

Teaching, Learning and Assessment of International Baccalaureate Organization Biology Students.

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Abstract

The aim of this article is to present various teaching methods, learning strategies and assessment methods integrated in lessons imparted to Biology students of International Baccalaureate Organization. The application of teaching, learning and assessment practices enhanced students learning outcomes, engaged students in classroom, virtual laboratories and field trips, developed critical thinking, effective communication, social, research and management skills.

Introduction

Teaching, Learning and Assessment are integral part of International Baccalaureate Organization Middle and Diploma Program curriculum. Active engagement of students in classroom, laboratories and field trips enhances skills and content. The student go through a process of learning by engagement in various learning activities as individual students and collaborative team resulting in learning and understanding content by utilization of skills and also development of new skills. In this study teaching, learning and assessment practices were employed for both face to face classes and online classes before and post COVID – 19.

I taught International Baccalaureate Biology to Diploma Program and Middle Year Program students.

Teaching

Lessons included teaching via White Board and Marker, Power Point Slides, Pointer and Videos. The remaining lessons were divided into learning activities and assessments. I taught two units of Diploma Program which are Molecular Biology & Genetics and two units of Middle Year Program which are Transpiration in Plants and Evolution respectively. The lessons were delivered Face to Face at Campus and Online with aid of Online Microsoft White-Board, Zoom, Skype Business and Microsoft Teams. An indigenous teacher-student portal was used to post the online activity-based questions.

Learning

The learning activities included individual and group activities to build content and skills.

The learning activities integrated in Face to Face and Online

1. **Stump your partner** – Each student was asked to think of a challenging question and share it with other instructor and students in classroom.

For example: Students asked whether with given condition on Mars Planet can plants and microbe evolve to form new species.

What will be the impact of new condition of Mars Planet on Transpiration in Plants?

2. **Think-Pair Share-** The questions from stump your partner activity were selected and then students were divided into group of two to do research, think critically and finally communicate the response to other students in classroom.

Students worked in groups of two to explore the condition on Mars Planet and further explored how these weather and atmospheric condition will impact the diffusion, turgor pressure, osmosis and water potential which are important for movement of water from soil to plants.

3. **Write- Pair Share-** Each group was further asked to communicate the responses in written form.

Students did research and communicate their written responses on the student-teacher portal.

4. **One Sentence Summary** – Each student was asked to write one sentence summary of the concept taught or of the video shown or presentations made by students in classroom.

Students listened and prepared summary of the presentations on following topics – Insulin, Rubisco, Immunoglobulins, Rhodopsin, Spider Silk and Collagen.

5. **Minute Paper** – Each student was asked to respond briefly to a subject question or response related to lesson which could include what are the most significant, useful, surprising things student have learned in the lesson or unit.

Students were occasionally asked minute paper on weekly basis towards end of the session for learning check.

6. **Notes Making** – Each student was shown animations in classroom and were asked to make notes.

Students were taught what is the structure of protein, transcription and translation and were further shown animations on structure of proteins, transcription, and translation via McGraw Hill Education open access web portal. Students were then asked to prepare notes to enhance their learning.

7. **Send a Problem Activity-** In this group activity students were divided into group of four students to discuss the response to a problem-based question. Each group solved the problem and then passed on their written responses to other group to evaluate and finally the second group passed on their evaluation to first group responses to last group for further evaluation.

Students were explained what is evolution and types of evolution such as convergent, divergent, coevolution and parallel evolution. Students were presented with A case study of coevolution: squirrels, crossbill birds, and the pinecones. In this study the pinecones were available for eating by Birds and Squirrels however due the shape and size of the pinecones they were not easily available for eating by predators – birds and squirrel due to an adaptation by these pinecones. In due course of time due to less availability of pines to predators – the competition and evolutionary processes allowed the pines and birds to coevolve but the squirrels had a difficult time with wide pinecones in a way specific species of pines and birds evolved leading to easy predation of pines by birds. On the contrary in some habitats crossbill birds were the only predator and were better able to extract the seeds from the pinecones.

