AP RESEARCH SUMMER ASSIGNMENT 2020

Congratulations on the successful completion of AP Seminar—and welcome to AP Research, the second course in the two-year AP Capstone experience!

Over the next year, you will draw on the skills and habits acquired in AP Seminar to dig even deeper into an academic topic, problem, issue, or idea of your own interest. This can be a topic that you’ve already encountered in high school, or it can be a brand-new topic that you’ve always wanted to explore—the choice is 100% your own! Beginning in August, I will be your principal research adviser and will guide you through the process of designing, planning, and implementing a yearlong investigation to address your research question.

This summer assignment is intended to introduce you to the process of formal research (what you’ll hear me call “big-R” Research) and to help you brainstorm research topics. As you know, coming up with a good research topic takes time, and coming up with a topic that you’ll want to study for over seven months takes even longer. So, don’t wait until August to start thinking about what you’d like to research!

It is my expectation that you will have completed all parts of this assignment by the first day of school. If you have questions or concerns, do not hesitate to email me over the summer.

Best,
Mr. Cecil

What’s inside this packet:

- Leedy and Ormond, “The Nature of Research” (adapted) ................. pp. 2-10
- Analysis questions for “The Nature of Research” ........................... p. 11
- AP Research Interest Inventory assignment sheet .......................... pp. 12-13

What I expect you to complete over the summer:

- Read “The Nature of Research” and answer the analysis questions.
- Complete an interest inventory to brainstorm ideas for your AP Research project.
THE NATURE OF RESEARCH

In everyday speech, the word research is often used loosely to refer to a variety of activities. In some situations the word connotes simply finding a piece of information or taking notes and then writing a so-called “research paper.” In other situations it refers to the act of informing oneself about what one does not know, perhaps by rummaging through available sources to locate a few tidbits of information. Such uses of the term can create considerable confusion for students, who must learn to use it in a narrower, more precise sense.

Yet when used in its true sense—as a systematic process that leads to new knowledge and understandings—the word research can suggest a mystical activity that is somehow removed from everyday life. Many people imagine researchers to be aloof individuals who seclude themselves in laboratories, scholarly libraries, or the ivory towers of large universities. In fact, research is often a practical enterprise that—given appropriate tools—any rational, conscientious individual can conduct.

WHAT RESEARCH IS NOT

Following are three statements that describe what research is not. Accompanying each statement is an example that illustrates a common misconception about research.

1. Research is not merely gathering information. A typical high school student comes home from school and tells her parents, “The teacher sent us to the library today to do research, and I learned a lot about natural selection.” For this student, research means going to the library (or an online database) to find a few facts. This might be information discovery, or it might be learning reference skills. But it certainly is not, as the teacher labeled it, research.

2. Research is not merely rummaging around for hard-to-locate information. The house across the street is for sale. Your parents consider buying it and call their realtor to find out how much someone else might pay them for your current home. “I'll have to do some research to determine the fair market value of your property,” the realtor tells your parents. What the realtor calls doing “some research” means, of course, reviewing information about recent sales of properties comparable to yours; this information will help the realtor zero in on a reasonable asking price for your own home. Such an activity involves little more than searching through various files or websites to discover what the realtor previously did not know. Rummaging—whether through records in one’s own office, at a library, or on the Internet—is not research. It is more accurately called an exercise in self-enlightenment.

3. Research is not merely transporting facts from one location to another. A college student reads several articles about the mysterious Dark Lady in William Shakespeare’s sonnets and then writes a “research paper” describing various scholars’ suggestions of who the lady might have been. Although the student does, indeed, go through certain activities associated with formal research—such as collecting information, organizing it in a certain way...
for presentation to others, supporting statements with documentation, and referencing statements properly—these activities do not add up to true research. The student has missed the essence of research: the interpretation of data. Nowhere in the paper does the student say, in effect, “These facts I have gathered seem to indicate such-and-such about the Dark Lady.” Nowhere does the student interpret and draw conclusions from the facts. This student is approaching genuine research; however, the mere compilation of facts, presented with reference citations and arranged in a logical sequence—no matter how polished and appealing the format—misses genuine research by a hair. Such activity might more realistically be called fact transcription, fact documentation, fact organization, or fact summarization.

