Department of Biotechnology
ACHARYA INSTITUTE OF TECHNOLOGY
Acharya Dr Sarvepalli Radhakrishnan Rd, Soladevanahalli, Karnataka 560107

RECORDS OF INSTRUCTIONAL METHODS & PEDAGOGICAL INITIATIVES USED IN TEACHING AND LEARNING

Faculty members of the department of Biotechnology strive to inculcate innovative teaching methodologies in addition to the conventional methods like blackboard teaching and sharing learning materials. The objective is to establish an effective and quality learning system, the practices followed have two components namely conventional and innovative ones. A summary of the teaching-learning components, as well as conventional and innovative methods, is provided.

Summary of the teaching-learning components

Components	Conventional method	Innovative method
A. Learning Material	• Textbooks • Reference books • Journal papers	a. Learning outcome-based lesson plan b. Course-study materials c. E-learning materials
B. Instructional Delivery	• Classroom lectures using white/black board • Handouts	a. Digital class b. Model-based learning i) Model making ii) Model display c. Beyond class activities i) Practical demonstrations ii) Industrial visit iii) Hands-on-workshop d. Classroom interaction i) Learn while teaching ii) Competitive peer-learning iii) Surprise quizzes iv) Pictionary
C. Assessment and Evaluation	• Internal assessments (IA) • Written assignments	a. Modified MCQ b. Innovative questions in IA c. Charts/Posters/Model d. Peer-learning e. Group discussion

A brief description of the components utilized is as follows.

A. Learning Materials:

Conventional: Text books, Reference Books, Journal papers.

Innovative:

a) **Learning outcome based lesson plan:** Lesson plan written with course objectives are provided to the students and the syllabus frame work is discussed with them.

b) **Course-study materials**: Course specific study materials are communicated to the students through various platforms such as Alive, Edmodo or Google classroom for use by the students. Relevant e-posters through google classroom is made available to students.

c) **E-learning materials**: E-learning from renowned learning platforms such as SWAYAM, COURSERA EDX, NPTEL etc. are made use by the teachers and students. While the teachers utilize them to upskill themselves for contemporary knowledge, students are encouraged to utilize them to gain a wider scope of understanding and augmented learning. These resources are accessible through digital library of the institute (A-LRC Acharya learning resource center). In addition, A-LRC has e-journals and e-books for students' reference.

B. Instructional Delivery: Use of teaching aides

Conventional: Classroom lectures using black/white board, handouts.

Innovative:

a) Digital classroom: The availability of audio capable classrooms enable faculty to utilize the following modes of teaching. 1.Powerpoint presentations 2. Videos. This incorporates audio-visual learning into TLP.

The digital board's representation in class room

b) Model based teaching and learning practice:

i. **Model making**

- The students are assigned certain topics for which they will prepare working models.
- This will enable students to think critically and obtain better understanding of the concepts.
- The students would construct, mimic, evaluate and revise the concept thoroughly through this learning practice.
- The models will be evaluated by an expert either from college or industry and give suggestions to improve.

ii. **Model display**-

Displaying models in the classroom helps students to better understand systems and their working principle or concept. The model-based learning has been a highly effective tool to teach open elective courses as students are from other disciplines. The following is a visual representation of the same.

c) Beyond classroom activities:

Conventional: Nil

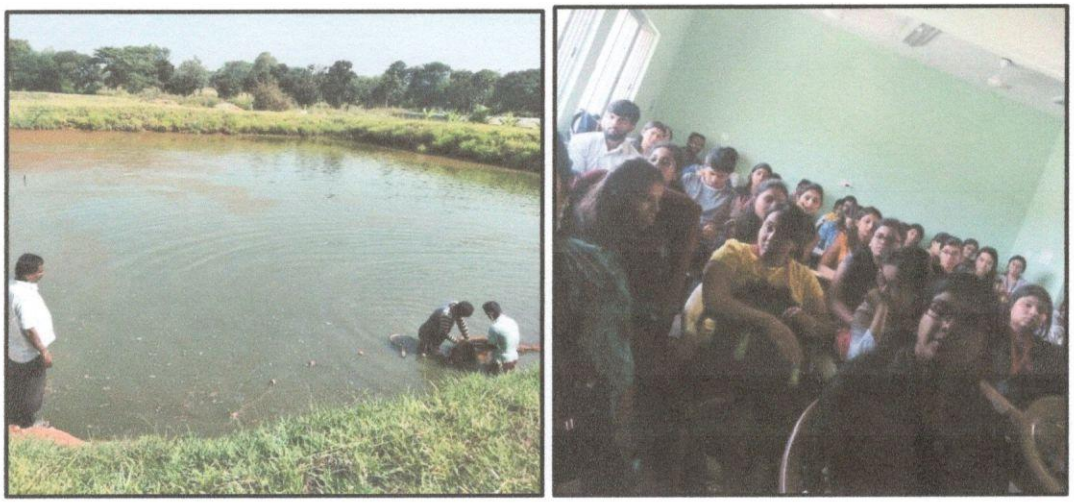
Innovative:

