
BEST PRACTICES



BEST PRACTICES / INNOVATIONS – DEPARTMENT OF ZOOLOGY

RESEARCH & CONSULTANCY

ACTIVITIES- ENHANCING SKILLS AMONGST STUDENTS

INTERNSHIPS- Create multiple linkages

**TEACHING – LEARNING PROCESSES –
Multimodal pedagogies**

SOCIAL RESPONSIBILITY- Mandatory Community outreach activities and environment consciousness



BEST PRACTICE – DEPARTMENT OF ZOOLOGY

RESEARCH & CONSULTANCY

Create linkages for consultancy and enhance research skills

Encourage student participation in workshops / conferences

Research projects – to tackle Issues of environment/society

14 research papers published

Research methodology course

Faculty Invited as resource person for conferences / Guest lectures etc.

Integration of research papers as resources for learning

‘Technical support group (TSG)’ - Goa State biodiversity Board (GSBB)

Offers internship / Summer trainings – Genetic techniques / pathological techniques (139 students)



2) ACTIVITIES INTEGRATED WITH CURRICULUM TO ATTAIN PROGRAM OUTCOME AND ENHANCE SKILLS AMONGST STUDENTS



- **Enhance leadership skills**
- **Importance of team spirit**
- **Coordinate and execute multiple events**
- **Understand social responsibility**

**BIRDERS' CLUB
ACTIVITIES**

**INTERCOLLEGIATE
EVENT-SYMBIOSIS**

**WORKSHOPS/ GUEST
LECTURES**

FIELD TRIPS

**COMMUNITY
OUTREACH ACTIVITIES**

LINKAGES- INTERNSHIP

MEDICAL SECTOR: 18

1. Goa Medical College (GMC)
2. Hospicio hospital, Margao
3. Trimurti hospital
4. Mother care hospital
5. Rajagiri victor hospital
6. Divine medical centre
7. Dr. Mahesh Raikars pathological lab
8. Medilab, Ponda.
9. Centre for Genetic Health Care, Mumbai.
10. Ghodekars clinical lab
11. Atul's Clinical Lab
12. Sidad's pathology lab
13. Subarban diagnostics
14. Dr Abhijits fetal medicine and infertility centre
15. Shriprasad diagnostic laboratory
16. Womenite lab
17. Techno-clin pathology lab
18. Primary Health Centre, Canacona



LINKAGES- INTERNSHIP

WILDLIFE SECTOR: 08

1. Periyar wildlife sanctuary
2. Mhadei Research Centre
3. Nature conservation foundation, Mysore
4. IISER, TVM
5. IISER, Mohali
6. ICAR- Central Costal Agricultural Institute
7. Goa State Biodiversity Board
8. Goa Forest Department

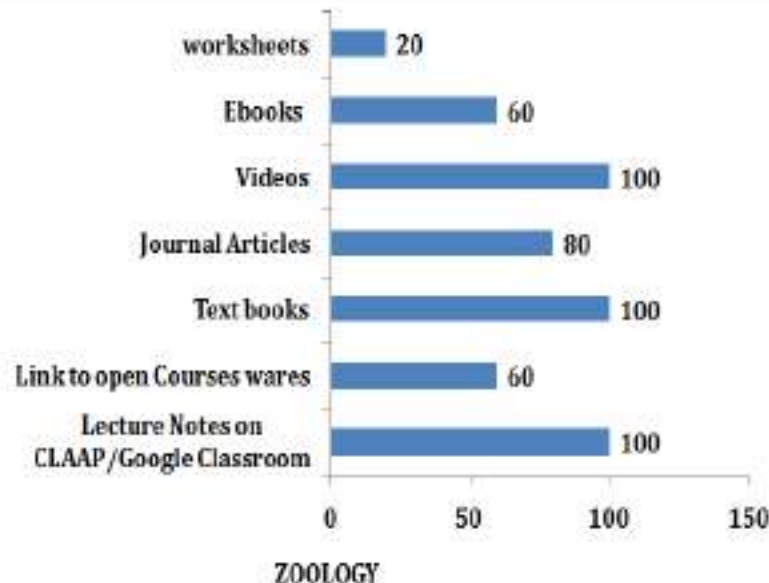
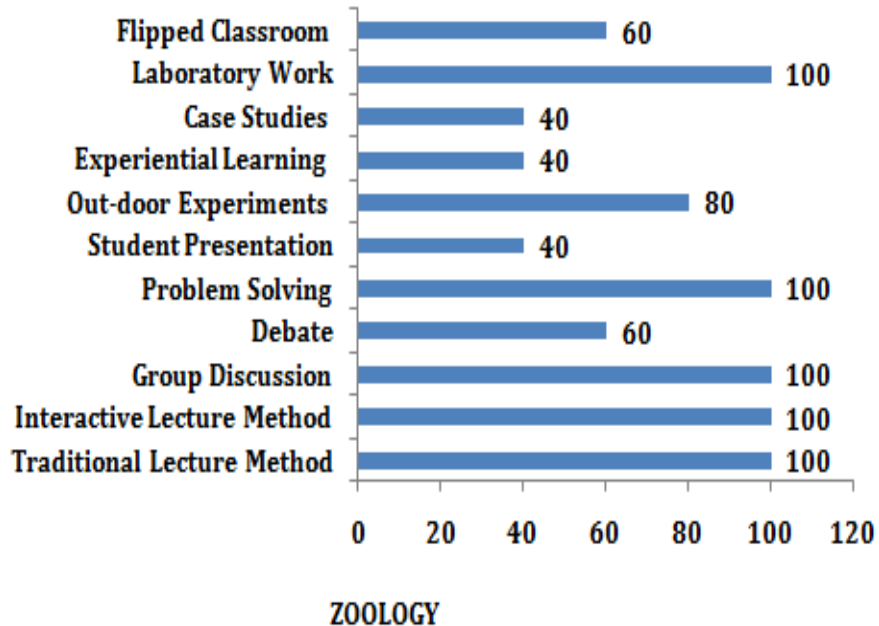
FISHERY SECTOR: 04

1. National Centre for Sustainable Coastal Management, Chennai
2. Central Marine Fisheries Research Institute, Mumbai
3. Marine biology regional center, Zoological survey of India, Chennai
4. Department of Fisheries, Goa



BEST PRACTICES / INNOVATIONS – DEPARTMENT OF ZOOLOGY

TEACHING – LEARNING – EVALUATION PROCESSES



RESEARCH ARTICLE

STUDENT PERCEPTION OF EFFECTIVE TEACHING METHODOLOGIES FOR UNDERGRADUATE DEGREE COURSES - CASE STUDY FROM INDIA

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ABSTRACT

Many researchers are stressing on the need to change the teaching methodologies to make learning more effective. Various new modes of teaching are suggested especially in the field of medical sciences. The studies mostly focus on the need to adopt Problem-based learning in medical field. The present study was undertaken to see the effectiveness of various teaching methodologies in undergraduate degree colleges in India. Effectiveness was measured from the students' perspective as this study was focused on the response of the students to the questionnaire prepared to evaluate the effectiveness of different modes of teaching. The modes evaluated were 'Lecture-based learning' (LBL), ICT supplemented lectures (ISL), Interactive Classroom method (ICM), Problem-Based Learning (PBL) and Multiple Teaching Mode (MTM). The present study indicated that LBL, ISL and ICM was not very effective method of teaching as it only focused gaining of knowledge and comprehension. PBL method is good as it enabled triggering higher order thinking of bloom taxonomy in the students. But PBL, if adopted as the only method of teaching did not cater to the diversity of learners in a classroom. Therefore, we recommended MTM as the new effective method of teaching as it has a combination of LBL, ISL, ICM and PBL. On a Five-point-Likert-scale, MTM was indicated to enable students to learn the correct method of data collection and investigation (4.41±0.75), transform data and develop logical argument (4.04±0.76), be more creative (4.11±0.66) and thus helped to improve practice learning abilities. The present study thus demonstrates that PBL can be used as component of MTM for effective learning even for the undergraduate nonprofessional degree courses of Bachelor of Science or Bachelor of Arts.

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Creation: Dr. Nandini Vaz Fernandes 2016. "Student perception of effective teaching methodologies for undergraduate degree courses - case study from India", International Journal of Open Research, 8, (06), 11040-11072.

INTRODUCTION

In this era of multiple sources of knowledge gathering, the role of a teacher in undergraduate and postgraduate colleges should reflect a paradigm shift towards making classroom teaching learner centric. The role of a teacher should not merely involve a simple transfer of knowledge to students. What is required is a transformation of teaching methodologies which will facilitate and influence the process of active learning. Different teaching tools and methodologies are suggested by various authors to meet this demand. However, no single method can be considered as the aptest method for imparting about effective learning, as the classroom consists of different categories of learners. If students in a classroom can be categorized as per Felder and Silverman (1988) categories based on their preferred modes for receiving information, we propose that the teaching methodologies should be a combination of methods

It is accepted that the feedback from students serves as an effective tool in developing teaching methodology and evaluation methods in undergraduate teaching (Chavris *et al.*, 2011; Shrivastha *et al.*, 2015) and so the study was focused on the response of the students to the questionnaire. Thus, the present study was undertaken to assess the student's attitude, perception and feedback on the effectiveness of different teaching methodologies in the classroom consisting of different types of learners.

MATERIALS AND METHODS

The present study was conducted to assess the student's attitude, perception and feedback on teaching-learning methodology to finally judge the most effective teaching methodology. The subjects of the present study were

CHANGING AND EXPANDING ROLE OF TEACHER IN HIGHER EDUCATION FROM 'INFORMATION DISPENSER' TO 'MANAGERS OF LEARNING'

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Keywords: Pedagogies of teaching-learning, curriculum, skills.

ABSTRACT:

Education system is undergoing transformation at a very fast pace globally. Most of the higher education institutions all over the world are focusing on 'quality' of education rather than 'quantity'. There is paradigm shift in making education more relevant rather than just awarding a degree. A lot of emphasis is laid on imparting education which enhances employability skills. Government has introduced multiple initiatives for improvising quality of education in the country. There are also quality checks and motivations for excellence through assessments and ranking initiatives by the government. With this paradigm shift of quality over quantity, the role of teachers in the higher education sector also needs to change to meet the demands of a new era. The present research is a case study which focuses on initiatives taken by Parvatibai Chowgule College, in Goa India, to help impart quality education. The present study throws a gainful insight on the changing and expanding role the teacher, in order to enable the institution to achieve its vision of quality enhancement of education. It emphasizes that the teacher in higher education institutes have to be multi-tasker with ten key competencies to impart quality education, which can then have cumulative impact on the overall scenario of quality in higher education institutions in India.

Modern Perspectives in Language, Literature and Education Vol. 8

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Study on Curriculum Redesigning-Suggestive Framework for Skill Enhancement in Higher Education in India

Neelkamal Srivastava; Susmita Das Fernandes

Modern Perspectives in Language, Literature and Education Vol. 8, 13 August 2021, Page 114-124

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Abstract

The last century of the twenty-first century is knowledge. There is little doubt that education is undergoing a paradigm shift, with a stronger emphasis on skills and employability. On the one hand, attempts are being made to improve the gross-enrolment rate, while on the other hand, there is a growing and legitimate concern that graduates would be unemployed. There is a growing evidence that our graduates need to improve their skills in order to be more employable. This would be accomplished through the use of a well-designed curriculum. The present research attempts to explore various educational models/theories of curriculum designing to make education relevant. Does a non-professional undergraduate degree programme offered by higher education institutions, an outcome-based education framework can be combined with explicit learning goals and ways or processes for measuring these learning outcomes. The study concludes that many more curriculum frameworks in the Indian context need to be designed, to adopt “Skill for Model” for institutions of higher education.

Keywords: Curriculum, higher education, knowledge, skills, teaching/learning, outcome based education



A Perspective on an Interdisciplinary Approach to Education

Rajesh D'Souza; Susmita Das Fernandes

Modern Perspectives in Language, Literature and Education Vol. 8, 13 August 2021, Page 126-133

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Abstract

Interdisciplinary learning is fundamentally a process in which learning is not compartmentalized in a way that it crosses traditional disciplinary boundaries and, most significantly, allows learners to evaluate their own learning. Encouraging learners to think divergently, laterally and to apply conceptual thinking to the world around them to help them understand different domains needs a focused strategy. Interaction of various subjects is what keeps things fascinating to the learners. The present study proposes the ways by which an interdisciplinary approach of multi-learning can be applied. The proposed strategies are systematic approaches to promote creativity, critical thinking, deep learning and team-based work abilities in the learners. The success of multidisciplinary and experiential learning may depend on this shift in focus and strategy.

Keywords: Engaging students, performance task, mathematical concepts, higher order thinking



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BEST PRACTICE AREA: TEACHING LEARNING EVALUATION DEPARTMENT OF ZOOLOGY

1. Title of the Practice: ICT INTEGRATED TEACHING-LEARNING-EVALUATIONS

2. Objectives of the Practice

The main objective of the practice is to promote learning by the use of different modes of teaching and learning using ICT. The different modes cater to different types of learners as it exposes them to different ways of learning a particular concept. It helps students apply the theoretical concepts through experiential learning, problem based learning and project based learning.

3. The Context:

The traditional form of teaching includes lectures given to large groups of students, followed by tutorials and some independent study. However, there are several other teaching methodologies which will facilitate and influence the process of active learning and make teaching and learning more learner center. The different modes also help to cater to different kinds of learners. ICT based teaching-learning evaluation hones the ICT skills in the students.

4. The Practice

Changes in pedagogical practice, student prospects and technology have led to the development of different modes of teaching or altering the more traditional approaches, such as the lecture setup, to include a more dynamic interaction between teachers and students.

'MTM' is proposed in my research publication of 2016. According to my findings, methods like Problem based learning, gobbet, flipped classroom, field-based learning, group assignments, activities, quizzes; ICT, brain storming, mind mapping, case studies, etc should be regular feature of classroom teaching.

Integration of ICT in T-L-E processes is reflected in the following:

- 1) Every lecture is supplemented by Class presentation.
- 2) All resources are uploaded on MOODLE platform- CLAAP
- 3) Discussion forum initiated on the CLAAP

- 4) Information of course schedule, course details, course syllabus, course resources, course evaluation dates and rubrics, class policies all are also available on CLAAP.
- 5) Submissions and correspondences via emails / moodle.
- 6) Encourages used of multiple softwares, statistical tools etc.
- 7) E-portfolio encouraged.
- 8) Cooperative learning strategies adopted.
- 9) Use of Ed-puzzle, online discussion forums etc for interaction.
- 10) Use of online tools for assignment writing, mind map creation, plagiarism checks, data analysis and statistics.

5. Evidence of Success

The screenshot displays the Moodle interface for the course 'CELL AND MOLECULAR BIOLOGY (Theory)'. The page is organized into several sections:

- Navigation Menu (Left):** Includes 'My home', 'Site pages', 'My profile', 'Guided tour', 'ZOO4-03-01', 'Participants', 'Feedback', 'Content', 'CONTINUOUS ASSESSMENTS', 'UNIT 1: TECHNIQUES OF CELL STUDY', 'UNIT 2: CELL CHEMISTRY', 'UNIT 3: CELL MEMBRANE STRUCTURE AND FUNCTION', 'UNIT 4: CELL ARCHITECTURE', 'UNIT 5: TRANSPORT ACROSS CELL MEMBRANE', 'IN SORTING: VESICULAR TRANSPORT AND CELL SIGNALLING', 'Topic 8', 'Topic 9', 'Topic 10', 'My courses', 'Settings', 'Course administration', 'Turn editing on', 'Full editing', 'Completion tracking', 'Links', and 'Control me from'.
- Course Title and Description (Center):** 'CELL AND MOLECULAR BIOLOGY(ZOO-I.C-2)'. Below it are links for 'HOME PAGE', 'HOME PAGE : COURSE DESCRIPTION & FACULTY DETAILS', 'COURSE DETAILS', 'CLASS POLICIES', and 'COURSE EVALUATION'.
- Course Details (Center):** Lists 'COURSE SYLLABUS-ZOO4-03-02', 'COURSE OBJECTIVES AND LEARNING OUTCOMES', 'COURSE DETAILS', and 'LEARNING METHODOLOGY'.
- Class Policies (Center):** Includes 'CLASS POLICIES'.
- Course Evaluation (Center):** Includes 'COURSE ASSESSMENT RUBRICS'.
- Continuous Assessments (Center):** Lists 'CA-1-PBL - COMPONENT 1', 'CA-1- ASSIGNMENT - COMPONENT 2', 'CA-2- PBL - COMPONENT 1', 'CA-3-PBL - COMPONENT 1', and 'CA-3-QUESTION-COMPONENT 2'.
- Unit 1: Techniques of Cell Study (Center):** Lists 'Unit 1- PPT 1- Microscopy', 'UNIT 1 - PPT 2 - Types of Microscopes', 'UNIT 1- PPT 3- Electron Microscope', 'VIDEO 1- Introduction to Microscopes', 'Video 2- Microscope parts and functions', and 'Link to Google Maps: 1) about microscopy'.
- Online Resources (Center):** Lists 'LINK to Google Maps 2: Plotted progress in microscopy', 'BOOK RESOURCE 1', 'BOOK RESOURCE 2', 'BOOK RESOURCE 3', 'WORKSHEET 1-2-3-4', 'worksheet 1', and 'worksheet 2'.
- Unit 2: Cell Chemistry (Center):** Lists 'UNIT 2 - CHEMICAL BONDS' and 'UNIT 2 - MICRO AND MACRO MOLECULES'.
- Right Side:** Includes 'Search forum', 'Advanced search', 'Latest news', 'Add a new item', 'Recent activity', 'There are no upcoming events', 'Go to calendar', 'Now event...', 'Recent activity', 'Activity since Tuesday, 20 April 2019, 20:11 PM', 'Full report of recent activity', and 'Nothing new since your last login'.

Callout boxes highlight specific features:

- Details on Course Syllabus, objective, teaching pedagogies, class policies:** Points to the 'COURSE SYLLABUS-ZOO4-03-02' link.
- Details on Dates, Modes of Assessments and Rubrics declared on Moodle:** Points to the 'COURSE ASSESSMENT RUBRICS' link.
- Details on Dates, Modes of Assessments:** Points to the 'CONTINUOUS ASSESSMENTS' section.
- Online Resources:** Points to the 'LINK to Google Maps 2: Plotted progress in microscopy' link.

At the bottom of the screenshot, the URL is visible: <http://moodle2.chengulikes.ac.in/moodle/course/view.php?id=2704>.



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**BEST PRACTICE AREA: TEACHING LEARNING EVALUATION
DEPARTMENT OF ZOOLOGY**

BEST PRACTICE 2: CONDUCT OF PRACTICAL (EXTENSIVE USE OF ICT)

1. Title of the Practice: Method of conducting practical and assessment.

2. Objectives

To be familiar with the process that will help the students in establishment of practical knowledge. Mode and method of conducting practical helps the student to learn the various techniques that develops employability skills.

The course content is locally relevant and prepares students for entrepreneurship and self-employment.

This practice also promotes research based learning.

3. The Context

The practical's require to be designed in a manner that will promote research and application of the learned concept. The preliminary question require to be assigned prior to the practical's to obtain prior knowledge and the interpretation of the obtained results.

