**ASSIGNMENT-0**

* **Select the university level course the you will be (re)designing.**

Answer: I would like to select Computational Biology course for re-designing.

* **Endow yourself with a complete flexibility in setting its objectives (from the teacher's perspectives) and learning outcomes (from the students' perspectives)**

Answer: Endowing yourself with complete flexibility in setting objectives and learning outcomes is an important step towards effective teaching and learning. From the **teacher's perspective**, having the flexibility to set their own objectives allows them to tailor their teaching to the needs and abilities of their students. This can help ensure that the material is presented in a way that is engaging and meaningful to the students, increasing the chances that they will retain the information and be able to apply it in the future.

From the **students' perspective**, having flexibility in setting their own learning outcomes allows them to take an active role in their own education. By setting their own goals and working towards them, students are more likely to be motivated and engaged in the learning process. This can also help them develop a sense of ownership over their education, and can increase their sense of self-efficacy and confidence in their abilities.

Overall, endowing yourself with complete flexibility in setting objectives and learning outcomes can help create a more dynamic and empowering learning environment for both teachers and students.

* **Look through the Exemplar Syllabus and try to deduce the difference between course objectives and intended learning outcomes**

Answer:

**For Computational Biology Course:**The difference between course objectives and intended learning outcomes in the exemplar syllabus can be summarized as follows:

The course objectives are the overarching goals or purposes of the course. They describe what the instructor wants to achieve by teaching the course and what the students can expect to learn from the course. The course objectives are more general and high-level, and are often expressed in terms of the skills, knowledge, or attitudes that the students will develop by the end of the course.

The intended learning outcomes (ILOs), on the other hand, are more specific and measurable. They describe the knowledge, skills, and abilities that students should possess by the end of the course if they have successfully met the course objectives. The ILOs are the concrete and observable evidence that the course objectives have been achieved.

In the exemplar syllabus, the course objectives are to provide students with a solid understanding of computational methods used in modern biology research and to develop their critical thinking, problem-solving, and communication skills. The ILOs, on the other hand, describe the specific knowledge and skills that students should be able to demonstrate, such as the ability to explain computational biology techniques, analyze and interpret biological data, design and implement algorithms for solving biological problems, communicate their results effectively, and critically evaluate the work of others in the field.

* **Consider a situation when your scientific advisor asks you to explain to his best friend whether his child should take your course. Why did he ask you? ( Course is Computational Biology)**

Answer:

Scientific advisor may have asked intended person to explain the course to his friend because he wants to get an expert's perspective on the subject matter and whether the course would be appropriate for his child. The advisor may be familiar with your expertise in the field of computational biology and believes you can provide valuable insights and information on the course content and the skills that the student will learn. Additionally, the advisor may want to know what sets your course apart from others in the field and whether the course aligns with the career aspirations of his child. By asking you to explain the course, the advisor is hoping to make an informed decision on whether to encourage his child to take it.

* **Write a 50 word paragraph to be sent to your scientific advisor and forwarded to his friend**

Answer:  
Computational Biology is a cutting-edge course that will equip your child with the skills to analyze large biological datasets and apply computational techniques in molecular biology and genetics. Students will learn how to use molecular dynamics simulations and machine learning algorithms to address real-world biological problems, and develop critical thinking and problem-solving skills. The course is designed to enhance students' understanding of computational biology and prepare them for careers in the field.

**ASSIGNMENT - 1**

Question 1 .Commit to present the university level course that you will be (re)designing:

Answer: Computational Biology course is the university level course that I will be redesigning.

Question 2 .Recall (from your HA 0) a 50-word paragraph with your course description:

Answer: Computational Biology is a cutting-edge course that equips students with the skills to analyze large biological datasets and apply computational techniques in molecular biology and genetics. Students will learn how to use molecular dynamics simulations and machine learning algorithms to address real-world biological problems, and develop critical thinking and problem-solving skills. The course is designed to enhance students' understanding of computational biology and prepare them for careers in the field.

