Doi: 10.30473/IDEJ.2023.66060.1130 **ISSN:** 2588-4476

Iranian Distance Education Journal

Vol. 4, No. 2, (New Series) Summer-Autumn 2022 (P 86- 99), Payame Noor University

Original Article

The Challenges of Learning and Practical Activities of the Undergraduate Biology Curriculum in the Coronavirus Conditions

Wahidullah Abdurahimzai1[*1], Mahbobah Arefi [2], Kourosh Fathi Vajargah [3], Esmaeil Jafari [4],

1. PhD Student of Curriculum Studies, Faculty of Education and Psychology, Shahid Beheshti University, Tehran, Iran.
2. Associate Professor, Faculty of Education and Psychology, Shahid Beheshti University, Tehran, Iran.
3. Professor, Faculty of Education and Psychology, Shahid Beheshti University, Tehran, Iran.
4. Assistant Professor, Faculty of Education and Psychology, Shahid Beheshti University, Tehran, Iran.

Received: 2022/07/22 **Accepted:** 2022/11/22

Abstract

Learning and practical activities in biology is an important element of the curriculum, which has faced challenges and opportunities in the distance education process in the conditions of the coronavirus. The aim of the research was to identify the learning challenges and practical activities of biology professors and undergraduate students of Kabul Education University - Afghanistan in virtual classes under the Covid-19 conditions. This research was conducted with a qualitative approach and grounded theory method. The research population was 36 professors and students who participated in targeted interviews of 20 men and 16 women. The results showed that (limited access to the Internet, non-implementation of practical and laboratory activities, evaluation challenges and changes in the time and place of teaching) are the things that have affected the quality of education, learning and practical activities' of biology in the Corona conditions. By creating a balanced e-learning infrastructure in all regions of the country and investing more in educational technology, can be reduced learning challenges and practical activities.

Keywords

Biological curriculum, Coronavirus, Challenges, Learning activities, Virtual classes.

Introduction

Afghanistan's higher education had no experience in the distance education process, and the situation of the Coronavirus forced it to provide online classes for the first time. Biology is an important discipline of basic science and its curriculum is based on experiences, practical activities, laboratory, and observation; but the lack of information and communication technology tools in the conditions of the coronavirus has made the distance education of the biology curriculum vulnerable. With the spread of the Coronavirus and the transformation in teaching and learning methods, laboratory activities have been more affected due to the lack of sufficient experience in the field of virtual education as well as its practical aspect (Farhadi and Arzoo. 2021). The reduction of practical units, laboratories and learning activities weakens the biology curriculum (Rajaei, 2019). During the mentioned era (Covid-19), challenges came into being throughout higher education and universities were forced to switch to distance learning; but students had limited access to laboratories and facilities (Gamage et al. 2020). Educational and laboratory activities in the field of biology have faced with many challenges due to the global spread of Covid-19, which was presented as a combination of distance education. The

*Corresponding Author: abdurahimzai.w.@gmail.com

authorities of distance education at universities are investigating so that they can make the necessary actions and changes in the field of practical and laboratory programs (Vivien and Emmanuel, 2021). Students can gain some learning experiences through online resources in virtual environments; but some others cannot learn to learn and practical activities without being in the laboratory (Velarde, 2022). Attendance of students for training in laboratories is still a basic requirement (Gasparello et al., 2022).

Coronavirus is a deadly and dangerous disease quickly transmitted from one person to another. The Corona epidemic has challenged the curricula of Afghanistan's higher education, especially the learning and laboratory activities in the field of Biology. On December 31, 2019, Chinese officials reported to the World Health Organization an unknown case of pneumonia, known as the flu, in Wuhan, China (Biswas et al., 2020). The World Health Organization declared Covid-19 a global epidemic on March 11, 2020 (Armstrong, et al., 2020). After analyzing the virus genome section of the respiratory tract samples of infected patients, a new virus called SARS-CoV-2-associated coronavirus was identified, which the World Health Organization named Covid-19 (Biswas et al., 2020). With no successful vaccine or treatment available and in an attempt to contain the spread of Covid-19, most governments around the world, including the US, authorized unprecedented social containment measures. These measures, among others, included social distancing and the temporary physical closure of educational institutions. Educational institutions had to adopt a digital approach to instruction and student learning, dramatically transitioning from traditional in-person classroom instruction to predominantly distance learning where teaching are provided remotely on digital platforms (Petar and Sarah, 2020). With advancements in communication technology such as the telephone, radio, television, and most recently the internet, new methods of learning, including distance learning, have emerged (O'Malley and McCraw, 1999). While a more expensive option for education in terms of setup, distance education has progressed in concept and practice from an "anywhere" to an "anytime" education delivery method (Shah, 2016).

