful instruction for learning and teaching of biology. Tertiary institutions (universities) are expected to share in research to enhance the method of social improvement, but their roles are very limited and focus on teaching. These desires can be met if sufficient funds are available (World Bank, 2010; Coppi, 2018).

Methodology

Research Design

This study employed a qualitative research design, utilizing a structured questionnaire that included both closed-ended and open-ended questions. The design aimed to explore challenges in biology education based on students' lived experiences in Yemeni secondary schools.

Participants

The target population consisted of secondary school students and recent graduates from science-track programs in Yemen. A convenience sampling technique was used due to accessibility constraints in the current conflict environment. A total of 30 participants voluntarily completed the survey. Demographic information (gender and current educational status) was collected to describe the participant characteristics. Inclusion criteria:

- Studying or having graduated from secondary school (science section)
- Experience studying biology in Yemeni schools
- Voluntary consent to participate

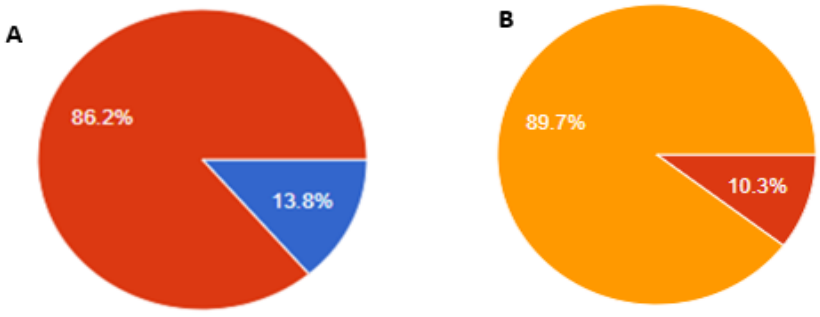

Figure 1. *Demography of participants.*

Fig. 1 A shows the percentage of males and females, in which 86.2% are female, and 13.8% are male. Fig. 1 B illustrates the percentage of respondents' grade level, in which 89.7% are graduates of secondary school (scientific section). and 10.3% are still students at secondary school (scientific section).

Data Collection Instrument

Data were collected using an online questionnaire created through Google Forms. The instrument consisted of 14 items: 11 closed-ended questions (multiple-choice/selection) designed based on previous literature and the aims of the study, focusing on curriculum, teacher effectiveness, laboratory access, resources, and teaching methods. 3 open-ended questions enabling participants to freely express challenges and suggestions related to biology education. The questionnaire was reviewed by two experts in science education and one educational sciences for content clarity and relevance before administration, ensuring its face and content validity.

Data Collection Procedure

The survey link was distributed via WhatsApp to the intended audience. Respondents were informed about: The voluntary nature of participation, anonymity of responses, and that data would be used only for research purposes. No personal identifiers were collected. The data were automatically recorded in Google Forms and accessed only by the first author.

Ethical Considerations

The study respected principles of research ethics including:

- Informed consent
- Confidentiality of participant data
- Protection of participants from harm

As no sensitive/personal information was collected and participation was voluntary, the study posed minimal ethical risk.

Data Analysis

Closed-ended question responses were analyzed using descriptive statistics (frequency and percentage distributions). Open-ended responses were analyzed using a thematic analysis approach, enabling emerging themes related to major challenges in biology education to be identified from participants' statements.

Results

The responders are 30 individuals who are students and graduates of the secondary school, scientific section in Yemeni schools in Yemen. The pointed challenges that have been reported in this work were articulated into 16 questions to give a close eye and highlight the challenges based on students' responses. The first two questions were about gender and grade level, which are illustrated above under the method section. The rest 14 questions are illustrated in this section, which include 11 questions that are based on multiple choices, as well as three questions are open-ended questions. Table 1 shows the students' responses to multiple-choice questions of multiple choices. The highest number of students think the relevance of the biology curriculum to the real world is somewhat relevant, and they think the current biology curriculum is preparing them for the future. Also, they see that the situation of biology education faces real problems. For the effectiveness of biology teachers, the students think that the effectiveness of the teacher is good, but most of them stated that most teachers use textbooks as the main tool of teaching biology.