4. The Practice

The Practical component of the Courses is designed to deliver content and learn skills in an effective manner. The department not only devised pedagogies for conduct of practicals, but also devised means of making practicals a better learning experience for students by introducing practicals with 'Prelab' work to be done at home followed by conduct of practicals in the laboratory. Being an autonomous institution, the department also devised means of redesigning practicals in order to enable students to understand application of the learned concepts and promote research.

1) CLAAP RESOURCES FOR PRACTICALS:

- course objective
- lab policies
- online journal

2) LAB PROCEDURES:

- a. PPTs to enhance understanding
- b. Protocol / method of execution based on type of practical practicals
- c. Involves prelab work, experiment, activities on blooms taxonomy(application based), interpretation.

3) LAB ASSESSMENTS:

- I have devised rubric of assessment for continuous evaluation which is now adopted by most of the dept faculty with modifications to suit the course taught.
- Rubric consists of:
 - 1) Lab performance/skill (For the Pre-Lab work, and higher order questions)
 - 2) Lab record / Journal:(for ability to analyse and interpret results obtained)
 - 3) Comprehension assessment test: (to evaluate understanding of the principle and application of experiment)
 - 4) Attendance (for ensuring students perform all practicals prescribed in syllabus)

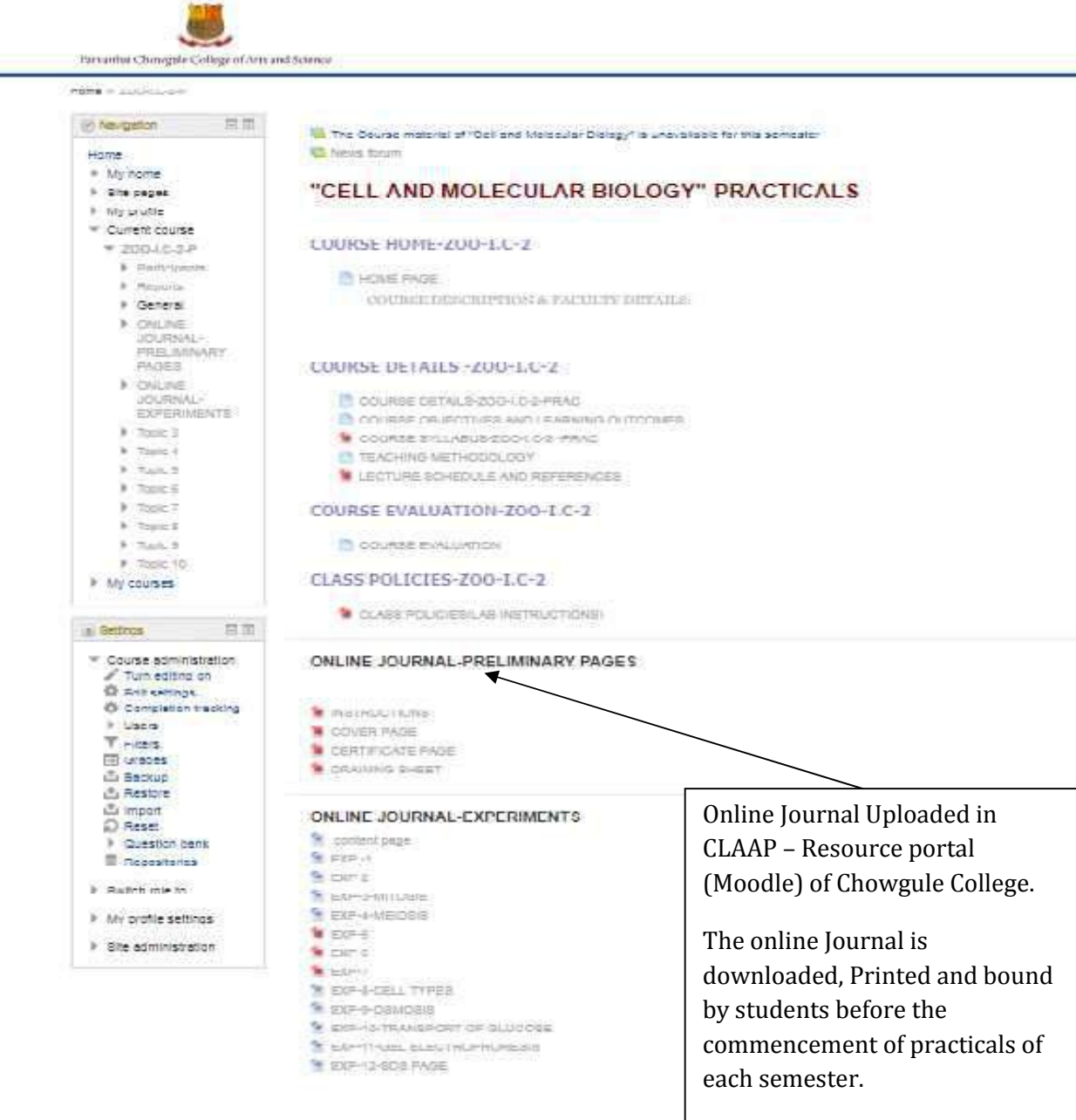
Journal: The journal is designed to be a comprehensive document of learning. All procedures are given as an E-Journal. However, the students have to perform experiments/ procedures and analyze and interpret results critically. All observations are entered in the journal with pen and if errors in findings occur, students have to make noting as to why the results differed from the expected. The students are also given opportunity to pen down their reflection of the learning process and precautions that they need to take to conduct a specific procedure/experiment. The learning experiences are followed by feedback, reflection and follow-up.

Laboratory session: For the practical purpose, the students are grouped into five members each, to develop technical, cognitive and team work skills. Online journal is made available to the students on CLAAP (*Chowgule's Learn Anytime Any place – Moodle of Chowgule College serving as resource portal*). Before the conduct of practicals, students are expected to do the Prelab work- preliminary learning, which involves answering questions given as prelab work and reading about the concepts so that they understand the basics of the experiment. This practice helps students to understand and get a good idea about the experiment to be conducted and also to interpret the results obtained during the experiment/ activity. It involves opportunity to carry out experiments, field-based activities and project-based learning. Students then perform the experiment in groups and record their observations. The interpretations are

supported by references and the same is recorded in the journal. References are listed in the APA format.

We have observed that this interactive new method helps students in improving skills in collecting, analyzing, interpreting and presenting findings.

5. Evidence of Success



The screenshot displays a Moodle course page for "CELL AND MOLECULAR BIOLOGY" PRACTICALS. The page is titled "The Course material of 'Cell and Molecular Biology' is unavailable for this semester." and "News forum". The main content area is divided into several sections: "COURSE HOME-ZOO-I.C-2" with links for "HOME PAGE" and "COURSE DESCRIPTION & FACULTY DETAILS"; "COURSE DETAILS-ZOO-I.C-2" with links for "COURSE DETAILS-ZOO-I.C-2-PRAC", "COURSE PRIORITIES AND LEARNING OUTCOMES", "COURSE SYLLABUS-ZOO-I.C-2-PRAC", "TEACHING METHODOLOGY", and "LECTURE SCHEDULE AND REFERENCES"; "COURSE EVALUATION-ZOO-I.C-2" with a link for "COURSE EVALUATION"; "CLASS POLICIES-ZOO-I.C-2" with a link for "CLASS POLICIES (SILABUS INSTRUCTIONS)"; "ONLINE JOURNAL-PRELIMINARY PAGES" with links for "INTRODUCTION", "COVER PAGE", "CERTIFICATE PAGE", and "DRAWING SHEET"; and "ONLINE JOURNAL-EXPERIMENTS" with links for "content page", "EXP-1", "EXP-2", "EXP-3-MEIOSIS", "EXP-4", "EXP-5", "EXP-6", "EXP-7", "EXP-8-CELL TYPES", "EXP-9-OSMOSIS", "EXP-10-TRANSPORT OF GLUCOSE", "EXP-11-CELL ELECTROLYSIS", and "EXP-12-60S PAGE". A text box on the right contains the following text: "Online Journal Uploaded in CLAAP – Resource portal (Moodle) of Chowgule College. The online Journal is downloaded, Printed and bound by students before the commencement of practicals of each semester." An arrow points from this text box to the "ONLINE JOURNAL-PRELIMINARY PAGES" section of the screenshot.

6. Problems Encountered and Resources Required

Implementation of the practice required extensive work on the designing of the practical's that will improve critical learning, research and employability skills.

Pre lab questions are designed in such a way that it helps the students to gain the basic knowledge about the experiment.



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BEST PRACTICE AREA: TEACHING LEARNING EVALUATION DEPARTMENT OF ZOOLOGY

BEST PRACTICE: MULTIPLE LEARNING RESOURCES

For teaching and evaluation the faculty of department of zoology use '**Multiple Mode of Teaching**' which is a technique found to be the most effective (research finding published in international journal of Current research, by Fernandes NV, 2016 of Department of Zoology).

1. Title of the Practice: Providing multiple resources

2. Objectives of the Practice

The main objective of the practice is to promote learning by the use of different modes of teaching and learning and multiple resources. The different modes cater to different types of learners as it exposes them to different ways of learning a particular concept. Different types of resources enrich the students knowledge and helps students apply the theoretical concepts through experiential learning, problem based learning and project based learning.

3. The Context:

The traditional form of teaching includes lectures given to large groups of students, followed by tutorials and some independent study. However, there are several other teaching methodologies which will facilitate and influence the process of active learning and make teaching and learning more learner center. The different modes also help to cater to different kinds of learners. Offering multiple resources enables students to understand things holistically.

4. The Practice

Changes in pedagogical practice, student prospects and technology have led to the development of different modes of teaching or altering the more traditional approaches, such as the lecture setup, to include a more dynamic interaction between teachers and students.

'MTM' is proposed in the research publication of Dr. Nandini Vaz Fernandes in 2016. According to her findings, methods like Problem based learning, gobbet, flipped classroom, field-based learning, group assignments, activities, quizzes; ICT, brain storming, mind mapping, case studies, etc should be regular feature of classroom teaching. Therefore faculty at the department uses MTM method for teaching which

caters to different types of learners. Besides multiple forms of Resources are provided to the students.

TABLE 2: TYPES OF RESOURCES PROVIDED FOR THE COURSES AT THE DEPARTMENTS	
Resources provided by Course coordinator/faculty	Different types of resources provided for Course
	<ol style="list-style-type: none"> 1. Worksheets 2. Ebooks 3. Concept Videos 4. Journal Articles/link to journal articles 5. Links to recent discoveries 6. Link to open Course ware 7. Text books 8. Link to open Courses wares 9. Lecture notes on CLAAP(moodle) 10. Instructional supplementary Videos 11. Audiotext 12. Online Questionnaires 13. Video Adaptations 14. Mindmaps

The screenshot displays a Moodle course interface. The browser address bar shows the URL: moodle.chowgules.ac.in/moodle/course/view.php?id=775. The page title is "HOME PAGE : COURSE DESCRIPTION & FACULTY DETAILS".

COURSE DETAILS

- COURSE SYLLABUS 20040-2
- COURSE OBJECTIVES AND LEARNING OUTCOMES
- COURSE DETAILS
- TEACHING METHODOLOGY
- LITERATURE CITED AND REFERENCES

COURSE EVALUATION

- COURSE EVALUATION

CLASS POLICIES

- CLASS POLICIES

INTRA SEMESTER ASSESSMENTS

- CA-1-PBL-1
- CA-2
- CA-3
- CA-4

UNIT 1: TECHNIQUES OF CELL STUDY

- Unit 1 - PPT 1- Microscopy
- UNIT 1- (Y1) 2- Types of Microscope
- UNIT 1 - PPT 3- Electron Microscope
- VIDEO 1- How to use a Microscope
- Video 2- Microscope parts and functions
- Click to Know More: 1) about microscopy
- Click to Know More: 2) Recent progress in microscopy
- BOOK RESOURCE 1
- BOOK RESOURCE 2
- BOOK RESOURCE 3
- BOOK RESOURCE 4
- worksheet 1
- worksheet 2

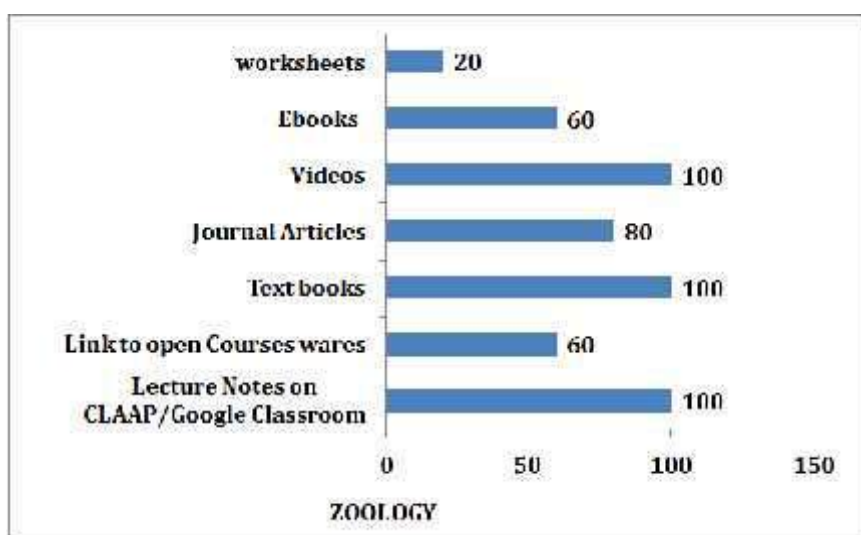
UNIT 2: CELL CHEMISTRY

The left sidebar contains navigation options: Home page, Reports, General, INTRA SEMESTER ASSESSMENTS, UNIT 1: TECHNIQUES OF CELL STUDY, UNIT 2: CELL CHEMISTRY, UNIT 3: CELL MEMBRANE STRUCTURE AND FUNCTION, UNIT 4: CELL ARCHITECTURE, UNIT 5: TRANSPORT ACROSS CELL MEMBRANE, UNIT SORTING, VESICULAR TRANSPORT AND CELL SIGNALLING, Topic 6, Topic 9, Topic 10, My courses.

The bottom sidebar contains settings: Course administration, Turn editing on, Edit settings, Completion tracking, Users, Filters, Grades, Backup, Restore, Import, Reset, Question bank, User records.

5. Evidence of Success

Different activities, problems and cases are assigned to students using approaches like problem-based learning, gobbet, group assignments, activities, quizzes, etc. The activities are initiated by assigning of groups followed by activities by the course faculty based on the curriculum which involve a set of questions/ problems/cases from lower order to higher order. The questions are based on hypothetical situations or real life events. Students are expected to collect resources based on the questions/ problems/cases and the concepts taught in class. They then have group discussions on the resources collected and the given problem. Finally, students are expected to present a report of the given activity in a collaborative manner. The practice promotes leadership qualities and group collaboration / team work along with helping students understand the core concepts and applications of the same. Also visits to industries, outdoor visits, wildlife sanctuaries, national parks, other colleges and research institutes to improve learning and teaching is extended to a site outside the classroom or laboratory.



6. Problems Encountered and Resources Required

Proper planning is essential. Designing the teaching methodologies should be carried out from your students' perspective and appropriate feedback should be taken.

Best practice: Use of MINDMAPS in Teaching- Learning- Evaluation

1. Title of the Practice: Using Mindmaps for teaching, evaluating learning.

2. Objectives

A mind map is a learning tool that allows users to create and share visual representations of things like lectures, notes, and research. In fact, mind mapping in education is useful for a wide variety of tasks, and can be easily tailored to the user's needs. For teachers and students, mind maps play an important role in education.

3. The Context

The department of Zoology introduced use of mindmaps in T-L-E processes in 2013. It was thereafter standardised and marked as to when and how mindmaps will be use in the T-L-E processes.

4. The Practice

Educators and students have been drawing concept maps and mind maps on paper for many years. Visual software applications, in particular mind mapping tools, have automated this process, making it more efficient to brainstorm concepts as ideas or branches. This allows for the creation of much larger mind maps, and the ability to easily re-organized branches by dragging and dropping them around the map.

At the department of Zoology, students are encouraged to use softwares such as 'E-Draw, Free mind, Compendium, Freeplane, Wisemapping, Semantik, Xmind, Coggle or Mindmeister.

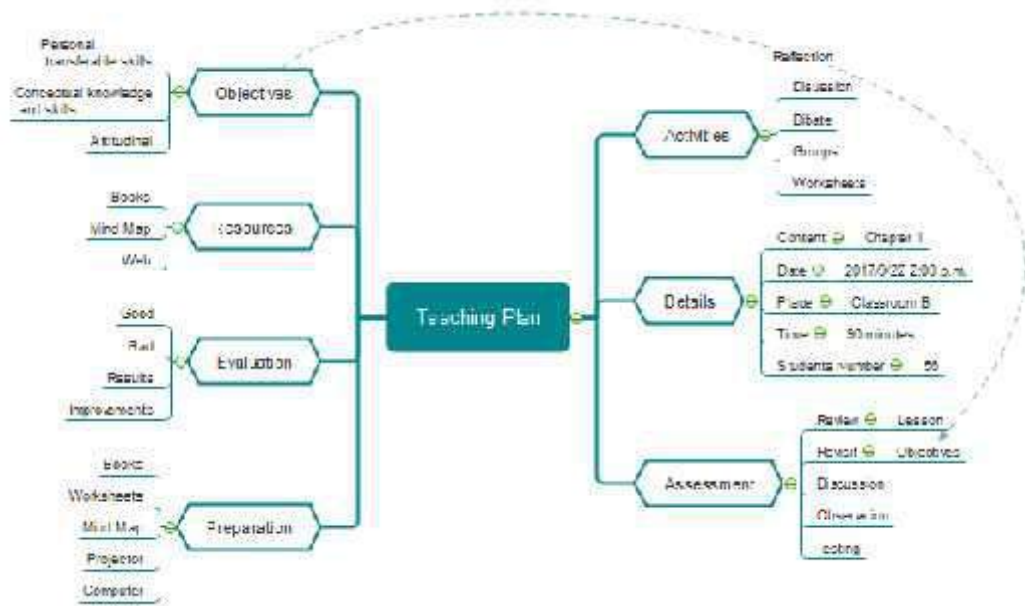
The students are first trained through a workshop on how to use the software and the requirements of creating mindmaps.

Steps include:

- Identify the 'Central topic' - Intro to Visual Facilitation
- Structure
 - Why, What, How to, What If
 - Subtopic - Problem, Consequences, Solution, Benefits, Examples, Call to action
 - Add Audio, Images, time-consuming, less expensive

For teachers: Mindmaps can be used in teaching, learning as well as evaluation. A teacher can use mindmaps to prepare the lesson Plan, Summarise the content taught; prepare summary charts for each lecture etc. thus mind maps can be used every day in the classroom to make your lessons more interactive and engaging.