When the first person in Herat Province of Afghanistan it was infected with Corona on February 15, 2020, and doctors confirmed that she was infected, the first episode of Corona began and spread to other provinces of Afghanistan within 30 days (Mousavi et al, 2020). Higher education in Afghanistan closed universities and schools on March 26, 2020, to prevent the spread of the coronavirus, and school and higher education curricula were suspended without specific planning. The officials and managers of higher education universities were advised to formulate the necessary measures, laws, and guidelines in the crisis of Corona and to provide the appropriate platform for electronic education and distance education (Taghizadeh and Mohammadi, 2020).

Considering that the universities of Afghanistan suddenly started the process of distance education with new experiences in the conditions of the Coronavirus, they faced many challenges, as well as the teaching and learning of the undergraduate biology course, especially the learning and laboratory activities in the curriculum suffered a lot of damage considering the aforementioned challenges, this research was conducted with the aim of identifying learning challenges and practical activities in the curriculum of the bachelor's degree in biology under the conditions of the spread of the Coronavirus, and the following special goals were also considered and investigated:

This research proposes to identify the challenges of lecturers' activities in virtual classrooms, identify students' challenges in the online classroom, and identifies the challenges of laboratory activities in Covid-19. These research questions:

-What are the challenges of student learning activities in virtual classrooms?

- What are the challenges of lecturers teaching activities in virtual classrooms?

Literature Review

The shift to distance learning and teaching created a variety of challenges and experiences for students in the spring of 2020, and educators had to tailor their content and curriculum for student

learning and participation. Here are some ways in which having a student help you to, both internally and externally, through your online learning experience (Mickey & Neumann, 2003). Biology is a branch of the experimental sciences, and its findings are based on observation and experimentation. At the time of the coronavirus, all laboratories were closed, and students did not have access to experimental activities. In this regard, (Humphrey and Wiles, 2021); has shown in its research that Biology lecturers have a challenge of 23.37% in the teaching planning phase, 48.63% in the implementation phase, and 28.10% in the assessment phase. These problems indicate that learning and the implementation phase of Biology in person have the mentioned challenges. Another study shows that there are challenges in biology education. These challenges profoundly affect the success of students. The problems mentioned are related; is, there is a cause-and-effect relationship. One of the main problems is that students feel that Biology depends on conservation. Furthermore, the abstract nature of biology frightens students. These students' feelings may be related to the fact that lecturers do not use different types of materials and do not conduct laboratory studies (Hadiprayitno and Kusmiyati, 2019).
The Covid-19 epidemic has caused the biggest disruption to education systems in human history, affecting nearly 1.6 billion students in more than 200 countries. The coronavirus has also shut down schools, institutions, and other educational facilities (Olabiyi, 2015). According to the (Pokhrel and Chhetri, 2021). Reported to WHO, as of the date of 13/10/2022, the number of deaths caused by the coronavirus has reached 6,540,487. Which changes every day? The Biology curriculum is inextricably linked to cognition and viral diseases. Biology is the science that discusses the life of living organisms based on their function, the production of existing genes, the creation of new species, and their characteristics. One of its branches is virology (World Health Organization. Coronavirus Disease (Covid-19) Situation Report –2022). Findings show that teachers made changes in their Biology courses that in some cases had potential negative effects on students' grades. Women also reported a greater negative impact on their learning and job preparation than men, which provides insights into students' perceptions of how they have been deprived of distance learning as a result. Instructors can take potential steps to create more inclusive forward-looking training (Victor and George, 2020). Another study to keep the focus on the basic concepts of Biology takes too much time to go into the details of Covid-19. Biology curricula are also often used to educate people about public health (Supriya et al., 2021). Based on the findings Roberts (2021), which states that other educators should be encouraged to continue to examine the impact of e-service learning content and assignments to help maximize online classroom learning during the Covid-19 epidemic and beyond.

Design and Methods

This paper was conducted with a qualitative approach to the Grounded Theory Method. The Grounded theory method is a valuable, flexible and accurate approach in studies and research during the Covid-19 crisis (Smith, 2021). A purposeful interview was used to collect data. In this study, 36 professors and students including 20 men and 16 women in the field of Biology were interviewed. Five professors, including professor guide, consultant professors, and two professors from the undergraduate biology department of Kabul Education University confirmed the validity of the interview questions. Two coders including professors of biology department of Kabul Education University confirmed the reliability of this research. The reliability of this number was checked based on Miles and Hubertaman's index (1999; quoted by Mohsenpour, 2017) as follows. Total cods 180. Reliability cods 64. Multiplication 2. Divided by total cods = Computational reliability between coders.

Reliability calculation =(64.2)=128/180=0.71. As a result, found 0.71. Considering that the result is 0.71 and it is more than 60%, it can be said that the reliability percentage of coding is case.

