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Abstract

This study was conducted in effort to increase class participation and excitement about science in an urban science classroom. It focused on a class of ninth-grade students enrolled in a secondary general science class. The subjects were given a problem-based learning (PBL) project that required them to research an endangered species found in North America. Observations regarding engagement and behavior were recorded daily in a journal. The results show that excitement and participation increased for most, but not all students. However, no decrease in engagement was seen. Classroom behavior also improved during the course of the study. The PBL method proved to be a useful tool for use with this particular class.

Effect of Problem-based Learning in an Urban Science Classroom

There are many challenges that confront the urban teacher. One of the greatest of these is how to motivate and engage the students. My goal by doing this research is to increase motivation and engagement in my classroom by introducing the students to problem-based learning (PBL).

I am a first-year teacher in the Rochester City School district. I teach a class called Science I, which is taken primarily by ninth-graders. In this district, there are many students who make it as far as high school without the skills they will need to succeed in upper level science classes. These skills include graphing, drawing inferences, interpreting data, and in some cases, even reading. Science I was designed as an intermediate between eighth grade science and Regents Biology, for those students who may not be ready for a Regents class. It is mainly a life-science class, with very minimal chemistry. That is a problem in and of itself. Students in this district study life science in sixth grade, eighth grade, and again in biology. By making Science I a life-science class as well, the students are getting tremendous life science instruction, but not much of chemistry, earth science, or physics. The Science I curriculum itself is very repetitive of what the students studied in eighth grade, as well as of what they will study the following year. The students have told me that the redundancy of the material makes it somewhat boring for them. This year, Science I was not used as it was originally intended. Instead, almost all of the ninth graders were put into Science I. This created classes with great disparity between readiness levels. Some students are in the class because they need it, and others should be in a higher-level class.

My students come from a wide variety of backgrounds. They are predominantly African-American and Hispanic. A very small percentage of them are Caucasian. They all live in the inner city, and our school is nestled amongst factories on Rochester's west side. Many of my students have jobs and/or care for their other siblings when they are not in school. Some of my students have children of their own at home to take care of. That means they come in tired and unwilling to do work in class. I have some students who are intrinsically motivated to do well, and others who are just waiting out the minutes until they can go home. With such a mixture of abilities and attitudes, I need to find ways to make the material in the class relevant and motivating to all of my students.

The purpose of my research is to find a way to make the material I teach engaging, despite the redundancy. My hope is that by introducing the students to problem-based learning (PBL), their motivation and interest in the class will increase. By engaging in the class, their understanding of the material should increase as well. In the fall, I ran a smaller version of a PBL with one of my classes. Student involvement and excitement about the material seemed to increase, and even students who rarely came to class were showing up more. The overall quality of work was much better than assignments that they had handed in previously. For this study I conducted a more complex PBL. The questions I sought to answer were: "Will student engagement and motivation increase by using the PBL method?", and "Will an increase in engagement cause an improvement in class behavior?"

Literature Review

Challenges of Urban Schools

Each school and each school district has its own set of challenges. There are a group of particular challenges that are shared among urban schools. One group of challenges that students have to deal with in urban schools is a result of their lives outside of school. Mitchel (2000) acknowledges that students come to the classroom with a whole host of outside issues. They may be dealing with problems at home, problems in interpersonal relationships, and even language barriers. Once students get to school, they are presented with a new set of issues. They may not be adequately prepared academically for their classes. They may not have the materials they need (Mitchel 2000). Despite these barriers, students are still expected to come to school and do work. Haberman (2000) points out that due to the outside stressors in their lives, many students are chronic absentees, or come to school with no intrinsic motivation to learn.

What is PBL?

According to Magnussen, Ishida, and Itano (2000), the PBL method was formally created in the 1960's at McMaster University School of Medicine in Ontario, Canada. It has been used extensively in medical schools (Patel and Kaufman, 2001). PBL problems involve a real-world problem that students are asked to find a solution to. They must synthesize new information with their prior knowledge to make authentic decisions. Over the course of solving the problem, they will expand their understanding by asking questions, discussing with peers, discussing with experts, and peer teaching (Magnussen, Ishida, Itano, 2000; Schroeder, Zarinnia, 2001). Schroeder and Zarinnia (2001) suggest that PBL "can be a context for developing information problem- solving skills… supports critical

thinking, teaching for understanding, and development of student information literacy skills."