i. **Practical demonstration:** Coordination between the black/white board work and the practical aspects are made through laboratory demonstrations which enhances the understanding of the components/ equipment/ instruments/ devices /process etc.

ii. **Industrial Visit:**

Theoretical knowledge is inadequate for current industrial needs. With an aim to corelate theoretical knowledge to current industrial applications, industrial visits are organized to provide students a practical perspective.

An industrial visit to the Central Institute of Freshwater Aquaculture (CIFA) to learn about aquaculture was organised and is depicted below.



Industrial visit to CIFA. Left panel shows an artificial breeding environment and the right panel shows the students attending an expert talk.

iii. **Hands-on-workshop/training**

We have organized various hands-on-training/workshops in collaboration with research institutes." Students participating in a two-day hands-on training entitled "Bioanalytical Techniques- Synthesis and Characterization of Nanoparticles" at Visveswaraya Institute of Advanced Technology on 24th and 25th October 2019 are shown below. The training focused mainly on green synthesis of nanomaterial, its fabrication and characterization. The event was organized to include topics on bioanalytical techniques in course-Nanobiotechnology (15BT662) and this training gave practical experience to the students.

Left panel shows the X RAY diffractometer and the right panel shows equipment to synthesize nanomaterials under high pressure and vacuum.

d) Classroom Interaction:

Conventional: Classroom lectures followed by QA sessions.

Innovative:

i. **Learn while teaching:** The students are invited to volunteer for delivery of topics / subtopics related to the course in consultation with the faculty, who guides the student with relevant learning materials. A discussion session is held after the delivery of the topic. Such an experience develops the self-learning capacity, technical articulation, confidence, and communication skill of the student.

ii. **Competitive peer-interaction:** Quizzes and question answer sessions are arranged to make them competitive between different student groups in the class. The subject / topics are announced beforehand. It promotes self-learning capacity and team work amongst the students. To make it more interesting, the questions may be framed by the competitive groups for the opponent groups.

iii. **Surprise quizzes-** Random surprise quizzes are conducted to ascertain the general understanding of the class.

iv. **Pictionary**- Students are divided into groups and one representative from each group is assigned one terminology from the syllabus. The student gets few seconds to look at the terminology and they conceptualize the term using technical pictorial drawings on the board within the stipulated time. The teams need to guess the terminology correctly. This enhances the students to memorize the vocabularies word, while interacting with the group effectively

C. Assessment and Evaluation:

Conventional: Internal assessments, written assignments.

Innovative: Modern technical education demands learning outcome-based assessment.

Certain courses/concepts require extensive learning and a broader understanding. Hence the faculty have incorporated extensive learning processes such as

a) **Modified format for MCQ**- The MCQ's are framed and uploaded on LMS platforms.

b) **Innovative Questions in Internal Assessment**: case study-based question/scenario-based questions are incorporated in IA QPs to evoke critical thinking in students.

c) **Chart/poster/model making**- Student's understanding of concepts are evaluated based on their creation of appropriate structures such as charts/posters/models etc.

d) **Peer learning** (individual assessment) and **Group discussion-** (group assessment). Tables below tabulate the process and method of evaluation for each.