In the first stage, open coding was carried out. The data, in this case, were categorized early in the research process, concurrently with the research process. Then, line-by-line interpretation began to analyze the actual data from the interview data, in which the researcher was able to identify and categorize key points of the behavior under study. The data were then subjected to an abstract process. Through the process of abstracting, the researcher placed the underlying categories in the framework of higher-level structures. Then was centrally coded, which at this stage provided the recognition of concepts in the form of their inter-relationships and dynamics, to construct the theory. Finally, in the creation of central categories, the study population consists of 10 professors and 26 students from department of Biology at Kabul Education University in Afghanistan. Below are all the steps of data analysis in the form of a diagram (Fig. 1).

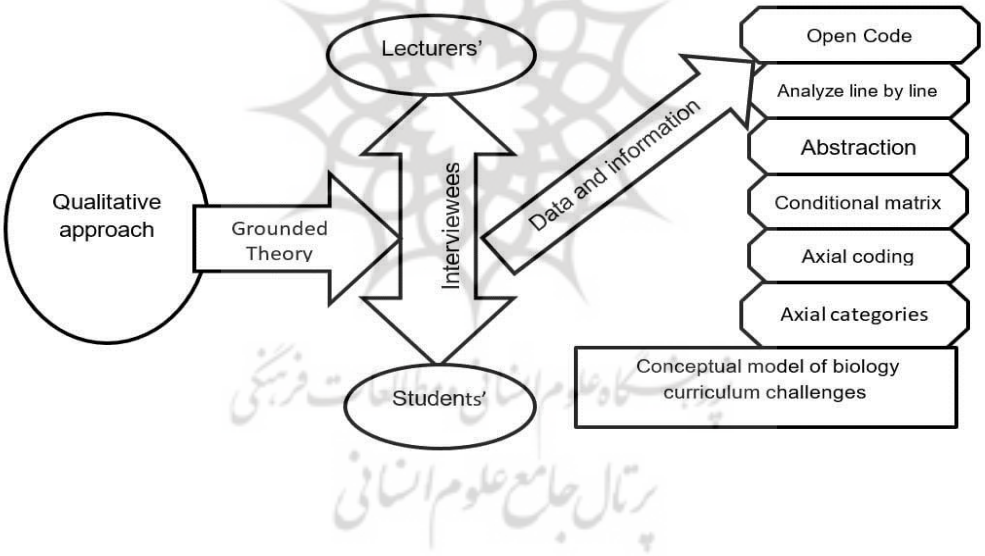

Figure 1. The figure shows the steps of the Grounded theory approach

Findings

The findings are written according to the objectives and research questions using the contextual theory method as follows: In the first step, the spoken evidence of the interviewees was organized. After summarizing and analyzing line by line, they were classified into 19 key categories. Finally, six final categories have been identified that highlight the challenges of learning biological activities under coronary conditions.

Table 1. In Table 1, the findings of the first and second questions of the research on the challenges of learning activities in the field of biology from the point of view of students-

teachers were shown in a consolidated form.

Open coding	Axial coding	Final categories
infrastructure facilities remote areas communication disruptions lack of internet	Construction communication technology networks	**Need for long-term goals in the technology sector for online education and teaching**
lack of communication networks lack of government electricity economic problems for internet packages lack of a suitable place to deliver lessons rotation lack of access to attend online lessons being busy with social issue	Government attention technology equipment	
harassing children at home not synchronizing lessons in all areas Lack of specialists and various technology software	Controlling the price consumption of the Internet	
Lack of understanding comprehension of the content inability to access course content inability to access the full text of the courses	Students do not have access to the specific content of online biology lessons	**Challenges in Biology Curriculum Content for online education in Covid-19**
reliance on submitted materials inability to purchase books pamphlets journals	Challenges in understanding the content of the virtual classroom	
Lack of practical lessons role-playing problem solving group lessons	Use practical lessons in biology	**Challenges in learning activities and strategies for teaching biology**
factory scientific visits to plants and animals lack of access to the laboratory	access to the laboratory	
lack of biology educational models Lack of access to plant cultivation in the Environment. Contacts: WhatsApp YouTube, Messenger Video Recorder Voice Recorder	Failure to view training models in coronavirus conditions	
Send silent videos send slides send textbook send biology shapes without explanation Provide lessons in different forms in different Software.	Design lessons in social networks and software Reduce the quality of course content	

Open coding	Axial coding	Final categories
Lack of a suitable place to deliver lessons government electricity rotation lack of access to attend online lessons	There was no suitable place to advance the lessons	**Challenges in the place and time of biology learning activities in Covid-19**
being busy with social issues harassing children at home	Being busy with social issues	
the challenge of not synchronizing lessons in all areas Lack of time for all courses choosing the time and time of courses to the liking of lecturers	Harassment of children while teaching female teachers online	
problems setting time at home, social challenges when pursuing online courses in the area	Challenges in setting the timing of biology lessons	
Lack of facilities to advance online lessons smartphones laptops	materials equipment for e-learning	**The role of educational materials, tools, and resources in biology learning activities**
Solving problems in a timely manner Reliance on submitted materials.	not used materials tools in biology education	
Inequalities in exams lack of evaluation of union activities lack of daily activities of students	Challenges in evaluation justice and transparency	**Challenges in evaluating biology lessons**
lack of group lessons by students lack of consideration of individual differences	Challenges in the ongoing evaluation of biology lessons	

Key: Open categories, main categories, and final categories related to the challenges of educational activities in the conditions of Corona in the table above, after the final analysis, six final and key categories were received from the interviewees' verbal evidence.
It's shown key concepts are below.

