The American Journal of Social Science and Education Innovations
ISSN 2689-100X | Open Access

TYPE Original Research
PAGE NO. 41-46
DOI 10.37547/tajssei/Volume07Issue05-04

Check for updates

Using modular educational technology in teaching the topic of “the interaction of microorganisms and other organisms”

Zulaykho Abdunazarova

Researcher of Tashkenrt state pedagogical university named after Nizami., Uzbekistan

OPEN ACCESS

SUBMITTED 13 March 2025
ACCEPTED 09 April 2025
PUBLISHED 11 May 2025
VOLUME Vol.07 Issue 05 2025

CITATION

Zulaykho Abdunazarova. (2025). Using modular educational technology in teaching the topic of “the interaction of microorganisms and other organisms”. The American Journal of Social Science and Education Innovations, 7(05), 41–46.
https://doi.org/10.37547/tajssei/Volume07Issue05-04

COPYRIGHT
© 2025 Original content from this work may be used under the terms of the creative commons attributes 4.0 License.

Abstract: This article contains information on the methods of effective lesson planning and organization of classes using modular educational technology, as well as on how to achieve high efficiency indicators in the mastering of the topics presented in the module by students in the discipline of microbiology and virology.

Keywords: Module, test, microbiology, virology, bacteria, parasites, metabolites, modular education, technology, phytopathogenic microorganisms, epiphytic microorganisms.

Introduction: The use of modular educational technologies in teaching biology is of great importance. A distinctive feature of modular educational technology is that the topic studied in the lesson is divided into logically complete thought-out modules and a module program is drawn up. The module program is a program for managing the student’s educational and cognitive activities in this lesson, which includes the didactic purpose of the module program, educational tasks that students must complete, and instructions for completing the tasks.

Let’s have a general idea about microorganisms. Microorganisms are everywhere, but they rarely act alone. The best illustration of this fact is the Great Plate Count Anomaly, which claims that < 1% of all known microorganisms can be successfully cultured on their own. It is now clear that many microorganisms depend on the activity of other microorganisms to successfully grow and reproduce via mechanisms including acquisition and exchange of metabolites. The diversity of microbiomes is being explored using surveys that

draw on hundreds or thousands of samples and controlled experiments, with rapid genetic assessment techniques providing much of the evidence for taxonomic and functional diversity. Long-standing questions in microbial ecology such as whether everything is everywhere, but the environment selects can now be tested in fine detail by examining the geographic and habitat distributions of microorganisms. The web of microbial interactions spans all taxonomic ranks, from strain to super kingdom, and underscores the need for community-centric approaches to understanding microbial diversity [1].

Theoretical bases and results.

Lesson topic: Interactions between microorganisms and other organisms

Educational aim of the lesson: to introduce students to the interaction of microorganisms and other organisms.

Upbringing aim of the lesson: to form a conscious attitude towards the interaction of microorganisms with plants, phytopathogenic microorganisms, rhizosphere and rhizoplan microorganisms, epiphytic microorganisms, soil microorganisms and soil animals, to provide ecological, economic, sanitary-hygienic and moral education.

The developmental goal of the lesson: To develop students' skills in the main types of interactions of microorganisms with other organisms, symbiosis, metabiosis, antagonism, types of relationships between microorganisms, neutralism, mutual competition, mutual competition for elements, ammensalism, parasitism, predation, commensalism, protocooperation, mutualism, independent work on the textbook.

Lesson equipment: illustrated diagrams of microorganisms and their relationships, electronic methodological manual, animation and multimedia tools.

Technology used in the lesson: Modular educational technology (modular program designed by students)

Lesson progress:

I. Organizational part.

II. Determining and assessing students' knowledge on the topic of work in small groups using test questions.

III. Introducing students to the topic, purpose, and course of the lesson and directing their activities to complete educational tasks.

IV. Studying a new topic:

a) distributing a module program compiled on a new topic and introducing students to the didactic purpose of the module program;

b) directing students to independently complete educational tasks in the module program;

c) monitoring the full implementation of the tasks of each educational activity element, giving appropriate instructions;

g) conducting a question-and-answer or discussion at the end of each educational activity element.