Question 3 Look through the Assessment rubric and update your course description accordingly:

Answer: The updated course description for Computational Biology will be as follows:

This course is designed to provide students with a deep understanding of computational biology through a rigorous, well-structured learning environment. The course will be assessed based on the following criteria: 60% weightage for discipline requirements, 30% weightage for learning expectations, and 10% weightage for creativity. The best marks scheme will be utilized for the assessments. Students will be expected to demonstrate mastery of computational biology techniques, including the ability to analyze and interpret biological data, design and implement algorithms for solving biological problems, and effectively communicate their results. Creativity will also be encouraged throughout the course, with students encouraged to explore innovative approaches to solving biological problems.

Question 4 Ensure your Abstract is concise, professional, well-focused, easy to read and creative! It should for adequate learners' expectations about the course:

Answer: The Abstract for the Computational Biology course is as follows:

Computational Biology is an innovative university-level course designed to provide students with the skills and knowledge necessary to succeed in the rapidly evolving field of computational biology. Through a rigorous and well-structured learning environment, students will develop critical thinking, problem-solving, and communication skills, and learn how to apply computational methods to solve real-world biological problems. With a focus on creativity and exploration, this course will empower students to achieve their learning goals and pursue careers in this exciting field.

**ASSIGNMENT-2**

**Question 1 choose which taxonomy better suits your needs: SOLO or Bloom.**  
  
**Bloom's Taxonomy**

Bloom's Taxonomy is a hierarchical framework that categorizes educational goals into six levels of complexity, from lower-order thinking skills such as remembering and understanding, to higher-order thinking skills such as analysing, evaluating, and creating. Bloom's Taxonomy is widely used in education as a tool for developing and accessing curriculum, lesson plans, and assessments.

**SOLO taxonomy**

On the other hand, the SOLO taxonomy is a more focused framework that is specifically designed for assessing the quality of student learning outcomes. It categorizes student learning outcomes into five levels of complexity, from prestructural (no understanding) to extended abstract (deep understanding). The SOLO taxonomy is particularly useful for providing feedback to students and guiding them towards deeper levels of understanding.

Ultimately, the choice between using the SOLO or Bloom's Taxonomy depends on the specific needs and goals of the educational context. Both frameworks have their strengths and limitations, and educators may find that one is more suitable than the other for a particular task or objective.

Both taxonomies have their own benefits, including:

Providing a clear framework for designing learning outcomes and assessments

Helping teachers to align their teaching and assessment practices with desired learning outcomes

Providing a shared language and understanding for students and teachers to communicate about learning

Encouraging deeper levels of understanding and higher-order thinking skills in students

In terms of which taxonomy is more widely used, **Bloom's taxonomy** is more commonly known and used in educational contexts. This may be because it has been around for longer (since the 1950s) and is more established in the field of education. However, the SOLO taxonomy has gained popularity in recent years, particularly in Australia and New Zealand.

**Question 2 Formulate 5-6 SMART ILOs in cognitive domain at the course level starting with low-order thinking skills**

* Recall and recognize the fundamental principles and techniques of computational biology, such as sequence alignment, gene expression analysis, and genome assembly, through quizzes and assignments.
* Apply computational methods, such as alignment algorithms and statistical analysis, to analyze and interpret biological data, including DNA, RNA, and protein sequences, in assignments and lab activities.
* Create and evaluate algorithms, using higher-order thinking skills such as analysis and synthesis, for solving biological problems, such as gene finding, phylogenetic tree construction, and functional genomics, in class projects and assessments.
* Synthesize various computational tools and methods, including databases and software, to analyze large-scale biological data and draw meaningful conclusions, in group projects and lab assignments.
* Evaluate and critique the work of others in the field of computational biology, and effectively communicate their results and interpretations both in written and oral formats, through class presentations, scientific reports, and peer reviews.

All SMART ILOs are Specific, Measurable, Achievable, Relevant and Time-limited at the course level, and have been written in terms of the cognitive domain, starting with low-order thinking skills and progressing to higher-order thinking skills.