Research Outcomes

In the above table, six important categories extracted, which are:

- Need for long-term goals in the technology sector for online education and teaching
- Challenges in Biology Curriculum Content for online education in Covid-19
- Challenges in learning activities and strategies for teaching biology
- Challenges in the place and time of biology learning activities in Ccovi-19
- The role of educational materials, tools, and resources in biology learning activities
- Challenges in evaluating biology lessons

Below are the final categories that have been-received with all their details.

Need for Long-term Goals in the Technology Sector for Online Education and Teaching

Virtual education on coronavirus in Afghanistan was the first experience that is very important for Higher Education, especially Biology education, based on research findings, infrastructure construction, and technology networking in this country. Higher Education leadership and technology professionals must set long-term and short-term goals to address the challenges and problems of the curriculum.

Challenges in Biology Curriculum Content for Online Education and Teaching

Content selection and access were one of the most important elements of the biology

curriculum, which in the case of Covid-19. Impairs comprehension, lack of access to course content, lack of access to educational resources, reliance on materials submitted by the lecturers, lack of content, lack of practical work, intensification of courses and learning disabilities, the backwardness of courses are the challenges that have affected students.

Challenges in Learning Activities and Strategies for Teaching Biology

Biology professors communicate with their students through various social networks YouTube, Messenger, Video recording, Audio recording, sending silent Videos, sending slides without description, sending textbooks, and various animal shapes without explanation. They took and offered different types of lessons. Teaching activities and methods play the most important role in the Biology Curriculum, and procrastination disrupts the entire curriculum. Accordingly, students have given priority to face-to-face lessons. On the other hand, Biology activities, such as laboratory work, factory work, group lessons, scientific visits, experimental visits, and small gardens, did not take place at the Covid-19 condition.

Challenges in the Place and Time of Biology Learning Activities in Covid-19

The right place to teach is an important issue that used to be taught in schools and universities; but in the case of Covid-19, it took a high position. The right place for online lessons, the lack of access to any place for lessons, and the use and annoyance of children while taught by female teachers have been challenges that have affected the biology curriculum in coronavirus condition:

Participant One story of a female lecturer, that my children were sensitive to sitting at the computer and behind the desk and did not allow me to teach online classes (Interweaver, 14).

Time was wasted during the Covid-19 conditions, including lack of time to attend the classes, lack of time to exchange ideas with the lecturer about academic and class problems, being busy on social media, disconnecting Audio, video, and course materials, being time-consuming downloading materials to the Internet was poor. There was no regular schedule for instructors (one instructor at 10 and one instructor at 3).

The Role of Educational Materials, Tools, and Resources in Biology Learning Activities

Educational materials and resources are one of the most important elements of the curriculum that has done the most damage to the biology curriculum under Covid-19. There were various problems such as lack of teaching facilities for biology, lack of use of local materials in teaching biology, lack of access to laboratory materials and equipment, lack of an image of cells, tissues, and images of animals and plants. The negative effect of communication networks during the virtual class, lack of the availability of permanent electricity, the use of solar energy were issues that were problematic during virtual classes.

Challenges in Evaluating Biology Lessons

Evaluation, which has been an important element of the curriculum, has been challenged condition of Covid-19. Because students are not present and the same evaluation guidelines have been -revealed, including the lack of appropriate criteria for evaluating virtual classroom courses, individual inequalities between students, and the lack of formative evaluation of courses.

One of the biggest problems in the conditions of the coronavirus was the non-compliance with the evaluation criteria in the biology curriculum, in the virtual classes; the professors cannot do the evaluation properly (23).