Going a little further, this student would have traveled from one world to another: from the world of mere transportation of facts to the world of interpretation of facts. The difference between the two worlds is the distinction between transference of information and genuine research—a distinction that is critical for novice researchers to understand.

**WHAT RESEARCH IS**

Research is a systematic process of collecting, analyzing, and interpreting information—data—in order to increase our understanding of a phenomenon about which we are interested or concerned. People often use a systematic approach when they collect and interpret information to solve the small problems of daily living. Here, however, we focus on formal research, research in which we intentionally set out to enhance our understanding of a phenomenon and expect to communicate what we discover to the larger community of practice.

Although research projects vary in complexity and duration, in general research involves seven distinct steps. We now look at each of these steps more closely.

1. **The researcher begins with a problem—an unanswered question.** Everywhere we look, we see things that cause us to wonder, to speculate, to ask questions. And by asking questions, we strike a spark that ignites a chain reaction leading to the research process.

   An inquisitive mind is the beginning impetus for research; as one popular tabloid puts it, “Inquiring minds want to know!” Look around you. Consider unresolved situations that evoke these questions: What is such-and-such a situation like? Why does such-and-such a phenomenon occur? What does it all mean? With questions like these, research begins.

2. **The researcher clearly and specifically articulates the goal of the research project.** A clear, unambiguous statement of the problem one will address is critical. This statement is an exercise in intellectual honesty: The ultimate goal of the research must be set forth in a grammatically complete sentence that specifically and precisely answers the question, “What problem do you intend to solve?” When you describe your objective in clear, concrete terms, you have a good idea of what you need to accomplish and can direct your efforts accordingly.
3. **The researcher often divides the main problem into more manageable subproblems.** From a design standpoint, it is often helpful to break a main research problem into several subproblems that, when solved, can resolve the main problem.

Breaking down main problems into small, easily solvable subproblems is a strategy we use in everyday living. For example, suppose you want to drive from your hometown to a town many miles or kilometers away. Your main goal is to get from one location to the other as quickly as possible. You soon realize, however, that this problem involves several subproblems:

- **Main problem:** How do I get from Town A to Town B?
- **Subproblems:**
  1. What route appears to be the most direct one?
  2. Is the most direct one also the quickest one? If not, what route might take the least amount of time?
  3. Which is more important to me: minimizing my travel time or minimizing my energy consumption?
  4. At what critical junctions in my chosen route must I turn right or left?

What seems like a single question can be divided into several smaller questions that must be addressed before the main question can be resolved.

So it is with most research problems. By closely inspecting the main problem, the researcher often uncovers important subproblems. By addressing each of the subproblems, the researcher can more easily address the main problem. If a researcher doesn’t take the time or trouble to isolate the lesser problems within the major problem, the overall research project can become cumbersome and difficult to manage.

4. **The researcher identifies hypotheses and assumptions that underlie the research effort.** Having stated the problem and its related subproblems, the researcher sometimes forms one or more hypotheses about what he or she may discover. A **hypothesis** is a reasonable guess, and it provides a tentative explanation for a phenomenon under investigation. It may direct your thinking to possible sources of information that will aid in resolving one or more subproblems and, as a result, may also help you resolve the main research problem.

Hypotheses are certainly not unique to research. In your everyday life, if something happens, you immediately try to account for its cause by making some logical guesses. For example, imagine that you come home after dark, open your front door, and reach inside for the switch that turns on a nearby table lamp. Your fingers find the switch. You flip it. No light. At this point, you identify several hypotheses regarding the lamp’s failure:

- **Hypothesis 1:** A recent storm has disrupted your access to electrical power.
- **Hypothesis 2:** The bulb has burned out.
- **Hypothesis 3:** The lamp isn’t securely plugged into the wall outlet.
- **Hypothesis 4:** The wire from the lamp to the wall outlet is defective.
- **Hypothesis 5:** You forgot to pay your electric bill.
Each of these hypotheses hints at a strategy for acquiring information that may resolve the nonfunctioning-lamp problem. For instance, to test Hypothesis 1, you might look outside to see whether your neighbors have lights, and to test Hypothesis 2, you might replace the current light bulb with a new one.

