Year Long Plan
General Biology
Grade 10

Preface

The independent development of a year-long plan for teaching in one's content area is a major assignment in the SVSU course TE-308 Methods of Teaching in Secondary/Middle Schools. As many content areas and grade level interests are represented among students in the course, individual students choose a grade level interest and course of study to be planned.

One important aspect of development as certified teachers is the idea of purposeful teaching, that is, planning each aspect of teaching with a specific educational goal in mind. The year long plan requires students to examine their planning strategies and make each decision about their teaching methods purposeful.

As a guide for creating the year-long plan, a rubric is provided; it includes several focus areas: A rationale for why the particular content being taught is important and how it would benefit students throughout their lives; explanation of why the unit is important to students as global citizens and neighbors was to be included. The unit rationale must include consideration of students' developmental needs, incorporation of content area goals, and activities planned towards those goals; these goals were to clearly reflect the rationale. Planning activities that helped students find meaning in their learning was crucial to the development of a good design; a minimum of four strategies for incorporating content into other curriculum areas was required. The strategies were to be unique, creative and designed to promote deep knowledge of the content area.

In keeping with the idea of meaningful learning, the year-long plans served an additional purpose. Once completed, the plans were used to facilitate further development of a single unit.

Year Long Plan

UNIT 1- Plant and Animal Kingdoms – Weeks 1 to 7
UNIT 2- Ecology and Ecosystems – Weeks 8 to 15
UNIT 3- Land, Sea and Air – Weeks 16 to 22
UNIT 4- Human Anatomy, Physiology and Systems – Weeks 23-30
UNIT 5 -You Make me Sick! Cells, Bacteria and Viruses – Weeks 31-37

Plan Rationale

Unit 1: In a year plan for biology, Plant and Animal Kingdoms are studied first--to get a basic understanding of students' knowledge of plants and animals and to take advantage of the weather this time of year for investigation and collection of plant specimens. As the weather turns more unpredictable, the unit will focus on other goals.

Unit 2: Ecology and Ecosystems are studied directly after Plants and Animals to help

students make connections between the systems they began investigating in Unit 1 and the comprehensive concepts of Unit 2. The Ecology and Ecosystems unit is meant to tie together everything the students know very early on. This will help them create understanding and provide a framework for future units. Ecology is also studied in the fall in the hopes of enough good weather for a field exploration project. Field work can be started as soon as Unit 1 is completed.

Unit 3: Land Sea and Air is timed to work around the Winter Break portion of the school year. It will be an anatomy and physiology study with dissection, in three parts. Discussion on the unit and guiding questions can occur before the break, with an easy transition to more detailed investigation of mammals, insects, birds and fish as soon as students return. This is also a good time of the year to discuss hibernation, and to arrange speakers from natural resource agencies to speak on such topics.

Unit 4: Human Anatomy, Physiology and Systems is placed to help students make a transition from anatomy studies of animals into studies of humans. The variety of activities in the unit is designed to help excite students during the winter months of the school year. Students will spend a significant amount of time investigating, interviewing and collaborating with one another. This unit has several presentations, and extra time is allotted at the end of this unit as needed to complete them. Spring Break also falls during Unit 4, giving students time for their community interviews.

Unit 5: "You Make me Sick!", ends the year with the smallest of biological subjects. Cells, bacteria and viruses are both interesting and challenging to investigate, and students now have enough background knowledge to make real-world connections with the information. Meaningful study of cells, bacteria and viruses would include taking samples and spending time in laboratory investigation. Hopefully by this time in the year, the weather will cooperate for one more field project. Students will then have the opportunity to analyze the results of their field work in relation to their ecosystem and plant studies.

Unit 1
Plant and Animal Kingdoms

Unit Rationale

To begin study of Biology, this unit focuses on building knowledge, discovering relationships, and making connections with past experiences students have had. It explores the methodology used by scientists to discover relationships, the language of science, as well as basic concepts of photosynthesis and taxonomy. In order for students to consider their work meaningful, and to discover the ways scientists think, what is important, and how to support their findings, questioning authority is promoted and defending one's work is required of students in this unit. Working alone, as a class, and in small groups helps students meet both their social development needs and their need to discover individual identity.

As scientifically literate citizens, young adults must understand and be able to express basic scientific concepts, methods and systems of classification, because it affects their everyday lives.

They need to recognize and point out to their neighbors the plants and animals they share within a community. Globally, students will apply taxonomic and other scientific knowledge to all ecosystems on Earth. The language of science is universal; thus they must have the ability to understand and evaluate information presented from other countries.