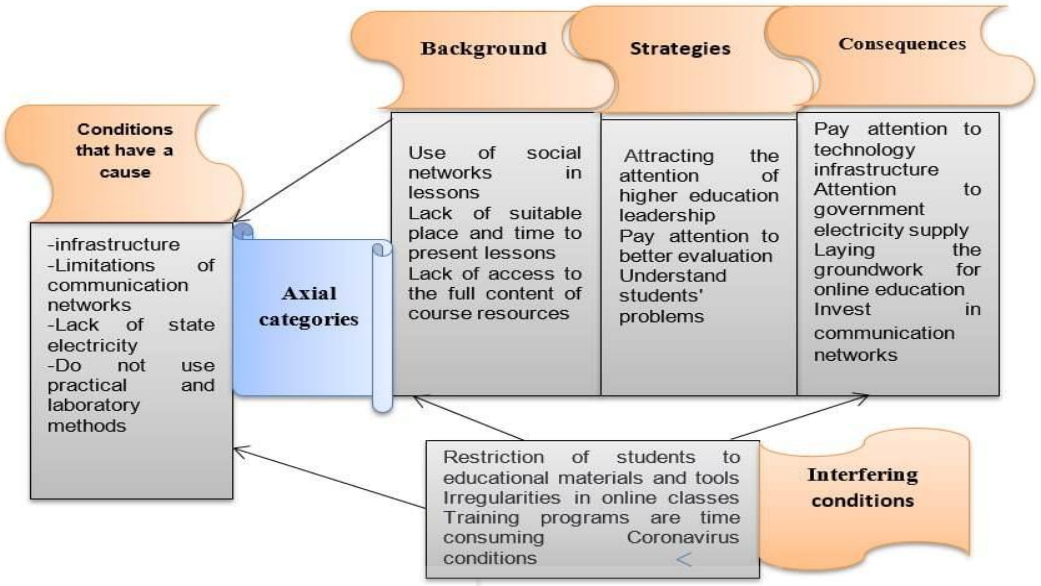

Figure 2. Conceptual Pattern 1 Open Coding

Fig. 2 shows that the main categories of choice options, which include causal conditions, background conditions, strategies, intervening conditions, and consequences.

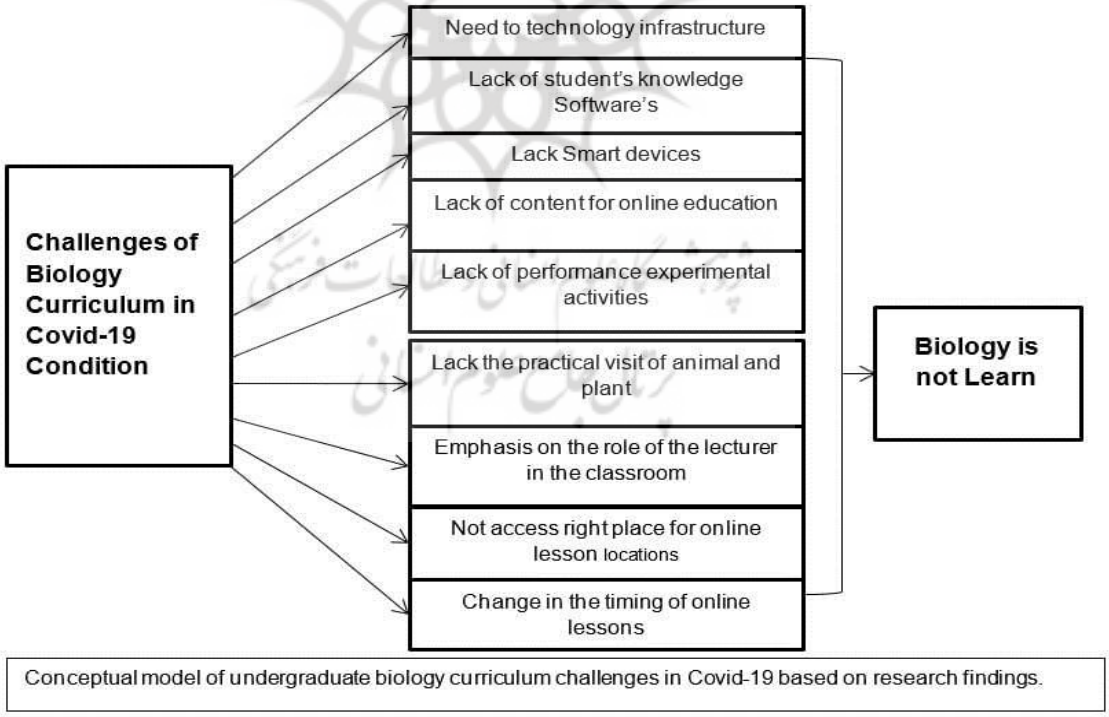

Figure 3. Conceptual structure model 1 of biology curriculum challenges.

Fig. 3 depicts the conceptual model shows, in addition to the challenges mentioned, other challenges, including female and male students, are the lack of smart devices, phones, and computers based on economic issues. Biology students have also stated that their academic

problems will be better solved with the presence of a professor. There are many challenges to higher education in Afghanistan. One of these challenges is the lack of government electricity in some provinces and government offices and universities. Therefore, when higher education institutions do not have electricity and internet, they will face many challenges. Students did not attend all of the virtual classes during the coronavirus outbreak. In addition, educational materials are scarce in educational institutions and family resources are not used, especially in cases of coronavirus. Students also face many problems in assessment.