Most students state that they have no hands-on experience for the practical lessons of biology and say that the biology classes focus on memorization, not understanding concepts. Also, 80% of students reported that their schools do not have a laboratory for biology teaching and learning. Students also state that they do not have access to the internet and other related technology that today has become an essential part of the teaching and learning process. Table 1 shows the question and the percentage based on respondents' answers.

Table 1. *Questions and respondents' answers*

The question	The choice with percentage
How relevant do you feel the current biology curriculum is to real-world scientific developments?	58.6% somehow relevant 31% very relevant 10% I do not know
Does the biology curriculum in your school adequately cover important topics in biology (e.g., genetics, ecology, evolution, human biology)?	55.2% yes 37.9% some topics are covered, but not all 6.9% no
Do you believe that the current biology curriculum in your school prepares you for future scientific studies or careers?	44.8% YES 17.2% NO 37.9% I do not know
How would you rate the effectiveness of your biology teacher's teaching methods?	37.9% very effective 37.9% somehow effective 13.8% I do not know 10.3% not effective at all
Do your teachers use different teaching tools to enhance biology lessons? (more than one choice)?	86% said it is used the textbooks 48% said it is used visual aids 17.2% said it is used laboratory experiments
How often do you have hands-on practical lessons (e.g., experiments, fieldwork) in biology?	55.2% never 20.7%sometimes 17.2% weekly 6.9 monthly
Do you feel that biology classes focus more on memorization than on understanding concepts?	57.1% sometimes 21.4% NO 21.4 YES
Does your school have a well-equipped biology laboratory?	75.9% NO 20.7% sometimes 6.9 YES
Do you have adequate access to learning materials (books, digital resources, lab equipment) for studying biology?	75.9%: NO, there is a lack of materials 20.7%:the materials are somewhat sufficient 3.4: Yes, the materials are sufficient
Is there internet access or technology available in your school to support biology education?	72.4% NO 10.3% YES 17.2 % limited access
What do you think are the biggest obstacles to learning biology effectively in your school? Multiple choice question	75.9% Lack of practical experience (laboratories, fieldwork) 62.1%o Insufficient teaching resources 44.8% Lack of interest or motivation

Additionally, three open-ended questions were included at the end of the online questionnaire of this work. In response to the first question, "Have you faced any challenges in learning biology due to the ongoing situation in Yemen?" the students stated that the situation has caused psychological fear. They also mentioned that the current situation has led teachers to not attend classes because they are not receiving their salaries. Moreover, it has resulted in the lack of basic infrastructure that was previously available at schools, such as water and electricity.

In answer to the second question of the three open-ended questions, "In your opinion, how can biology education in Yemeni schools be improved?" some students mentioned that security is the most important factor. Others stated that paying attention to the practical aspect of studying biology is crucial. One student pointed out that teachers must receive their salaries. Another student noted that teachers should be more qualified, and the teachers of biology have to give priority to the practical over the theoretical. Other students noted that the teachers have to use the available technology for teaching biology, and they have to develop their teaching methods accordingly. The curriculum has to be improved to engage with the developments in biological sciences.

In answer to the third question, "Do you believe improving biology education in Yemeni schools would help in fostering scientific innovation in Yemen?" the students stated that schools need to be improved. Schools should have access to the internet, labs, and qualified teachers, focusing on teaching biology through practice, making sure all students have access to the school's books, videos, and related materials.

Discussion

The findings of this preliminary study reveal substantial challenges hindering effective biology education in Yemeni secondary schools. Students emphasized that the ongoing conflict and security instability are among the principal barriers to learning, which aligns with Coppi (2018) and Yemen Education Crisis (2020), who reported widespread school disruptions, infrastructure destruction, and difficulties in teacher attendance. These conditions make it difficult for schools to offer an appropriate scientific learning environment.

A second major finding concerns the lack of qualified biology teachers and limited instructional methods. Although students perceived some teachers as generally effective, most reported that textbooks remained the dominant instructional tool, while laboratory-based learning was almost absent. This is consistent with Atilla (2012) and Raja (2020), who found that inadequate pedagogical skills and reliance on lecture methods diminish students' conceptual understanding and engagement. Practical science teaching has long been recognized as essential for developing scientific literacy, inquiry skills, and a deeper conceptual grasp of biology (National Research Council, 1990; McComas et al., 2018).