Role of the teacher in PBL. The role of the teacher in problem-based learning is more complicated than in a traditional classroom. The teacher is a metacognitive coach for the students (Boyce, VanTassel-Baska, Burruss, Sher, Johnson 1997). "It requires an on-going, dynamic interaction with individual learners and small groups of learners to assess their level of mastery that is related to both content and process considerations." Kolasa and Sullivan (2000) say that, "It is time to put the responsibility in the hands of the student." Jerry Singer (2001) found that when students were given more independence in learning situations, they became more successful. The more independence they were given, the harder they worked. Singer tried this approach in effort to decrease the number of social promotions in the urban middle school he had just taken over. Boyce, VanTassel-Baska, Burruss, Sher, and Johnson (1997) suggest that two ways to be a facilitator and assess student progress are by questioning, and by doing sets of group activities. They also point out that PBL helps students develop metacognition. As a result, they will learn to monitor their comprehension of material, think critically, solve problems, and develop study skills.

Benefits of PBL. PBL has proven to be successful with students of all ages. Medical schools have found that PBL can be exciting and motivating for students (Patel and Kaufman 2001). Patel and Kaufman (2001) also feel that students in PBL classrooms have better attitudes about their classes. Recent research (Gordon, Rogers,and Comfort 2001) has shown that PBL has had positive results in urban secondary classrooms. The students in the Gordon, Rodgers, and Comfort (2001) study conducted at Stoddart-

Fleisher Middle School in Philadelphia improved both in behavior and performance in science. The students responded positively to the activity, which was used to enrich the normal curriculum. A study conducted at the University of Hawaii at Manoa School of Nursing showed that nursing students developed better critical thinking skills as a result of doing this type of problem (Magnussen, Ishida, Itano 2000). Bowers (2000) cites problem- solving as a strategy to help students be successful in real life, as well as in school. Reed (1999) found that giving students a problem that they could act on, perhaps a community or world issue, really got students involved. Kolasa and Sullivan (2000) support that PBL helps students to become independent learners, and also may help students retain knowledge longer, both of which will also help them both in and out of school.

Drawbacks of PBL. PBL is not a miracle panacea for unmotivated students. Medical schools have found a few drawbacks to using the PBL method. On some achievement tests, students who have learned information through PBL actually have scored lower than traditionally taught students on questions testing basic science and reasoning skills (Patel and Kaufman 2001). In the medical schools, it has also been found that students taught through PBL are more likely to come up with an incorrect initial diagnosis when presented with an illness (Patel and Kaufman 2001). Patel and Kaufman (2001) go on to say that those students are quick to correct and refine their reasoning, leading them to correct diagnoses. In the medical school setting, it is agreed that PBL increases excitement about the classes, but does not always produce learners that can accurately assess a new challenge. Instead, they "rely on biomedical knowledge that they have used successfully with similar problems (Patel and Kaufman 2001). In summation,

"enthusiasm and active engagement by the learner do not guarantee successful learning (Patel and Kaufman 2001)."

Methodology

The Project

In the study, the students were presented with a problem-based-learning project dealing with extinction. We started off with a graphing activity on day one.(see Appendix A). In the activity, the students were asked to graph two sets of data, but are not told what the data are. The data actually represent human population growth and number of animal extinctions. There is quite a striking correlation between the two. Then we had a class discussion on what the data actually represented, which will led into a discussion of the ways humans affect other species.

On days two and three, the students participated in literature circle discussions based on a piece they read about endangered species (see Appendix B). They worked in groups of five, which they chose, and each person had a different job. One person served as the "facilitator". This person's job was to keep track of time, and make sure that their group members stayed on task. The students seemed to really enjoy this job. One person was the "summarizer", and their job was to make a list of the main points presented in the reading. Another student was the "word finder". Their job was to identify and define any unfamiliar words in the piece. The "artist" drew a representation of something from the reading, and the "connector" decided how the reading related to the world around them. On the third day, each student shared what they had prepared, and the groups worked together to answer the questions on the back of the reading (See Appendix B).