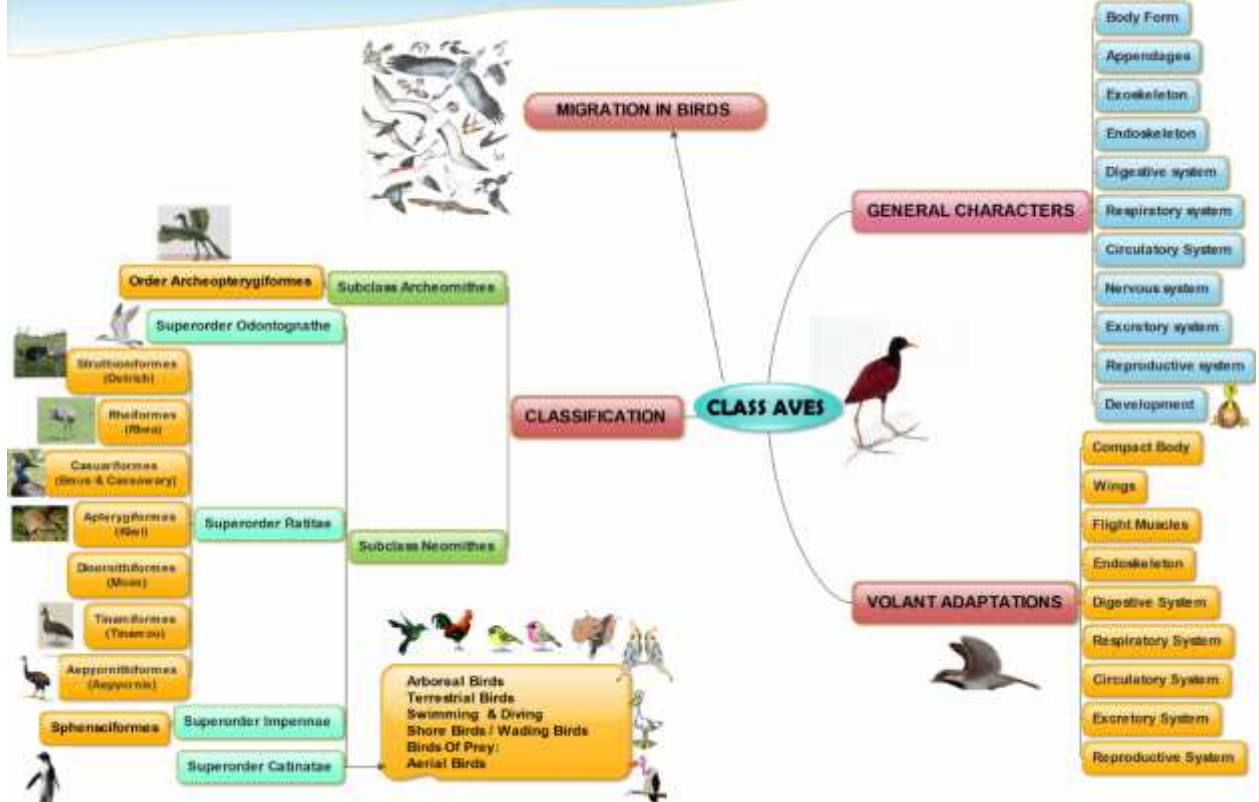
Example of Lesson Plan:



Example of Lecture:



UNIT 4 - CLASS AVES BY **DR. NANDINI VAZ FERNANDES**



For Students: As one of the most effective learning techniques, mind mapping can help students take better notes, improve comprehension, and foster creativity. Mindmaps can be used to summarise their understanding of any lecture, or assignment or lecture content or videos.

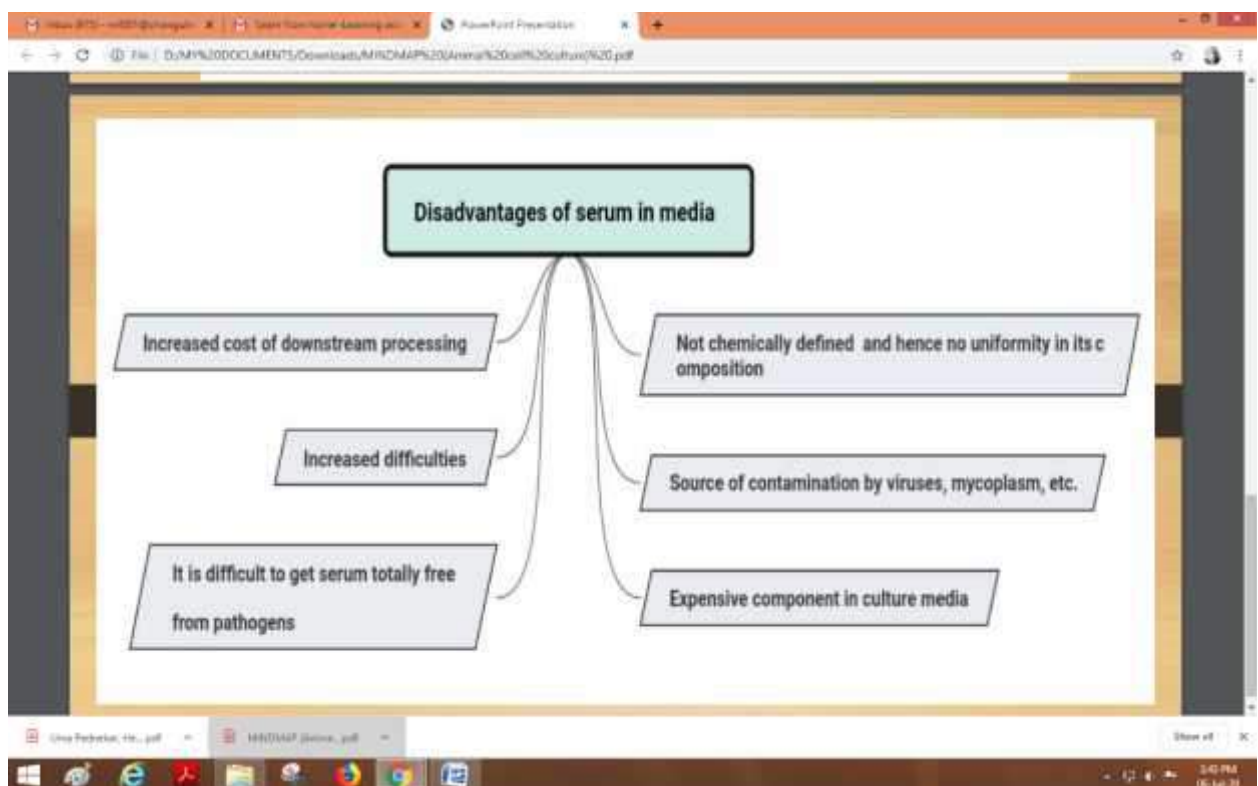
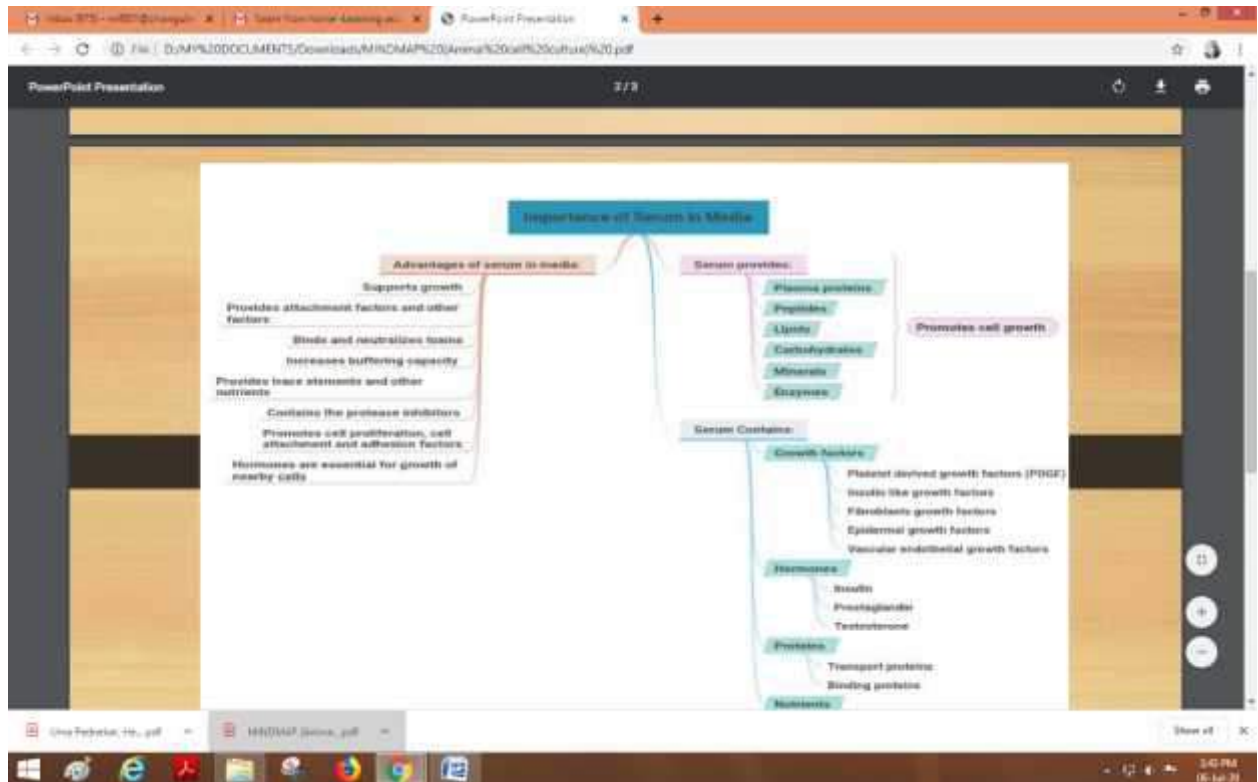
Organizing ideas and concepts into graphic patterns has been explored for years by cognitive educators. Mind Mapping builds a process structure or “map” over the content body of the material a person has gathered, thereby organizing it for development. Constructivism, simply stated, is the philosophy that we learn by organizing new concepts and ideas relative to our own experience. Mind Mapping mirrors the constructivist theory. Research has shown that developing mind maps increases thinking, memory and learning skills. Recently Lehigh acquired a software program called MindView, which takes the idea of Mind Mapping to a new level (J Brams).

5. Evidence of Success:

It was observed that when students were involved in creating mindmaps, it enhanced simulation learning significantly and positively impacted the learning experience, thereby making them understand concepts in better manner and thereby understand the application of knowledge.

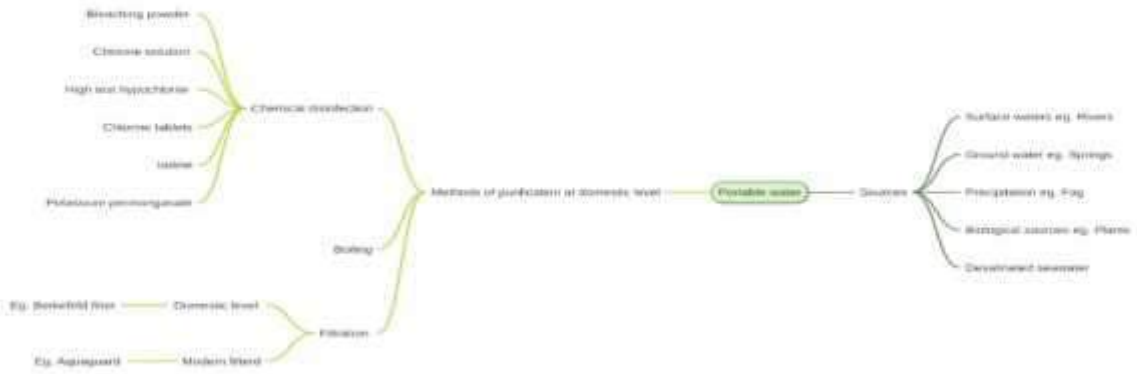
A mind map forces students to extract key information from lengthy book texts with key words and short phrases. This process makes students focus more on thinking rather than copy-pasting, thus understanding the book better.

Some of the mindmaps created by students:

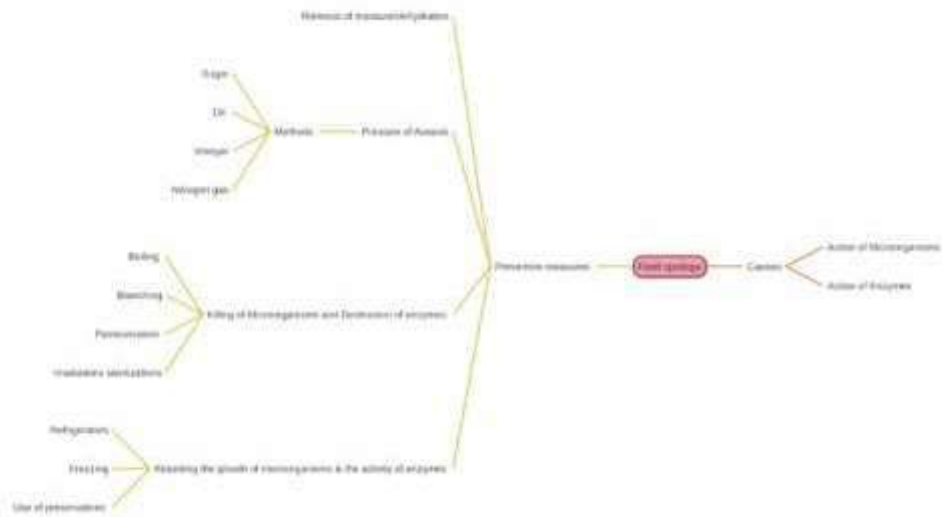




Potable water



Food spoilage





6. Problems encountered

- Learning to use the softwares.
- Conducting workshop on use of mindmapping software solves this issue. Also a guide was prepared on 'How to use software to create mindmaps' on the college moodle – CLAAP for the general reference of all students.



Parvatibai Chowgule College of Arts and Science

Autonomous

Accredited by NAAC with Grade 'A' (CGPA Score 3.41 on a 4 Point Scale in 3rd cycle)

Best affiliated College-Goa University Silver Jubilee Year Award

BEST PRACTICE AREA: TEACHING LEARNING EVALUATION DEPARTMENT OF ZOOLOGY

BEST PRACTICE: MULTIPLE OF TEACHING MODES (MTM)

*For teaching and evaluation the faculty of department of zoology use '**Multiple Mode of Teaching**' which is a technique found to be the most effective (research finding published in international journal of Current research, by Fernandes NV, 2016 of Department of Zoology).*

1. Title of the Practice: Multiple Teaching Modes

2. Objectives of the Practice

The main objective of the practice is to promote learning by the use of different modes of teaching and learning. The different modes cater to different types of learners as it exposes them to different ways of learning a particular concept. It helps students apply the theoretical concepts through experiential learning, problem based learning and project based learning.

3. The Context:

The traditional form of teaching includes lectures given to large groups of students, followed by tutorials and some independent study. However, there are several other teaching methodologies which will facilitate and influence the process of active learning and make teaching and learning more learner center. The different modes also help to cater to different kinds of learners,

4. The Practice

Changes in pedagogical practice, student prospects and technology have led to the development of different modes of teaching or altering the more traditional approaches, such as the lecture setup, to include a more dynamic interaction between teachers and students.

MTM' is proposed in the research publication of Dr. Nandini Vaz Fernandes in 2016. According to her findings, methods like Problem based learning, gobbet, flipped classroom, field-based learning, group assignments, activities, quizzes; ICT, brain storming, mind mapping, case studies, etc should be regular feature of classroom teaching. Therefore faculty at the department uses MTM method for teaching which

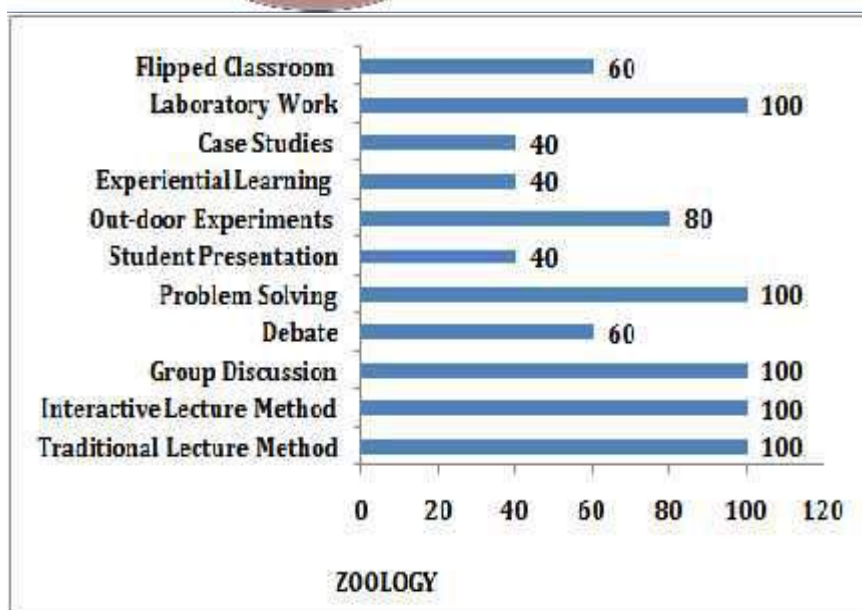
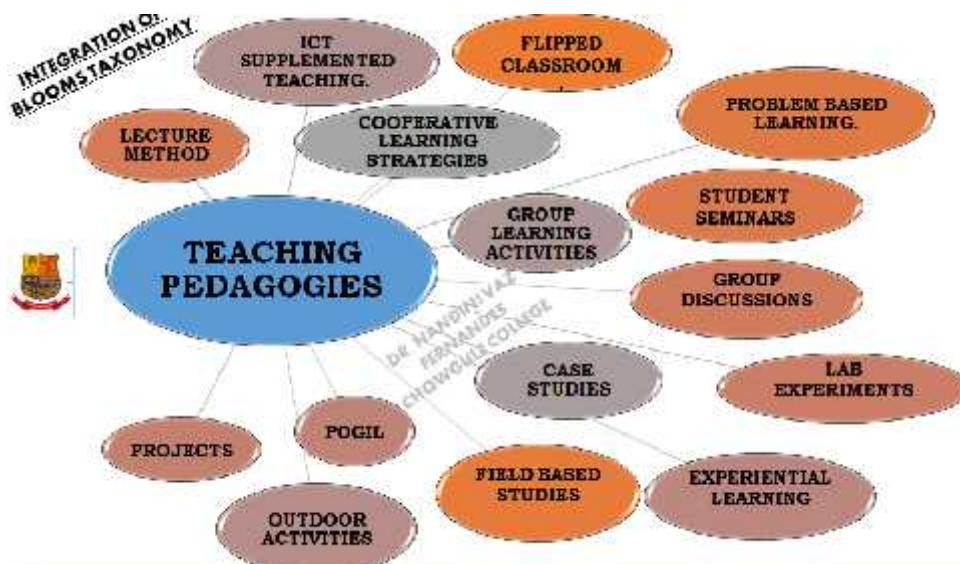
caters to different types of learners. Besides multiple forms of Resources are provided to the students.

The screenshot displays a Moodle course interface. The browser address bar shows the URL: moodle.chowgules.ac.in/moodle/course/view.php?id=775. The left sidebar contains a navigation menu with the following items: Home page, Current course, ZOO 10 2-T, Home page, Reports, General, INTRA SEMESTER ASSESSMENTS, UNIT 1: TECHNIQUES OF CELL STUDY, UNIT 2: CELL CHEMISTRY, UNIT 3: CELL MEMBRANE STRUCTURE AND FUNCTION, UNIT 4: CELL ARCHITECTURE, UNIT 5: TRANSPORT ACROSS CELL MEMBRANE, UNIT SORTING, VESICULAR TRANSPORT AND CELL SIGNALLING, Topic 6, Topic 9, Topic 10, and My courses. Below the menu is a 'Settings' section with options like Course administration, Turn editing on, Edit settings, Completion tracking, Users, Filters, Grades, Backup, Restore, Import, Reset, Question bank, and Unenrol course. The main content area is titled 'HOME PAGE : COURSE DESCRIPTION & FACULTY DETAILS' and features several sections: 'COURSE DETAILS' with links for Course Syllabus, Course Objectives, Course Details, Teaching Methodology, and Literature; 'COURSE EVALUATION' with a link for Course Evaluation; 'CLASS POLICIES' with a link for Class Policies; 'INTRA SEMESTER ASSESSMENTS' with links for CA-1, CA-2, CA-3, and CA-4; and 'UNIT 1: TECHNIQUES OF CELL STUDY' with a list of resources including PPTs, videos, and book resources. The 'UNIT 2: CELL CHEMISTRY' section is partially visible at the bottom.