Activities for this unit include a plant collection project, done in groups, and independent research on photosynthesis. Students will develop unique new systems of classifying plants and animals, defending their positions. Journaling and discussions, as well as other activities, help satisfy the goals and objectives of the unit.

Goals for this Unit

1. Learners will create and present an original collection of plant specimens gathered from their community or in their travels. They will key at least three specimens to the genus level of organization.
2. To further explore basic concepts, students will individually research photosynthesis and plant pigmentation. Presenting a poster project to the class, each student will explain the energy-gathering system of one plant or group of plants.
3. Small groups will research binomial nomenclature as a way of classifying organisms, their origins and benefits. They will develop a "new" method of taxonomical classification, and pick one plant and one animal to rename based on their system. They must defend their system and accept challenges from classmates on their research.
4. Students will pick 2 or 3 animals and find out the evolutionary history of the organisms. Possible evolutionary pathways, reasons for extinction and /or survival, and examination of fossil evidence will be recorded as an ongoing, whole-group journaling process.

Strategies for Integration with Other Subjects

1. History: Explore evidence of the plant and animal communities that once lived in our area. Are there prehistoric animals that no longer inhabit this area? What did the first settlers find in this area? What plants and animals did Native peoples use?
2. English: Write poetry about the scientific names of plants and animals. Some scientific names are humorous, some reflect the history of who discovered the organism.
3. Math: Calculate the age of the Earth from fossil and experimental evidence. How many days old is the Earth? Calculate the amount of sunlight needed to make a bean plant grow one inch in height. How much sunlight does an acre of beans use?
4. Art: Illustrate samples from their plant collection to accompany students' investigative work. Illustrate the plant in another season or under different weather conditions.

Unit 2
Ecology and Ecosystems

Unit Rationale

This unit focuses on the many ecological relationships and systems at work in the natural world. Students will engage in a long-term, ongoing investigation of a local ecosystem and will report their findings in an Agency Manual to the Department of Natural Recourses or other managing association with suggestions on how the ecosystem can be maintained or improved.

Solving a real problem helps students at this developmental stage feel that their work has meaning and is important. Predicting and suggesting methods to others creates opportunities for formal operational thought at the appropriate age level and satisfies the need for contribution. Also, students will better understand the methods and work of scientists.

The study format satisfies the need for social interaction and helps develop self-esteem. This study is important for students as citizens because they should be aware of and be able to express views and solutions to an observed condition in their community, or to explain to their neighbor what is happening locally and why. This unit helps develop an appreciation for natural resources and conservation, a global issue that people from all cultures should be aware of and understand. Students can apply their global knowledge and the research/questioning approach to any ecosystem study or question, anywhere on Earth.

Two major projects are included in this unit. Students will investigate an ecosystem at work, an invaluable experience for a biology student. They will keep journals and present their findings on ecosystem operation to their class. In addition, student research will be analyzed and used to create pamphlets for local agencies managing the study areas. Pamphlets will include research findings and management recommendations. Additionally, a classic conservation text has been chosen for use during the unit. Students will read independently and participate in discussions of the text.

Goals for this Unit

1. In pairs, students will use scientific investigative processes to conduct a thorough ecosystem study, recorded in journals, papers and presentations. Investigation of determining factors, the state of their system, and how populations may have adapted or evolved will be included.
2. Students will explain relationships between populations and a community and describe various ecosystem cycles.
3. Investigation into current practices in ecosystem management will lead to better understanding of the decisions managers face and the techniques scientists use.
4. Students will produce a comprehensive manual of suggestions for maintaining stasis or recommending change to a managing agency. They will outline management practices currently in use and what should be done to change or maintain the health of the ecosystem.

Strategies for Integration with Other Subjects

1. Math: Use student data to create graphs such as ecosystem component change over time, population increase or decline, etc. These graphs can be used in students' Agency Manuals.
2. Drafting: Survey the site and produce a scale map of the study area.
3. Social Studies/History: Investigate the local history and current geography of the area in which the ecosystems are found. Answers to this question can be helpful in determining the reasons the ecosystem developed as it did.
4. Art: Draw, paint or photograph a natural cycle at work.

Unit 3
Land, Sea and Air

Mammals, Fish and Birds

Unit Rationale

This unit, anatomy and physiology of animals, is important in understanding both evolutionary relationships and body systems. To think as scientists, use their methods, and develop critical thinking skills, students will engage in three self-guided dissection experiments. They will explore for themselves the anatomy of a variety of organisms. Being somewhat self-directed gives learners ownership of their learning and helps make it meaningful. Self-forming discussion groups help meet the need for students to feel part of a group. Students at this developmental level can use a variety of experiences to make connections; an assortment of activities and readings helps students question their knowledge and integrate it. Students will be required to teach first graders in a novel way, creating interest, developing moral character and promoting expertise in a subject area for biology students.