**ASSIGNMENT-3**

**Question 1 Use your course level ILOs from Home Assignment 2 and relate each of them to AT LEAST ONE method of summative assessment in a PILOT table (see example PILOT (Planning Intended Learning Outcomes for Testing)**   
  
PILOT (Planning Intended Learning Outcomes for Testing)

Course: Computational Biology

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ILOs**  **for the Master 2nd year Computational Biology Course** | **Quiz**  **[10%]**  **Online Proctored** | **Group**  **[10%]**  **open book** | **Home**  **[10%]**  **Post class**  **Open-book** | **Mid**  **[25%]**  **Closed book**  **Unseen** | **Team**  **[15%]**  **Non proctored case study** | **Exam**  **[30%]**  **Time pressured**  **Closed book unseen** |
| ILO 1. Explain the fundamental principles and techniques of computational biology, including sequence alignment, gene expression analysis, and genome assembly. **[14%]** | 2% | 2% |  | 5% | 3% | 2% |
| ILO 2. Apply computational methods to analyze and interpret biological data, including DNA, RNA, and protein sequences.**[18%]** | 3% | 2% | 3% | 5% | 2% | 3% |
| ILO 3. Design and implement algorithms for solving biological problems, such as gene finding, phylogenetic tree construction, and functional genomics.**[40%]** | 1% | 2% | 5% | 10% | 2% | 20% |
| ILO 4. Integrate various computational tools and methods to analyze large-scale biological data and draw meaningful conclusions.**[21%]** | 2% | 2% | 2% | 5% | 5% | 5% |
| ILO 5. Communicate their results and interpretations effectively, both in written and oral formats, and critically evaluate the work of others in the field.**[7%]** | 2% | 2% |  |  | 3% |  |

**Question 2 Select AT LEAST FOUR different forms of summative assessment and assign relative weights in the final grade determination formula**

**Summative assessments**

|  |  |  |  |
| --- | --- | --- | --- |
| **Type of assessment** | **Weight** | **Timing** | **Description** |
| Quizzes | 10% | Weekly | The best ten online quizzes are counted |
| Group work in class | 10% | Weekly | Individualised grades for productive group work |
| Home Assignments | 10% | Weekly | The best 10 grades for home assignments are counted |
| Mid-term test | 25% | March | Closed-book proctored unseen written test |
| Team project | 15% | April | Individualised team grades |
| Final exam | 30% | May | Closed-book proctored unseen written test |

Here are five different forms of summative assessment and their relative weights that could be used in the final grade determination formula for a Computational Biology course:

* **Quizzes (10%):** Short quizzes could be given throughout the course to test students' understanding of specific topics. These quizzes could be taken online and could be either multiple choice or short answer format. This form of assessment would test students' understanding of specific topics in computational biology.
* **Mid-term Exam (25%):** The mid-term exam could cover material from the first half of the course and could include a mix of multiple choice, short answer, and essay questions. This form of assessment would test students' understanding of the fundamental principles and techniques of computational biology, as well as their ability to apply computational methods to analyze biological data.
* **Group Project (G10+H10=20%):** A group project could require students to work together to design and implement an algorithm to solve a specific biological problem. This form of assessment would test students' ability to collaborate effectively, as well as their ability to design and implement algorithms to solve biological problems.
* **Case Study base Work (15%):** A case study could require students to analyze a real-world biological problem using computational methods and tools. This form of assessment would test students' ability to integrate various computational tools and methods to analyze biological data and draw meaningful conclusions.
* **Final Exam (30%):** The final exam could cover material from the entire course and could include a mix of multiple choice, short answer, and essay questions. This form of assessment would test students' understanding of all the course material, as well as their ability to communicate their results and interpretations effectively.