Discussion

The findings of this study show that Biology Curriculum Learning Activities face various challenges in coronavirus conditions. There are many important challenges that have affected the educational activities of the Biology Curriculum during the time of the Coronavirus. Solving these challenges requires building the technology infrastructure to achieve long-term goals. Implementing this online education, which is a relatively new phenomenon in Afghanistan, can be effective in all Higher Education Institutions. This result is consistent with the findings Jablonsky et al., (2021); the dominant approach to developing a long-term ICT program, he said, is to build IT infrastructure as an important requirement. The study found that the content of the biology curriculum faces challenges in online education and virtual classrooms, which is similar to the research result Pokhrel and Chhetri, (2021) because of his research, which stated that the main problems of the student in learning are scientific topics and the complexity of students' topics. An important challenge in the biology curriculum learning activities is the lack of use of practical and laboratory methods that are not aligned with research Rezaei et al., (2016) but rather in learning biology distance learning solutions. Using published research and teaching experience, the best ways to manage a biology class emphasize the distance between students. They provide ideas for resources for content, laboratory activities, safety, and interaction between class participants. Time and place are much more important than usual in coronavirus learning activities.

The study shows that the lack of coordination of curricula in the current situation and the challenges of its evaluation has ultimately led to a lack of better understanding of biological issues in students. This result is also consistent with Espino results Hallyburton, and Lunsford, (2013); states that the quality of virtual curriculum evaluation faces many challenges, and managers must be able to overcome obstacles and challenges with their decisions and actions. Communication, technology information, and network education can play a major role in changing the education paradigm today. Numerous challenges such as lack of access to students 'basic needs in virtual classrooms, lack of regular curricula that waste students' time, lack of infrastructure for extensive online education, and lack of content and materials, were all factors that led to learning activities in biology. Scientology has been affected. One of the biggest challenges was for students to worry about their health and that of their families. Díaz, et al., (2020); Said, everyone is at home and the Coronavirus has taken the life out of the cities, but people in all societies are looking to revive friendly and creative relationships with a revolution. Take. This is in line with the research findings Di Pietro et al. (2020); the report says that the conservative and indirect approach of educational systems to the coronavirus has affected the success of children. The report shows that, on average, students suffer from reduced learning. The coronavirus still does not affect students equally. However, for some students, the acquisition of cognitive and non-cognitive skills has a negative impact and in addition to the current processes, will have long-term consequences. In (Covid-19: Youth & Education: Impacts, Option, 2 0 2 0); "At the time of Covid-19, I was not able to complete my one-year curriculum on time," One UNICEF training package quoted me as saying. The biggest concern about the Coronavirus is that some students have not been able to watch online TV shows for months, and I know that some students have many difficulties learning at home. (Armstrong et

al., (2020); said universities should have developed distance learning programs but had no plans. The coronavirus challenged universities with a vague approach, and not much information was available for rapid transfer to universities, leading to an educational crisis.

Michael, (2020); Discusses how to develop and deepen students' moral philosophy in the context of the coronavirus, especially in biology, and says that the condition of Covid-19 also provides opportunities for students with sociological thinking and information skills. This result is in line with the research findings. In this case, Ortiz, (2020);"Years later, when I started online courses in a traditional classroom, I realized that virtual courses are not textual, but use a variety of tools. This is in line with research findings," he says. Findings show that many educators and students have relied on technology to ensure they continue to learn online during the coronavirus epidemic. However, in the present study, the challenges of the need for Technology Infrastructures such as Networks, Internet, Electricity, Access problems, and Lack of access to poor virtual skills, online education has faced problems. This study emphasizes that given the devastating effects of Covid-19 on the education sector and all educational institutions, educators and learners need to adapt to emerging global trends and realities in education to use technology and improve their virtual skills. These findings are similar to the results of the present study and confirm the challenges in education (Onyema et al., 2020). Emphasize that today e-learning and virtual experiences have gained considerable popularity in science education. During the Covid-19 closure, regular classes in several countries around the world were suspended. In this scenario, virtual classrooms and online resources could be a more effective alternative to learning science at home (Ray and Srivastava, 2020).

Conclusion

It is concluded that the educational activities of biology curriculum in different universities of Afghanistan, especially in Kabul University of Education, are facing various challenges during the Coronavirus conditions. According to the lecturers, there were many problems such as deficiency of infrastructure for online education, lack of attention to educational content and materials, non-use of educational materials and resources. In addition, other issues were harassment of children to promote online teaching for female lecturers, change of teaching time according to circumstances, non-use of methods student-centered was the lack of continuous assessment in online courses and the lack of experimental activities in the laboratory. Students' worries about themselves and their families, lack of access to the Internet and smart devices, lack of permanent electricity, use of solar energy in the family environment, students' emphasis on the presence of teachers in classes, and lack of a suitable place to continue teaching in virtual classes are all factors. Students' opinions affect the biology curriculum in the context of the coronavirus outbreak.