Department of Biotechnology
ACHARYA INSTITUTE OF TECHNOLOGY
Acharya Dr Sarvepalli Radhakrishnan Rd, Soladevanahalli, Karnataka 560107

Peer learning, an individual evaluation method

Peer learning – evaluation process	
Faculty Name	**Pruthvish R**
Course name and course code	**Bioinformatics 18BT63**

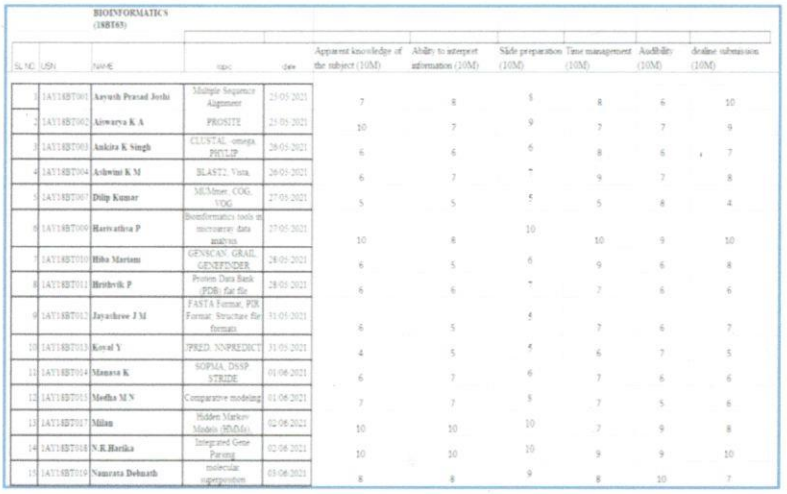
Assignment process

- Individual topics are assigned to students along with presentation schedule via email.
- Students are expected to submit the PPTs of their topics for correction and evaluation.
- Suggestions are to be incorporated for the final version and presented to the class during class hours.
- The students are allotted 15 mins for the presentation and 5 mins for Q&A.
- The faculty will facilitate the seminar so that the concept is explained to the whole class.
- The student receives feedback on slide preparation, body language, audibility, technical content, ethical use of materials, etc.
- The faculty sets certain criteria and rubrics for criteria to evaluate.
- The faculty evaluates based on the information provided by the students.

Objectives of assignment:

- Self-Learning.
- Organization of technical data.
- Addressing the scientific community.
- Technical discourse.
- Encourage peer learning through group discussion.
- Improve communication through Q&A

Evaluation sheet excerpt



BIOINFORMATICS (18BT63)

SL NO	USN	NAME	topic	date	Apparent knowledge of the subject (10M)	Ability to interpret information (10M)	Slide preparation (10M)	Time management (10M)	Audibility (10M)	deadline submission (10M)
1	1AY18BT001	Aayush Prasad Joshi	Multiple Sequence Alignment	25/05/2021	7	8	8	8	6	10
2	1AY18BT002	Aiswarya K A	PROSITE	25/05/2021	10	7	9	7	7	9
3	1AY18BT003	Ankita K Singh	CLUSTAL, omega, PHYLIP	26/05/2021	6	6	6	8	6	7
4	1AY18BT004	Ashwini K M	BLAST2, Vista,	26/05/2021	6	7	7	9	7	8
5	1AY18BT005	Dilip Kumar	MEMmer, COG, VOG	27/05/2021	5	5	5	8	8	4
6	1AY18BT006	Harivathsa P	Bioinformatics tools in microarray data analysis	27/05/2021	10	8	10	9	10	10
7	1AY18BT010	Hiba Mariam	GENSCAN, GRAIL, GENEFINDER	28/05/2021	6	5	6	9	6	8
8	1AY18BT011	Hrithvik P	Protein Data Bank (PDB) flat file	28/05/2021	6	6	7	7	6	6
9	1AY18BT012	Jayashree J M	FASTA Format, PIR Format, Structure file formats	31/05/2021	6	5	6	7	6	7
10	1AY18BT013	Keval Y	TPRED, NNPREDICT	31/05/2021	4	5	6	6	7	5
11	1AY18BT014	Manasa K	SOPMA, DSSP, STRIDE	01/06/2021	6	7	6	7	6	6
12	1AY18BT015	Medha M N	Comparative modeling	01/06/2021	7	7	5	7	5	6
13	1AY18BT017	Milan	Hidden Markov Models (HMMs)	02/06/2021	10	10	10	7	9	8
14	1AY18BT018	N.R.Harika	Integrated Gene Parsing	02/06/2021	10	10	10	9	9	10
15	1AY18BT019	Namrata Debnath	molecular superposition	03/06/2021	8	8	9	8	10	7

Department of Biotechnology
ACHARYA INSTITUTE OF TECHNOLOGY
Acharya Dr Sarvepalli Radhakrishnan Rd, Soladevanahalli, Karnataka 560107

Group discussion, a group evaluation method

Group Discussion – evaluation process	
Faculty Name	**Dr. Shilpa Sivashankar**
Course name and course code	**Cell culture techniques 18BT44**