Next, I handed out the project task (see Appendix C). This would be our main focus for the duration of the ten days. The students were asked to identify an endangered animal found in the United States. They were then asked to come up with a plan to keep

the species from becoming extinct. For a day by day summary of activities, see Appendix D. The class used library resources and the Internet to conduct their research. The whole class had one full class period to spend in the library. In addition to that, individuals were allowed to go to the library during class time to retrieve any information they felt they still needed as the project progressed. At the end of the project, the class formalized their plans and wrote letters with their proposals to Secretary Gale Norton. Secretary Norton is the head of the US Department of the Interior (DOI). Among other things, the DOI is makes sure that laws concerning the preservation of endangered species are carried out. On the last day of the project, after the students turned in their work, they each filled out an evaluation rating their contributions to the project. They also used this form to offer feedback on what they thought of the project, as well as how much they felt the other group members contributed.

The Subjects

In this study, I examined the students in my 2nd period class. They are a difficult group to work with for a few reasons. First of all, there is a vast difference in readiness level among the students. Some of them really belong in Regents Biology, so they are bored in Science I. Others are in the class because they did not pass eighth grade science. There are 24 students in the class. Out of those 24, four took Science I last year and did not pass. One student is taking the class for the third time. He is one of the biggest behavior problems in the class. He is sitting through the class for the third time, so he is bored, yet he does little work in class. In talking to him, it is apparent that he understands the material, but is unwilling to put forth any effort. The second challenge in working with this class is behavior. There are six chronic truants in the class. I will consider

chronic truants to be those students who are present less than 87% of the time. That is the attendance requirement in the Rochester City School District, and those students who are not in attendance at least 87% of the days fail the marking period. These students sporadically show up a few times a week or a few times a month. When they show up, they typically do not do any work and are a distraction to the other students. Those students do not want to be in class, so they use it as a social time. Their attitude quickly spreads to much of the rest of the class. They talk amongst themselves instead of listening, get up and walk around the room, use bad language, and are disrespectful. There are a select few students in the class who genuinely like science and want to learn, but have expressed frustration due to the behavior of the others. I have to stop class often to deal with behavior, and the students are missing out. So far this year I have been hesitant to do projects and labs with this class because I am concerned that the students are not mature enough to handle materials in an appropriate way.

Grouping

For this project, I chose the groups. In the pilot PBL we did in the fall, I found that the students who did not want to do work grouped themselves with students who would do the work. The students who were working were very frustrated that their partners were not contributing. For this reason I put together students of similar readiness and motivation levels. There are 27 students in the class, a few of which are chronic truants. I created six groups of four and one group of three. I distributed the truants among the groups of four such that each group had at least three members who are reliably in class. The first group consisted of my most motivated students: Jeff, Martin, Samantha, Debbie, Nicole, and Shannon. Nicole was dropped from the group because of

low attendance. The second group are sometimes engaged in class and consisted of: John, Kevin, Daryl, Zach, and Frank. The third group was also composed of students who are sometimes engaged and have a tendency to talk at inappropriate times: Karen, Latoya, Rachel, Carrie, and Amber. Amber was eventually dropped from the group due to low attendance. The fourth group was made up of my most disruptive and least motivated students: Sherri, David, Mark and Chris.

The Study

This project was part of a unit on biodiversity. The curriculum for this unit focuses on the wide variety of organisms on the planet, and how humans affect them. My goal in conducting this study was to make Science I engaging for the students. I want to find a way to interest those students who are difficult to motivate. This was a qualitative study. Before it began, I evaluated each student's current level of participation in class activities. On assessing the level of participation by these students, I looked at not only how often they are involved in class discussion, but also at if they are paying attention and if they are on task. I recorded these evaluations in a journal prior to beginning the project. As the study progressed, I judged the students in two areas. The first is their level of class participation. I will be comparing their levels of participation during the project to their previous levels. The second area is their classroom behavior. The students in my class who are disinterested and not participating in class also tend to be the students who behave inappropriately. I examined whether or not their behavior improved during the study. Every day, I recorded in the journal whether the students were engaged, and what their behavior was like that day. I had hoped to observe an increase in participation and improvement of behavior over the course of the study.

Throughout the project, there were embedded lessons to help the students along. We discussed how humans affect other species and in what ways. There were also lessons on how to write letters requesting information, and how to write a letter to a legislator.

