AP Environmental Science Student Perspectives on Environmental Education

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ABSTRACT

As anthropogenic climate change progresses, and human activities degrade and deplete our natural resources, we are slowly approaching a "point of no return." Consequences of climate change and environmental damage will affect all life, and many species, including humans, are feeling its effects already. Because of this, it is getting increasingly important for students to learn about the environment, and how humans play a role in its destruction. Environmental education is not widespread in public education, but it is occasionally offered in high schools via the College Board's Advanced Placement Environmental Science (APES) program. By surveying past APES students on their experience of the course, as well as its effects on them, I aimed to get an understanding of how APES is taught and whether it is effective in instilling urgency with optimism regarding the future of our environment. As the current and next generation of students will be the ones who need to solve environmental problems, giving them a strong foundation of environmental education is going to be necessary to ensure that they, first, know that the problems exist, and subsequently, are given the tools with which they can solve these problems.

KEYWORDS

environmental education, Advanced Placement, pedagogy, environmental perspectives

INTRODUCTION

Anthropogenic climate change is steadily progressing, and its consequences, such as rising temperatures and extreme weather events, will continue to increase in severity, as well as in reach — though the effects are disproportionately felt by coastal , they still affect all humans. As such, it is becoming increasingly important to learn about the world in which we live, its processes, and where things are headed. However, environmental education (EE) is often overlooked in public education. Environmental courses are often not a graduation requirement, usually offered as an elective Advanced Placement (AP) class through the College Board, if at all. If climate change affects everyone, why doesn't everybody need to learn about it? Learning about the world in which we live — what drives the physical processes that are essential for life, and how living things interact with each other and with the world — are all things that people should know in order to make informed decisions on how they live their lives. Environmental education is currently severely undervalued, and public education will only benefit from at least making it more readily available to students (Metz, 2008).

Evaluating educational competence of EE is difficult, as each country — and within the U.S., state — has its own standards. However, APES will be used as a model for a "standardized" EE around the world. As an AP course offered through the College Board, its curriculum is standardized and is offered internationally. But as mentioned above/will go into more detail, there are inherent access problems within AP.

We can raise EE to its best by increasing access and content. The more people that take ES, the more people there are that are educated on environmental problems. Since CC affects everybody, everybody, especially those in countries that have disproportionately high pollution-per-capita, should be well versed in ES and the consequences of CC. Making ES a graduation requirement, and offering more non-AP options, should increase access to EE. In addition, we should improve EE content. The APES material is currently very fact-based, presenting environmental problems and its causes. However, there is hardly an emphasis on environmental problem solving or engineering. Improving these two aspects in EE can give more students a more thorough and nuanced understanding of environmental problems, as well as how to solve them.

Effective EE should teach more than just the facts. Though the "facts" are inarguably the foundations of ES knowledge, teaching just that is far from giving students the tools that are

necessary to go forth with that information and spark change. Phenomenon like "ecoanxiety," "ecodepression," and what appears to be "apathy" have been seen in some people who are introduced to scientific environmental information, and this is frequently because it seems like the problem is far too large to handle (Lertzman, 2008). By introducing students to environmental engineering, advocacy, and research methods, more of them will have exposure to how environmental problems are solved in "real" life. It is also important to make sure students are able to come away from the course feeling optimistic, and that they are not bogged down by ecoanxiety or apathy (Doherty et al., 2011).

The importance of EE for the current and future generations of students is clear, and so it is also important to make sure students are getting it at its best. To better understand the effectiveness of APES in teaching EE, I surveyed students on their past experience with APES. The goal is to understand main pedagogical methods used, type of content emphasized, and the long-term impact it had on students.

Environmental Problems and Who They Affect

What are the problems?

Fluctuations in Earth's CO_2 levels are not unfamiliar across geologic time, but when looking at data on a shorter timescale, there is undeniable evidence that the exponential increase in CO_2 levels since the mid-1700s that correlate with certain human activities.

According to the Intergovernmental Panel on Climate Change (IPCC), human activities have already warmed the Earth by 1°C above pre-industrial levels, and are likely to see another 0.5°C increase between 2030 and 2052 should we continue current activities (IPCC, 2018). An October 2018 report from the IPCC detailed what the world may look like with a 1.5°C increase, including the intensification of extreme weather events in certain regions like heavy precipitation and drought, a rise in sea level, ocean acidification, and negative impacts on food and water security and public health. This report has been sensationalized in popular media, producing headlines like "[w]e have 12 years to act on climate change before the world as we know it is lost," or "[t]he world has just over a decade to get climate change under control" (Independent, 2018; Washington Post, 2018). The urgency conveyed in these articles may be somewhat misleading, or

"clickbait"-y, the report nonetheless shows the importance curbing global temperature increases in order to preserve the environment and living a more sustainable life. Nevertheless, the significance of the physical impacts of climate change, such as sea level rise, extreme weather events, changes in agricultural production patterns, and increase in heat stroke deaths, is undeniable.

While physical impacts are undoubtedly important, psychological impacts of climate change are often forgotten about. These psychological impacts can be classified into three types: direct, psychosocial, and indirect. Direct impacts are "acute or traumatic effects after extreme weather events," and can include distress from losing one's home from a natural disaster, or observing the depletion from a local resource. Psychosocial impacts are chronic effects of long-term climate change consequences, such as heat, drought, or climate-related conflicts. The difference between direct and psychosocial impacts is that direct impacts are acute, more immediate impacts, while psychosocial impacts are longer term, chronic stresses that are the result of dealing with physical or social fallout after climate-related events. Indirect impacts are based on observation of direct impacts, for example, from reading the news or viewing shocking images of environmental degradation or human suffering from it. There are a range of emotions that people experience about climate change, and these can be correlated with their strength of belief in climate change as an issue. For example, Americans who believe that climate change is a reality and danger most commonly felt sad, disgusted, angry, or afraid, while those who just as strongly believe climate change is a non-issue tend to feel more disgust and anger (Leiserowitz et al., 2009). Other reactions, like denial and apathy, are justifications for people to disbelieve or dismiss the severity of climate change consequences. Depressive emotions like guilt, despair, and grief, and anxious emotions can come from a person coming to terms with the fact that climate change is occuring, and that their own lifestyle and purchasing actions are contributing to it.