Assignment process

- An in-class assessment topic was given on module 1 and module 2. The class was split into 4 groups and allowed to discuss the topics assigned.
- The students were allowed to surf information from books/internet about one equipment and media composition for culturing various types of cell. Key points are written in a yellow book.
- Each member of the group will gather information on sub-topics like working principle, applications, average cost of the equipment, revenue generated by the company for the media sold quarterly etc.
- The students are allotted 20 mins for the task where 15 mins is spent on gathering information and 5 mins to discuss amongst each other. The faculty will choose one person randomly from the team to write the key points on board and explain the concept to the whole class. The faculty sets certain criteria and rubrics for criteria to evaluate. The faculty evaluates based on the information provided by the students.

Objectives of Assignment:

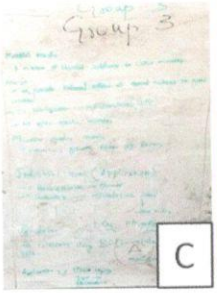
- To articulate a detailed description of the instrument, price and its application in various industries.
- Evaluate an approximate cost to set up a lab and revenue the company could generate with the help of other required facilities.
- Slow learners to understand the concept better and fast learners to know the importance of financial evaluation of the process/equipment from industry perspective.
- Mutually benefited each category of students.

Department of Biotechnology
ACHARYA INSTITUTE OF TECHNOLOGY
Acharya Dr Sarvepalli Radhakrishnan Rd, Soladevanahalli, Karnataka 560107

Evaluation sheet excerpt

Group no	Names	Topic	Working principle 10M	Analysis /troubleshooting 10M	Applications 10M
1	Lijo Kiran Prasthuthi Archana Nivedita Shruthika	Laminar air flow hood Plant tissue culture media	10	8	7
2	Revanth Abhishek Varshitha Vaishnavi Prakruthi	Hot air oven Animal cell culture media	10	10	9
3	Pawan Mubeena Gayathri Sanjay Meeraj Samyukta Akila	Incubator Microbial culture media	10	8	9
4	Monisha Adithi Jayashree Anu Spoorthi Adora	Microscopes Antibiotics and serum in tissue culture	10	9	8

An overview of the activity



Overall conduction of the activity.
A. Students split into groups and discuss the topic
B. One person representing the group
C. The key points written on board
D. Students explaining the information gathered meticulously

D. Need Based Classrooms:

Conventional: All students are treated at par.

Innovative:

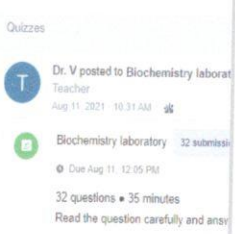
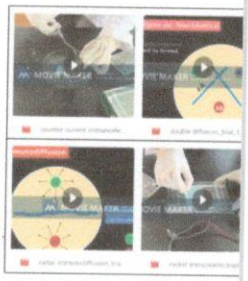
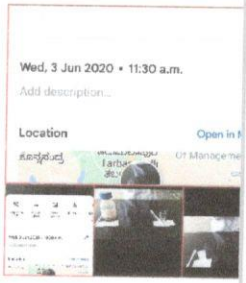
a) **For slow learners:** Identified via interactions, continuous evaluation, and university examinations (e.g., Back loggers). The classes are allotted at the pre first period of the day so that all students need not attend the college so early. In case of a handful of such students in a specific course, the teacher concerned is given the liberty to arrange such classes during their mutually convenient hours. This process has benefited students as they have been able to clear the hurdle.

b) **For fast learners:** They are identified through interactions, continuous evaluation, and university examinations. Since the University does not have provisions to reward them academically, such as, earning extra credits, the Department/Institute encourages such students through i) Rewards and Prizes ii) Arranging coaching for GATE for the motivated students are depicted below.