Hypotheses in a research project are as tentative as those for a nonfunctioning table lamp. For example, a biologist might speculate that certain human-made chemical compounds increase the frequency of birth defects in frogs. A psychologist might speculate that certain personality traits lead people to show predominantly liberal or conservative voting patterns. A marketing researcher might speculate that humor in a television commercial will capture viewers’ attention and thereby will increase the odds that viewers buy the advertised product. Notice the word *speculate* in all of these examples. Good researchers always begin a project with open minds about what they may—or may not—discover in their data.

Whereas a hypothesis involves a prediction that may or may not be supported by the data, an assumption is a condition that is taken for granted, without which the research project would be pointless. Careful researchers—certainly those conducting research in an academic environment—set forth a statement of their assumptions as the bedrock upon which their study rests. For example, imagine that your problem is to investigate whether students learn the unique grammatical structures of a language more quickly by studying only one foreign language at a time or by studying two foreign languages concurrently. What assumptions would underlie such a problem? At a minimum, you must assume that

- The teachers used in the study are competent to teach the language or languages in question and have mastered the grammatical structures of the language(s) they are teaching.
- The students taking part in the research are capable of mastering the unique grammatical structures of any language(s) they are studying.
- The languages selected for the study have sufficiently different grammatical structures that students might reasonably learn to distinguish between them.

Aside from such basic ideas as these, however, careful researchers state their assumptions so that other people inspecting the research project can evaluate it in accordance with their own assumptions. For the beginning researcher, it is better to be overly explicit than to take too much for granted.

5. The researcher develops a specific plan for addressing the problem and its subproblems. Research is not a blind excursion into the unknown, with the hope that the data necessary to address the research problem will magically emerge. It is, instead, a carefully planned itinerary of the route you intend to take in order to reach your final destination—your research goal. Researchers plan their overall research design and specific research methods in a purposeful way so that they can acquire data relevant to their research problem and subproblems. Depending on the research question, different designs and methods are more or less appropriate.

In the formative stages of a research project, much can be decided: Are any existing data directly relevant to the research problem? If so, where are they, and are you likely to have
access to them? If the needed data don't currently exist, how might you generate them? And later, after you have acquired the data you need, what will you do with them? Such questions merely hint at the fact that planning and design cannot be postponed. Each of the questions just listed—and many more—must have an answer early in the research process.

6. **The researcher collects, organizes, and analyzes data related to the problem and its subproblems.** After a researcher has isolated the problem, divided it into appropriate subproblems, identified hypotheses and assumptions, and chosen a suitable design and method, the next step is to collect whatever data might be relevant to the problem and to organize and analyze them in meaningful ways.

The data collected in research studies take one of two general forms. **Quantitative research** involves looking at amounts, or *quantities*, of one or more variables of interest. A quantitative researcher typically tries to measure variables in some numerical way, perhaps by using commonly accepted measures of the physical world (e.g., rulers, thermometers, oscilloscopes) or carefully designed measures of psychological characteristics or behaviors (e.g., tests, questionnaires, rating scales).

In contrast, **qualitative research** involves looking at characteristics, or *qualities*, that cannot be entirely reduced to numerical values. A qualitative researcher typically aims to examine the many nuances and complexities of a particular phenomenon. You are most likely to see qualitative research in studies of complex human situations (e.g., people’s in-depth perspectives about a particular issue, the behaviors and values of a particular cultural group) or complex human creations (e.g., television commercials, works of art). Qualitative research is not limited to research problems involving human beings, however. For instance, some biologists study, in a distinctly qualitative manner, the complex social behaviors of other animal species; Jane Goodall’s studies of chimpanzees is one well-known example.

The two kinds of data—quantitative and qualitative—often require distinctly different research methods and data analysis strategies. Nevertheless, we urge you not to think of the quantitative–qualitative distinction as a mutually exclusive, *it-has-to-be-one-thing-or-the-other* dichotomy. Many researchers collect both quantitative and qualitative data in a single research project—an approach sometimes known as **mixed-methods research**. Indeed, good researchers tend to be eclectic researchers who draw from diverse methods and data sources in order to best address their research problems and questions.

7. **The researcher interprets the meaning of the data as they relate to the problem and its subproblems.** Quantitative and qualitative data are, in and of themselves, only data—nothing more. The significance of the data depends on how the researcher extracts *meaning* from them. In research, uninterpreted data are worthless: They can never help us answer the questions we have posed.