Being able to teach and discuss science concepts in a critical way is essential for students as citizens. Students create a children's book and give their time reading with younger children; students contribute to the community in a very real way. They demonstrate that they are good neighbors. In the future, students will be more equipped to contribute to the global community of both adults and young children.

A variety of different methods are used to accomplish the goals of this unit. Students participate in dissections, discovering distinguishing characteristics of mammals, birds, fish and insects. Students have the opportunity to hear professionals speak on migration and hibernation. Creating and illustrating a children's book, using their knowledge of anatomy and physiology, is a novel way to deepen understanding of concepts. Students will complete their reading of A Sand County Almanac and reflect upon what they have learned in journals and discussions.

Goals for this Unit

1. Individually, students will question their knowledge and curiosities and will choose to perform at least three dissections out of the four groups of animals. They will explore gross anatomy, record their data, and discuss findings both individually and in small groups. A focus will be on laboratory and research techniques and safety.
2. Speakers from the Department of Natural Resources and other agencies will be invited to speak on migration, hibernation, and winter habitat of birds, fish, insects and mammals. Students will gain a more comprehensive understanding of the animal kingdom and of careers in science.
3. Utilizing their own and other resources, students will create an original children's book on one order of animals. They will describe and present their work by reading it to a 1st grade class.
4. Connections to conservation issues will be made by listening to and participating in reading and discussions of Aldo Leopold's classic conservation text, A Sand County Almanac. To further real-world connections, journaling will reflect on readings, speakers and students' book writing.

Strategies for Integration with Other Subjects

1. Art: Illustrate dissection subjects as study guides and to stimulate recall. Illustrate the children's books.
2. History: Investigate the father of modern conservationism, Aldo Leopold, and his lifetime.

What were major world events in his time? What were the main reasons for and outcomes of the establishment of National Parks?
3. Math: Calculate the reproduction rate of different animals. How many rabbits could theoretically be produced in a given population per year? How many salmon? Mosquitoes?
4. Music: Compose or play a song to accompany their original children's book or A Sand County Almanac. Students can play their songs to their 1st graders. They can also create songs to remember anatomy studies. This can be done individually or in groups, performed or simply written.

Unit 4
Human Anatomy, Physiology and Systems

Unit Rationale

This unit will look at how humans may have evolved over time and our own anatomy and physiology. Through interviews with specialists and research into a human disease, students will be engaged in learning about themselves. Interviewing will not only be an interesting form of investigation; students will be participating in their community and promoting the school and their own interests. Teaching comparative anatomy and physiology to 7th graders will help promote critical thinking about body systems and instill a sense of responsibility and meaning to their own learning. Socially, students will gain a sense of status and expertise in their field.

Tracing human evolution as a class will provide the opportunity for questioning theories, dispelling myths and making connections while promoting formal operational thought. Combinations of group, individual and partner work satisfy the need for social interaction. Students need to know about their body systems for their own health and to be good neighbors. Citizens with knowledge of disease and physiology can provide information and will know valid resources their neighbor can use. Knowledge of body systems is applicable globally. Students can contribute to research and discussion anywhere in the world because they understand and have communicated to others about the human body.

This unit's activities focus on community involvement and research. Students research a disease of their choice, and a system of the human body, preparing presentations on each for the class. Uniquely, students are required as part of the projects to interview specialists in their body system from the medical community. They are asked to interview their own families and families of persons afflicted with the disease they are studying. Lastly, students become teachers as they instruct a 7^{th} grade class on how human body systems compare to those of other animals.

Goals for this Unit

1. Students will use knowledge gained about anatomy and physiology of the human body to conduct a short unit in comparative biology with groups of 7th graders. In small groups, students will research and compare a human system to that of another animal, and teach it to the younger group. They will plan at least two activities for each meeting as well as an evaluation.
2. Individually, learners will consult at least three specialists in two different body systems and conduct interviews with them. They will prepare a final transcript, reflection and short presentation of their interviews, discussing anatomy, treatment of disease and system health.

3. Students will compile interview journals to share with their "Interview Club." Small groups will meet each week to discuss and share their learning.
4. Students will research a disease of a chosen body system by conducting an interview with someone afflicted with the disease and consulting a specialist; each person will present findings to his/her Interview Club groups.