The results show that all the challenges have arisen from the lack of an online education system in the country. Virtualizing the education system in Afghanistan is not an easy task; therefore, we must spend more time, effort, and resources on virtualizing the education system in universities. Thus, to create the facilities of the online education system, it is necessary to collect more financial aid and resources at the national and global levels. In this research, the researcher was faced with many limitations and problems to reach the participants due to the epidemic of the coronavirus, which was beyond the reach of the researcher.

References

[1] Armstrong, M. E., Ramsey, W. K., Yankey, B and Self, B. S. (2020). COVID-19 and Distance Learning: Effects on Georgia State University School of Public Health Students. Public Health, September 25, 8, 1-10. https://doi.org/10.3389/fpubh.2020.576227

[2] Biswas, A. B. U., Chakrabarti, AK. T. DN., Banu, H. D. (2020). The emergence of Novel Coronavirus and COVID-19: whether to stay or die out? Crit Rev Microbial. 46(2), 182-193. doi: 10.1080/1040841X.2020.

[3] Díaz, L.E., Caminero, G.F., Carmen, M. H.L., Gonzalez, H.G and Castillo J.L. A. (2020). Analyzing the Impact of COVID-19 on Education Professionals, Toward a Paradigm Shift: ICT and Neuroeducation as a Binomial of Action. Journal Sustainability, 12, 1-12. doi: 10.3390/su1214564.

[4] Di Pietro, G., Biagi, F., Dinis, M.D., Costa, P., Karpinski, Z and Mazza, J. (2020). The likely impact of COVID-19 on education: Reflections based on the existing literature and recent international datasets. European Union Luxembourg. doi: 10.2760/126686, JRC121071.1739001.

[5] Farhadi, M., Bahram and Zakir, A. (2021). Strategies and challenges of conducting an active biology laboratory classroom, with a view to the future based on the experience of the Corona pandemic era, the second national conference of future schools, Ardabil, https://civilica.com/doc /1404359. [In Persian]

[6] Gamage, Kelum A. A., Dilani I. Wijesuriya, Sakunthala Y. Ekanayake, Allan E. W. Rennie, Chris G. Lambert, and Nanda Gunawardhana.(2020). Online Delivery of Teaching and Laboratory Practices: Continuity of University Programmes during COVID-19 Pandemic. Education Sciences 10, no. 10: 291. https://doi.org/10.3390/educsci10100291

[7] Gasparello, J., Papi, C., Zurlo, M.,Cosenza, LC., Breveglieri, G., Zuccato, C., et al. (2022) Teaching during COVID-19 pandemic in practical laboratory classes of applied biochemistry and pharmacology: A validated fast and simple protocol for detection of SARS-CoV-2 Spike sequences. PLoS 1 17(4): e0266419. https://doi.org/10.1371/journal.pone.0266419.

[8] Hallyburton, C. L., and Lunsford, E. (2013). Challenges and Opportunities for Learning Biology in Distance-Based Settings. Interdisciplinary Science Literacy, 39 (1), 27-33.

[9] Hadiprayitno, G. M & Kusmiyati, A. (2019). Problems in learning biology for senior high schools in Lombok Island. The International Seminar on Bioscience and Biological Education, IOP Conf. Series: Journal of Physics: Conf. Series 1241 (2019) 012054 IOP Publishing, doi:10.1088/1742-6596/1241/1/012054.

[10] Humphrey, E. A and Wiles, J. R. (2021). Lessons learned through listening to biology students during a transition to online learning in the wake of the COVID-19 pandemic. Ecology and Evolution Willey. 11, 3450–3458. doi: 10.1002/ece3.7303.

[11] Jablonsky, S. A., Ryleigh, F., Marco. E., Diana, B. J. Jeffrey & Morris S. R. (2021). Impacts of a COVID-19 E-Service-Learning Module in a Non-Major Biology Course. Journal of Microbiology & Biology Education, 22, (1), 1-8. https://doi.org/10.1128/jmbe.v22i1.2489.

[12] Michael, J. R., (2020). Science Education in the Light of COVID-19 the Contribution of History, Philosophy, and Sociology of Science. Science & Education. 29(4), 1079–1092. https://doi.org/10.1007/s11191-020-00143-5.

[13] Mickey, S & Neumann, Y. (2003). Differences between traditional and distance education academic performances: a meta-analytic approach. International Review of Research in Open and Distance Learning. 4 (2), 1-20. doi: 10.19173/ rode.v4i2.153.