Didactic objective of the module program. Using the module program, we need to work with students in small groups, collaboratively, to introduce students to the interactions between microorganisms and other organisms, symbiosis, metabiosis, antagonism, types of relationships between microorganisms, neutralism, mutual competition, mutual competition for elements, ammensalism, parasitism, predation, commensalism, protocooperation, mutualism, and to introduce students to electronic educational materials about microorganisms enriched with visual aids and digital technologies, explain the role of beneficial microorganisms in human life and nature, and in the development of our economy, and develop students' skills in independent work on textbooks.

Completion of the module program.

I. Monitoring and evaluating the knowledge acquired by students on a new topic using test tasks.

II. Processing and finalizing the new topic.

III. Assigning homework.

After the end of the module program, the teacher recommends test tasks to students on a new topic. After the students have determined the answers to the test tasks, the teacher announces the correct answers. The student checks his answers himself and puts his mark in the appropriate graph of the module program. In this way, the student monitors himself. When monitoring the implementation of the module program, mutual monitoring between students also gives good results.

Additionally, interactions between native and non-native species are correlated with transmission of microbiota, often determined by relatedness or diet type, and the microbiome plays a key role in the control and competence of insect crop pests and vectors of disease. The following questions aim to address the shortfall in our understanding of the interactions between microbiomes and their human and non-human hosts.

What are the primary mechanisms within a host that mediate microbe–microbe and host–microbe interactions?

What are the relative contributions of host-associated and environmental factors in determining host

microbial community composition?

How do microbial communities function to affect the phenotype of the host?

Can compositional or evolutionary changes in microbiomes help hosts adapt to environmental change within the lifetime of the host?

What is the role of the microbiota in host speciation processes?

How can the associated microbiota be effectively included in risk assessments of invasive non-native species?

How does the microbiome of captive animals affect the success of reintroduction programmes?

How can a 'systems biology' approach improve our understanding of host–microbe interactions? [2]