Yet researchers must recognize and come to terms with the subjective and dynamic nature of interpretation. Consider, for example, the many books written on the assassination of U.S. President John F. Kennedy. Different historians have studied the same events: One may interpret them one way, and another may arrive at a very different conclusion. Which one is
right? Perhaps they both are; perhaps neither is. Both may have merely posed new problems for other historians to try to resolve. Different minds often find different meanings in the same set of facts.

Data demand interpretation. But no rule, formula, or algorithm can lead the researcher unerringly to a correct interpretation. Interpretation is inevitably a somewhat subjective process that depends on the researcher's hypotheses, assumptions, and logical reasoning processes.

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We must emphasize two important points related to the seven-step process just described. First, the process is iterative: A researcher sometimes needs to move back and forth between two or more steps along the way. For example, while developing a specific plan for a project (Step 5), a researcher might realize that a genuine resolution of the research problem requires addressing a subproblem not previously identified (Step 3). And while interpreting the collected data (Step 7), a researcher may decide that additional data are needed to fully resolve the problem (Step 6).

Second, the process is cyclical. The final step in the research process—the interpretation of the data—is not really the final step at all. Only rarely is a research project a one-shot effort that completely resolves a problem. For instance, even with the best of data, hypotheses in a research project are rarely proved or disproved—and thus research questions are rarely answered beyond a shadow of a doubt. Instead, hypotheses are either supported or not supported by the data. If the data are consistent with a particular hypothesis, the researcher can make a case that the hypothesis probably has some merit and should be taken seriously. In contrast, if the data run contrary to a hypothesis, the researcher rejects the hypothesis and turns to other hypotheses as being more likely explanations of the phenomenon in question. In either case, one or more additional, follow-up studies are called for.

Ultimately, then, most research studies don’t bring total closure to a research problem. There is no obvious end point—no point at which a researcher can say “Voila! I’ve completely answered the question about which I’m concerned.” Instead, research typically involves a cycle—or more accurately, a spiral—in which one study spawns additional, follow-up studies. In exploring a topic, one comes across additional problems that need resolving, and so the process must begin anew. Research begets more research.

To view research in this way is to invest it with a dynamic quality that is its true nature—a far cry from the conventional view, which sees research as a one-time undertaking that is static, self-contained, an end in itself. Here we see another difference between true research and the nonexamples of research presented earlier in the chapter. Every researcher soon learns that genuine research is likely to yield as many problems as it resolves. Such is the nature of the acquisition of knowledge.

**FINDING A RESEARCH PROBLEM**

Problems in need of research are everywhere. Some research projects can enhance our general knowledge about our physical, biological, psychological, or social world or shed light on
historical, cultural, or aesthetic phenomena. For example, an ornithologist might study the mating habits of a particular species of birds, and a psychologist might study the nature of people’s logical reasoning processes. Such projects, which can advance theoretical conceptualizations about a particular topic, are known as **basic research**.

Other research projects address issues that have immediate relevance to current practices, procedures, and policies. For example, a nursing educator might compare the effectiveness of different instructional techniques for training future nurses, and an agronomist might study the effects of various fertilizers on the growth of sunflowers. Such projects, which can inform human decision making about practical problems, are known as **applied research**. Occasionally, applied research involves addressing questions in one’s immediate work environment, with the goal of solving an ongoing problem in that environment; such research is known as **action research**.

Keep in mind, however, that the line between basic research and applied research is, at best, a blurry one. Answering questions about basic theoretical issues can often inform current practices in the everyday world; for example, by studying the mating habits of a particular species of birds, an ornithologist might lead the way in saving the species from extinction. Similarly, answering questions about practical problems may enhance theoretical understandings of particular phenomena; for example, the nursing educator who finds that one approach to training nurses is more effective than another may enhance psychologists’ understanding of how, in general, people acquire new knowledge and skills.

Regardless of whether you conduct basic or applied research, a research project is likely to take a significant amount of your time and energy, so whatever problem you study should be **worth** your time and energy. As you begin the process of identifying a suitable research problem to tackle, keep two criteria in mind. First, your problem should address an important question, such that the answer can actually **make a difference** in some way. And second, it should advance the frontiers of knowledge, perhaps by leading to new ways of thinking, suggesting possible applications, or paving the way for further research in the field. To accomplish both of these ends, your research project must involve not only the collection of data but also the **interpretation** of those data.