Results

Engagement and Motivation to Participate

Throughout the study, I found that engagement improved for some students, but not all of them. In terms of engagement and involvement prior to the study, I could divide my class into three groups: those that were almost never engaged, those who were engaged sometimes, and those who were usually engaged. Each group reacted to the project in a different way.

Almost never engaged. Prior to the study, Chris, Mark and David (all names have been changed) were almost never engaged in class activities. Mark's engagement did not improve at all during the project. Chris and David were a different story though. During the project, there was only one day out of the ten that Chris was not engaged and working. That shows 100% improvement from his typical behavior. Chris was engaged on two days of the study. That is not a high percentage, but compared to Chris' usual day, that was tremendous. Chris sits every day with his head down and refuses to do work. I can sit with him, put a pencil and paper in front of him, or even try to pair him up with other students, but he still sits with his head down. He does not speak, even when spoken to by the other students or myself. For him to be engaged for even two days of the project was an improvement. Chris did not contribute to his group's project. On the final evaluations, the other group members did not even consider him part of their group.

Sometimes engaged. Most of the class is engaged some of the time. This is the group that I really saw improvement in. Karen, Latoya, Rachel, and Carrie all showed improvement in engagement. They all worked together to complete the project. On their evaluations, they all agreed that they contributed equally to the group effort, and also

agreed that they were all on-task and working most of the time. Their feelings coincided with my evaluation of the group.

In the group that included Frank, Zach, John, Kevin, and Daryl, I saw improvement in engagement for everyone except for John. Kevin participates in class activities less than half the time. The fact that he did his portion of the group project shows improvement. He still was not on-task every day, but he was on task more than usual. Kevin was only responsible for the drawing of the blue whale. Frank, Zach, and Daryl did the rest of the project. Frank and Daryl were on task every day except one, but admined on the evaluation that Zach did most of the project. Zach was very concerned that his partners would not contribute, so he took the initiative to do most of the research outside of class. He even had his part done ahead of schedule because he knew that he would be absent on the due date.

Sherri and Samantha also fall into the category of sometimes involved. They are friends, and have a tendency to talk when they should be working. Once they were separated, Samantha showed improvement. She was put in the group with the other students who are highly motivated and almost always engaged. While in that group, Samantha was on-task almost every day. Sherri did not show improvement in motivation or engagement.

Usually engaged. Jeff, Martin, and Debbie are almost always engaged in class activities. They are highly motivated students who strive to get good grades. During this project I saw a slight decrease in their engagement. When they were put in a group setting, they started to talk amongst themselves and get off-task. They still handed in a complete project, and the time they spent on-task was still greater than the time they

spent off-task. On their group evaluations, they all said that each group member, including Samantha, contributed equally. The one person they did not comment on was Shannon. Although she worked very hard at the beginning of the project, she had stopped coming regularly by the end of the second week. The others did not consider Shannon part of their group.

Conduct

Prior to the study, there were five varieties of poor conduct that I observed on a regular basis in this class: inappropriate language, talking while I was trying to give instructions, off-subject talking during work time, drawing instead of participating, and wandering around the room. As the project progressed, all three of these behaviors declined.

Inappropriate language. The most frequent users of bad language were Chris and Mark. Others who had a tendency to use it were: Karen, Samantha, Sherri, and Shannon. Chris started out as the biggest offender, but quickly improved. He and Mark would sit together and talk all through class, swearing without even realizing what he was doing. He became very involved with his part of the project, and was so intent on it that he did not speak to Mark much at all anymore. When he did speak to his group members, it was related to the project. Mark did not become as involved as Chris, but with Chris working on the project, he did not have an audience any more. For a while, he started laying his head down on the desk and not doing anything, but he found a new person to talk to in Sherri. The two of them would bicker amongst themselves and continued to use bad language. Something interesting happened at that point though. Shannon was in the group that sat next to Mark and Sherri's group. Shannon started reprimanding other students for their language and behavior. The students generally responded to her and stopped

doing whatever they had been doing. If Mark and Sherri were using bad language, Shannon would look over at them and say, "You guys need to cut that out" or "Quit it- you don't need to talk like that". Karen began to do the same. Now two students were helping out with classroom management. When those two young ladies took on that role, they also stopped using bad language. As for Samantha, as soon as she was not working with Sherri, she stopped using the bad language. The students in her group did not use it, and so she did not either, especially with Samantha right there to keep her in line.