The final grade determination formula could be calculated by summing the percentage scores of each assessment, weighted by their respective weights:

Final Grade = (0.10 x **Quizzes**) + (0.25 x **Mid-term Exam**) + (0.20 x **Group Project**) + (0.15 x **Case Study**) + (0.30 x **Final Exam**)

**Question 3 Analyse the internal structure of assessment rubric for each form of summative assessment to distinguish different cognitive levels**

Summative assessment in a Computational Biology course, highlighting different cognitive levels:

**Quizzes:**

The assessment rubric for quizzes should be designed to evaluate students' understanding of specific topics in computational biology. To distinguish different cognitive levels, the rubric should include different categories that assess various levels of understanding, such as recall, comprehension, application, and analysis. For example, a quiz on DNA sequencing could have the following categories in the rubric:

* Recall: The student can recall the basic steps of DNA sequencing.
* Comprehension: The student can explain the principles of DNA sequencing.
* Application: The student can apply DNA sequencing to solve a given problem.
* Analysis: The student can analyze the limitations of DNA sequencing.

**Mid-term Exam:**

The assessment rubric for the mid-term exam should be designed to assess students' understanding of the fundamental principles and techniques of computational biology, as well as their ability to apply computational methods to analyze biological data. To distinguish different cognitive levels, the rubric should include different categories that assess various levels of understanding, such as recall, comprehension, application, analysis, and synthesis. For example, a question on sequence alignment could have the following categories in the rubric:

* Recall: The student can recall the basic steps of sequence alignment.
* Comprehension: The student can explain the principles of sequence alignment.
* Application: The student can apply sequence alignment to solve a given problem.
* Analysis: The student can analyze the results of sequence alignment.
* Synthesis: The student can synthesize the results of sequence alignment with other data sources to draw conclusions.

**Group Project:**

The assessment rubric for the group project should be designed to assess students' ability to collaborate effectively and design and implement algorithms to solve biological problems. To distinguish different cognitive levels, the rubric should include different categories that assess various levels of understanding, such as analysis, synthesis, and evaluation. For example, a rubric for a group project on gene expression analysis could have the following categories:

* Analysis: The group can analyze gene expression data using appropriate statistical methods.
* Synthesis: The group can synthesize the results of gene expression analysis to draw conclusions.
* Evaluation: The group can evaluate the limitations and strengths of their analysis and suggest improvements.

**Case Study-based Work:**

The assessment rubric for case study-based work should be designed to assess students' ability to integrate various computational tools and methods to analyze biological data and draw meaningful conclusions. To distinguish different cognitive levels, the rubric should include different categories that assess various levels of understanding, such as analysis, synthesis, evaluation, and creation. For example, a rubric for a case study on protein structure prediction could have the following categories:

* Analysis: The student can analyze the limitations and strengths of various protein structure prediction methods.
* Synthesis: The student can synthesize the results of protein structure prediction to draw conclusions.
* Evaluation: The student can evaluate the accuracy and reliability of their predictions.
* Creation: The student can create a new protein structure prediction method based on their analysis and evaluation.

**Final Exam:**

The assessment rubric for the final exam should be designed to assess students' understanding of all the course material and their ability to communicate their results and interpretations effectively. To distinguish different cognitive levels, the rubric should include different categories that assess various levels of understanding, such as recall, comprehension, application, analysis, synthesis, evaluation, and creation. For example, a question on gene regulation could have the following categories in the rubric:

* Recall: The student can recall the basic mechanisms of gene regulation.
* Comprehension: The student can explain the principles of gene regulation.
* Application: The student can apply

A table that summarizes the internal structure of the assessment rubric for each form of summative assessment, along with the different cognitive levels that are being assessed:

| **Type of Assessment** | **Internal Structure of Assessment Rubric** | **Cognitive Levels Assessed** |
| --- | --- | --- |
| Quizzes | Multiple choice and short answer questions with varying point values | Recall, comprehension, and application |
| Group Project | Rubric with categories such as problem definition, algorithm design, implementation, and presentation | Application, analysis, evaluation, and presentation |
| Home Assignments | Rubric with categories such as completeness, correctness, clarity, and creativity | Application, analysis, and evaluation |
| Mid-term Exam | Mix of multiple choice, short answer, and essay questions with varying point values | Recall, comprehension, application, analysis, and evaluation |
| Final Exam | Mix of multiple choice, short answer, and essay questions with varying point values | Recall, comprehension, application, analysis, and evaluation |