How can a beginning researcher formulate an important and useful research problem? Here are five recommendations:

1. **Look around you.** In many disciplines, questions that need answers—phenomena that need explanation—are everywhere. For example, let’s look back to the early 17th century, when Galileo was trying to make sense of a variety of earthly and celestial phenomena. Why did large bodies of water (but not small ones) rise and fall in the form of tides twice a day? Why did sunspots consistently move across the sun’s surface from right to left, gradually disappear, and then, about 2 weeks later, reappear on the right edge? Furthermore, why did sunspots usually move in an upward or downward path as they traversed the sun’s surface, while only occasionally moving in a direct, horizontal fashion? Galileo correctly deduced that the various “paths” of sunspots could be explained by the facts that both the Earth and sun were spinning on tilted axes and that—contrary to popular opinion at the time—the Earth revolved around the sun,
rather than vice versa. Galileo was less successful in explaining tides, mistakenly attributing them to natural “sloshing” as a result of the Earth’s movement through space, rather than to the moon’s gravitational pull.

We do not mean to suggest that novice researchers should take on such monumental questions as the nature of the solar system or oceanic tides. But smaller problems suitable for research exist everywhere. Continually ask yourself questions about what you see and hear: Why does such-and-such happen? What makes such-and-such tick? What are people thinking when they do such-and-such?

2. Read what people have already written about a topic. One essential strategy is to find out what things are already known and believed about your topic of interest. Little can be gained by reinventing the wheel. In addition to telling you what is already known, the existing writing about a topic is likely to tell you what is not known in the area—in other words, what still needs to be done. For instance, your research project might

- Address the suggestions for future research that another researcher has identified
- Replicate a research project in a different setting or with a different population
- Consider how various subpopulations might behave differently in the same situation
- Apply an existing perspective or theory to a new situation
- Explore unexpected or contradictory findings in previous studies
- Challenge research findings that seem to contradict what you personally know or believe to be true

Reading what’s already been written about your topic (a process researchers call “reviewing the literature”) has other advantages as well. It gives you a theoretical base on which to generate hypotheses and build a rationale for your study. It offers potential research designs and methods of measurement. And it can help you interpret your results and relate them to previous research findings in your field.

As you read about other people’s research related to your topic, take time to consider how you can improve your own work because of it. Ask yourself: What have I learned that I would (or would not) want to incorporate into my own research? Perhaps it is a certain way of writing, a specific method of data collection, or a particular approach to data analysis. You should constantly question and reflect on what you read.

We also urge you to keep a running record of helpful journal articles and other sources (i.e., an annotated bibliography). Include enough information that you will be able to track each source down again—perhaps including the author’s name, the title and year of the journal or book, key words and phrases that capture the focus of the work, and (if applicable) the appropriate library call number or Internet address. You may think you will always be able to recall where you found a helpful source and what you learned from it. However, our own experiences tell us that you probably will forget a good deal of what you read unless you keep a handwritten or electronic record of it.
3. **Seek the advice of experts.** Another simple yet highly effective strategy for identifying a research problem is to ask an expert: What needs to be done? What burning questions are still out there? What previous research findings seemingly don’t make sense? Your professors will almost certainly be able to answer each of these questions, as will other scholars you might contact through e-mail or meet on campus and elsewhere.

Some beginning researchers—including many students—are reluctant to approach well-known scholars for fear that these scholars don’t have the time or patience to talk with novices. Quite the opposite is true: Most experienced researchers are happy to talk with people who are just starting out. In fact, they may feel flattered that you are familiar with their work and would like to extend or apply it in some way.

4. **Choose a topic that intrigues and motivates you.** As you ask questions about the world around you, dip your toes into the scholarly literature, and summon the courage to talk with experts, you will uncover a number of potential research problems. At some point you need to pick just one of them, and your selection should be based on what you personally want to learn more about. Remember, the project you are about to undertake in AP Research will take you seven months to complete, so it should be something you believe is worth your time and effort—even better, one you are truly passionate about. Peter Leavenworth, at the time a doctoral student in history, explained the importance of choosing an interesting dissertation topic this way: “You’re going to be married to it for a while, so you might as well enjoy it.”