Talking during instructions. I had had trouble getting, and keeping, this class' attention all year. I almost never could get through the instructions for the day without being interrupted by talkers. In addition, it also took several minutes to even get their attention in the first place. On the first and second days of the project, I had to wait over five minutes for them to settle down and give me their attention. Once the project got going, we got into somewhat of a rhythm. For the first few minutes of class, I would give the expectations for the day, and answer any questions. Then, the groups would be on their own to work for the rest of the period. After the literature circle on the third day, some students began to tell the others to quiet down at the beginning of class. Again, Shannon and Karen were the first to start this. For the second half of the study, the class came in more calmly, and I only had to wait about two minutes for them to quiet down.

Off-task talking during work time. Off-task talking has been a class-wide problem since the beginning of the year. Karen, Latoya, Rachel, and Carrie are friends, and have a tendency to get off-task very quickly during group work. For the literature circle activity, Karen was the group's facilitator. The facilitator's job was to keep the group on task, and keep an eye on the time. Even after that activity was over, she kept that role. For the most

part, she made sure that her group was working on the project, not talking about other things. On a few occasions when her group started to get off task, all I had to say was, "Does this group need a facilitator?" Immediately, Karen would say, "I am. I am", and she would bring them back on task.

Mark and Chris also had a tendency to be off-task. In fact, they usually did not get on-task until I would sit down with them and work with them. Sometimes, even when I did that, Mark would either ignore me or move away. Chris became very involved with his portion of the project, and became frustrated when Mark would try to distract him. One day, Mark tried to get Chris to talk to him, but Chris was intently drawing a picture of the American Bald Eagle, their research topic. Chris tried to ignore him for a while, but finally he said, "Leave me alone man, I'm drawing. Why don't you help Sherri?" There were even two days when Chris separated his desk from Mark and Sherri so that they would not distract him. Unfortunately, Mark and Sherri continued to be off-task throughout the project. They did not show improvement in this area.

One group had a change that I did not expect. Jeff, Martin, and Debbie were three of my most attentive students. Once they were in a group though, they were constantly talking, and not about the project. They would talk about basketball games, what fight went on the day before, or what movie they had just seen, but never the project. They brought in research they did outside of class, but they would talk instead of using class time to work. I would come by and remind them to work on their project frequently throughout the period, but as soon as I left, they were back talking. Shannon became very frustrated with this development. She would get very indignant and yell at her group for not working. She came and spoke to me privately on one occasion and told me that she

felt that she was the only one working on the project, and said that she was considering doing the project alone. Shannon was successful in getting her group to be on-task for a while, but then she stopped coming to class regularly. She did not finish the project with them. This was the only group in which I saw an increase in off-task talking.

Drawing instead of participating. John and Kevin are my class artists. They sit together and draw in their notebooks all though class instead of participating in the class activities. My hope for them was that the project would catch their interest, and help engage them. Kevin drew the blue whale that they handed in with their final project. However, that was his only contribution. John did not contribute to the group, and instead drew cartoon characters instead of helping his group out. After the project was over, when the group members evaluated each other, they all agreed that John should not receive any credit for the project. It was interesting to me that they did feel that Kevin should receive full credit, even though he did not contribute much. Kevin did not fill out an evaluation, so I do not know how much he felt he contributed to the group effort. I do not feel that the project improved Kevin and John's behavior, and they continued their drawings after the project was over.

Wandering. The three students who wander around the room are: Mark, Chris, and Karen. I saw improvement in all of them except for Mark. Karen and Chris both became focused on doing the project with their respective groups, and did not wander any more. Mark still wandered around and tried to distract the other students. He found that most of them began to ignore him though, except for Sherri. Once he found that he could distract Sherri, he did not really have to wander, because she was in his own group.

Discussion

Overall, I feel that this study was successful. It taught me invaluable lessons that will affect my future lesson planning. It may not have implications for all classrooms, but it has practical value for the class that the study centered around.