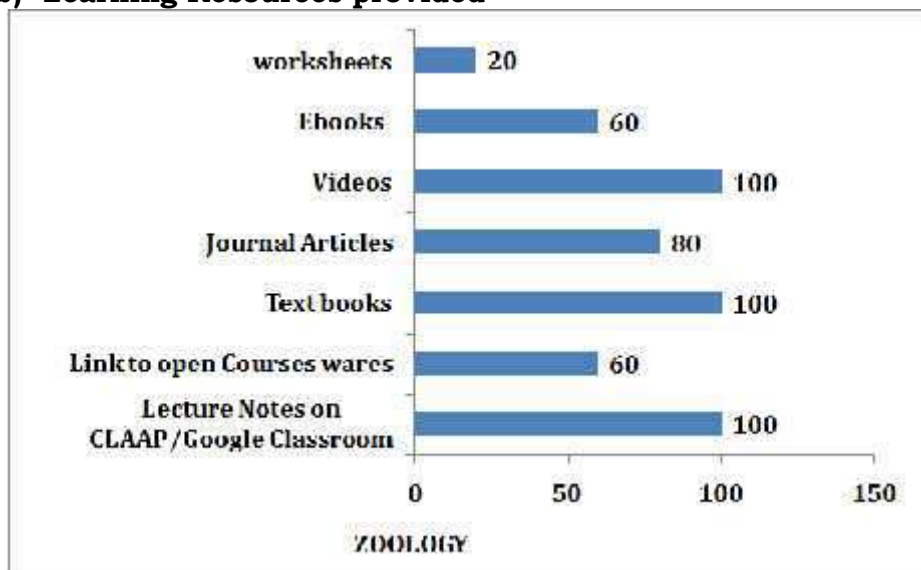
5. Evidence of Success

Different activities, problems and cases are assigned to students using approaches like problem-based learning, gobbet, group assignments, activities, quizzes, etc. The activities are initiated by assigning of groups followed by activities by the course faculty based on the curriculum which involve a set of questions/ problems/cases from lower order to higher order. The questions are based on hypothetical situations or real life events. Students are expected to collect resources based on the questions/ problems/cases and the concepts taught in class. They then have group discussions on the resources collected and the given problem. Finally, students are expected to present a report of the given activity in a collaborative manner. The practice promotes leadership qualities and group collaboration / team work along with helping students understand the core concepts and applications of the same. Also visits to industries, outdoor visits, wildlife sanctuaries, national parks, other colleges and research institutes to improve learning and teaching is extended to a site outside the classroom or laboratory.

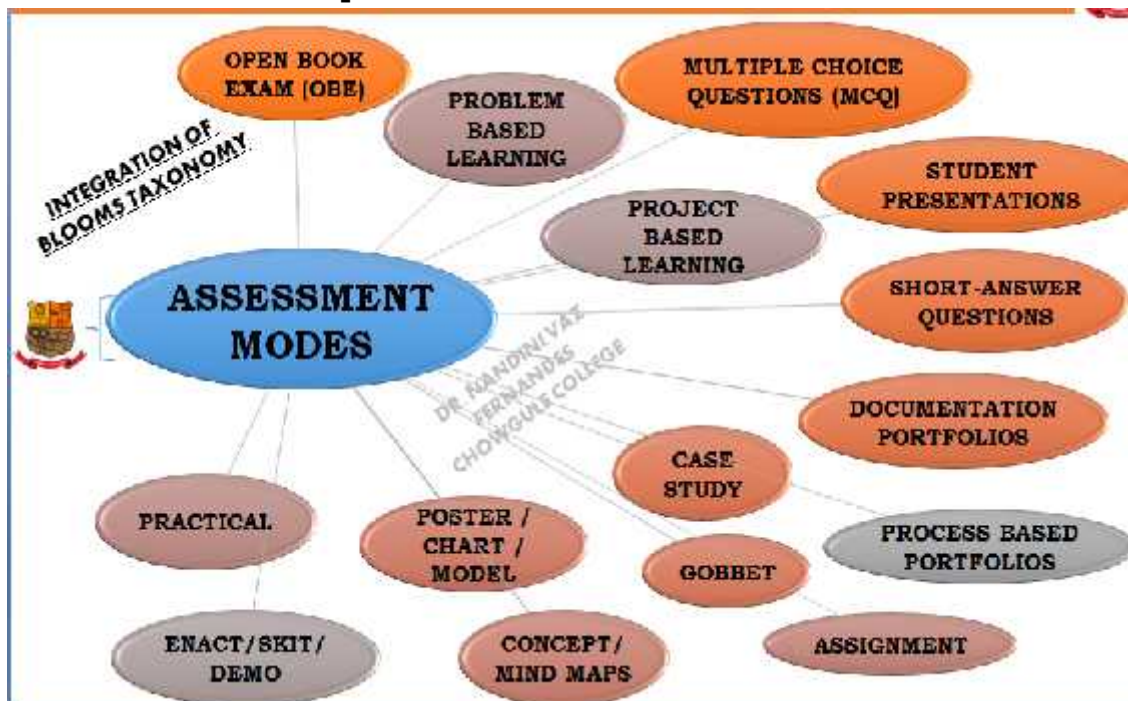
a) Teaching Pedagogies



b) Learning Resources provided



c) Evaluation modes adopted:



6. Problems Encountered and Resources Required

Proper planning is essential. Designing the teaching methodologies should be carried out from your students' perspective and appropriate feedback should be taken.

BEST PRACTICE AREA: TEACHING LEARNING EVALUATION

1. Title of the Practice: LEARNING THROUGH ENACTING (PRACTICAL COURSE) (FORENSIC INVESTIGATION OF CRIME SCENE)

2. Objectives

To help students apply theoretical concepts of forensic investigation learnt in the classroom to field activity. It also promotes team work spirit and critical thinking skills in solving problems. This practice also promotes research-based learning.

3. The Context

The present best practice given here is adopted by Dr. Nandini Vaz Fernandes and Ms. Tessa Vaz, of Department of Zoology. The activity is from a course on Forensic science. The Practical activity requires to be designed in a manner that will promote research and application of the learned concept, enables students to analyze the different aspects of the activity and use theoretical concepts to solve the problems in a group. The practical needs to be in line with the concepts taught in theory so that the students are able to work through it on their own.

The type of experiment taken for this activity should be field based (outdoor) and should be simple enough for students to comprehend and solve the given problem. This helps to evaluate traits such as the depth of the knowledge, skills, application of principles to problem solving, creativity, ability to communicate and ability to face unknown situations etc.,

4. The Practice

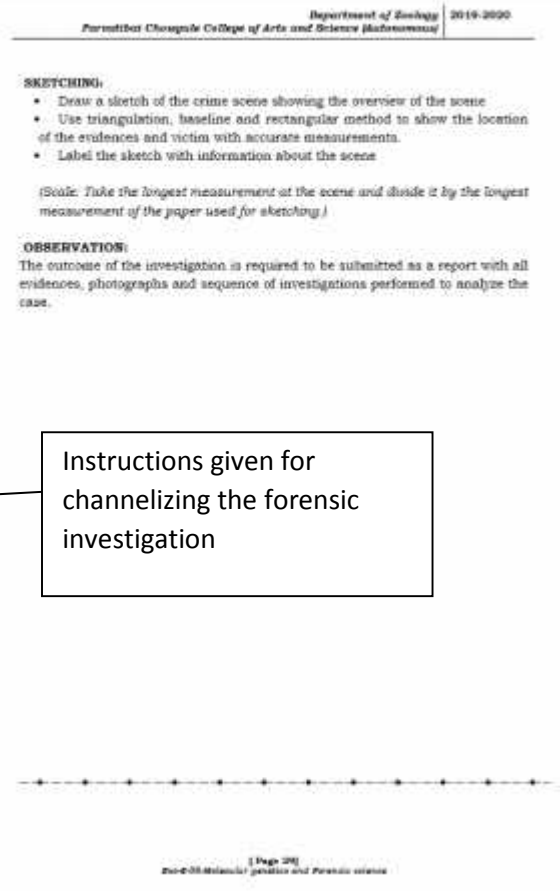
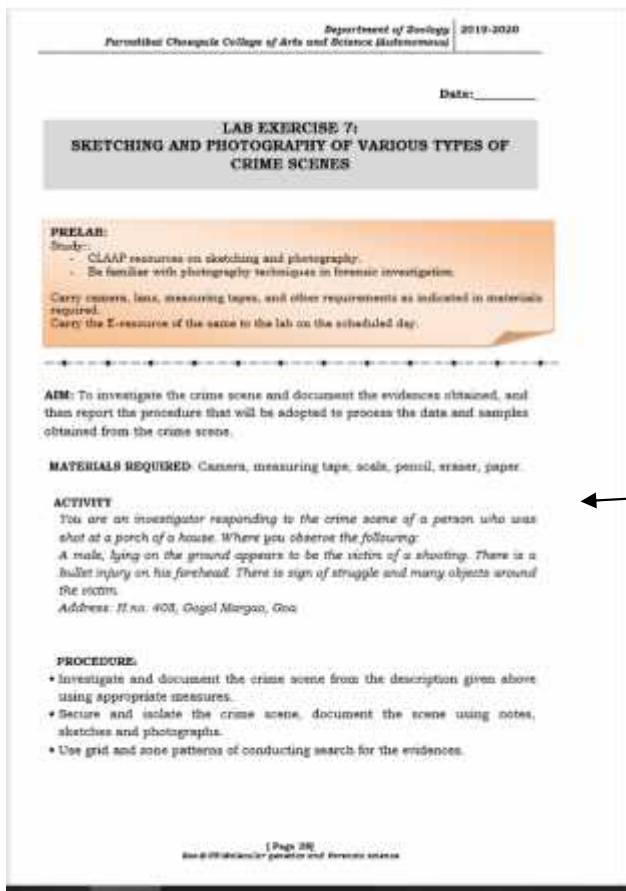
Students were well aware of the activity weeks before the practical. They were required to do the basic research to understand the concepts involved before the experiment in relation to the activity as given in their preliminary work on the journal. This helps the students to revise the basic knowledge pertaining to the subject. On the day of the practical students assemble with all the necessary material required which is mentioned in advance on their journal. The students were then divided in groups for analyzing the experiment and recording observations during a span of 2 hours. The assessment was carried out based on the report that is submitted which gives a detailed explanation of all the steps taken to record the observations and the techniques involved in successful completion of the activity. The activity has to be based off of the components taught in theory and make it easier for the students to apply the theoretical knowledge in the hypothetical situation staged during the practical.

Example: Enactment of a Crime Scene.

A crime scene enactment was planned at a specific location on the campus. The scene involved identifying a student to act as victim shot dead. The evidences were assembled in specific places and a natural crime scene like scenario is created.

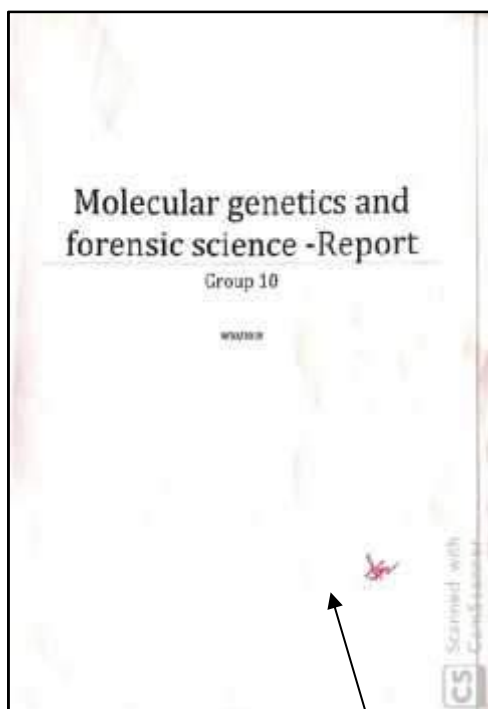
Preliminary requirements are explained in the journal. How the students need to proceed with the forensic investigation is laid down in the online journal. Students are then divided into groups of 05. Each group had to investigate the crime scene based on the theory taught to them in class. This activity expects students to apply all the theoretical knowledge learnt by them, to investigate the crime scene. The students have to do the crime scene evaluation, Photography, perspective drawings, collection of forensic evidences as per forensic protocols, decide the type of medical analysis that needs to be done to obtain forensic data required to investigate a crime.

The students perform the activity and submit a Portfolio report on the same.
Journal Instructions Given:



Instructions given for channelizing the forensic investigation

Report Submitted by student:



NAME	ID NO. NUMBER	SIGNATURE
KIMBERLEY QUADROS	20170516	<i>[Signature]</i>
AREHAJINE BHATE	20170508	<i>[Signature]</i>
ELRICA TOURENO	20170517	<i>[Signature]</i>
VIANEY CARVALHO	2017055	<i>[Signature]</i>
SIMONA FERNANDES	20170523	<i>[Signature]</i>

Scanned with CamScanner

Report submitted by group of students



Overview Picture 1



Overview Picture 2



Overview Picture 3



Overview Picture 4



Evidence Number 1



Evidence Number 2

Forensic evidences collected by students from the crime scene

Crimescene report

Date: 16 September 2019

Time: 13:45pm

Address: Block 408, Geylang Mews, GRC

Case no: 687402169

Case type: Homicide

Weather: Sunny

The crime scene is in the front porch of the victim's house. The weather conditions on arrival was 25-26°C with slight precipitation.

A dead body of an adult male was found in the porch of house. The victim appeared to be in his 40s and no source of identity was registered from the crime scene. Since the crime scene was in the porch of the house, it can be considered an outdoor crime scene. The victim was found dead and blood was flowing from the head region. The body was lying towards the ground.

The initial responder is Mr. Clark Kang, the neighbor of the victim, Mr. Liak. Based on the arguments arising from the house and their team 2 guards and moved toward the entrance of the victim's house, only to see the victim fallen on his face and blood flowing out into a pool. He immediately called the authorities at 9999 and reported the crime. No other persons were seen by him at the crime scene however, a few other neighbors had also gathered outside the house by the time the authorities had got there. All other witness statements were taken by another officer, Mr. Scott Long, which revealed that the victim lived alone in his house and didn't have many visitors. In addition to the first responder, all other witnesses described the same chain of events beginning from the arguments and then the 2 guards.

The first responder arrived at the crime scene at 13:42pm and immediately ordered for the crime scene to be sealed off and clear any possible crimes and exits that may have existed to and from the victim's house and also ordered for them to be sealed off and guarded. The crime scene of the crime scene was measured from end to end and measured about 3m x 2m x 1m.

Report written and submitted



Evidence Number 3



Evidence Number 4



Evidence Number 4



Evidence Number 4



Evidence Number 5



Evidence Number 5

Summary of the crime scene

The crime scene occurred on the 16th of September, 2019 at Block 408, Geylang Mews. A dead body of an adult male in the age of 40 years was found in the porch of a house. The crime scene was considered as an outdoor crime scene as it occurred outdoors. The scene was a porch where the victim was found lying on his face and blood was flowing from his head region. The initial responder claimed that he heard arguments from the house and also heard two guards and entered to the victim's house. They immediately called on the 9999 with blood rushing out from his head. He immediately reported the crime to the authorities, secured the crime scene and no other visitors of the crime scene. All other witness statements were noted from Mr. Clark Kang, Mr. Scott Long revealed that the victim lived alone and didn't have many visitors.

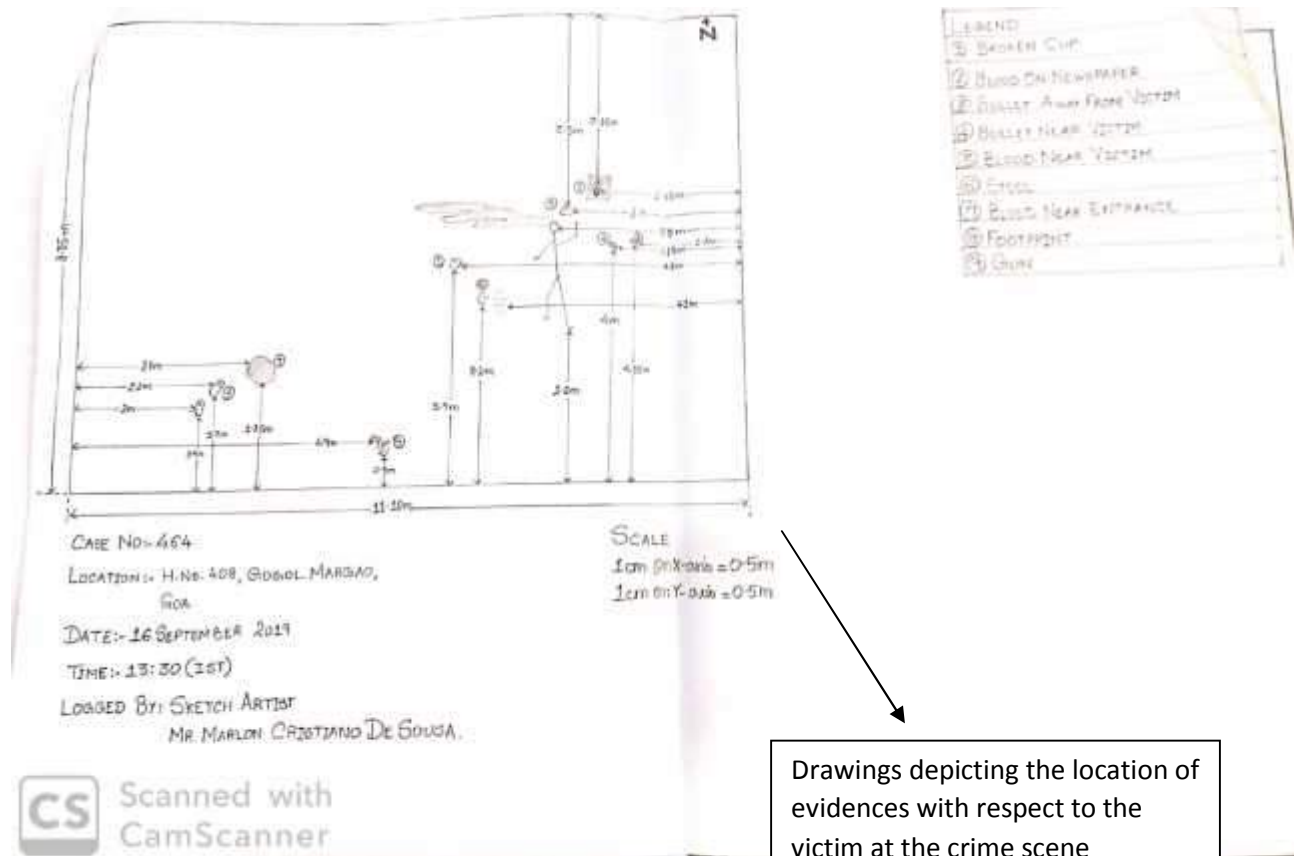
The first responder arrived at 13:42pm and ordered the crime scene to be sealed off and guarded. The forensic team which consisted of a sketch artist, photographer etc. were employed at the crime scene. They found out evidence like guns, bullet marks, newspapers, steel etc and transferred them to the laboratory with much precaution for further investigation.