Microbiology practice questions

1. Which of the following structures contains genes for enzymes and antibiotic resistance?

A. Plasmid

B. Pilus

C. Capsule

D. Plasma Membrane

2. Which of the following is the most important structure related to microbial attachment to cells?

A. Flagellum

B. Plasmid

C. Peptidoglycan

D. Glycocalix

3. Which of the following is not a gram-negative bug?

A. Clostridium perfringens

B. Vibrio cholerae

C. Escherichia coli

D. Bordetella pertussis

4. Which of the following is not true related to endotoxins?

A. Endotoxins are secreted from cells.

B. Can be linked to Meningococcemia

C. Produced by gram negative microorganisms

D. Can cause fever

5. Which of the following microorganisms stain well?

A. Escherichia coli

B. Legionella pneumophila

C. Treponema

D. Chlamydia

6. Which of the following microorganisms are not matched correctly with the appropriate isolation media?

A. Fungi – Sabourand's agar

B. Neisseria gonorrhoeae – Pink colonies media

C. Haemophilus influenzae – Chocolate agar

D. Mycobacterium tuberculosis – Lowenstein-Jensen agar

7. Which of the following diseases and bacteria are matched up incorrectly?

A. Cellulitis – Pasteurella multocida

B. Tularemia – Francisella tularensis

C. Gastritis – Heliobacter pylori

D. Lyme disease – Yersinia pestis

8. Which of the following diseases and bacteria are matched up incorrectly?

A. Treponema pallidum – Syphilis

B. Tinea nigra – Cladosporium werneckii

C. Borrelia burgdorferi – Lyme disease

D. Yersinia enterocolitica – Diptheria

9. Which of the following is not true concerning Staphylococcus aureus?

A. S. aureus is related to inflammation.

B. S. aureus can cause pneumonia

C. S. aureus can lead to acute bacterial endocarditis

D. S. aureus does not make coagulase

10. Which of the following signs and symptoms is not linked to Haemophilus influenzae?

A. Otitis media

B. Pneumonia

C. Malaria

D. Epiglottis

11. The Tsetse fly is a transmission factor for which of the following organisms?

A. Trichomonas vaginalis

B. Trypanosoma gambiense

C. Entamoeba histolytica

D. Toxoplasma

12. The Ixodes tick is a transmission factor for which of the following organisms?

A. Trichomonas vaginalis

B. Leishmania donovani

C. Babesia

D. Giardia lamblia

13. Chagas' disease is commonly treated with

Nifurtimox and is linked to the ____ microorganism.

A. Naegleria

B. Schistosoma

C. Wucheria bancrofti

D. Trypanosoma cruzi

14. Which of the following is not fungal related?

A. Cryptococcus neoformans

B. Candida albicans

C. Tinea nigra

D. Chlamydiae

15. Which of the following is not a DNA virus?

A. Adenovirus

B. Calicivirus

C. Papovirus

D. Poxvirus

16. Which of the following is not a RNA virus?

A. Reovirus

B. Orthomyxovirus

C. Deltavirus

D. Herpesvirus

17. Which of the following viruses is not a double strand linear DNA virus?

A. Poxvirus

B. Papovavirus

C. Adenovirus

D. Herpesvirus

18. Which of the following viruses is not a single strand linear RNA virus?

A. Togavirus

B. Retrovirus

C. Bunyavirus

D. Picornavirus

19. The Tzanck test is not used on which of the following viruses?

A. VZV

B. HSV-2

C. HHV-8

D. HSV-1

20. Which of the following microorganisms has not been linked to UTI's?

A. E. coli

B. Pseudomonas

C. Klebsiella

D. Haemophilus [3]

Answer key

1. A, 2. D, 3. A, 4. A, 5. A, 6. B, 7. D, 8. D, 9. D, 10. C, 11. B, 12. C, 13. D, 14. D,

15. B, 16. D, 17. B, 18. C, 19. C, 20. D

An Injecting Drug User presents to ED with the lesion (as shown) on his arm. He also has a fever.

1) What disease is very important to exclude as a cause of his lesion?

2) The clinician phones the microbiology laboratory asking what samples to take. What advice do you give?

3) How would you diagnose this condition in the microbiology laboratory?

Answers:

1) What disease is very important to exclude as a cause of his lesion?

Cutaneous anthrax would be an important diagnosis not to miss here. There are three main forms of anthrax, cutaneous, inhalational, and gastro-intestinal. Early treatment of cutaneous anthrax is associated with a high survival rate. Injecting Drug Users mainly suffer from either the cutaneous or inhalational forms of anthrax.

Cutaneous anthrax in its early stages may present as a papule,vesicle or ulcer (as opposed to the classical black eschar seen in the latter stages). They may be multiple, particularly in injecting drug users.

2) The clinician phones the microbiology laboratory asking what samples to take. What advice do you give?

Superficial swab of the lesion for culture (Further swab if PCR for B. anthracis is locally available).

2 x punch biopsies, one in formalin for histology, the other for culture. 2 set of blood cultures.

Acute and convalescent serum samples for serological testing.

Although not a "sample", the clinician should be strongly encouraged to get a photograph of the lesion/s

How would you diagnose this condition in the

laboratory?

B. anthracis is a Hazard Group 3 Pathogen and sample can be safely handled in containment level 3, in a class 1 safety cabinet.

Initially a Gram stain should be made after fixing a smear in 100% ethanol for one minute. The sample should also be cultured on routine media which should include straightforward blood agar.

A classical Gram stain is shows short chains of "boxcar" like Gram positive bacilli. Spore formation may or may not be present.

Colonies of B. anthracis (after 24 hrs incubation) are white, non-haemolytic with irregular edges and can be described as oval or comma shaped. They are also granular and "tacky". They are catalase positive.

Any positive/suspicious cultures should be sent to a reference laboratory for confirmation.