Prize distribution for students at "Technotsava" Project exhibition

c) **For the enhancement of domain knowledge of students:** Domain knowledge lectures by senior and experienced faculty taking care of explaining/combining the important topics/areas for prospective employers. Details about the experts and the event are displayed. Although few examples are enumerated in the instances above, the following table summarizes the platforms and the activity performed by various faculty at the department. The platforms used during the classroom are tabulated.

d) **Innovation in Teaching and learning**

Activity and platforms used				
Quiz				
Faculty name	**Dr. Shilpa Sivashankar**	**Dr.Ashalatha**	**Dr. Thriveni V**	**Ms. Liny P**
Platforms	Quizlets, Kahoot, Edmodo quizzes	Edmodo quizzes	Edmodo quizzes and case studies.	Quiz through google forms and edmodo
Sample representation	 Kahoot	 Edmodo	 Edmodo	 Google form
Course name and course code	Microbiology 18BT32 Environmental BT 18BBT332 Nanobiotechnology 17BT663 Biotechnology for Sustainable Environment-18BT751	Clinical and Pharmaceutical Biotechnology 18BT71, Food Process Engineering 18BT741, Cell Biology and Genetics 18BT35	Clinical Biochemistry 18BT46 Introduction to Biomolecules 18BT34 Plant Biotechnology 17BT73 Cell culture techniques 17BT653	Forensic Science 15BT753 Bioprocess Equipment Design& CAED 18BT62 Biochemical Thermodynamics 18BT45
Video				
Faculty name	**Dr. Shilpa Sivashankar**	**Dr.Ashalatha**	**Dr. Thriveni V**	**Dr. Suneetha T.B.**
Platforms	Windows video maker, iMovie	Videos	Windows video maker.	Windows video maker, iMovie
Sample representation				https://youtu.be/uv_dc8GtTIY Diffusion models for characterizing Covid-19 pandemic
Course name and course code	Immunotechnology 18BTL48	Biokinetics and Enzyme technology Lab 18BTL57	Clinical Biochemistry laboratory 18BTL47	Stoichiometry 18 BT41
Serves as	Flip class for labs during COVID pandemic			

Model making/Idea presentation				
Faculty name	**Dr. Shilpa Sivashankar**	**Dr. Ashalatha**	**Dr. Thriveni V**	**Dr. Suneetha T.B.**
Platforms	Simulation software based, Animation, do-it-yourself models,	Idea Presentation using charts and models	Idea presentation using charts and models	Model presentation
Sample representation				
Course name and course code	Tissue engineering 18BT743	Environmental Biotechnology 18BT821	Introduction to Biomolecules 18BT34	Bioprocess Engineering 18BT71
Serves as	Assessment tool			

Interactive classroom learning				
Faculty name	**Dr. Shilpa Sivashankar**	**Dr. Ashalatha**	**Dr. Thriveni V**	**Dr. Suneetha T.B.**
Platforms	White board or computer	Edmodo platform	Classroom	Coursera
Sample representation				
Name of the activity	Pictionary	Case studies	Case studies using charts. using charts	Online certification on sensor manufacturing and process control
Course name and course code	Cell Culture Techniques 18BT44	Clinical and Pharmaceutical Biotechnology 18BT71, Food Process Engineering 18BT741	Environmental Biotechnology 18BT821 and Clinical Biochemistry 18BT46	Process Control and Automation 18BT61
Serves as	Interactive tool	Assessment tool		

Project-based learning, a group evaluation method

In addition to trivial in-class innovation in teaching and learning methodology, we have tried project-based learning from semester to semester inculcating outcomes from various courses. Each faculty has inspired another to conduct one project-based learning per semester based on the skills learnt by the students in the previous semester. One of the examples is described below.

Course	Course ID	Semester	Course coordinator	Assignment
Cell culture techniques	18BT44	4	Dr. Shilpa Sivashankar	Project based learning
Students have learnt to culture microbes and tissues in 3rd semester (Microbio lab) and 4th semester (cell culture course) respectively. Keeping this as a base for the assignment students were asked to culture microbes using DIY media with available ingredients at home. Students have reported the ingredients of media, preservation, species grown, problems faced during culture and ways to overcome the problems. The students together will prepare a homemade media and use various equipment in the lab like autoclave, incubator, BOD incubator and hot air oven to grow microbes and optimize culture conditions. The students will be able to explicitly organize their thoughts for culturing microbes. During the process, students have acquired practical knowledge to prepare traditional media used in the past century. Students will track the progress for about a week until they see the growth of microbes in the media and present their findings. This assignment includes report making and presentations in the class about their findings. In order to evaluate their skills during the process and know-how from peer learning a question from this learning was incorporated during the Internal assessment 3.				
Stoichiometry	18BT41	4	Dr. Akhela Umapathi	Research-paper writing
In this assignment, students were given individual publications on diverse topics of pyrolysis, ideal law equation and other chemical related topics. The students were asked to identify the common basis such as DOI, research journal where the publication was made, research publisher and then write a short summary of their understanding of the paper. The students were asked even to identify related papers and make comparison between the assigned and other paper to understand the strengths of weakness of the publication. This gave the student acquaintance with the research paper, the format of the research publication and contents of each part of the paper.				