Implications for Engagement and Motivation

I feel that most of my students showed improvements in motivation and engagement. I think part of that was due to the actual goal of the project. The goal I had set for the students was to come up with a creative way to help an endangered species, and pitch that idea to Secretary Gale Norton. At least half of the students asked me at some point if Secretary Norton was an actual person, and if the letters would really be sent to her. Many students told me that it made them feel good to be sending their ideas to someone who could make a difference. Many of them showed real concern for the animals they chose as topics, and they came up with some very creative ideas to help these animals out. I felt that the class was genuinely interested in the project. Shannon, Latoya, Daryl, Zach, and Martin would come in every day and eagerly ask what we were doing that day.

There were two general trends in motivation and engagement in the class during the study. First, students who are usually difficult to motivate showed increased engagement in class activities. Even David was involved some of the time, which was a sharp contrast to his normal routine of putting his head down on the desk. The students who are generally the most motivated became more social, but their level of engagement did not necessarily decrease as a result. The only student who did not show any sort of change was Mark.

No students showed decreased engagement during the project. Since there was no decrease in engagement, I feel that the project was a success. It got students involved who are typically disruptive. Once they got involved in the project, their behavior improved tremendously. Since the project has been over, I have seen a return to some of the old habits, so it was only a temporary fix. However, I feel that if I were to plan more projects like this one, I might be able to hold the students' interest for longer. This would help them to deepen their understanding of the material, and it would also help with classroom management.

Implications for Classroom Management

Structuring class around the PBL helped tremendously with classroom management. The students began to take responsibility for keeping each other on task. The two most obvious examples I saw were Shannon and Karen. For other students, like Chris, the more involved they were in the project, the less likely they were to be engaging in unacceptable behaviors. As I took on the role of coach and facilitator, I was freed up to address the more serious behavior problems. I was not competing with the students for their attention, and I was not forced to stop class to address behavior. As the groups worked, I was able to meet with students privately and speak to them without singling anyone out. This was especially helpful with Mark. He has been a constant challenge because he does not want to be in class, and he is very disruptive. The problem was not entirely solved, but Mark responded better to a discrete talk than he normally would. During the ten days of the project, the class was more manageable and more fun for me to interact with. Even now that the project is over, I have seen an overall lasting improvement in class behavior.

Recommendations for further research

This study was done with a very particular group of students. I chose this class because they were not very motivated, and there were behavior problems. I would not consider my second period class to be a representative cross-section of ninth grade students, or even of urban ninth grade students. The information gathered in this study has practical use for me in dealing with this particular class. However, I do not feel that the results of this study indicate that PBL would be successful in every classroom. I would like to do similar studies with my other classes at my present school, especially those that do not have serious behavior problems. I would also be curious to know what the results would be if the same study were done in a suburban or rural school.

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Appendix A: Data Graphing Activity

Name _____ **Class** _____ **Date** _____

8.1 Data Graphing Activity

Two sets of data are given in tables A and B below. Use the axes given below to make line graphs of the data.

- Use a blue pen or pencil to graph the data from Table 8-A, using the left axis.
- Use a red pen or pencil to graph the data from Table 8-B, using the right axis.