As with all exotic diseases like this it is important to seek expert assistance as soon as possible, both from a laboratory and clinical perspective. Public Health Authorities should also be made aware of the case at an early stage.

The above answers are just a summary of the complete picture….. Here are two good references for more detailed information on the diagnosis of anthrax in all its forms [4].

Have a look at these pictures from two different patients with the same clinical condition, and answer the questions below:

1) What is the likely clinical disease in these two patients?

2) What are the likely causes of this condition?

3) How is it diagnosed in the laboratory?

4) What are the main complications of the condition?

Answers:

What is the likely clinical disease in these two patients?

Hand, Foot and Mouth syndrome. Sometimes the lesions do not always appear on all three areas. Sometimes the lesions appear in other areas also, such as the buttocks and peri-oral area.

Classically the lesions are papulo-vesicular, but sometimes vesicles are not present.

When the lesions only appear on the oro-pharynx, it is sometimes called "herpangina"

What are the likely causes of this condition?

Hand, foot and mouth disease is a clinical syndrome caused by enteroviruses. The most common enteroviruses causing this syndrome worldwide are Enterovirus 71 (EV71), Coxsackie A6 (CA6), Coxsackie A16 (CA16), and Coxsackie A10 (CA10).

How is it diagnosed in the laboratory?

In most cases the clinical diagnosis is obvious. If laboratory diagnosis is required then Enterovirus PCR can be attempted in either vesicle fluid, throat swab or stool. Only with vesicle fluid can a positive result be firmly attributed to the patients clinical symptoms and signs, and this is what I would recommend if available.

Enteroviruses can be isolated by viral culture, but this goes hand in hand with all the well known limitations of viral culture.

Enterovirus serology suffers from significant sensitivity and specificity problems and many laboratories no longer offer it.

What are the main complications of the condition?

Most cases of Hand, Foot and Mouth Disease are mild and self-limiting. However serious complications (and

fatalities) can occur with clinical syndromes such as aseptic meningitis, encephalitis & acute flaccid paralysis. There may also be pulmonary oedema, possibly neurogenic in nature. These complications occur most commonly with EV71[4].

CONCLUSION

Xulosa o‘rnida shuni aytish mumkinki, talabalar mikrobiologiya dunyosini juda xilma-xil deb bilishadi va mikrobiologiyadan mavzularning barchasi tabiatda uchraydigan ozaro munosabatlar natijasida yuz beradi, deb o'ylashadi. Modulli ta’lim texnologiyasi yordamida mavzuni kichik guruhlarda test savollari yoki rasmli topshiriqlarni yechish usulida berilsa talabalarda mavzuni o‘zlashtirishning samaradorlik ko‘rsatkichlari oshadi.

REFERENCES

Eva Boon, Conor J Meehan, Chris Whidden, Dennis H-J Wong, Morgan GI Langille, Robert G Beiko. Interactions in the microbiome: communities of organisms and communities of genes. FEMS Microbiol Rev. 2013 Aug 28;38(1):90–118. doi: 10.1111/1574-6976.12035

Rachael E. Antwis1, Sarah M. Griffiths, Xavier A. Harrison, Paz Aranega-Bou, Andres Arce, Aimee S. Bettridge, Francesca L. Brailsford, Alexandre de Menezes, Andrew Devaynes, Kristian M. Forbes, Ellen L. Fry, Ian Goodhead, Erin Haskell, Chloe Heys, Chloe James, Sarah R. Johnston5, Gillian R. Lewis, Zenobia Lewis, Michael C. Macey, Alan McCarthy, James E. McDonald, Nasmille L. Mejia-Florez, David O’Brien, Chloe Orland, Marco Pautasso, William D. K. Reid, Heather A. Robinson, Kenneth Wilson and William J. Sutherland. Fifty important research questions in microbial ecology. FEMS Microbiology Ecology, 93, 2017, fix044. –Pp.1-10.

https://www.testprepreview.com/modules/microbiology1.htm

https://microbiologymatters.com/?page_id=1139