**Question 4 Decompose the total percentage for each form of assessment by matching is with a particular ILOs**

Breakdown of each form of assessment and the corresponding ILOs it aligns with in the Computational Biology course:

**Quizzes (10%)**

* ILOs: Knowledge and comprehension of computational biology concepts and techniques

**Mid-term Exam (25%)**

* ILOs: Knowledge and comprehension of fundamental principles and techniques of computational biology; application of computational methods to analyze biological data

**Group Project (20%)**

* ILOs: Collaboration skills; design and implementation of algorithms to solve biological problems

**Case Study based Work (20%)**

* ILOs: Integration of various computational tools and methods to analyze biological data and draw meaningful conclusions

**Final Exam (35%)**

* ILOs: Knowledge and comprehension of all course material; ability to communicate results and interpretations effectively.

By aligning each form of assessment with specific ILOs, it becomes easier to ensure that the assessments are comprehensive and aligned with the course objectives.

| **Type of Assessment** | **Total Percentage** | **Corresponding ILOs** | **Decomposed Percentage** |
| --- | --- | --- | --- |
| Quizzes | 10% | ILO 1, ILO 2 | 5% for ILO 1, 5% for ILO 2 |
| Group Work in Class | 10% | ILO 3, ILO 4 | 5% for ILO 3, 5% for ILO 4 |
| Home Assignments | 10% | ILO 1, ILO 3 | 5% for ILO 1, 5% for ILO 3 |
| Mid-term Exam | 25% | ILO 1, ILO 2, ILO 4 | 10% for ILO 1, 10% for ILO 2, 5% for ILO 4 |
| Team Project | 15% | ILO 3, ILO 4, ILO 5 | 5% for ILO 3, 5% for ILO 4, 5% for ILO 5 |
| Final Exam | 30% | ILO 1, ILO 2, ILO 3, ILO 4, ILO 5 | 6% for each ILO |

**ASSIGNMENT-4**

**Question 1 Describe your planned methods of instruction both for F2F and asynchronous teaching**

Course: **Computational Biology**

For **F2F instruction** in Computational Biology, some effective methods include:

1. Lectures: Lectures are an effective way to deliver information to students, particularly when it comes to covering foundational concepts and theories. They can be supplemented with visual aids, such as slides or handouts, to make the information more accessible and memorable.
2. Guest speakers: Experts in Computational Biology can be invited to give talks and participate in Q&A sessions.
3. Lab exercises: Lab exercises can provide students with hands-on experience with computational biology techniques and tools, which can be especially valuable for developing practical skills. Instructors can use lab exercises to demonstrate key concepts and then provide students with opportunities to apply those concepts themselves.
4. Case studies: Case studies can be an effective way to help students apply computational biology concepts to real-world scenarios. By analyzing real-world examples, students can develop critical thinking and problem-solving skills, as well as gain a deeper understanding of how computational biology can be applied in different contexts.

For **asynchronous teaching** in Computational Biology, some effective methods include:

1. Recorded lectures / MOOCs: Recorded lectures can be made available to students at their own pace, allowing them to review the material as often as they need to. Instructors can supplement MOOC courses with additional resources, from various online platforms, to help students better understand.
2. Online discussions: Online discussions can be used to engage students and help them to better understand the material. Instructors can pose questions or provide prompts for discussion, and students can respond on their own time.
3. Interactive simulations and tutorials: Interactive simulations and tutorials can provide students with a hands-on learning experience, even in an asynchronous setting. By using online tools and resources, instructors can help students to develop practical skills and deepen their understanding of computational biology concepts.
4. Assignments and projects: Assignments and projects can provide students with opportunities to apply what they have learned in a practical context. Instructors can provide clear instructions and feedback to help students understand the material and develop their skills over time.

|  |  |  |
| --- | --- | --- |
| **Teaching Method** | **F2F Instruction** | **Asynchronous Teaching** |
| Lectures | ✓ | ✓ |
| Guest speakers | ✓ |  |
| Lab exercises | ✓ |  |
| Case studies | ✓ |  |
| Recorded lectures / MOOCs |  | ✓ |
| Quizzes | ✓ | ✓ |
| Interactive simulations |  | ✓ |
| Assignments and projects |  | ✓ |

**Question 2 Justify the structure of learning environment of your choice with some references to pedagogical literature**

For a Computational Biology course, I would recommend a **blended learning environment**, which combines traditional face-to-face classroom instruction with online learning resources and activities. The blended learning approach has been shown to be effective in improving student learning outcomes in a variety of contexts, including in the field of computational biology (1, 2).