Enzyme technology and Biotransformation	18BT53	5	Dr. Thriveni V	Experiment based learning

In continuation to the assignment in the 3rd semester, Students were assigned to perform experiment-based learning as a part of their assignment in 4th semester where, each student group has to isolate enzymes from various sources, such as animal, plant, and microbial sources. Students used the microbes grown on media prepared by DIY methods. Each student group isolated enzymes by various methods performed confirmatory tests such as Hoffman's test, etc., analyzed the various kinetic parameters, including pH and temperature, etc., and standardized the optimum conditions for the maximum activity of an enzyme. The students will be able to design the experiments and organize their thoughts for the isolation of enzymes from various sources.

They will get to know the various enzymes, their substrates, and the different factors that affect the enzymatic activity. Students will continuously monitor the growth of MOs, which can be used as a source for the extraction of enzymes. Students are asked to write technical report based on assignments given in the previous semester.

Department of Biotechnology
ACHARYA INSTITUTE OF TECHNOLOGY
Acharya Dr Sarvepalli Radhakrishnan Rd, Soladevanahalli, Karnataka 560107

Audio-video learning, a group evaluation method

Course Name and Code: **Immunotechnology-18BT72**

Course Coordinator name: **Dr. Ashalatha**

Need analysis: Modern tool usage for making teaching tool

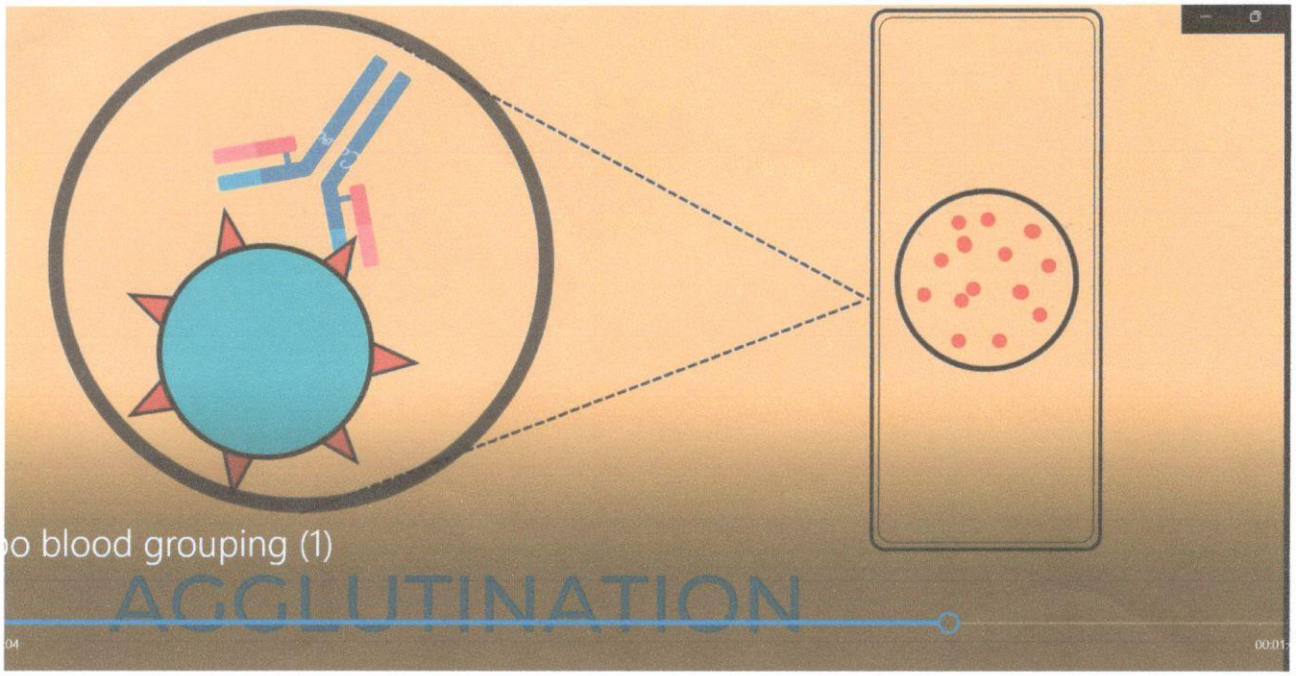
Activity name: Audio-Video tool development for immunodiagnostics