In addition, the results highlighted that students face serious limitations regarding laboratory resources, technological tools, and internet access. More than three-quarters of respondents indicated the absence of school laboratories, a finding compatible with Saif (1999), who also documented a longstanding deficiency in practical facilities in Yemen. Lack of access to technology and digital learning tools further marginalizes students from global scientific advancements, restricting digital literacy and modern STEM competencies (Okenyi, 2012).

The curriculum itself also emerged as a significant issue, with students reporting excessive focus on memorization and theoretical knowledge. They expressed dissatisfaction with its relevance to real-life biology and current scientific developments. Previous studies similarly argue

that the Yemeni biology curriculum has not evolved to match advancements in scientific knowledge and the needs of modern society (BSCS, 2003; Saif, 1999; Muthanna et al., 2022).

Collectively, these factors indicate that biology education in Yemen remains far from achieving its instructional goals. The literature suggests that effective biology learning requires:

- updated curricula aligned with real-world science,
- access to laboratory-based inquiry,
- qualified teachers supported by continuous professional development, and
- adequate technology and learning resources

(Özcan, 2003; Reiss, 2018).

Therefore, the current findings are important because they validate previous concerns, provide student-centered evidence, and reinforce the urgency for policymakers to adopt reforms targeting curriculum modernization, teacher training, and school infrastructure improvement. Ensuring security and educational funding will be essential first steps toward advancing scientific literacy and promoting a more empowered scientific generation in Yemen.

Conclusion and recommendations

Finding solutions to the challenges of biology education is a crucial need. Developing countries, Yemen one of them, cannot find a way to develop and improve as long as these obstacles are underestimated. In this paper, it is recommended that such challenges, which are stated in the section on challenges of education in Yemen, and discussed in the section on discussion and results, can be resolved if the following recommendations are considered for implementation:

- It should be more focused in Yemen to prepare a biology education curriculum that matches the needs of society and according to standards.
- Biology teachers and mentors should be sponsored for seminars and sharing in scientific activities. This will motivate them.
- Provide schools with the infrastructure of biological laboratories and give the students access to them.
- Biology students should learn the skills of communication to work in teams and adapt to emergencies. These skills will enable them to be creative and familiarize them with new technological approaches.
- Above all, security is the first step to getting biology education to its required position, with the remaining considerations. It is the responsibility of every single individual in Yemen to think about ending the conflict. The economy is the source of financial matters which is the main factor in pushing the people toward improvement. However, Yemen's economy was already fragile before the conflict, and it was affected more negatively on the current conditions. As we all know, the strongest and the most advanced nations in the world are where the biology section is at its highest stages. Therefore, ending the conflict and then working on this section with the available facilities will help Yemeni society to recover and become intellectually independent.

Geniş Özet

Yemen Okullarında Biyoloji Eğitiminin Zorlukları: Ön Çalışma

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Giriş

Biyoloji eğitimi, öğrencilerin canlılar dünyasını anlamalarını, bilimsel düşünme becerileri geliştirmelerini ve günlük yaşamla ilişkili biyolojik süreçleri kavrayabilmelerini sağlayan temel bir fen alanıdır. Ancak bu eğitsel hedeflerin gerçekleştirilebilmesi, büyük ölçüde eğitim sisteminin istikrarına, öğretim ortamlarının niteliğine ve öğretmen-öğrenci etkileşiminin sürekliliğine bağlıdır. Savaş, iç çatışma, ekonomik kriz ve toplumsal istikrarsızlık gibi olağanüstü koşulların yaşandığı ülkelerde eğitim sistemleri bu işlevlerini yerine getirmekte ciddi güçlüklerle karşı karşıya kalmaktadır. Yemen'de uzun süredir devam eden çatışma ortamı, özellikle ortaöğretim düzeyinde fen ve biyoloji eğitiminin niteliğini doğrudan etkilemektedir. Okulların fiziksel altyapısının zarar görmesi, öğretmenlerin çalışma koşullarındaki belirsizlikler ve öğrenme ortamlarının sürekliliğinin bozulması, biyoloji eğitiminin etkililiğini önemli ölçüde sınırlamaktadır.