The sketch artist Mr. Bruce Brown drew a sketch using head to head as well as one view sketch. The photographer had clicked two view pictures as well as close-up pictures of the evidence. The investigation was carried out with proper methods with positive marks in powder by examination. The evidences were marked with tags, a search for more evidences had to be carried out for the time.

Witness Card of

SUPPLIER

T.Y. D & Zooling



5. Evidence of Success

- Students were able to work in their groups to solve the activity given to them.
- They were able to write a good report based on the different components related to the activity.
- The same was assessed as a continuous assessment for practical's

6. Problems Encountered and Resources Required

Implementation of the practice required extensive work on the designing of activity.

To ensure that students are well versed with the concerned topic they have to be taught in details in theory class before portraying it as an activity.

BEST PRACTICE AREA: TEACHING LEARNING EVALUATION

Best practice: Project based practical

1. Title of the Practice: Project based practical (Comparision Of Nutrient Labels)

2. Objectives

To enable students, learn and understand concepts through field work. At the end of the course students are able to analyze and interpret results. The students understand the importance of team work and comprehend the information attained for presentation.

3. The Context

This present practice is adopted by Dr.Nandini Vaz Fernandes and Ms.Tessa Vaz of department of zoology in the course 'Health and Nutrition" . This Practical requires to be designed in a manner that will enable students understand the theoretical concepts and its application. The activity is designed in such a manner that it enables students to analyze the different aspects of the activity and use theoretical concepts to solve the problems in a group.It helps them build team work and understand different food groups.

4. The Practice

This practice is a field based/ project based practical where in students are required to go out in the field during the practical hours and complete the project.

Example:Comparison of nutritional labels if different food groups.

This practical is a component of the course Health and Nutrition of TYBSC. It is in line with the concepts taught in theory as it requires them to interpret the results. Students should be taught about the different food groups and their importance indifferent diets, based on requirements of individuals specially those suffering from diet based diseases.

On the day of the practical students go to different supermarkets in their respective groups and assess the nutritional labels of a food group belonging to different brands. The distribution of the food groups for eg: noodles, jams, biscuits, flour etc. is done by the respective faculty prior to the day of the activity. The students analyze atleast 4 brands in each food group allotted to the group. After careful observation they compare the macro and micro nutrient quantities displayed on the nutrient label's and then submit their portfolio. This practical is a component of the continuous assessment for practical for which the students are evaluated based on their observations, results and the conclusions related to different diets.The students submit their results in a form of a portfolio and presentation followed by an interaction with the faculty and students in the class.

5. Evidence of Success

Students were able to work in their groups to solve the activity given to them. They were able to write a good report based on the different components related to the activity. They are able to evaluated and read nutritional labels .The same was assessed as a continuous assessment for practical's which had two components i.e portfolio submission and presentation.


**COMPARISON OF
 NUTRITIONAL QUALITY OF
 JUICES ACROSS VARIOUS
 BRAND**



[Handwritten signature]

Name	Roll no.	Signature
Reuben Rajbhaksha	SU160152	<i>[Signature]</i>
Rive in Rodrigues	SU160120	<i>[Signature]</i>
Leander Banerji	SU160108	<i>[Signature]</i>
Prachin Sudhir	ST160127	<i>[Signature]</i>
Declina Dias	ST160141	
Dibetsaj Hahli	SU160216	<i>[Signature]</i>

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Introduction

All packaged foods come with a nutrition label meant to provide you with the information essential to know exactly what you're eating. Understanding what's in the foods you consume helps you make healthier choices (Reese, 2017).

The nutrition label provides key information such as serving size, calories, total fat, percent fat, cholesterol, protein, carbohydrate and vitamin content. The label also has a list of the ingredients. This data helps you stay on track with your everyday targets. It also helps you avoid certain ingredients if you have a food intolerance or are following a diet that excludes certain components. (Reese, 2017).

The current Indian government has suggested and projected all drink companies of India to have at least 2% of fruit content in their drinks, so that it has some nutritive character added to it and along with it benefit the farmers working towards production of fruits in India. Mango has the biggest share in fruit juice industry with about 60% share and all other fruits altogether have the remaining percentage (Singh, 2018).

Dietary recommendations for healthy eating include the consumption of fruit juices whose beneficial health effects arise, in part, from vitamin C, a natural antioxidant which may limit the development of major clinical conditions including heart disease and certain cancers. However, many fruit juices also have phenolic compounds and carotenoids, some of which have antioxidant properties and whose intake have also been inversely related with heart disease and cancers (Gambas, White, McPhail, & Duthie, 2005).

The nutritional relevance of such phenolics is uncertain as they may be poorly absorbed and rapidly metabolised and thus have limited active life ability in vivo. In contrast, vitamin C is highly bioavailable and is consequently one of the most important water-soluble antioxidants in cells, efficiently scavenging reactive oxygen species such as O₂⁻, OH (peroxy) radicals and single oxygen. Moreover, by efficiently trapping peroxyl radicals in the aqueous phase of the plasma or cytosol, vitamin C can prevent bio-oxidation and low density lipoproteins from peroxidative damage. Consequently, when relating the antioxidant activities of fruit juices to disease risk and health, it is important to consider the contribution of vitamin C in addition to that of phenolic compounds with antioxidant activity in chemical systems (Gambas, White, McPhail, & Duthie, 2005).

Methodology

For this experiment, first we brainstormed certain ideas. We decided that the 5 brands would be Tropicana, Real, Minute Maid, B Natural and Ceres. We then chose the flavours to be Orange, Mango and Mixed fruit as these were readily available in most markets.

We further divided ourselves into groups and went to supermarkets and grocery stores. On finding any one of the brands with the same flavour mentioned above, we clicked pictures of the Nutritional value. Once we got all the brands we tabulated the value and excluded all the various brands for a certain flavour of juice.

To form the graphs, Excel sheet was used.

Results and Discussion

Orange Juice

1. Brand A (Tropicana)



Nutritional Information	Per 100ml
Energy	50 kcal
Total Carbohydrates	12.4 g
Sugars	12 g
Protein	0.1 g
Total Fat	0
Sodium	34 mg
Potassium	82 mg

2. Brand B (Real)



Nutritional Information	Per 100ml
Energy	54 kcal
Total Carbohydrates	13.3 g
Natural Fruit Sugars	6.7 g
Added Sugars	6.8 g
Protein	0.4 g
Total Fat	0
Calcium	4 mg
Iron	0.3 mg

3. Brand C (Minute Maid)



Nutritional Information	Per 100ml
Energy	54 kcal
Total Carbohydrates	13.6 g
Sugars	11 g
Protein	0
Total Fat	0

4. Brand D (B Natural)



NUTRITIONAL FACTS PER 100ml*

ENERGY	56 kcal
PROTEIN	0.2 g
CARBOHYDRATE	13.8 g
OF WHICH	
- NATURAL FRUIT SUGARS	6.3 g
- ADDED SUGARS	7.5 g
FAT	0 g
CALCIUM	0.3 mg
SODIUM	9 mg
POTASSIUM	85.9 mg
VITAMIN C	30.8 mg

*All values are based on 100ml of juice. Values may vary slightly due to natural variations in the fruit.

Nutritional Information	Per 100ml
Energy	56 kcal
Total Carbohydrates	13.8 g
Natural Fruit Sugars	6.3 g
Added Sugars	7.5 g
Vitamin C	30.8 mg
Total Fat	0
Calcium	0.3 mg
Iron	0.3 mg
Sodium	9 mg
Potassium	85.9 mg
Protein	0.2 g

5. Brand E (Ceres)



NUTRITIONAL INFORMATION	
Energy	100 kcal
Total Carbohydrates	22 g
Sugars	22 g
Dietary Fibre	0 g
Protein	1 g
Total Fat	0
Sodium	5 mg
Vitamin C	60 mg

Nutritional Information	Per 100ml
Energy	100 kcal
Total Carbohydrates	22 g
Sugars	22 g
Dietary Fibre	0 g
Protein	1 g
Total Fat	0
Sodium	5 mg
Vitamin C	60 mg

Nutritional Value of various Brands for Orange

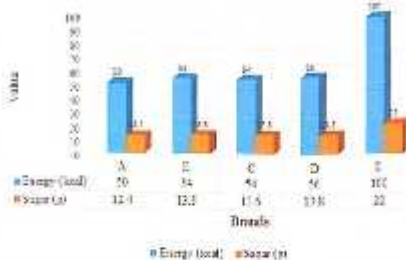


Fig. Graph depicting the sugar and energy of the 5 different brands for orange juice.

In the graph given above:

- It is clearly noticed that Brand E (Ceres) gives the highest amount of energy i.e. 100 kcal per 100ml. The remaining four brands give pretty much the same amount of energy with Brand A (Tropicana) being the lowest with 56 kcal. Brand B (Real) and C (Minute Maid) give equal amount of energy, i.e. 56 kcal. Brand D (Natural) gives 56 kcal.
- If we look at the sugar graph, the trend is the same with Brand E being the highest (22 g) followed by D (13.8), C (13.5), B (13.8), A (13.8).
- It is also noticed that Ceres has the highest amount of protein present with 1g, followed by Real (0.4g), B Natural (0.2g), Tropicana (0.2g) and lastly Minute Maid (0).

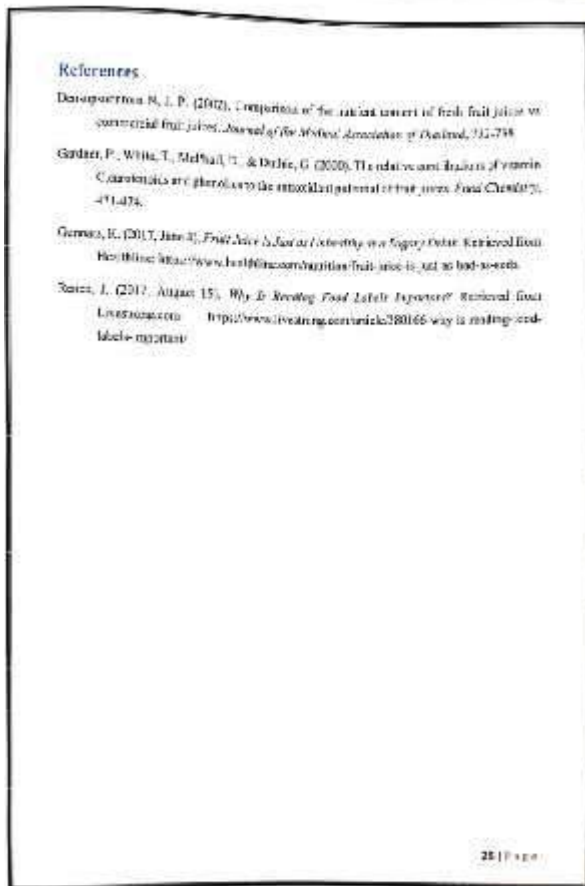
We would offer Brand E to a person who undergoes a lot of exercise or physical labour as she will require a lot of energy which will be obtained from the juice. We would also recommend Brand A to any patient who has a high sugar level or is diabetic as this particular brand has very sugar level.

Conclusion

While comparing the nutritional values for orange juice, it was seen that the energy level was seen highest in Ceres with 100 kcal and lowest in Tropicana 56 kcal. Real and Minute Maid give equal amount of energy, i.e. 56 kcal. If Natural gives 56 kcal. If we look at the sugar graph, the trend is the same with Ceres being the highest (22 g), followed by B Natural (13.8), Minute Maid (13.5), Real (13.5) and Tropicana (12.4). It is also noticed that Ceres has the highest amount of protein present with 1g, followed by Real (0.4g), B Natural (0.2g), Tropicana (0.2g) and lastly Minute Maid (0). Hence, we would recommend Ceres orange juice to a person who works out a lot, exercise or undergoes immense physical activity.

Whereas, for Mango flavoured across the brands it was seen that the energy level was similar throughout as well as the sugar level. We would recommend this flavoured, irrespective of the brand, to young adults and teens who have a high energy requirement.

While evaluating the brands for mixed fruit, again, the energy content was similar across Real, Minute Maid and B Natural, while Tropicana had the lowest amount of energy level. The sugar content was also similar across brands. Hence, we would recommend Tropicana to people with a comparatively more sedentary lifestyle, followed by Ceres. People with high energy requirements would be recommended Real, B Natural and Minute Maid.



6. Problems Encountered and Resources Required

Implementation of the practice requires the faculty to complete the respective modules before the activity is announced as the students have to understand the nutrients well

Food groups allotted should be easily available in nearby local supermarkets having atleast 3-4 brands of the required food products to make it feasible for the students. Students have to be given sufficient time during practical's to record and compile all their data in the form of a portfolio

INNOVATION: TEACHING LEARNING EVALUATION **BY** **DR. NANDINI VAZ FERNANDES**

BEST PRACTICE AREA: TEACHING LEARNING EVALUATION

1. Title of the Practice: GOBBET AS AN EVALUATION METHOD.

2. Objectives of the Practice: The main objective of this evaluation practice is to evaluate the understanding of learning and assess the analytical skills of students.

3. The Context:

'GOBBET' refers to a passage of literature, an image, a cartoon, a photograph, a map or an Artefact which provides a context for analysis, translation or discussion in an assessment. The students are given set of instructions.

4. The Practice:

Gobbet as a mode of assessment, if effective tool to encourage the students to work as a team and analyse content of Gobbet rationally. The practice promotes leadership qualities and group collaboration / team work along with helping students understand the core concepts and applications of the same. The activities are initiated by assigning of students into groups followed by activities by giving set of guidelines and explaining the rubric of assessment. All the matter related to assessment is also uploaded on CLAAP (College Moodle – Chowgule's Learn Anytime Anyplace).



Provide students the time period, guidelines and assessment criteria. Along with the photo/map/scene/artifact, series of questions can be asked (lower and higher order of Blooms taxonomy).

Ensure the students know what the objectives of the assessment are.

Inform students that the gobblet should involve evaluation of the information and not paraphrasing what is already in the piece.

Students need to be advised to:

Include cross-references to any other primary sources, written.

feel free to answer in bullet-point form

Be PRECISE, CONCISE and STRICT about only sticking to relevant information.

Rubric of Assessment:

MARKING RUBRICS	<i>Excellent (70% and above)</i>	<i>Average (69 - 50%)</i>	<i>Below average (49 - 30%)</i>	<i>Poor (Below 30%)</i>
1) Context: (5%)	Outstanding grasp and a mature understanding of the gobbet and its contexts	Comments on the nature, authorship, and other material pertinent to the context and interpretation of the piece	Make some pertinent comments on the nature, authorship, and other relevant aspects of the gobbet.	Fails to expand on the nature, authorship, and other issues relevant to the gobbet.
2) Analysis: (30%)	Clear, coherent and compelling analysis	Demonstrates familiarity with the area under discussion	Demonstrates some familiarity with the area under discussion	May paraphrase rather than analyse the gobbet under discussion
3) Meaning: (30%)	Comprehensive coverage. This may be achieved by citation	Identify the point of the document or the theme that it illustrates	Identify the point of the gobbet – the subject or the theme which it illustrates	Fails to identify the point or the theme of the piece
4) Citation: (5%)	Economic and effective use of all material cited	Substantiates the points that are made from evidence	Contains some citation but not appropriately used to substantiate the piece	Contains no citation
5) Significance: (30%)	Identifies the gobbet's significance in an independent, distinctive, and authoritative way	Explores some of the significance of the gobbet with reference to such issues as typicality, representativeness, uniqueness, reliability, bias	Touches on the wider significance	Fails to identify the gobbet's wider significance

5. Evidence of Success

GOBBET
ZOO-E-5: ANIMAL CELL CULTURE AND APPLICATIONS
CA 2 (15 MKS) - TO BE SUBMITTED ON 10th February 2020

1) See the image given below. Identify the process that it describes. Explain every step/event numbered from '1 to 11'. Comment on the significance of the process.

The diagram illustrates the Gobbet process in 11 numbered steps: 1. A cell with organelles is shown. 2. A mouse is injected with a needle. 3. Four green spherical cells are shown. 4. A cell with organelles is shown. 5. A beaker containing a red liquid. 6. A beaker containing a red liquid with green cells. 7. A beaker containing a green liquid. 8. A beaker containing a red liquid with green cells. 9. A beaker containing a red liquid with green cells. 10. Four beakers containing different colored liquids (blue, red, yellow, green). 11. Four beakers containing different colored liquids (blue, red, yellow, green).

Figure 1: Gobbet

- 2) Analyse the image 2. What is it indicative of? Compare and contrast the 4 portions of the image viz. A,B,C and D and give justification as to when such a phenomena can occur.

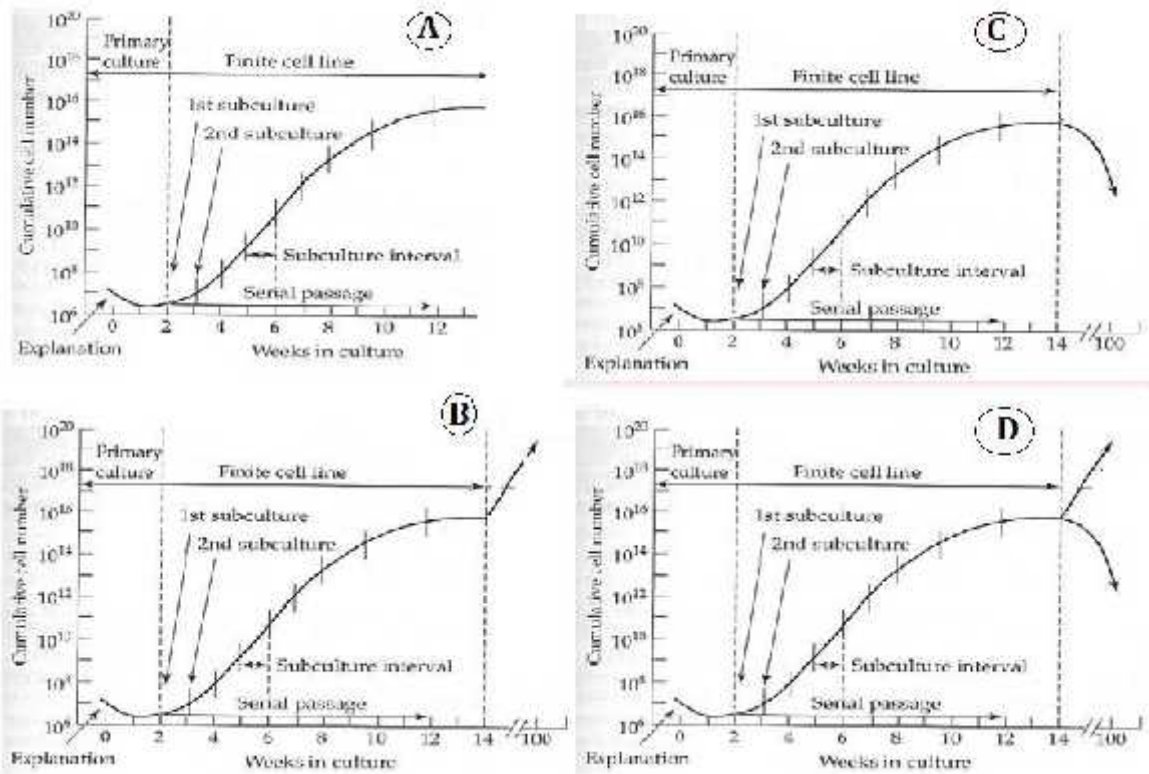


Figure 2: Gobbet

- 3) Given below is an image with clippings of lab and the procedure conducted. Looking at the sequence of events from A to F, describe the procedure conducted and steps involved.