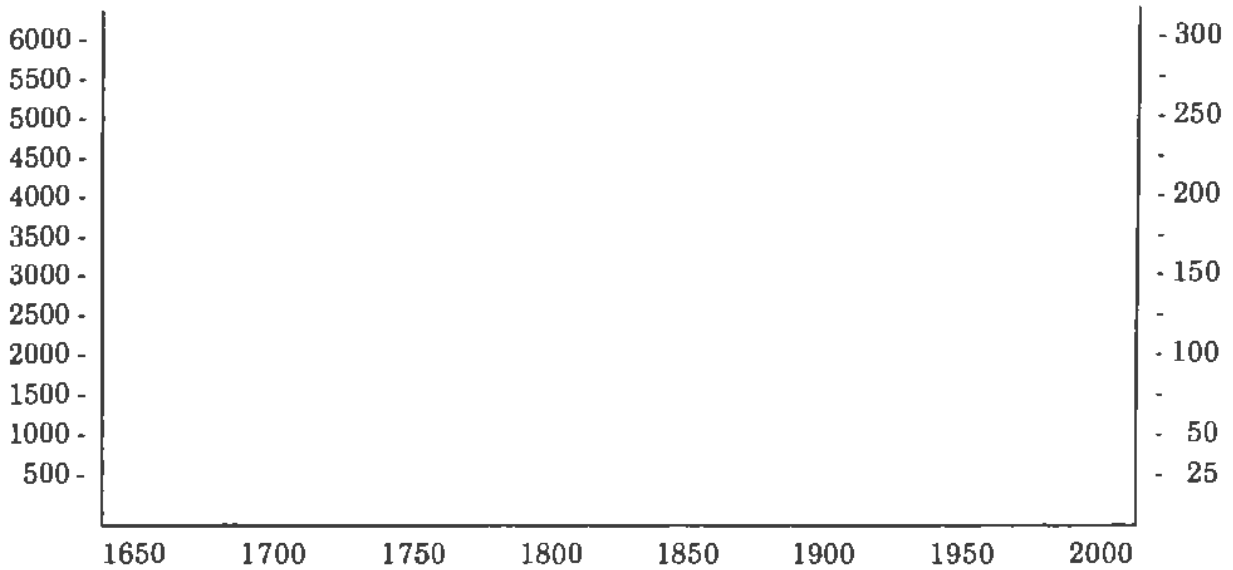
Table 8-A

1650	550
1700	610
1750	760
1800	950
1850	1210
1900	1630
1950	2520
2000	6000

Table 8-B

1650	5
1700	9
1750	7
1800	12
1850	27
1900	70
1950	124
2000	??

GRAPH OF ???



1. How are the two graphs similar? _____

_____

2. Can you guess what the data from tables A and B might represent?

   Table 8-A might represent: _____

   Table 8-B might represent: _____

3. If the trend continues, what will happen to each graph after 2000?

_____

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Appendix B: Literature Circle Reading Assignment

8.2 Endangered Species I—What's Happening?: Information

The data in Table A represent the human population of the world, in millions. The data in Table B represent the numbers of birds and mammals that became **extinct** during each 50-year period. It is important to note that these are only the species known to have become extinct during that time. There may have been others that we do not know about. It is also very important to keep in mind that these are only the birds and mammals. Reptiles, fish, amphibians, insects, and plants are not included in the data. Loss of plants and insects can be especially important to ecosystems and, most likely, to mankind.

No doubt you noticed that the rate of species loss has accelerated along with the growth in human population. This makes sense, because as human populations grow they will have more and more impact on their environment.

Species have been becoming extinct for as long as organisms have been evolving on the earth. Some scientists estimate that the average rate of vertebrate extinctions over the last 200 million years has been about 90 species per century or less than 1 per year. The data in the table show that in the 50 years between 1900 and 1950, about 124 species of birds and mammals became extinct. When other vertebrates are included, it is easy to see that the rate of vertebrate extinctions has nearly tripled the historical average!

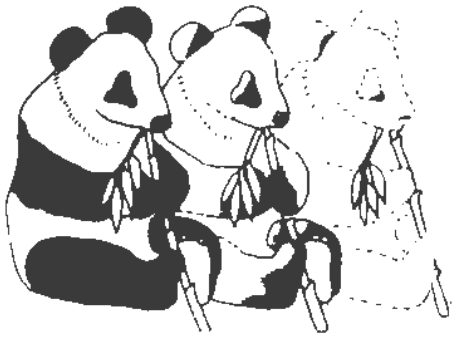
The data are even more alarming when one considers plants and invertebrates. Some scientists estimate that we are losing at least one species per day! The loss of plants is especially important partly because many animals are dependent on specific species of plants, so if the plant becomes extinct so will some species of animals. There are even estimates that the annual rate of loss may accelerate to 50,000 species per year by the year 2000. This would be a loss of about 130 species per day!

There are several reasons for this alarming loss of species. Even today, some species undoubtedly become extinct due to "natural causes," but most are due to human activities. The following table lists some of these human activities and the percentage of extinctions caused by each.

Table 8-C: Causes of Extinction

habitat alteration	30%	pest control	7%
commercial hunting	21%	subsistence food hunting	6%
competition with introduced species	16%	captured to serve as pets	5%
sport hunting	12%	superstitious beliefs	2%
		pollution	1%

It is important to realize that many extinctions are caused by combinations of these factors. Also, the percentages and causes may change with time. For example, extinctions caused by pollution may increase while those caused by superstitious beliefs may decrease.



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Name _____ Class _____ Date _____

8.3 Endangered Species I—What's Happening?: Questions

1. Do the data provided in Tables 8A and 8B prove that the increase in extinctions is due to the increase in human population? Explain your answer.