[14] Mohsenpour, K., H. (2017). Explaining the conceptual framework of promoting the culture of curriculum planning in universities and institutions of higher education in the Islamic Republic of Iran. Shahid Beheshti University. Ph.D. Thesis. [In Persian].

[15] Mousavi, S. H., et al. (2020). The First COVID-19 Case in Afghanistan acquired from Iran. Publish Online March 23, 2020. https://doi.org/10.1016/S1473-3099 (20)30231-0.
[16] O'Malley, J., McCraw, H. (1999). Student's perceptions of distance learning, online learning, and the traditional classroom. Online J Dist. Learn Admin. 2, 1–10.
[17] Olabiyi, T. D. (2015). Biology Curriculum Problems as Perceived by Secondary School Students. University of Ibadan.1-40. doi: 10.13140/RG.2.2.12563.30240/1.
[18] Ortiz, P. A., (2020). Teaching in the time of COVID-19, Biochemistry and Molecular Biology Education, and State University of New York, Albany. Biochemist Mole Boil Educ. 48, 200-201.doi: 10.1002/bmb.21348.
[19] Onyema, E. M., Nwafor, C. E., Faith, A. O., Shuvro, S., Fyneface G. A., Aabha. S., Alhuseen, O. A. (2020). Impact of Coronavirus Pandemic on Education, Journal of Education and Practice, 11 (13), 108-121. doi: 10.7176/JEP/11-13-12.
[20] Petar, J., Aras. B., Miranda, M., and Sarah. H. (2020). Teaching in the Age of Covid-19.Postdigital. Post digital Science and Education. 3, 743–770. https://doi.org/10.1007/s42438-020-00169-6.
[21] Pokhrel, S. and Chhetri, R. (2021). A Literature Review on Impact of COVID-19 Pandemic on Teaching and Learning. Higher Education for the Future 8(1), 133–141. doi: 10.1177/2347631120983481.
[22] Ray, S. and Srivastava, S. (2020). Virtualization of science education: a lesson from the COVID 19 pandemic. Journal of Proteins and Proteomics. 11(2), 77–80. https://doi.org/10.1007/s42485-020-00038-7.
[23] Roberts, D. J. M. (2021). How might Covid 19 affect the biology curricula of the future? Two principles for curriculum developers, Published Online 51, 279-283. dio: 10.1007/s11125-020-09531-9.
[24] Rezaei, E., Yazdan, R., Maryam, G., Atene, F., and Mohammad Amin, A. (2016). The infrastructure attitude to strategic planning of information technology in organizations Marketing and Branding Research. Research Gate 3, 97-108. doi: 10.19237/MBR.2016.02.01
[25] Rajaei, S. M. (2020). Examining the strengths and weaknesses of the new curriculum of biology education at Farhangian University compared to the previous curriculum, specialized scientific quarterly - research in biology education, 1 (1), pp. 5-14. [In Persian]
[26] Supriya, K., Chris. M, Ariel, D. A., Joshua L. C., James, P. C., Katelyn, M. C., Paul, C. L., Tiffany. L., Amy, P., Rachel, A. St and Sara, E. B. (2021). Undergraduate Biology Students Received Higher Grades during COVID-19 but Perceived Negative Effects on Learning Frontiers in Education. Frontiers in Education. 6, https://doi.org/10.3389/feduc.2021.759624.
[27] Shah, D. (2016) online education: should we take it seriously? Climacteric, 19(1), 3-6, doi: 10.3109/13697137.2015.1115314Shachar.
[28] Taghizadeh, S., Haji, J. and Mohammadimehr, M. (2020). A Comparative Study of the Challenges and Opportunities of Higher Education in the Corona Pandemic in Iran and around the World. Journal of Nurse and Physician. 8 (27), 47-57. URL: http://npwjm.ajaums.ac.ir/article-1-804-en.html. [In Persian]
[29] Victor, V. T and George, V. T. (2020). A new biological definition of life. BioMol Concepts. 11, 1–6. doi: https://doi.org/10.1515/bmc-2020-0001.
[30] Velarde, V., Casado-Barragán, F., Thamar. M., Rands, VF and Gonzalez A. (2022). Home-based laboratory experiences during COVID-19 pandemic in undergraduate biochemistry students. Front. Educ. 7:965438. doi: 10.3389/feduc.2022.965438

[31] Vivien, R and Emmanuel, A. (2021). Bioscience laboratory practicals, projects and placements in a Covid-19 world, Journal of Biological Education, DOI: 10.1080/00219266.2021.1941187
[32] World Health Organization, Coronavirus Disease (COVID-19) Situation Report (2022). Available online at: https://www.who.int/docs/defaultsource/ (accessed September 9, 2022).
[33] Yu, M. and Smith, S. M. (2021). Grounded theory: A guide for a new generation of researchers. International Journal of Doctoral Studies, 16, 553-568. https://doi.org/10.28945/4836.