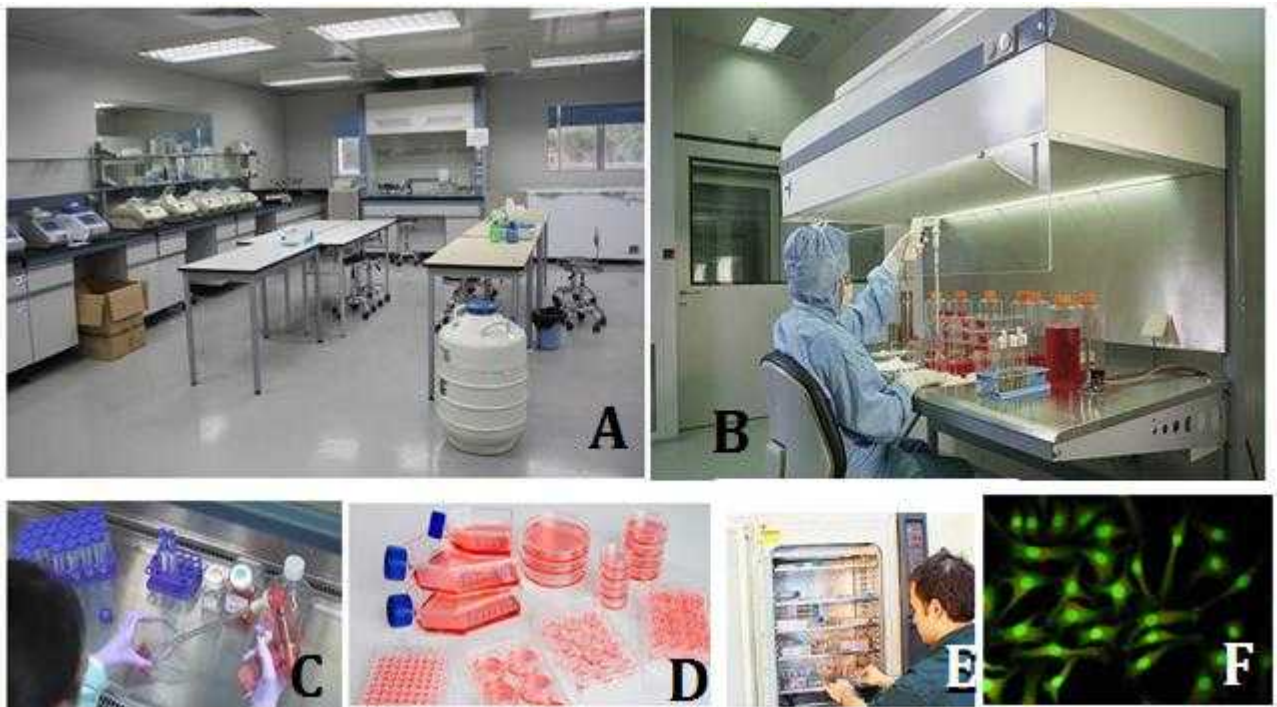


Figure 3: Gobbet

- 4) What do you understand by the term hybridoma technology? What are the valuable products obtained from Hybridomas as of today. Suggest an alternative method to obtain valuable products instead of hybridoma technology.

Course faculty: Dr. Nandini Vaz Fernandes Ms. Madhu Balekai Ms. Prasanna Naik Gaonkar

GOBBET
CA-2

COURSE TITLE- ZOOIV-E-5- ANIMAL CELL CULTURE AND APPLICATIONS
GROUP 6
SEMESTER IV
CLASS - SVRSC7

- 4- Formation of antigen-antibody complex- Since every antibody binds to its specific unique binding site on antigen (depicted in the picture with different colour) the splenocytes containing various parasites fuse with antigens containing the respective epitopes and form an antigen antibody complex.
- 5- Blood suspension containing Antibodies-We can obtain the antibodies from the antigen-antibody complex through Blood clotting. This serum contains polyclonal antibodies which bind to multiple epitopes of a given antigen.
- 6- Test tube containing splenocytes having antibodies - These are normal cells having controlled growth and possess the property of producing antibodies. Since blood exists as suspension, we allow the splenocytes to centrifuge and resuspend in lysine solution. This is done to preserve the cell integrity, allow cell growth and make the cells compatible for fusion with myeloma cells.
- 7- Test tube containing Myeloma cells- These are cancerous plasma cells having the property of uncontrolled growth but do not produce any antibodies. These act as fusion partners.
- 8- Fusion of the splenocytes and myeloma cells- After ensuring they are present in appropriate ratios, mix both the cells and allow them to centrifuge. After removing the supernatant, poly ethylene glycol (PEG) is added to the pellet to allow adherence between both the cells for proper fusion.
- 9- Formation of hybridomas- The fusion of a normal splenocytes with cancerous blood cells called myeloma cells, results in the formation of new hybrid cells called hybridomas. They possess the property of immortal and indefinite growth as well production of the desired antibodies.
- 10- Selection of monoclonal antibodies- In order to retrieve fused cells, they are subjected to HAT (Hypoxanthine Aminopterin and Thymidine) selection. Since the fused cells are resistant to HAT medium, only these cells will grow thereby separating them from unfused cells and giving rise to pure colony of hybridomas. These hybridomas are cultured and cloned to produce identical daughter cells.
- 11- Production of monoclonal antibodies - After obtaining pure hybridoma cells, the identical daughter cells secrete the immune products called monoclonal antibodies. Different test tubes containing different types of antibodies, but they are derived from the same hybridoma cells, hence the produced antibodies are monoclonal in nature.

1) See the image given below. Identify the process that it describes. Explain every step numbered from 1-11. Comment on the significance of the process.

The diagram illustrates the production of monoclonal antibodies (mAb) using hybridoma technology. It shows the fusion of a normal spleen cell (1) with a myeloma cell (2) to form a hybridoma cell (3). The hybridoma cell is then cultured in a test tube (4) and produces antibodies (5). The antibodies are purified (6) and used for various applications (7). The process is repeated to produce more antibodies (8). The final product is a monoclonal antibody (9). The process is then used to produce a large quantity of antibodies (10) for various applications (11).

2) The process described below is production of monoclonal antibodies (mAb) using hybridoma technology. Monoclonal antibodies are antibodies made from identical immune cells that are clones of a single parent cell (Khad T, 2007). They are derived from a single B cell clone that recognize and bind to a single, unique epitope of an antigen. The steps involved in their production are as follows:

- 1- Selecting an antigen having multiple epitopes. This antigen is susceptible to producing multiple antibodies.
- 2- Immunization of mice- the mouse is injected with the specific antigen but acts as an immunogenic protein for testing the antiserum. This is done via intraperitoneal immunization or subcutaneous immunization. This will trigger the immune system to produce antibodies against that specific antigen. These antibodies are passively immunized and isolated from the spleen.
- 3- Isolation of different splenocytes from the spleen of mouse - these are lymphocytes capable of producing specific antibodies. They are raised via intraperitoneal immunization.

3) The significance of hybridoma technology is mentioned below-

1. In vivo diagnostic- alternative way for diagnosing and monitoring the progression of a disease through the analysis of biomarkers within the body.
2. Highly specific imaging like Positron emission tomography, magnetic resonance imaging, fluorescent molecular tomography and ultrasound.
3. Used for monoclonal antibody production and exploiting the therapeutic potential in the form of cytotoxicity, inhibition, and immunomodulation.
4. mAbs are used in treating autoimmune disorders like and inflammatory disorders like rheumatoid arthritis, Crohn's disease, HIV and cancer as well as immunosuppression during organ transplant.
5. mAbs are conjugated with fluorophore or a drug to deliver cargo to specific targets. They can help in targeted drug delivery for immunology and oncology studies through ADC's and targeted biologics in the form of chimeric antigen receptor T-cell therapy (CAR T) where they target T cells to a tumor associated antigen through single chain variable fragments expressed on the surface of the T cell (Tan, 2019).
6. They are used in research purposes and analyzing human lymphocytes, MHC antigens, antigenic differences between viral and viral related proteins (Pian, 2013).

2) Analyze the image 2. What is it indicative of? Compare and contrast the 4 portions of the image via A, B, C and D and give justification as to when such a phenomena can occur.

The four graphs (A, B, C, D) show cell growth curves over time. Each graph plots Cell Number (log scale) against Time (days). Graph A shows a typical sigmoidal growth curve. Graph B shows a similar curve but with a different growth rate. Graph C shows a curve that starts with a lag phase before entering the exponential phase. Graph D shows a curve that starts with a lag phase and then enters the exponential phase at a different time point.

► The above images show a typical cell growth curve for cultured cells. Each image displays subculture of primary cell culture to form secondary culture. Continuous passaging of cells leads to the establishment of a cell line having finite growth for a certain period of time. But after undergoing the stationary phase, the fate of these cell lines differ except for portion A) as mentioned below:

A) Ideal growth curve of cells showing stationary growth phase.

B) Transformed cell line-Cell line undergoes transformation to form an immortal cell line. This is, due to mutation which leads to infinite and uncontrolled cell growth and increase in cell number.

C) Finite cell line undergoes senescence-Cell death due to reduction in viable cell number is a part of natural progression of cell cycle. This phase is also called decline phase.

D) Cell culture with certain cells either undergoing senescence (finite cell line) or transformation (continuous cell line).

► The similarities between all 4 portions of the image are given below:

• Each curve shows sigmoid pattern of proliferation depicting a relationship between the relative cell number and the weeks to which it was cultured.

• Continuous passaging of primary cells leads to the formation of finite cell lines in each curve.

• Each curve shows different phases of cell growth i.e.

a. Lag phase- The initial phase where no cell growth occurs but cells take time to get adapted to their culture environment. The length of this phase depends on the growth phase of the cell line at the time of cell culture and seeding density (in all 4 portions, nearly 2 weeks). As per the curve, this time period coincides with the time period of primary culture.

b. Logarithmic phase- The actual phase of cell growth, where cells proliferate and cell growth exponentially increases with increase in cell density. As the cell population is more dense during this phase (in this case, around 2-12 weeks), it helps in assessing the various cell functions. As per the figure, all cell are sub cultured and passaged during initial portion of this phase i.e. 1st subculture at 2 weeks (regrain of secondary cell culture), followed by 2nd subculture at 1 week and so on till 3 subcultures. Each subculture occurs after specific time period known as subculture interval.

2. Stationary Phase- As cells start attaining confluency, cell growth ceases and cells are most susceptible to injury at this phase. As per the curve, after 12 weeks, the cells undergo stationary phase.

► As mentioned above, the 4 portions of the curve differs based on the cell behaviour after establishment of finite cell line. Each curve shows different pattern of growth of cell line depending upon the type of cells, culture and environmental factors.

Image A- shows the cells in a stationary phase. The stationary growth phase results from a situation in which growth rate and death rate is equal. The number of new cells created is limited by the growth factor and as a result the rate of the cell growth matches the rate of cell death. The result is a smooth horizontal linear part of the curve during the stationary phase. An exponentially growing cell can enter the stationary phase due to a growth-limiting factor such as the depletion of nutrient or due to the accumulation of waste (Kotler R, 1995).

In image B, a transformed cell line is obtained when the cell line undergoes conversion to a state of unregulated growth in culture. The cells undergo transformation and acquire the ability to divide indefinitely and thus, it becomes a continuous cell line. The continuous cell lines are transformed, immortal and nonogenic. It occurs spontaneously or through mutators arising due to interaction with viruses, oncogenes, radiation or drugs and chemicals. Hence the curve once again increases linearly and exponentially after finite cell line (Smith JR, 1992).

In image C, Cell senescence is the final, common pathway for actively dividing cells which leads to the reduction in the number of viable cells in the culture. Cell death is not due to the reduction of nutrients, but to the natural progression of the cellular cycle. By imposing a growth arrest, senescence limits the replication of the old or damaged cells. Senescent cells undergo many other phenotypic alterations such as metabolic reprogramming, chromatin reorganization, or autophagy resolution. Senescence is a stress response that is often triggered by a persistent DNA damage response and can be induced by a wide range of intrinsic and extrinsic stimuli, including oncogene activation, oxidative and genotoxic stress, mitochondrial dysfunction, irradiation, or chemotherapeutic agents. Hence the curve tapers down after finite cell line (Nicolai Ferranti, 2018).

In image D, the curve shows 2 different growth patterns. Some cells undergo differentiation to senescence whereas some cells continue to proliferate at an enhanced rate and show die to senescence due to cell transformation. Most of the cells will undergo fixed number of

population doublings and these cells are known as finite cells while some cell lines that undergo transformation and acquire the ability to divide indefinitely, become a continuous cell line due to mutation (Dowd, 2019).

3) Given below is an image with clippings of lab and the procedure conducted. Looking at the sequence of events from A to F, describe the procedure conducted and steps involved.



► The events occurring in the above images take place while sub culturing adherent cells. After obtaining cells from primary cell culture, they are subcultured multiple times to obtain secondary cell culture and cell lines. The cells are obtained via cell dissociation methods (mechanical or enzymatic) followed by viable cell count, determining optimal cell density and progression of new culture vessels for passaged cells. Based on the images, the steps are mentioned below:

✓ This procedure takes place in a cell culture laboratory as seen in image A. This laboratory is a single use facility and must be separate into an area specifically reserved for handling quarantine material, free of contamination. The main function is to maintain sterile environment as well as appropriate temperature for producing cells in a safe and efficient manner. It must be an air conditioned room consisting of CO₂ incubators, laminar air flow, liquid nitrogen freezer, refrigerator, balance, centrifuge, inverted microscope, hemocytometer, washing sink and ornaments.

► Image D shows a specially cabinet called laminar air flow hood, that provides specific and sterile environment for cell culture and protect the operator from aerosol. It consists of highly specialised HEPA (high efficiency particulate air) filters that filter the airflow. As seen in the picture, there are specialised T-flasks made out of polystyrene containing the special culture media placed within hood's reach. All the activities and equipment must be sterile. Most importantly, the operator must wear sterilized gloves, mask and laboratory apron to ensure no contamination takes place while working.

✓ Using a sterile pipette, the laboratory worker is pouring the media in specialised flask made out of sterile polystyrene material called T-flask.

✓ As seen in image C, the spent cell culture media from the culture vessel is recovered using sterilised pipettes (one-time use).

✓ Rinse the solutions using balanced salt solution while ensuring conductivity and pH for preserving cell integrity is maintained.

✓ Now remove the traces of salt solution by rinsing with wash solution.

✓ After discarding the wash solution from the vessel, subject it to sufficient cell dissociation reagent like trypsin or trypLE to one side of the T-flask for cell adherence and coverage of complete cell layer.

✓ The culture vessels mentioned in the image D are designed for seeding cell culture medium. The cell culture medium is GMEM (Gibco) or Minimum Essential Medium, EMEM (Eagle's Minimum Essential Medium) and DMEM (Dulbecco's Modified Eagle Medium) which are supplemented by hormones and growth factors like platelet derived growth factor (PDGF) serve as nutrients and source of energy for cell growth. These include T-flask, petri plates and micro tubes of different sizes, shape, coating and lids. The coatings such as collagen, gelatin and fibronectin help in providing the cells with natural environment condition. These are made out of special plastic material like polystyrene, Teflon or polyethylene that can withstand cell culture conditions and low efficient working (M.K.S, 2011). They are discarded after one-time use.

✓ Image E shows CO₂ incubator that provides completely closed sterile environment with suitable temperature, humidity and CO₂ to the growing cells.

✓ Using the flask in a gentle manner, such that all cells in the flask are completely dissociated. To confirm this, observe them under microscope where they appear round in three

- ✓ After almost 90% of cell dissociation, incubate the culture vessel at room temperature for 10 minutes, once again add complete growth medium using a new sterile pipette several times to ensure the entire cell layer covers the surface.
 - ✓ Now transfer the cells to a circular tube and centrifuge them at a high speed. Discard the supernatant containing any residual traces of growth medium or dissociating agent.
 - ✓ Resuspend the pellet in growth medium, while gently pipetting to ensure all cells take up the medium.
 - ✓ Now take a small portion of the pellet and use a hemocytometer or any cell counter to do a viable cell count. Use trypan blue stain for indicating the ratio of live to dead cells (thermofisher, 2018).
 - ✓ The image E displayed screen depicts spindle shaped cells seeded with a fluorescent marker (green nuclear dye that is permeable to cell membrane thereby staining the nucleus) to detect presence of viable cells.
- 4) **What do you understand by the term hybridoma technology? What are the valuable products obtained from hybridomas as of today. Suggest an alternative method to obtain valuable products instead of hybridoma technology.**

Hybridoma technology refers to the production of antibodies in large amounts for diagnostic or therapeutic use (Ali, 2018). It features effective usage of innate functions of both immune cells and cancers, allowing production of hybridoma cells, which continuously generate monoclonal antibodies specific to antigens of interest. For the generation of hybridoma cells, B lymphocytes must be continually fused with myeloma cells using various technologies (Masahito Tomita, 2011).

The valuable products obtained from hybridomas as of today are monoclonal antibodies. the application of the monoclonal antibodies are as follow

a) **Diagnostic Applications-**

- MAbs may be employed as diagnostic reagents for biochemical analysis or as tools for diagnostic imaging of diseases.
- Detects the proteins of interest either by western blotting or immunofluorescence.
- Used in cardiovascular diseases and deep vein thrombosis.
- Radiolabeled MAbs can be used to locate 125 I and 99 Tc metastatic tumours.
- Used in immunocytochemistry.

- Used in pregnancy testing kits in detecting the urinary levels of human chorionic gonadotropin.
- It also helps in the hormonal analysis of thyroxine, triiodothyronine and thyroid stimulating hormone for thyroid disorders (W. Payne, 1981).

b) **The Therapeutic Applications**

- MAbs are laboratory produced molecules engineered to enhance or mimic the immune system's attack on cancer cells, they are used to carry drugs and radioactive or toxic substances to cancer cells (Saljoughian 2019).
- It is used in the immunosuppression of organ transplantation.
- It is the treatment of AIDS, autoimmune diseases, malignant leukaemia, B-cell lymphoma.
- Used in the preparation of vaccines, particularly against certain viral strains or against some parasites.
- The toxins can be coupled with MAbs to form immunotoxins and is used in therapy (Aryal, 2017).
- c) **Protein purification**
MAbs columns can be prepared by coupling them to cyanogen bromide activated Sepharose. The immobilised MAbs in this manner are very useful for the purification of proteins by immunoaffinity method.