Strategies for Integration with Other Subjects
1. History: Create maps of the distribution of certain diseases in the community and the state. Compare these to factors such as mean income, prevalence of medical insurance and population density.
2. Art: Study ancient and contemporary artwork depicting the human body. How are they different and why?
3. Drama: Create skits or a play for children, centered around body systems and health.
4. English: Write descriptive essays describing the travels of a molecule through an organ system or throughout the body. What is the molecule's purpose? What is its eventual fate?

Unit 5
You Make Me Sick!
Cells, Bacteria and Viruses

Unit Rationale
In this final unit, several "hot topics" are investigated. High school aged students are naturally curious and are often driven to be socially aware. We will discuss and debate topics that are scientifically current, such as stem cell research, DNA testing and genetic engineering. Activities in this unit help satisfy the need for students to be involved in their community and to solve a real problem. Revisiting an earlier project and reflecting on the health of their ecosystem in novel ways helps generate understanding of new concepts and has innate value.

The topics students will discuss and the techniques they use are current, challenging and not always available to high school students. Good citizens must be aware of and be able to objectively judge the research and news on this important issue. Students should be able to inform their neighbors about current research and why it should matter to them as well as help them determine the truth in reporting. Global citizens must be acutely aware of the potential for disease and the biological hazards both at home and abroad. Global citizens must be properly informed and sensitive to the values of other cultures.

The activities for this unit combine investigation, reporting and lab work. Students in the lab will become familiar with laboratory techniques including culturing samples. They will test the quality of local water, and water from their ecosystem study, if applicable. Students will investigate pathogens found in the school, reporting on their levels and interpreting results in a pamphlet to school officials. Finally, a debate will be held on the subject of genome investigation of animals and food products. The debate will focus on genetic engineering and ethics.

Goals for this Unit
1. Students will conduct a series of water quality tests on their ecological study area, determining

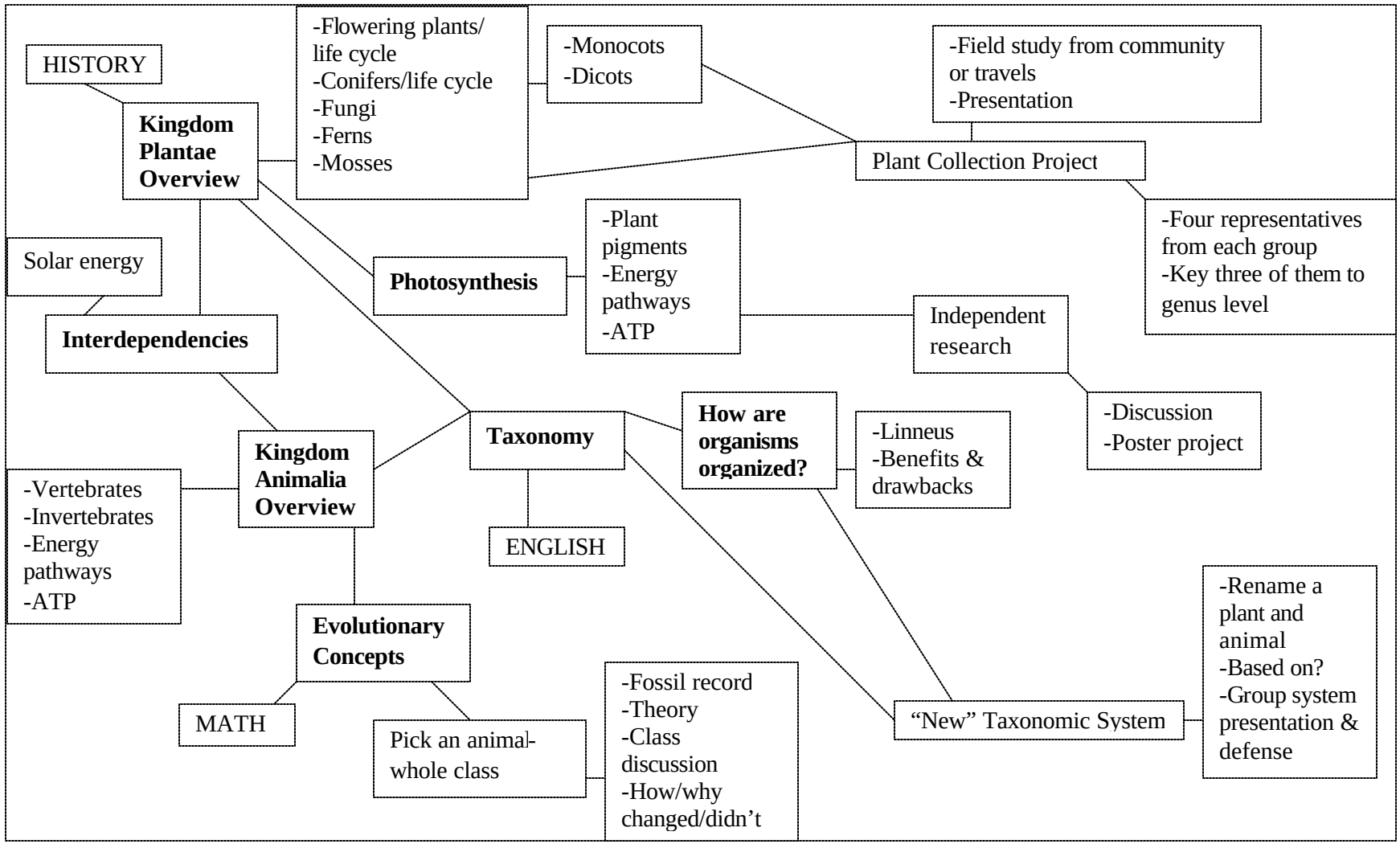
additional factors and agents working on the system. They will also test other sites and compare their sites to published standards for water quality.
2. In a laboratory setting, students will learn basics of microbiological techniques and safety and apply them to unit projects.
3. The class will prepare a comprehensive Pathogen Report for the school community, listing the types of pathogens found in the school, their origins, and the measures that should be taken to reduce or maintain the current levels.
4. Students will hold a debate among all classes on ethical issues stemming from current genetic research. Students in groups will prepare to argue their stand and defend their viewpoint and research.