5. **Be realistic about what you can accomplish.** Although it is important to address a problem that legitimately needs addressing, it is equally important that the problem be a manageable one. For example, how much time will it take you to collect the necessary data? Will you need to travel great distances to get the data? Will you need expensive equipment? Will the project require knowledge and skills far beyond those you currently have? Asking and then answering such questions can help you keep your project within reasonable, accomplishable bounds.
ANALYSIS QUESTIONS: “THE NATURE OF RESEARCH”

Directions: Type your responses to these analysis questions on a separate sheet of paper. You don’t need to provide any direct quotations from the essay in your response. Be prepared to submit these AQs when school resumes in August.

1. Would Leedy and Ormond say that AP Seminar students conduct research? Why or why not?

2. In your own words, what is the difference between a hypothesis and an assumption?

3. An evolutionary biologist is conducting research on the ethical lives of animals and is trying to answer the following question: Do chimp societies follow a code of ethics? Brainstorm two assumptions you’d expect this researcher to have about their topic.

4. A sociologist conducts interviews with emergency room doctors to understand the psychological effects of treating patients infected with COVID-19. What kind of data has the researcher collected?

5. What is a “mixed-methods” research design?

6. In your own words, what is the difference between what Leedy and Ormond call “basic research” versus “applied research”?

7. An early step in the research process is to conduct a “literature review”. What does this phrase mean?
AP RESEARCH INTEREST INVENTORY

In AP Seminar, your choice of research topics was constrained by me, your teammates, and the College Board’s stimulus packet. In AP Research, by contrast, you’ll be conducting an independent investigation of a topic 100% of your own interest. Some of you might already have an idea of what you’d like to research, while others might be feeling overwhelmed by the possibilities. For those of you in the first group, this assignment will give you the chance to confirm your interests; for those in the second group, this assignment will give you opportunities to discover what excites you.

The assignment should be ready to submit as a single document, but it is divided into two parts:

**Part A: Discover Your Interests**
The best way to discover your passion is to explore the world around you, so the first step in creating an interest inventory is to read, watch, listen to lots of different sources. **Find TEN (10) sources that interest you; they don’t need to be connected to each other.** Below are some places where you can look:

- Read articles in popular magazines such as *Time, The Economist, The Atlantic, Psychology Today, The New Yorker, Scientific American.*
- Watch the news to identify a local, regional, national, or global issue of interest.
- Watch TED Talks to identify issues of interest and problems that need a solution.
- Listen to podcasts like *Radiolab; Invisibilia; Left, Right, and Center; The New Yorker Radio Hour, This American Life.*
- Talk to respected leaders in the field (start with someone you know; ask for their recommendations) to ask about problems that need solving within their industries.

**Organize these sources into a simple graphic organizer modeled after the one below.** Make a note of the themes/topics that might become the seed of your research project/question, and record whether or not you found this source interesting. Use this process to figure out what you are and are not passionate about!

<table>
<thead>
<tr>
<th>Name</th>
<th>Citation</th>
<th>Topics/Themes</th>
<th>Interesting?</th>
</tr>
</thead>
</table>
• Things or ideas that unify people in the USA  
• Cold War  
• Archives | This podcast got me thinking about how we might preserve the memory of life during COVID-19: What objects tell this story? |

**Part B: Explore the Scholarly Literature**
**Choose two interesting topics/themes from your list, and then find and skim THREE (3) scholarly articles from peer-reviewed journals that are connected to each topic.** These articles won’t necessarily become part of your literature review, so don’t feel pressured to read
them thoroughly. Instead, use them to give you a better sense of what scholarly research looks like in your field of interest. As you read/skim the articles, ask yourself:

- What kinds of questions are researchers in this field asking?
- What kinds of data do researchers collect and how do they analyze the data?
- Is it a problem for you if research in this field of study requires a lot of math?
- Does research in this field of study require access to specialized equipment?

**For each of the two areas of interest, write a short paragraph that addresses some of the questions above. Include a “references” list (i.e., a bibliography) at the end of each paragraph.**

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**HOW TO ACCESS THE LAUSD DIGITAL LIBRARY FROM HOME**

1. Log into Schoology.

2. Find the Apps Icon in the upper right-hand corner of your screen. Click on LAUSD Digital Library. (Note: Your drop down menu might look different than mine.)

3. Type in your LAUSD username and password. They are the same you use to access Schoology.

4. Browse! The EBSCO link will direct you to **EBSCO Academic Search Premier**.