An alternative method to obtain valuable products instead of hybridoma technology is the recombinant DNA technology. Recombinant antibodies (rAbs) can be generated in vitro through gene manipulation or production of synthetic genes (Fedarko, 2015). After synthesising a gene, capable of artificially producing antibody for the given antigen, using polymerase chain reaction to increase the production, transforming a plasmid to carry the gene of interest and insert into the cancerous cell lines (myeloma or lymphoma) will directly give off interest and insert into the cancerous cell lines immunology products. Recombinant DNA leads to uncontrolled growth of new cells giving immunology products. Recombinant DNA technology is playing vital role in improving the health conditions by developing new vaccines and pharmaceuticals. It offers new opportunities for innovations to produce a wide range of therapeutic products with immediate effect to the medical practices and biomedical research by modifying microorganisms, animals, and plants to yield medically useful substances (Shahmoradian, 2016).

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INNOVATION: TEACHING LEARNING EVALUATION

BY

DR. NANDINI VAZ FERNANDES

BEST PRACTICE: TEACHING- LEARNING- EVALUATION

1. Title of the Practice: PROBLEM BASED LEARNING

2. Objectives:

Problem-based learning (PBL) is a student-centered approach in which students learn about a subject by working in groups to solve an open-ended problem. This problem is what drives the motivation and the learning and is practised by teachers of 03 departments viz. Geography, Zoology and Economics extensively and 03 departments partially (Biotechnology, Biochemistry, Botany).

The main objective of the PBL, is improving the learning of our students. In addition to this general objective, we have other more specific objectives:

- i) Development of team skills
- ii) Development of conceptual skills
- iii) Depth and focus of knowledge acquired
- iv) Development of self directed study skills.
- v) Improves critical thinking and problem solving

3. The Context

The present description of the best practice is PBL conducted by department of Zoology. All faculty members use PBL as mandatory T-L-E method. PBL is an instructional method in which students work in small groups to gain knowledge and acquire problem-solving skills. A major characteristic of PBL is that the problem is presented to the students before the material has been learned rather than after, as in the more traditional 'problem-solving approach'. A second notable feature of PBL is that the problems are presented in the context in which students are likely to encounter the given (or a similar) problem in real life. It is this contextualisation of material which makes PBL an attractive strategy for the education of professionals

PBL encourages open-minded, reflective, critical and active learning; it acknowledges that both teachers and students have knowledge, understanding, feelings and a shared interest in the educational process.

4. The Practice

PBL fits best with process-oriented course outcomes such as collaboration, research, and problem solving. It can help students acquire content or conceptual knowledge, or develop disciplinary habits such as writing or communication. After determining whether your course has learning outcomes that fit with PBL, you will develop formative and summative assessments to measure student learning.

Next you design the PBL scenario with an embedded problem that will emerge through student brainstorming. Think of a real, complex issue related to your course content.

We develop a single scenario and let each group tackle it in their own way, or you could design multiple scenarios addressing a unique problem for each group to discuss and research.

Prior to adopting PBL as mode of teaching- evaluation, students are taught 'Steps of Problem Solving' and 'Thinking skills' (Logical thinking, lateral thinking and critical thinking). The students are the divided into groups of 5. Each group has one group leader. The execution follows the process described. PBL research begins with small-group brainstorming sessions where students define the problem and determine what they know about the problem (background knowledge), what they need to learn more about (topics to research), and where they need to look to find data, how to analyse it, how to critically evaluate and how to present the solutions in multiple perspectives. Therefore PBL serves as a very effective means of teaching-learning as students learn to reason, analyse, evaluate and create (Higher order learning – Blooms taxonomy).

PBL can also be used as an effective Evaluation tool. During the PBL assessment step, evaluate the groups' performances. Use rubrics to determine whether students have clearly communicated the problem, solutions.

Example of PBL at department of Zoology:

Given below is the PBL question posed to the students for the Course "Molecular Genetics and Forensic Science". These questions are posed to the students and the groups of students are expected to solve them by following the 'steps of problem solving'.

**PARVATIBAI CHOWGULE COLLEGE OF ARTS AND SCIENCE MARGAO – GOA
(AUTONOMOUS)**

**SUBJECT: ZOOLOGY
I-IV-E-9: MOLECULAR GENETICS AND FORENSIC SCIENCE**

PROBLEM BASED LEARNING ACTIVITY – I(CA- I) MARKS: 15

**ACTIVITY TO BE SUBMITTED ON
29th August 2019 AT CHGRJL BETWEEN before 11.30 – 12.30 PM**

- 1) What is Phenyl ketonuria? Explain its genetic basis of PKU. A couple with history of PKU in the family is expecting a baby. What are the possible types of genetic tests should the couple opt for? In case their child tests positive for PKU, what measures will enable their child to grow up healthy? If the child is PKU positive, and if the couple plans to go for second child what should be the counselling given to the couple for preventing birth of another child with PKU. (Solve this in 1500 words).
- 2) What is cystic fibrosis (CF)? What are the tests which enable detection of CF? Explain the symptoms and genetic basis. A newborn baby born to a couple is detected with cystic fibrosis disease. Discuss the consequences if there is no intervention in treating CF. What counselling can be offered to the couple to help their child with CF (Solve this in 1500 words).
- 3) A woman is detected with G-G translocation of chromosome 21. She is 8 weeks pregnant. As a geneticist what would you advise her? Explain the tests that can be recommended to her. How would your counselling session differ if she was 14 weeks pregnant? Explain the tests that can be recommended to her if she was 14 weeks pregnant. Comment on her pregnancy outcomes if she plans for future pregnancies and justify your statements. (Answer in 1500 words. Support your discussion with two journal references).
- 4) You are an investigator responding to the scene of a shooting in a hotel room, where you observe the following: A male is sitting on a sofa and appears to be the victim of a shooting. A Crime Scene Investigator has photographed the scene, and is awaiting your instructions regarding the collection of evidence. There is a firearm at his right hand. There is no sign of a struggle, but there are many objects in the room. One of them is a hand written note which is signed with an initial at the bottom and some scattered items on the table next to the victim. Based on the standard protocol for conducting search and analyzing evidence give a detailed report of evidence collection and processing.

PBL AND GOBBET

MOLECULAR GENETICS AND FORENSIC SCIENCE

SAMPLE PBL

Group 4:

Name	Roll No	Sign
Meha Parida	SU170029	
Haroon Khan Asghar	SU170015	
Shahni Keerthi	SU170015	
Kevin D'Silva	SU170011	
Saravani Moolan	SU170010	

Work Paper

The researchers on the first three questions was done on 25th August 2019. All the members contributed in these questions. The answer to the last two questions were discussed on 27th August 2019. The last two questions was report by Shahni and Haroon. The 2nd and 4th questions was typed by Meha, Dev or and Kevin. The information on the goblet was contributed by all the members and was typed by Kevin.

We ask team leader to submit report about the interactions and participation of all team members

Well written.

1.1 What is Phenylketonuria? Explain its genetic basis of PKU.

Phenylketonuria (PKU) is an inherited error of metabolism caused by a deficiency in the enzyme phenylalanine hydroxylase. PKU is an autosomal recessive disorder, caused by mutations in both alleles of the gene for phenylalanine hydroxylase (PAH) which is found on chromosome 12. In the body, phenylalanine hydroxylase converts the amino acid phenylalanine to tyrosine, another amino acid. If PKU is not treated then phenylalanine can build up to harmful levels in the body, causing intellectual disability and other serious health problems. If two parents carry the gene, they have roughly a 25 percent chance of having a baby with PKU, a 25 percent chance that their child will not develop PKU or be a carrier, and a 50 percent chance that their child will also be a carrier of the disease.

ii) A couple with history of PKU in the family is expecting a baby. What are the possible types of genetic tests should the couple get for?

Newborn blood testing identifies almost all cases of phenylketonuria. If the couple have PKU or a family history of it, the doctor may recommend screening tests before pregnancy or birth. It's possible to identify PKU carriers through a blood test. The baby should have a newborn screening test. In PKU, newborn screening checks for serious but rare conditions in birth. It includes blood, hearing and heart screening. With newborn screening, PKU can be found and treated early so babies can grow up healthy. The doctor can recommend another kind of test, called a diagnostic test. This test can check to see if your baby has PKU or if there is some other cause for abnormal test results.

iii) In case their child tests positive for PKU, what measures will enable their child to grow up healthy?

Following are the measures that would enable the child to grow up healthy:

- A lifetime diet should be followed with very limited intake of protein, since foods with protein contain phenylalanine. As the child lacks PAH, and the phenylalanine might get accumulated, it could result in health problems.
- The child should be taking a PKU formula having a special nutritional supplement. This make sure that the child gets enough essential protein (without phenylalanine) and nutrients that are crucial for growth and general health.
- There should be regular review of clinic records, growth charts and blood levels of phenylalanine.
- Blood tests needs to be conducted frequently to monitor phenylalanine levels as they change over time, especially during childhood growth spurs.
- Other tests to assess growth, development and health should be conducted.
- The amount of phenylalanine that an individual with PKU can safely eat is so low, it's crucial to avoid all high-protein foods, such as milk, egg, cheese, nuts, soybeans, beans, chicken, beef, pork, and fish. Potatoes, grains and other vegetables that have protein should be limited.
- They should also avoid certain other foods and beverages, including many diet sodas and other drinks that contain aspartame (NutraSweet, Equal), since aspartame is an artificial sweetener made with phenylalanine.
- The regular infant formula and breast milk contain phenylalanine. Therefore babies with PKU instead need to consume a phenylalanine-free infant formula.

iv) If the child is PKU positive and if the couple plans to go for second child, what should be the counselling given to the couples for preventing birth of another child with PKU?

Parents should be advised to get for

SAMPLE PBL

a) Pre-implantation diagnosis. This is when cells that have been fertilised in vitro (in a laboratory, outside of the womb) are tested for defects at the 4-cell (blastocyst) stage. Only non-affected blastocysts are implanted in the uterus to establish a pregnancy.

b) Using donor sperm or donor eggs. As PKU is an autosomal recessive disorder, the child can inherit it from either of the parents (child could be unaffected, affected or carrier). To avoid the child being affected, the couple can opt for donor eggs or donor sperm.

c) Adoption: the parents can go for adoption. This allows them to have a child without the anxiety of potentially passing on the disease to the new.

d) Becoming pregnant and having specific prenatal testing: prenatal testing will help them to detect any problems that could affect the, like brain defects or genetic diseases. The results can help you make the best health care decisions before and after the child is born.

e) If the woman is suffering from phenylketonuria, she should continue to a low-phenylalanine diet at least 3 months prior to pregnancy, and continue the diet throughout her pregnancy. This way PKU syndrome can be prevented. In other words, a healthy pregnancy is possible for women with PKU as long as she plans ahead and carefully monitors her diet throughout pregnancy.

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2. (1) What is Cystic Fibrosis (CF)?

Cystic fibrosis is an inherited disease characterized by the buildup of thick, sticky mucus that can damage many of the body's organs. The disease's most common signs and symptoms include progressive damage to the respiratory system and chronic digestive system problems. The severity of the disorder and their severity varies among affected individuals. Mutations in the CFTR gene in chromosome number 7 cause cystic fibrosis. The CFTR gene provides instructions for making a channel that transports negatively charged particles, called chloride ions (Cl⁻), out of cells. This condition is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition.

1) Explain the symptoms and genetic basis.

Cystic fibrosis symptoms can vary from person to person, depending on the severity of the disease. For example, one child with cystic fibrosis may have respiratory problems but no digestive problems, while another child may have both. In addition, the signs and symptoms of the same newborn, the first sign of cystic fibrosis may be that they have difficulty passing their first bowel movement (meconium). This occurs when the meconium becomes so thick that it can't move through the intestines, sometimes causing a blockage. Parents may later notice that baby is not gaining weight or growing normally. The baby's stools may be unusually bulky, bad-smelling, and greasy due to poor digestion of fats. Fibrosis may vary with age.

The most common symptoms of CF are:



SAMPLE PBL

1. Salt-crystal skin

People with cystic fibrosis tend to have two to five times the normal amount of salt (sodium chloride) in their sweat. Parents sometimes notice this symptom of cystic fibrosis first, because they taste the salt when they kiss their child.

2. Persistent coughing, shortness of breath, wheezing

They may experience shortness of breath and have difficulty with exercise. Persistent coughing or wheezing is another possible symptom, especially when accompanied by frequent chest and sinus infections with recurring pneumonia in adults. A child may have very thick phlegm (snot). Infants and young children often swallow what they cough up. However, so parents may not be aware of it.

3. Poor weight gain in spite of excessive appetite

Pediatric cystic fibrosis may also have many of these symptoms. Growth delays often continue, and kids with cystic fibrosis tend to be significantly smaller than other children.

4. Greasy, bulky stools

Hard-to-pass stools can occasionally cause anal prolapse. This means that part of the rectum protrudes, or sticks out, through the anus. About 20% of kids with cystic fibrosis experience this. In some cases, anal prolapse is the first noticeable sign of cystic fibrosis. It's not very common in children without cystic fibrosis, but it does occur.

5. Slow physical and mental growth found in the nose

Some people with cystic fibrosis develop polyps (growths) in their nasal passages. They may experience nose or chronic sinusitis, which is inflammation of the sinuses. Their pancreas may become inflamed too; this condition is known as pancreatitis. Clubbing (enlargement or rounding) of the fingertips and toes eventually occurs in most people with cystic fibrosis, as well. However, clubbing also occurs in some people born with heart disease and other types of lung problems.

CF's obstruction of the lungs increases the risk of lung infections such as bronchitis and pneumonia, as it creates optimal conditions for the growth of pathogens. Obstruction in the pancreas can lead to malnutrition and poor growth. It has also been associated with an increased risk of diabetes and osteoporosis.

USA newborn baby born to a couple is detected with cystic fibrosis disease. What are the tests which enable detection of CF?

a. Sweat Chloride Test

The sweat test, more appropriately referred to as the sweat chloride test, is caused when a defective form of a protein, known as cystic fibrosis transmembrane regulator (CFTR), obstructs the normal flow of water and mineral ions in and out of cells. When this occurs in the sweat glands, it prevents sodium from being reabsorbed into cells and causes chloride to accumulate in the sweat ducts. As the excessive amounts of sodium and chloride get pushed close to the surface of the skin, they combine to form salt. The level of accumulation on the skin, specifically, the chloride content can be used diagnostically to confirm CF.

a. Genetic Testing

Genetic testing can also be used to detect cystic fibrosis by detecting specific genetic mutations associated with the disease.

Cystic fibrosis is an autosomal recessive disorder, meaning that you need to inherit the CFTR mutation from both parents to have the disease. If you inherit only one mutation, you won't



5. Evidence of Success

The evidences of success can be quantified through the following:

- 1) Research publications by faculty in zoology (Dr. Nandini Vaz Fernandes): The department of Zoology has also researched PBL and devised an effective pedagogy of using PBL as effective T-L-E tool.
- 2) Faculty of Chowgule College Invited as Resource persons by other Colleges:
 - a. Dr. Nandkumar Sawant and Dr. Nandini Vaz Fernandes – Conducted hands-on workshop for the faculty members of Gogate Joglekar College, Ratnagiri Maharashtra on 'Problem Based Learning- Pedagogical tool for T-L-E'.
 - b. Dr. Nandkumar Sawant, Dr. Nandini Vaz Fernandes and Mr. Andrew Barreto- Conducted workshop for faculty members of Carmel College, Nuvem Goa on 'Integration of Blooms Taxonomy in T-L-E'
- 3) Students progression in Foreign Universities: 14 students from department of Zoology were selected for PG courses in Foreign Universities in UK, Canada, Australia and USA. The students gave feedback that the PBL method adopted in Zoology department enabled them to adapt to the foreign T-L-E techniques as it was similar.

Publication on PBL:



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INTERNATIONAL JOURNAL
OF CURRENT RESEARCH

RESEARCH ARTICLE

STUDENT PERCEPTION OF EFFECTIVE TEACHING METHODOLOGIES FOR UNDERGRADUATE DEGREE COURSES - CASE STUDY FROM INDIA

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ABSTRACT

Many researchers are stressing on the need to change the teaching methodologies to make learning more effective. Various new modes of teaching are suggested especially in the field of medical sciences. The studies mostly focus on the need to adopt Problem-based learning in medical field. The present study was undertaken to see the effectiveness of various teaching methodologies in undergraduate degree college in India. Effectiveness was measured from the students perspective in this study was focused on the response of the students to the questionnaire prepared to evaluate the effectiveness of different modes of teaching. The modes evaluated were Lecture-based learning (LBL), ICT supplemented lectures (ISL), Interactive Classroom method (ICM), Problem-Based Learning (PBL) and Multiple Teaching Mode (MTM). The present study indicated that LBL, ISL and ICM was not very effective method of teaching as it only fostered gaining of knowledge and comprehension. PBL method is good as it enabled triggering higher order thinking of blooms taxonomy in the students. But PBL, if adopted as the only method of teaching did not cater to the diversity of learners in a classroom. Therefore, we recommend MTM as the new effective method of teaching as it has a combination of LBL, ISL, ICM and PBL. On a Five point Likert scale, MTM was indicated to enable students to learn the correct method of data collection and investigation (4.45±0.75), transform data and develop logical argument (4.04±0.79), be more creative (4.33±0.90) and thus helped to improve proactive learning abilities. The present study thus demonstrates that PBL can be used as component of MTM for effective learning even for the undergraduate nonprofessional degree courses of Bachelor of Science or Bachelor of Arts.

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INTRODUCTION

In this era of multiple sources of knowledge gathering, the role of a teacher in undergraduate and postgraduate colleges should reflect a paradigm shift towards making classroom teaching learner centric. The role of a teacher should not merely involve

It is accepted that the feedback from students serves as an effective tool in developing teaching methodology and evaluation methods in undergraduate teaching (Chavda et al. 2011, Bhasale et al. 2013) and so the study was focused on the response of the students to the questionnaire. Thus, the

6. Problem encountered and resources required

A change of methodology like this implies difficulties of adaptation for both teachers and students, as it changes the traditional roles.

For teachers

- It can mean an increase in the workload, particularly in the evaluation work.
- Teacher has to devise higher order problems which is time consuming and involves a lot of thinking.

For the students

- Participation and equal involvement and contribution in discussions by all students is an issue. Department devised means to monitor active involvement of all students.
- At first they may become disoriented. However guided learning helps students to channelize their work and learn effectively.

PBL when used as T-L-E mode, enables students to understand, analyze and interpret the result. This practice also helped students to modify the procedures.

INNOVATION: TEACHING LEARNING EVALUATION

BY

DR. NANDINI VAZ FERNANDES

Best practice: Teaching- Learning- Evaluation

1. Title of the Practice: PEDAGOGY OF CONDUCT OF PRACTICAL COMPONENT OF A COURSE (Funded by DHE)

2. Objectives

To provide students a comprehensive understanding of practical knowledge. The content is locally relevant and prepares students for entrepreneurship and self-employment. This practice also promotes research-based learning and enables students to design and conduct experiments and analyze results critically.

3. The Context

The department of Zoology introduced new format of Journal which is a comprehensive document of learning. The conduct of practicals is also done in specific manner to promote research and application of the learned concepts.

4. The Practice

The Practical component of the Courses is designed to deliver content and learn skills in an effective manner. The department not only devised pedagogies for conduct of practicals, but also devised means of making practicals a better learning experience for students by introducing practicals with 'Prelab' work to be done at home followed by conduct of practicals in the laboratory. Being an autonomous institution, the department also devised means of redesigning practicals in order to enable students to understand application of the learned concepts and promote research.