Buna karşın Yemen'de biyoloji eğitiminin mevcut durumunu, doğrudan öğrencilerin ve yeni mezunların deneyimleri üzerinden ele alan ampirik çalışmaların oldukça sınırlı olduğu görülmektedir. Mevcut çalışmalar çoğunlukla eğitim sisteminin genel sorunlarına odaklanmakta, ders düzeyinde yaşanan pedagojik ve uygulamaya yönelik problemlere yeterince ışık tutmamaktadır. Bu bağlamda, bu çalışmanın amacı Yemen'deki ortaöğretim kurumlarında biyoloji eğitiminin karşılaştığı temel sorunları, fen alanında öğrenim gören öğrenciler ve yeni mezunların görüşleri doğrultusunda ortaya koymaktır. Çalışma, biyoloji eğitiminin mevcut durumuna ilişkin bütüncül bir tablo sunarak, gelecekte yapılacak iyileştirme çalışmaları ve eğitim politikaları için veri temelli öneriler geliştirmeyi amaçlamaktadır.

Yöntem

Araştırmada nitel araştırma yaklaşımı benimsenmiş ve veri toplama aracı olarak yapılandırılmış bir çevrim içi anket kullanılmıştır. Anket formu, katılımcıların biyoloji eğitimine ilişkin deneyimlerini çok boyutlu biçimde ortaya koymayı amaçlayan 11 kapalı uçlu ve 3 açık uçlu olmak üzere toplam 14 maddeden oluşmaktadır. Kapalı uçlu sorular, öğretim yöntemleri, öğrenme ortamları ve eğitim olanaklarına ilişkin genel eğilimleri belirlemeye yönelikken; açık uçlu sorular, katılımcıların yaşadıkları sorunları ayrıntılı biçimde ifade etmelerine olanak tanımıştır.

Çalışma grubunu, Yemen'de ortaöğretim düzeyinde fen alanında öğrenim görmekte olan ya da bu alandan yeni mezun olmuş toplam 30 gönüllü katılımcı oluşturmaktadır. Katılımcılar, ülkedeki güvenlik koşulları ve fiziksel erişim sınırlılıkları nedeniyle kolayda örnekleme yöntemiyle belirlenmiştir. Veri toplama sürecinde etik ilkelere dikkat edilmiş; katılımcılara gönüllülük esasına dayalı olarak çalışmaya katıldıkları ve verdikleri yanıtların gizli tutulacağı bilgisi sunulmuştur. Kapalı uçlu sorulardan elde edilen veriler betimsel istatistikler aracılığıyla analiz edilmiş, açık uçlu sorular ise tematik analiz yöntemiyle çözümlenmiştir. Tematik analiz sürecinde, katılımcı ifadeleri kodlanmış, benzer kodlar temalar altında birleştirilmiş ve bulgular anlamlı bir yapı içerisinde sunulmuştur.

Bulgular

Araştırma bulguları, Yemen'de biyoloji eğitiminin çok boyutlu ve yapısal sorunlarla karşı karşıya olduğunu açıkça ortaya koymaktadır. Katılımcıların büyük bir bölümü, devam eden çatışma ortamının eğitim süreçlerini doğrudan ve dolaylı biçimde olumsuz etkilediğini

ifade etmiştir. Güvenlik sorunları, okul binalarının zarar görmesi, elektrik ve su kesintileri gibi altyapı eksiklikleri, öğrenme ortamlarının işlevselliğini ciddi biçimde azaltmaktadır. Bunun yanı sıra öğretmenlerin maaş alamamaları ya da okula düzenli devam edememeleri, öğretim sürecinin sürekliliğini zedeleyen önemli bir etken olarak öne çıkmıştır.