Strategies for Integration with Other Subjects

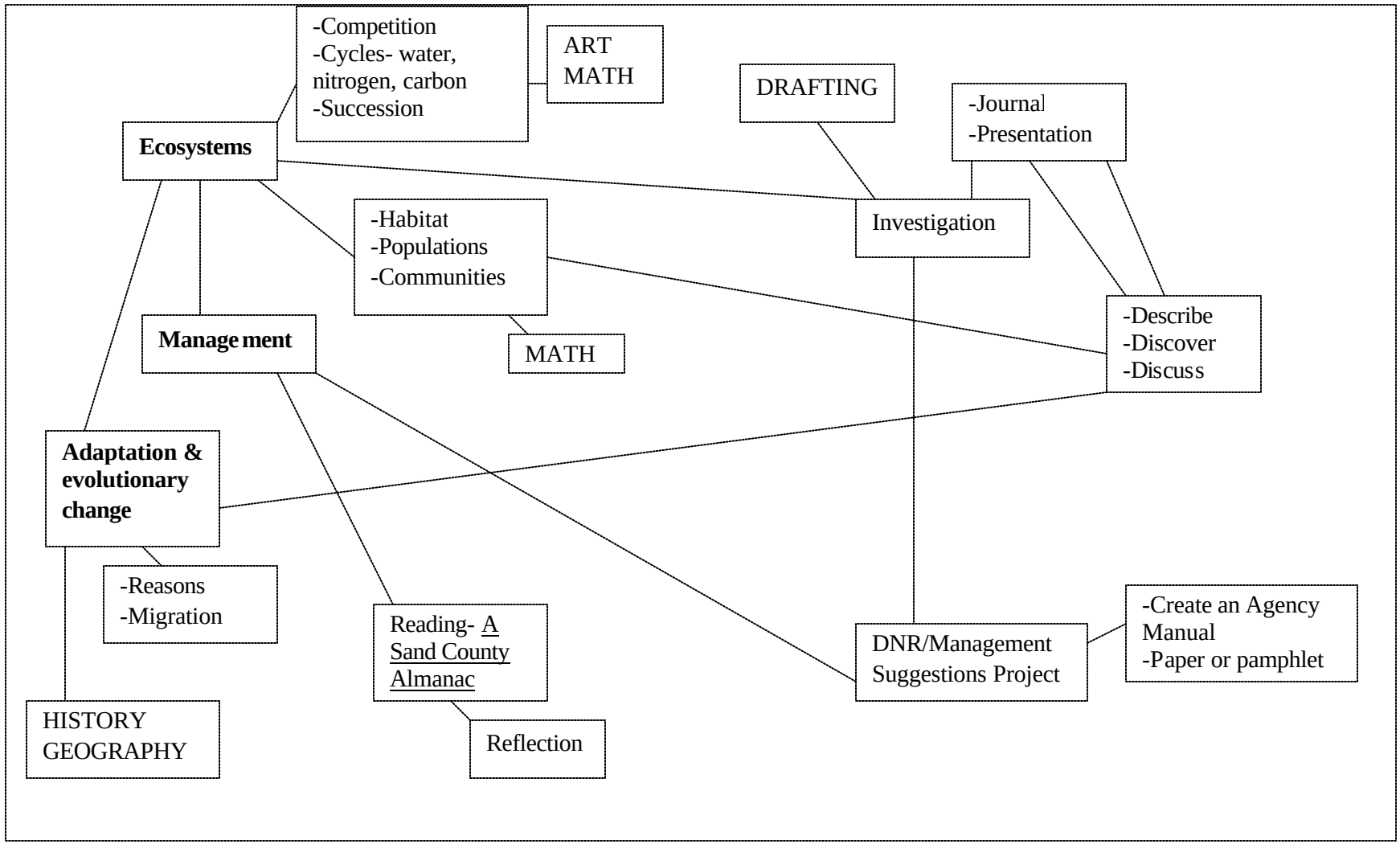
1. History: Discuss historical responses to disease. What did people believe about certain diseases? Compare the causes of death between contemporary and historical times.
2. English: Decode Latin names. So many scientific names and descriptions are based on Latin. Discover ways to extract meaning from unknown words.
3. Art: Depict the Earth as it may have been during the time of its origin. Draw, paint, or create a model or sculpture of the Earth or part of it.
4. P.E.: Investigate how health and exercise play a role in keeping human pathogens under control? What is it about exercise that helps keep our bodies healthy? Discuss how and if health and exercise traits are inherited or learned from generation to generation.