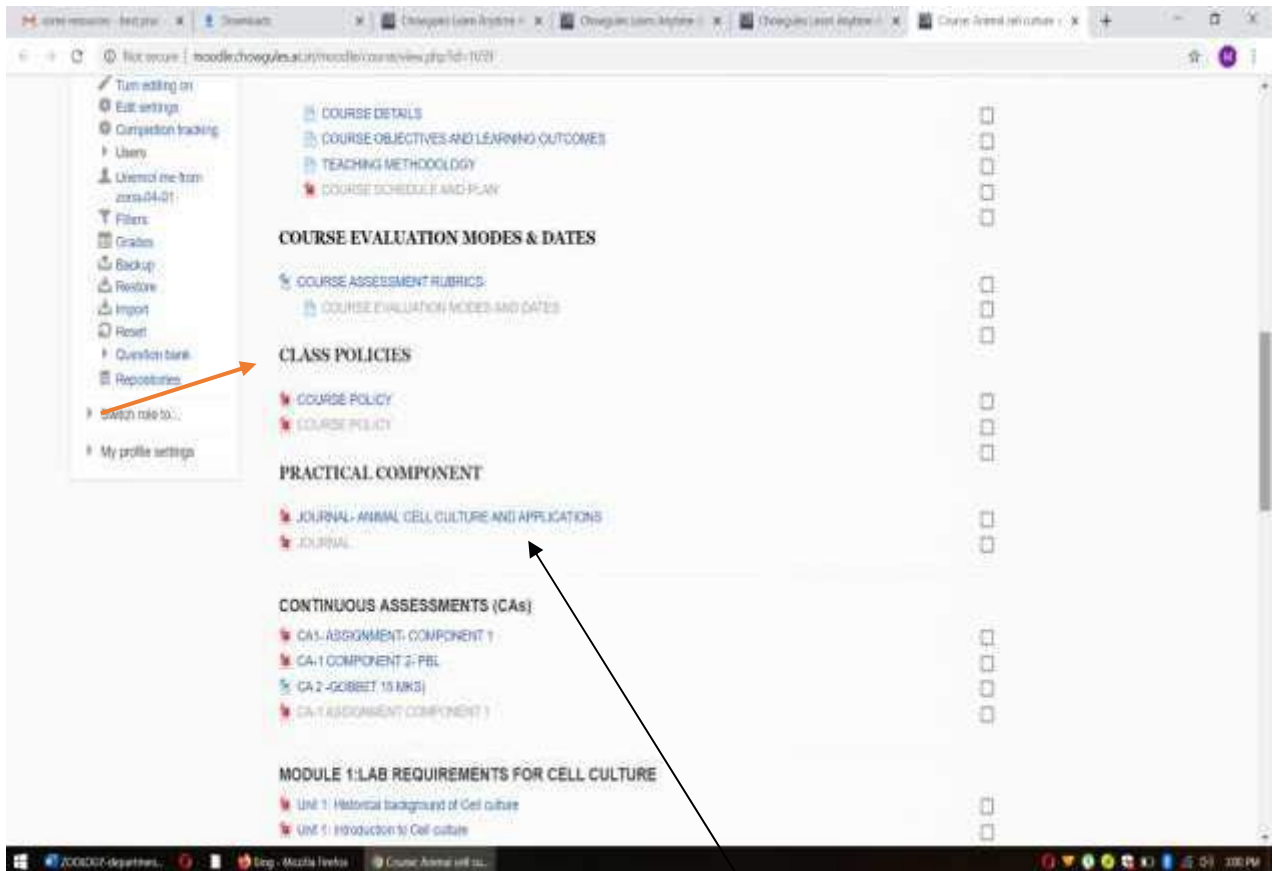
Journal: The journal is designed to be a comprehensive document of learning. All procedures are given as an E-Journal. However, the students have to perform experiments/ procedures and analyze and interpret results critically. All observations are entered in the journal with pen and if errors in findings occur, students have to make noting as to why the results differed from the expected. The students are also given opportunity to pen down their reflection of the learning process and precautions that they need to take to conduct a specific procedure/experiment. The learning experiences are followed by feedback, reflection and follow-up.

Prelab: Every experiment has preliminary questions that students are assigned prior to the conduct of practical to obtain prior knowledge and the interpretation of the experiment to be conducted in the practical laboratory.

Laboratory session: For the practical purpose, the students are grouped into five members each, to develop technical, cognitive and team work skills. Online journal is made available to the students on CLAAP (*Chowgule's Learn Anytime Any place - Moodle of Chowgule College serving as resource portal*). Before the conduct of practicals, students are expected to do the Prelab work- preliminary learning, which involves answering questions given as prelab work and reading about the concepts so that they understand the basics of the experiment. This practice helps students to understand and get a good idea about the experiment to be conducted and also to interpret the results obtained during the experiment/ activity. It involves opportunity to carry out experiments, field-based

activities and project-based learning. Students then perform the experiment in groups and record their observations. The interpretations are supported by references and the same is recorded in the journal. References are listed in the APA format.

We have observed that this interactive new method helps students in improving skills in collecting, analyzing, interpreting and presenting findings.



Online Journal Uploaded in CLAAP – Resource portal (Moodle) of Chowgule College.

The online Journal is downloaded, Printed and bound by students before the commencement of practicals of each semester.



ZOO-E-02: Basic Microbiology and Fundamentals
of Animal Biotechnology
JOURNAL

DEPARTMENT OF ZOOLOGY

NAME: Shaurya Gail Mascarenhas
 ROLL No: SUI20096
 SUBJECT: Zoology
 CLASS: SYBSc
 SEMESTER: III
 PERIOD AND YEAR: 2019-2020

First Page of the Journal

Recording of Observation and writing down the interpretations of the results

PRELAB work given for the practical

Gogol Margan Goa, India - 403602
www.chowgules.ac.in

Department of Zoology
Parvati Bai Chowgule College of Arts and Science (Autonomous)
Date: 15/07/19

**LAB EXERCISE 7 & 8 :
IDENTIFICATION OF PRODUCTS OF METABOLIC PATHWAYS OF
MICROBIAL CELLS**

PRELAB:
- Collect information on:
o Principle of positive and negative results for:
• Indole production test
• Methyl red test
• Voges-Proskauer test
• Citrate Utilization test
o Application of IMVIC test.

AIM: To identify the product of metabolic pathways of microbial cells (IMVIC test).

INTRODUCTION: On the basis of the biochemical properties and enzymatic reactions in the presence of specific substrate bacteria can be identified. IMVIC test consists of four different test namely:
(A) Indole production test
(B) Methyl red test
(C) Voges-Proskauer test
(D) Citrate utilisation test

TEST 1: INDOLE PRODUCTION TEST:
Principle Positive - formation of a pink coloured ring after the addition of appropriate reagent if added. As indole reacts with aldehyde in the reagent and forms a pink coloured ring. Indole is produced along with pyruvic acid and ammonia.
Negative - No colour change is observed even after the addition of all the appropriate reagents are added. Indole does not react with the aldehyde.

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Zoo-E-02: Basic Microbiology and Fundamentals of Animal Biotechnology

Department of Zoology
Parvati Bai Chowgule College of Arts and Science (Autonomous)

REQUIREMENTS:
Tubes containing Tryptone broth, Kovac's reagent, dropper, inoculating loops, bacterial culture.

PROCEDURE:
1. Take around 3ml of Tryptone broth in test tube A and test tube B.
2. Inoculate the test tubes A with bacteria X and the other with Bacteria Y
3. Incubate the inoculated tubes at 35°C for 24-48 hours
4. After incubation period, add 1ml of Kovac's reagent to each tube.
5. Mix the contents well and allow the tubes to stand.
6. Examine the tubes to check the colour in the reagent layer (top layer).

RESULT:
Test tube A (bacteria X): Positive (formation of a red colour ring)
Test tube B (bacteria Y): Negative (formation of a yellow ring)

INFERENCE:
Bacteria in test tube A were found positive for indole test production test as a red coloured ring was formed on addition of Kovac's reagent, while, bacteria in the test tube B was found negative as the red coloured ring was not formed, but instead a yellow ring was seen.

TEST 2: METHYL RED TEST:
Principle Positive - The formation of a red coloured ring on addition of methyl red reagent as methyl red is an indicator which stays red in colour at a pH of 4.4 or less and the glucose is utilized. A stable acid produced.
Negative - The lack of red colour after addition of the reagent methyl red, as methyl red does not remain red in colour at a pH more than 4.4.

REQUIREMENTS:
Peptone glucose broth, methyl red indicator, sterile test tubes, nichrome loop, droppers, bacterial culture.
(Preparation of peptone glucose broth: Peptone 7g, glucose 5g, potassium phosphate 5g and distilled water 1000ml) sterilized by autoclaving.

[Page 27]
Zoo-E-02: Basic Microbiology and Fundamentals of Animal Biotechnology

PROCEDURE:

1. Take 2 tubes with peptone glucose broth (3ml) and mark them as A and B.
2. Inoculate test tubes A with bacteria X and the other with Bacteria Y.
3. Incubate at 35°C for 24-48 hours.
4. Add 3 drops of methyl red indicator in each tube and observe the colour change.

RESULT:

Test tube A (bacteria X): Positive, red colour.
Test tube B (bacteria Y): Negative, yellow colour.

INFERENCE:

The bacteria in test tube A was tested positive for methyl red test, so there was no change in appearance of the red colour on addition of methyl red. Bacteria in test tube B was tested negative because there was a change in colour appearance from red to yellow after addition of methyl red reagent.

TEST 3: VOGES-PROSKAUER TEST:

Principle: Positive - A pinkish red colour is observed at the surface of the tube as acetoin reacts with VP reagent to give the red colour. Bacteria produces acetyl methyl carbinol from glucose.
Negative - A lack of pinkish red colour is observed at the bottom surface of acetoin does not react with VP reagent.

REQUIREMENTS:

Peptone glucose broth, sterile test tubes, nichrome loop, VP reagent 1 (naphthol solution), VP reagent 2 (40% Potassium hydroxide), droppers, E.Coli culture, bacterial culture.

(Preparation of peptone glucose broth: Peptone 7g, glucose 5g; Potassium phosphate 5g and distilled water 1000mL, sterilized by autoclaving).

PROCEDURE:

1. Take 2 test tubes with peptone glucose broth (3ml) and mark them as A and B.
2. Inoculate test tubes A with bacteria X and the other with Bacteria Y.
3. Incubate at 35°C for 24-48 hours.

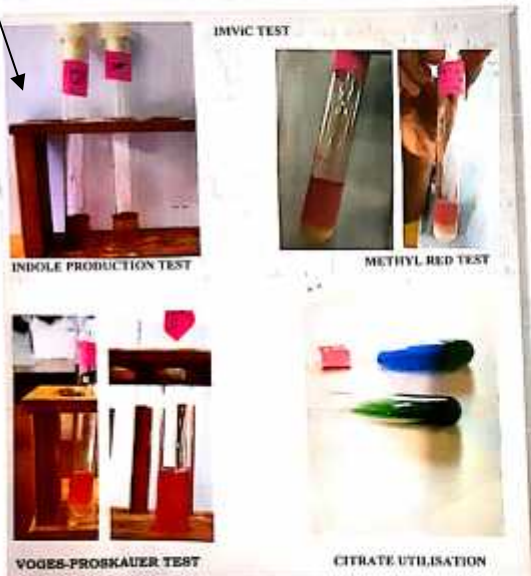
Clicking images of results obtained and sticking on the journal

RESULT:

Test tube A (bacteria X): Positive, green colour.
Test tube B (bacteria Y): Negative, blue colour.

INFERENCE:

The bacteria in test tube A was tested positive for the test, this showing the production of alkaline carbonates and bicarbonates giving rise to the green colour. While the test was negative for bacteria in test tube B, since the slant gave rise to a blue colour.



4. Add 12 drops of VP reagent 1 and 2-3 drops of VP reagent 2 to each test tube.
5. Shake the tubes for 30 seconds to expose the media to oxygen.
6. Allow the reaction to complete for 30-60 minutes.
7. Observe the tubes for change in colour for the VP test.

RESULT:

Test tube A (bacteria X): Negative, No colour change / colourless.
Test tube B (bacteria Y): Positive, red colour.

INFERENCE:

The test is positive for bacteria Y from test tube B which shows that the bacteria produces acetyl methyl carbinol from glucose that is later converted to diacetyl giving rise to the red-to-pink colour polymer. Whereas test tube A with bacteria X is negative as no colour change was observed.

TEST 4: CITRATE UTILISATION TEST:

Principle: Positive - When there is any growth on the medium, with or without the change in colour of the medium; usually a green colour. Alkaline carbonates and bicarbonates are not produced.
Negative - When there is no growth on the medium and there is no colour change or green is observed, but rather the slants remain blue as alkaline carbonates and bicarbonates are produced.

REQUIREMENTS:

Simmon's citrate agar slants, Inoculating loops, bacterial culture, droppers, etc.

PROCEDURE:

1. Take 2 sterile tubes and add Simmon's citrate agar to prepare slants.
2. Mark the tubes as A and B.
3. Inoculate test tubes A with bacteria X and the other with Bacteria Y.
4. Incubate the slants at 37°C for 24-48 hours.
5. Observe the slants for colouration of the medium.

List of References

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SPECIAL POINTS OF INTEREST

- Do not discard the test tubes soon after the test are done.
- Note down and label the correct initials on the test tubes to avoid mixing.
- Carry out the tests carefully ensuring complete sterilization and maintaining the bacterial sequence to enable the isolation of a particular colony only.
- In indole test, the reagents should be added from the side to observe the colour change.

Name/Bacteria used	Indole Production test	Methyl red test	Voges-Proskauer test	Citrate Utilization test	Inference
Bacteria I	Positive	Positive	Negative	Negative	E-coli bacteria
Bacteria II	Negative	Negative	Positive	Positive	Klebsiella bacteria

Special Points noted by students as a summary of their learning

Scanned copy of Pre lab work recorded in the lab note book:

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(CR)

Lab No. _____ Date _____ Page No. _____ For Microbiology & Biochem.

S. No.	Date	Title	Page No.	Teacher's Sign/Remarks
1.	19-07-19	Lab No. 1. Preparation of culture Media nutrient agar, nutrient broth.		
2.	02-08-19	Preparation of culture plates/slants		
3.	06-08-19	Negative staining procedure		
4.	08-08-19	Substrate utilization method: Starch Hydrolysis Method.		
5.	20-08-19	Gram staining procedure		
6.	22-08-19	DNA Sequencing/Analysing units		
7.	12-09-19	Identification by Production of metabolic pathway of microbial cells		
8.	12-09-19	Bacteriological testing of milk		

classmate
Date _____
Page _____

19-07-19 Lab No. 1. Preparation of culture Media nutrient agar, nutrient broth.

- A tube agar: For those with bacteria.

Q) Principle of indole production test:

Ans: Tryptophan is an amino acid that can undergo decarboxylation and hydrolysis by bacteria that possess tryptophanase enzyme. Indole is produced by metabolic decarboxylation from tryptophan via the intermediate molecule indolepyruvic acid. Tryptophanase catalyzes the decarboxylation reaction, during which the amino (-NH₂) group of the tryptophan molecule is removed. Final products of the reaction are indole, pyruvic acid, ammonium (NH₄⁺) and energy. Pyruvic acid is released as a byproduct.

Positive test gives a pink coloured ring after appropriate reagent is added because indole reacts with aldehyde in the reagent to produce a pink coloured ring. Production of indole is observed.

Negative test shows no colour change even after the addition of the appropriate reagent. As indole does not react with the aldehyde present in the reagent.

Q) Methyl red test:

Ans: The bacteria initially metabolise glucose to pyruvic acid, which is further metabolised through the mixed acid pathway to produce the stable acid. The acid decreases the pH to 4.5 or below, which is indicated by a change in the colour of methyl red from yellow to red.

Positive test shows the appearance of a red colour after the methyl red reagent is added. Since methyl red is an indicator which changes its colour at a pH 4.4 or less, the glucose is utilized.

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This test is negative when there is lack of colour change after the addition of methyl red reagent; as methyl red is added, no colour is observed. Since the methyl red does not remain red and does not maintain its colour at a pH more than 4.4.

Q) Voges Proskauer Test

Ans: This test is used to check for microorganism's ability to produce acetyl methyl carbonyl from the fermentation of glucose. If there is a red colour, an acetyl methyl carbonyl will be converted to decetyl with the help of naphthol, strong alkali, and atmospheric oxygen.

A pink red colour is observed at the surface as carbon reacts with the VP reagent and gives a pinkish red colour is obtained. Bacteria then produces acetyl methyl carbonyl from glucose.

If the test is negative, then a lack of pink red colour is seen at the surface of the tubes as reaction does not react with the reagent.

Q) Citrate Utilization Test

Ans: The basic principle of this test is to observe and detect the ability of an organism which can utilize citrate as a sole source of carbon for their metabolism with resulting alkalinity. The citrate oxygen hydrolyses the citrate to form oxaloacetic acid and acetic acid.

Positive growth of the medium is observed with or without the change in colour of the medium forming a blue colour. Alkaline carbonates and bicarbonates are produced giving a blue coloured medium.

The test is negative when the absence of growth is present on the medium as well as no colour change is seen. The slant remains green and not blue.

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Q) Application of IMViC test:

- The IMViC test series is a group of four individual tests that are commonly used to identify bacterial species, especially coliforms. They are particularly useful for differentiating *Escherichia coli*, *Enterobacter aerogenes*, *Enterobacter cloacae*, and *Klebsiella pneumoniae*.

References:

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5. Evidence of Success

Students were able to understand, analyze and interpret the result. This practice also helped students to modify the procedures. Currently all faculty members of department of Zoology follow this method of conduct of practicals.

This method of conduct of practicals was initiated by Dr. Nandini Vaz Fernandes. Thereafter, the method was followed by all faculty members of department of Zoology. A workshop was conducted by Ms. Madhu Balekai to share this method with faculty of Life sciences too. Such protocol is now followed by three departments of the college.

Dr. Nandini Vaz Fernandes also received Research project on innovative method of Pedagogy of conducting Practical for biological sciences. This research project is funded by Goa-DST and DHE.

6. Problems Encountered and Resources Required

- Implementation of the practice required extensive work on part of the faculty members to design the practical, such that it will improve critical learning, research and employability skills.
- Some experiments require time beyond the allocated hours.

7. Notes (Optional)

This process can be replicated if teachers are trained through hands on workshop, focusing on Blooms taxonomy, redesigning practical curriculum, creating journal with appropriate prelab work and then enabling teachers to understand integration of blooms taxonomy in the conduct of practicals.

INNOVATION: TEACHING LEARNING EVALUATION
BY
DR. NANDINI VAZ FERNANDES

1. Title of the Practice: TEACHING PRACTICE BASED SKILL COURSES

2. Objectives of the Practice

The main objective of the practice based skill course is to promote learning by learning through activities and performing projects. Skill enhancement courses develops skills of specific subject and makes them proficient in a technique of performing a task associated with the skill course.

3. The Context:

The description given here is the pedagogy adopted for teaching Skill enhancement course which has 25% teaching and 74% practice based learning.

4. The Practice

Changes in pedagogical practice, student prospects and technology have led to the development of different modes of teaching or altering the more traditional approaches, such as the lecture setup, to include a more dynamic interaction between teachers and students.

‘the course is taught in three components:

- 1) Classroom teaching
- 2) Learning through guided process of performing multiple activities.
- 3) Presenting the learning

5. Evidence of Success