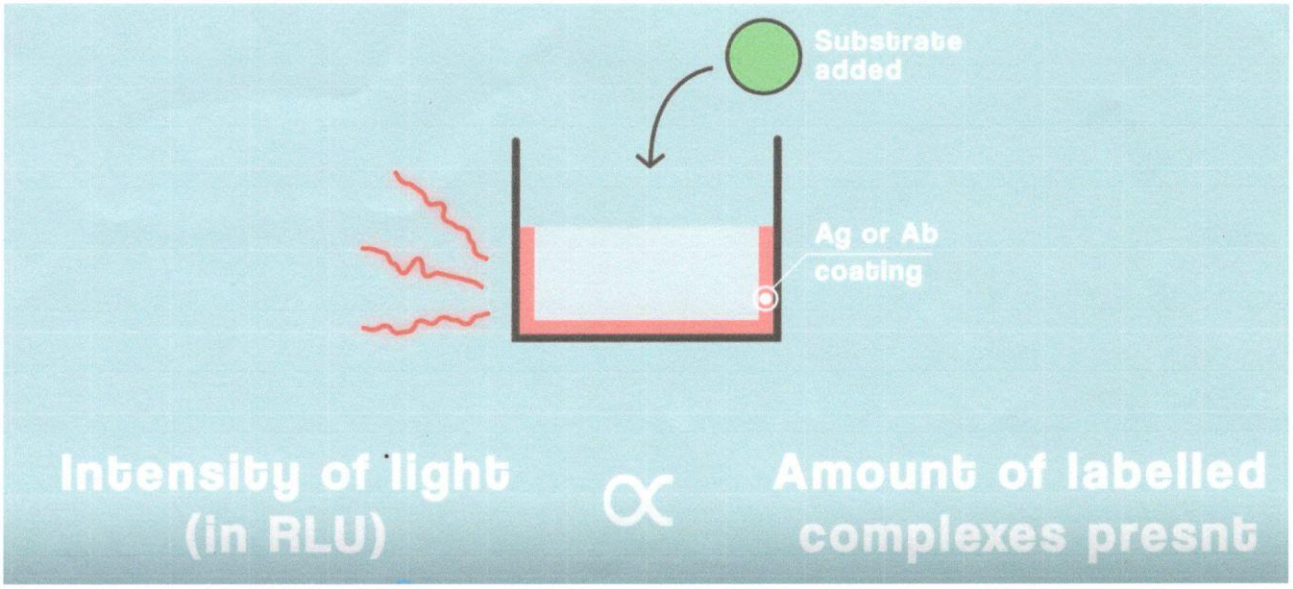
Brief Description: Integration of animation tool with technical topic in development of audio-video teaching aid

Proof:

ABHISHEK R	
ADORA G CHRISTINA	
AISHWARYA.D	Precipitation reactions
AKILA SRIRAMAN	
ANANYA V	
ANU K	Agglutination reactions
ARCHANA P SINGH	
ADITI CY	
FARSY SHINAL E K	ABO Blood typing
GAYATHRI KANNAN PILLAI K	
JAYASHREE S	
KIRAN B S	ELISA
LIJO PAILY	
MADAN Y N	
MADHU H N	RIA
MERAJ AQIB	
MONISHA PRASHANT	
MUBEENA H	Western Blotting
NIVEDITHA H	
PAWAN S	
PRAKRUTHI C K	Immunofluorescence
PRASTHUTHI	
REVANTH C G	
SAMYUKTHA R	Chemiluminescence
SANJAY SARDAR P	
SHRUTIKA V	
SPURTHI P PATIL	FACS
VAISHNAVI P	
VARSHITHA P	Immunotherapy

Department of Biotechnology
ACHARYA INSTITUTE OF TECHNOLOGY
Acharya Dr Sarvepalli Radhakrishnan Rd, Soladevanahalli, Karnataka 560107





Screenshots of videos submitted by students during the course.

Head of The Department
Department of Biotechnology
Acharya Institute Of Technology
Soladevanahalli, Bangalore-560107

PRINCIPAL
ACHARYA INSTITUTE OF TECHNOLOGY
SOLDEVANAHALLI, BENGALURU - 560 107