Conclusion

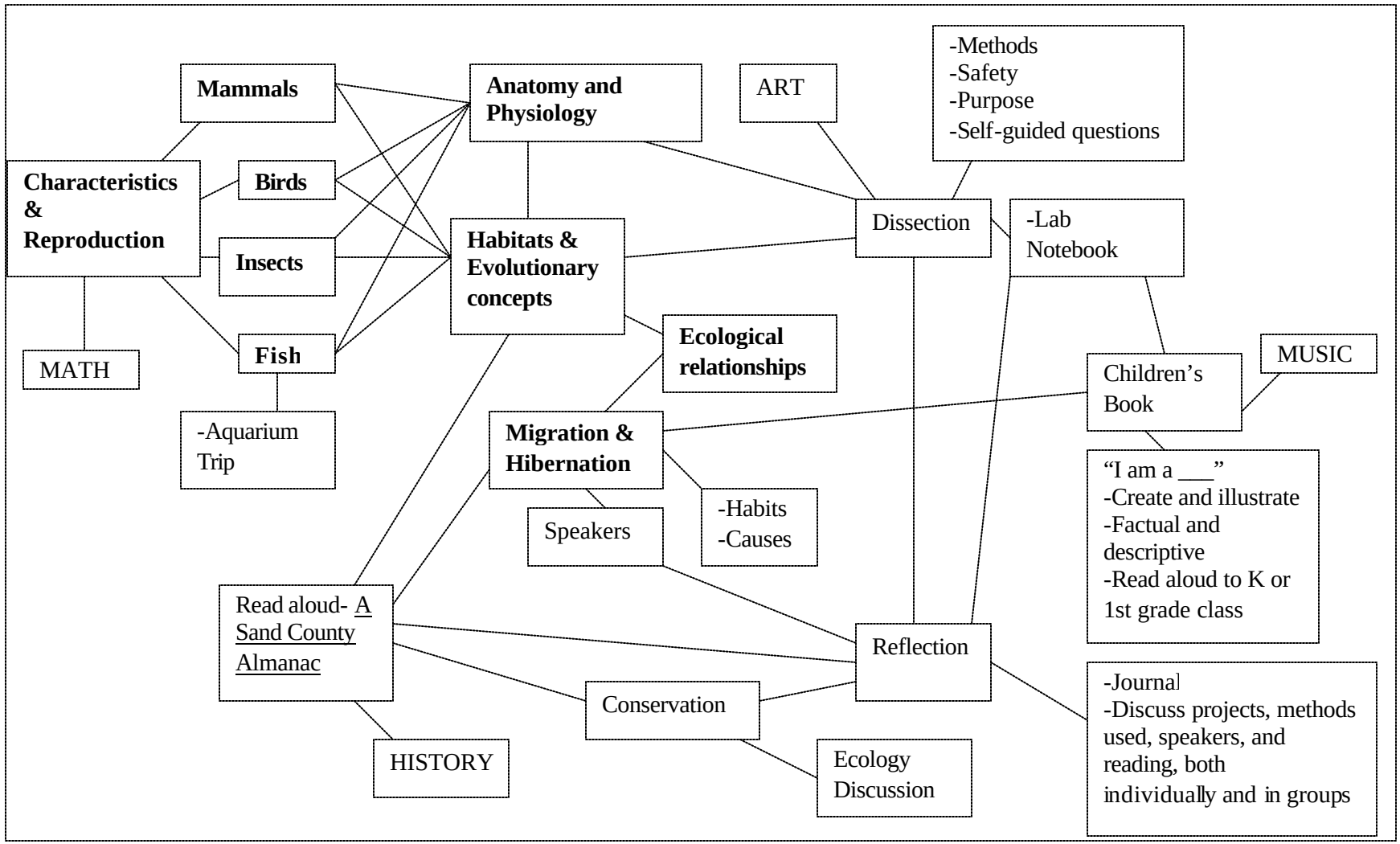
This Year Long Plan for biology is responsive to students' developmental needs, learning styles and the curriculum. It incorporates a variety of teaching and learning techniques and engages students with the content in multiple ways. The strategies for integration improve real-world connections and student understanding. Through the units, students are able to see their learning progress. They are developing skills, learning about trends and scientific processes, connecting previous knowledge with new knowledge and most importantly, finding meaning in the content that they can use in the real world. This comprehensive biology course promotes deep understandings of the content, which is what every classroom teacher strives for in her students.