Bulgular, biyoloji öğretiminde ağırlıklı olarak teorik anlatıma ve ders kitabına dayalı yöntemlerin kullanıldığını göstermektedir. Katılımcıların büyük çoğunluğu, okullarında biyoloji laboratuvarı bulunmadığını ya da mevcut laboratuvarların aktif olarak kullanılmadığını belirtmiştir. Bu durum, deney ve gözleme dayalı öğrenme fırsatlarının sınırlı kalmasına ve biyoloji derslerinin ezbere dayalı bir yapıya bürünmesine neden olmaktadır. Ayrıca internet erişiminin ve dijital öğrenme kaynaklarının yetersizliği, öğrencilerin güncel bilimsel bilgiye ulaşmalarını ve alternatif öğrenme yollarını kullanmalarını zorlaştırmaktadır. Katılımcılar, biyoloji müfredatının güncel bilimsel gelişmelerle ve günlük yaşamla yeterince ilişkilendirilemediğini de vurgulamıştır.

Sonuç ve Tartışma

Bu çalışma, Yemen'de ortaöğretim düzeyinde biyoloji eğitiminin güvenlik sorunları, altyapı yetersizlikleri, öğretmenlerin çalışma koşulları, öğretim yöntemlerinin sınırlılığı ve müfredatın güncelliği gibi birbirini besleyen çok sayıda sorun nedeniyle istenen düzeye ulaşamadığını ortaya koymaktadır. Elde edilen bulgular, biyoloji eğitiminin niteliğini artırmaya yönelik müdahalelerin yalnızca pedagojik boyutla sınırlı kalmaması gerektiğini; aynı zamanda yapısal ve sistemsel sorunları da dikkate alması gerektiğini göstermektedir.

Bu doğrultuda, biyoloji müfredatının güncel bilimsel gelişmeleri ve günlük yaşamla ilişkili konuları içerecek şekilde yeniden yapılandırılması, öğretmenlerin mesleki gelişimlerinin desteklenmesi ve uygulamaya dayalı öğretim yaklaşımlarının yaygınlaştırılması önerilmektedir. Ayrıca laboratuvar ve teknolojik altyapının güçlendirilmesi, öğrencilerin deneyim temelli öğrenme fırsatlarına erişimini artıracaktır. Bununla birlikte, güvenli ve sürdürülebilir bir eğitim ortamının sağlanması, Yemen'de biyoloji eğitiminin geliştirilmesi için temel ve vazgeçilmez bir ön koşul olarak değerlendirilmektedir. Bu araştırmanın, Yemen bağlamında biyoloji eğitiminin iyileştirilmesine yönelik farkındalık oluşturması ve gelecekte yapılacak daha kapsamlı çalışmalara zemin hazırlaması beklenmektedir.

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Yazar beyanları/Statements of the authors

Etik	**Ethic**
✓ "*Yemen Okullarında Biyoloji Eğitiminin Zorlukları: Ön Çalışma* " başlıklı çalışmanın yazım sürecinde bilimsel, etik ve alıntı kurallarına uyulmuş olup, toplanan veriler üzerinde herhangi bir tahrifat yapılmamış ve bu çalışma herhangi başka bir akademik yayın ortamına değerlendirme için gönderilmemiştir. ✓ Bu çalışmanın yazarları bu araştırmanın, makalenin yayınlanmasını sınırlayabilecek herhangi bir etik çatışma içermediğini beyan eder.	✓ Scientific, ethical and citation rules were followed during the writing process of the study titled "*Challenges of Biology Education in Yemeni Schools: A Preliminary Work*", no falsification was made on the collected data and this study was not sent to any other academic publication medium for evaluation. ✓ The authors of this work declare that this research does not have any ethical conflicts that may limit the publication of the article.
Yazar Katkıları	**Contribution of Authors**
✓ Bu çalışmaya yazarların katkı oranları eşittir	✓ The contributions of the authors to this study are equivalent.
Çatışma Beyanı	**Conflict Statement**
✓ Makalemiz ile ilgili herhangi bir kurum, kuruluş, kişi ile mali çıkar çatışması yoktur ve yazarlar arasında çıkar çatışması bulunmamaktadır.	✓ There is no financial conflict of interest with any institution, organization, or person related to our study and there is no conflict of interest between the authors.