Now the stage for evolutionary processes and its outcome is nearly set and question is whether the coevolution has happened?

8. **Jig Saw-**In this group activity students were divided into group of four . Each group discussed among themselves a topic and finally formulated the knowledge. Each of four group had a different approach to learn a new topic. And finally, students were regrouped in a way so that they can integrate the acquired knowledge from previous group to the new group (each new group had a student with new knowledge to impart).

Students were taught what is turgor pressure, osmosis, diffusion, and water potential. After these explanations and

elaborations students were divided into groups of four so that each group discusses the impact of rainy and dry day on turgor pressure, osmosis, diffusion, and water potential. Each group elaborated and explained assigned topics by engaging themselves in research and communicating these concepts. Further student from each group was assigned to a new second group to communicate their knowledge gained from previous group ; in this new group students were structured in a way that each student in every group had a new knowledge to impart.

9. Aesthetic Presentation- Each student was asked to prepare an oral presentation to deliver to other students in classroom.

Five topics were selected from Molecular Biology - Insulin, Rubisco, Immunoglobulins, Rhodopsin, Spider Silk and Collagen. Each topic was assigned to at least two to three students.

Also students selected the topics on their own on Genetic Diseases for presentation as part of Unit on Genetics.

10. Concept Mapping – Each student was asked to prepare their own concept map for the Unit which allowed students to identify their own doubts.

Students prepared concept maps for Units on Molecular Biology, Genetics, Evolution and Transpiration in Plants.

11. Fishbowl Debate – The students were divided into group of pros, cons and judges group so that they were able to discuss their views on a topic of international concern.

Students were taught what is a genetic modification and then students were given a topic to initially do research and further discuss the Pros and Cons of Genetically Modified Plants in which classroom was divided into groups of two – Pros and Cons. Also, a small group of students were designated as judges to support an argument. This activity gave students an opportunity to learn about Global Prospective of Genetically Modified Plants. This activity allowed how plants cells and tissues are changed when plants are genetically modified. The structure of Fishbowl debate allowed students to communicate and listen to understanding advantages and disadvantages of GMOs better. Students expressed their interest to further have more of these learning experiences.

Assessment

Students were challenged with both formative and summative assessments which included questions to test Knowing and understanding, Inquiring and designing, Processing and evaluating and Reflecting on the impacts of science.

A homework included design of a model of Transpiration in Plants using freely available resources. Students were also challenged with Multiple Choice Questions and short essay type questions.

As a result of above the teaching, learning and assessment experiences students developed and applied following skills- research, communication, self-management, critical thinking, and social skills as part their program to understand content and build skills.

Additional Learning Support and English as Second Language students were given support within classroom with differential learning support. The additional support by ALS and ESL teachers were also helpful beyond classroom for promoting learning diversity and autonomy within students.

Post COVID-19 Outbreak

All the lessons were conducted online using meeting platforms such as Zoom, Skype Business and Microsoft Teams. The teaching was conducted using Online Microsoft White Board which included text & images and Microsoft Power Point

Slides with text and images. The above learning activities were posted on Student-Teacher Portal. The virtual laboratories from HMMI Bio interactive, National Science Teaching Association and MERLOT resources were integrated in lessons. Finally, the assessments were conducted online using live sessions where students were in live session attempted examinations and were also invigilated at the same time.

The Theory of Knowledge, International mindedness topics were also explained and discussed with students both online and in face to face classroom which included resources from research articles.

The Extended Essay projects were developed online using Zoom and Microsoft Teams on Plant Physiology, Plant Biology, Microbiology and Biochemistry.

References

Learning activities were conducted from below resources

1. MERLOT – www.merlot.org
2. HMMI Biointeractive - <https://www.biointeractive.org/>
3. National Science Teaching Association – www.nsta.org