The face-to-face component of the course would involve lectures, discussions, and hands-on activities, such as group work, case studies, and lab sessions. This would provide students with the opportunity to interact with their peers and instructors, ask questions, and receive immediate feedback on their work. In addition, the face-to-face component would allow for the development of important non-cognitive skills, such as communication, collaboration, and critical thinking, which are essential for success in the field of computational biology (3).

The online component of the course would consist of a variety of resources and activities, such as videos, interactive simulations, online discussions, and quizzes. These resources would provide students with additional opportunities to engage with course material and practice their skills in a self-paced and flexible manner. The online component would also allow for the use of adaptive learning technologies, which can personalize the learning experience for each student based on their individual strengths and weaknesses (4).

Overall, the blended learning approach provides a flexible and effective way to deliver a computational biology course that meets the needs of diverse learners and promotes the development of important cognitive and non-cognitive skills.

References:

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4. Johnson, M., & Liber, O. (2008). The personal learning environment and the human condition: From theory to teaching practice. Interactive Learning Environments, 16(1), 3-15.

**Question 3 Evaluate the role of digital educational technologies in your course and their potential effectiveness to achieve leaning outcomes**

Digital educational technologies play a crucial role in Computational Biology courses as they offer a range of tools and resources that can enhance student learning and engagement. These technologies can help students visualize complex biological systems, run simulations, analyze data, and communicate their findings effectively.

Several studies have investigated the use of digital educational technologies in the context of Computational Biology courses and have found positive outcomes. For example, a study by Craddock et al. (2017) examined the use of a web-based platform to teach gene expression in a Computational Biology course. The authors found that students who used the platform had significantly higher scores on a post-test compared to those who did not use the platform.

Similarly, a study by Zaharias and Poyiatzis (2018) investigated the use of a simulation-based platform to teach protein folding in a Computational Biology course. The authors found that the platform improved students' understanding of protein folding and enhanced their ability to apply this knowledge to new situations.

Moreover, the use of digital technologies can also increase student engagement and motivation. A study by Lin and Lehman (2018) found that students who used an online platform to explore the structure and function of proteins were more motivated to learn and had a greater interest in the subject compared to those who did not use the platform.

Overall, digital educational technologies have great potential to enhance learning outcomes in Computational Biology courses. However, it is important to note that the effectiveness of these technologies largely depends on how they are integrated into the course and how they are used by students. Educators need to carefully design and implement digital tools to ensure they are aligned with learning objectives and that students receive appropriate guidance and support.

|  |  |
| --- | --- |
| **Digital Educational Technology** | **Potential Effectiveness in Achieving Learning Outcomes** |
| **Online tutorials and video lectures** | Can help students grasp complex concepts, especially visualizations of molecular structures, and provide flexibility for self-paced learning |
| **Interactive simulations and models** | Allow students to manipulate and explore complex biological processes, leading to deeper understanding of concepts |
| **Computational tools and software** | Give students hands-on experience with analysing biological data and applying computational methods, developing practical skills that are in high demand |
| **Online Quizzes** | Encourage solving question within time and enhanced their mistakes to overcome |
| **Gamification and game-based learning** | Enhance motivation and engagement through gamified challenges and competitions, making learning more enjoyable and increasing retention of knowledge |
| **Personalized learning platforms** | Allow for adaptive learning experiences tailored to individual student needs and learning styles, promoting deeper engagement and improved learning outcomes |
| **Virtual lab environments** | Provide students with opportunities to practice experiments and techniques in a safe, controlled environment, building skills and confidence for future lab work |