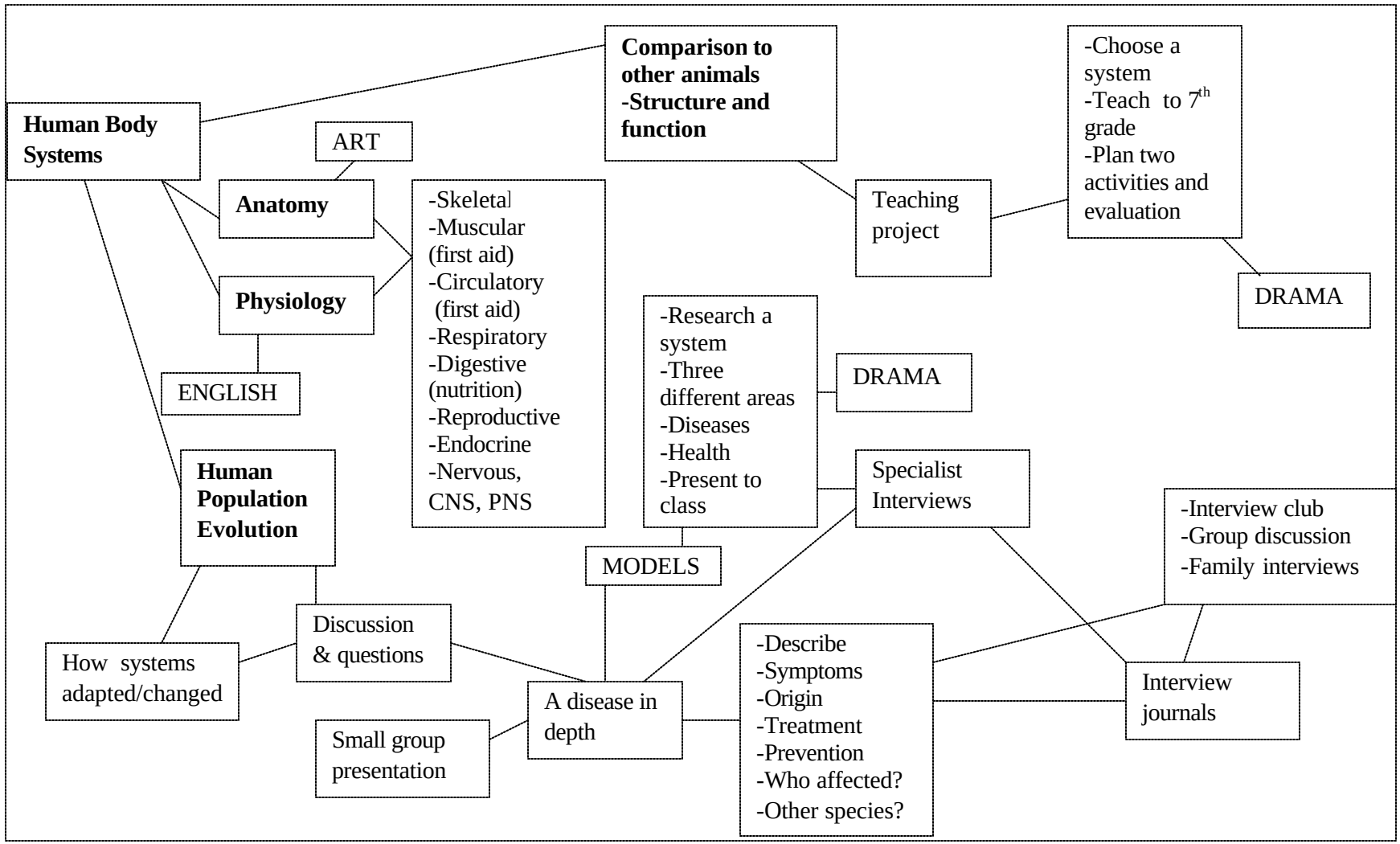
UNIT 1- Plant and Animal Kingdoms



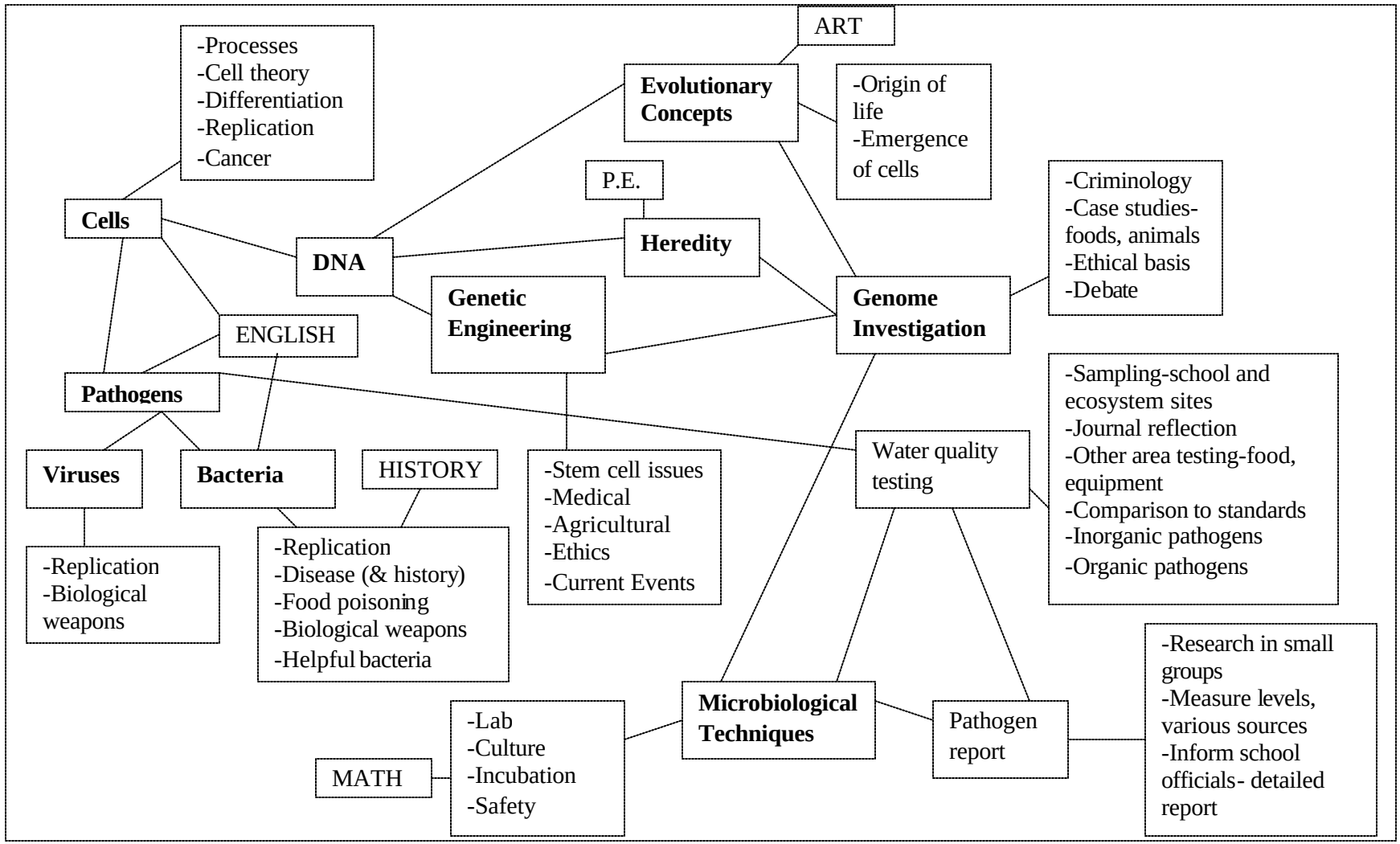
UNIT 2- Ecology and Ecosystems



UNIT 3- Land, Sea and Air



UNIT 4- Human Anatomy, Physiology and Systems



UNIT 5- You Make Me Sick!