_____

_____

_____

2. Why do you think statistics were given for birds and mammals, rather than some other kind of organism?

_____

_____

_____

3. Habitat alteration is a very important part of the species endangerment and extinction problem. List several ways that humans alter the natural habitat.

_____

_____

_____

4. For each of the following causes of extinction, discuss how increases in human population make the problem worse.

   a. habitat alteration _____

   b. commercial hunting _____

   c. competition _____

   d. sport hunting _____

   e. pest control _____

   f. hunting for food _____

   g. pollution _____

5. List some ways that you as an individual can help protect endangered species.

_____

_____

_____

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Appendix C: The Project Task

Name _____ Period _____ Date_____
Science I Ms. Pawlak

Extinction Challenge!

Your Mission: To help save an endangered species from going extinct

How: By coming up with a proposal on how to save the organism, and pitching your idea to the DOI. The DOI is the U.S. Department of the Interior. The DOI deals with environmental conservation. You will try to convince Secretary Norton, the head of the DOI that your idea is worth trying.

First you need to identify an endangered species that you are interested in helping. As part of this project, you will complete the following items:

1. A map of where your organism is found
2. A picture of your organism (found or created)
3. A proposal to help save the species
4. A letter to Secretary Norton

The proposal:
In the proposal you must include:
1. Information about your species: nutrition, habitat, etc.
2. Why the species is in danger
3. What has already been done to help that species (if anything)
4. What you suggest could be done to help the species
5. Where the money should come from for your project

Have fun with this project! Be creative! #1 and #2 have a lot of possibilities. Instead of a picture of your organism, make a model or diorama. Make your map out of something other than paper if you want. Your only limit is your imagination!

Hint: It may help to research what has been done in the past to help save endangered species. Have past ideas been successful?

Appendix D: Day by Day Lesson Summaries

Day1: Graphing activity

The students were asked to graph two sets of data. Then they were asked a series of questions about the data, after which they guessed what the data represented.

Day 2: Literature Circle

The students participated in a literature circle based on "8.2 What's happening". The jobs were: facilitator, artist, connector, summarizer, and word wizard.

Day 3: Literature Circle continued

The students shared the jobs they prepared the previous day with their groups. Then they worked together in their groups to answer the questions that were handed out with the reading.

Day 4: Task Introduction

On Day 4, we reviewed the questions as a class, and I explained the right answers. The project task was handed out, and the groups were assigned. I met with each group to help them divide up the items that needed to be researched. The homework for the next day was to make a list of species they would like to research.

Day 5: Writing for information

As a class we talked about different ways of researching the topics. I explained how they could write to organizations for information. I then passed out a handout for them to look at on writing for information. They discussed it wit their groups, and I met with each group individually. Some groups begin to draft letters.

Day 6: Library Day

The students all went down to the library to do research. Only a few had gotten their internet permission slips signed, so many of the students used books. I circulated and met with each group to see if they were finding information, and to help if I could.

Day 7: Coordinating Information

The groups met back in the classroom today. They compared what information they had found in the library, and made lists of what information they still needed. Then they made up a plan of who would gather that information.

Day 8: Work Day

Today was a day for the students to use class time to work on their projects. Supplies were available for those working on maps and drawings.

Day 9: Letter to Secretary Norton

I briefly introduced how and why we would write letters to legislators and government officials. I passed out a handout with tips and a sample letter. Then each group had the entire class time to work on drafting their letter. I met with each group to assess how much was done already, and help if needed.

Day 10: Last work day

This was the last class period for the groups to work together in class. The project would be due in class a week from this day.

Day 15: Projects are due!

The students handed in their projects. Then they filled out the evaluation forms, rating their participation, as well as the other members of their group.

Appendix E: Peer Evaluation

Name _____ Period ____ Date _____

Endangered Species Project- Peer Evaluation

1. Rate how much you participated and contributed to the group effort.
   1 (lowest) 2 3 4 5 (highest)

2. Rate how complete you feel your final project is.
   1(lowest) 2 3 4 5 (highest)

3. Do you feel that all of the members of your group contributed equally? Please comment.

4. Do you feel that all members of your group should receive equal credit for this project? Please comment.

5. What is one thing you liked about this project?

6. What is one thing you would do differently next time?