Understanding climate science is extremely important and necessary. However, the more one understands the gravity of the situation, the more one might feel indirect impacts, like anxiety. While some amount of anxiety or stress is beneficial to humans, the reality of the issues can be crippling for some, as their anxieties worsen with the current state of the environment. Environmental educators can use this anxiety as a springboard in instilling a sense of urgency to act, whether to improve individual habits or to push for top-down reform. Instead of letting the fear, anxiety, and depression anchor a person down, environmental programs and education can

help one navigate through those emotions and "[reinvest] emotional energy in [a] more ecologically stable" lifestyle (Doherty et al., 2011).

Direct, psychosocial, and indirect impacts can apply to a wide range of people, even in communities that are not experiencing physical effects of climate change. But eventually, if countries do not work together to lower greenhouse gas emissions, direct impacts will be felt across the globe. In one way or another, sooner or later, environmental problems will affect everybody.

Seeing as environmental problems are universal problems, and that the United States bears a disproportionately large burden of contributing to climate change, teaching environmental science should be prioritized more than it is in the education system today.

Environmental Education in the U.S. Today

Environmental Education (EE)

Definitions of environmental education have discrepancies between different time periods, authors, and institutions. For instance, in the 1970s, EE was apolitical and naturalistic, but rising concern over environmental problems in the 1990s shifted the approach to include "immediate environmental improvement as an actual goal," as well as "educating for sustainability in the long term" (Tilbury, 2006). Government institutions can send mixed messages at different levels. The U.S. Environmental Protection Agency (EPA) defines EE as "a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment," but "does not advocate a particular viewpoint or course of action," (EPA, 2018). On the other hand, UNESCO's definition for education for sustainability is the "lifelong learning process that leads to an informed and involved citizenry having the creative problem solving skills, scientific and social literacy, and commitment to engage in responsible individual and co-operative actions" (UNESCO, 2010). Under the current presidential administration, we see an undermining of scientific credibility and environmental skepticism, and the EPA's disengagement in advocating for a viewpoint or action can be hurtful to current and future generations of U.S. citizens.

The EE framework that I employ in this study argues that EE, in addition to educating people about how the physical environment functions and how human actions and lifestyles can affect it, should also encourage action to combat environmental problems.

EE can be taught in a classroom setting via classes like environmental science or environmental studies, or through camps that give children opportunities to interact with nature. While the latter is undoubtedly important, I will be focusing on EE in the classroom.

Environmental science (ES) does not yet have a strong foundation in U.S. Only 2 states require environmental science as a high school grad requirement, and 4 more offer it as a graduation elective option, among other science classes. Most environmental education in the U.S. takes place via the College Board's Advanced Placement (AP) program, which offers AP Environmental Science (APES).

The College Board

The College Board is a non-profit organization that aims to "[connect] students to college success and opportunity" (College Board, 2018). They offer examinations that colleges use to evaluate prospective students' applications, like the SAT, SAT subject, and AP exams. AP exams, usually taken after taking the respective AP class, have the potential to transfer to college-level units depending on the student's score. There are several AP exam disciplines: English, History and Social Science, Math and Computer Science, World Languages and Cultures, Arts, and Science. Within these disciplines, there are subjects - for example, the Science category is made up of biology, chemistry, 4 types of physics, and environmental science. The most popular science exams were biology and physics. Only around 3% of all AP tests administered in 2018 were AP environmental science (APES) exams (College Board, 2018).

Since the AP system is so geographically widespread, its base curriculum is uniform, and AP teachers are trained via summer workshops put on by the College Board themselves, it is the most appropriate way to study current EE across the states. Non-AP ES courses are taught at some schools, but this is rare. Although it is impossible to study every nuance of every APES teacher, having a nationwide (and even international) reach will allow us to study APES as a model for EE today.

However, AP courses and exams can have a barrier to entry for some, especially marginalized groups. For example, the high cost to register for the exams, or the the inequities created by the AP program through tracking makes it difficult for some students to even be allowed

in these classrooms (Kolluri, 2018). While APES may be one method of delivering EE to students, it is not the most inclusive way to study EE as a whole.

AP Environmental Science (APES)

Currently, the APES curriculum covers a wide range of interdisciplinary science topics, such as chemistry, biology, and geography. On the class's website on the College Board, they list out all the units covered, as well as how emphasized they are on the exam. Within each unit, there are several topics and subtopics. We can infer that units that have a higher percentage are more strongly emphasized than units that have a lower percentage. The units and their percentage distributions are shown in Table 1.

Table 1. Topic distribution on the AP Environmental Science exam.

Topic	**Percent covered on the exam**
Earth Systems and Resources	10-15%
The Living World	10-15%
Population	10-15%
Land and Water Use	10-15%
Energy Resources and Consumption	10-15%
Pollution	25-30%
Global Change	10-15%

From this, we can see that pollution is the most emphasized unit, and the rest are all relatively evenly distributed. The course focuses mainly on teaching students the basic science of the environment. There are a few topics that cover environmental problems and human-related issues, like population, land use in agriculture, anthropogenic climate change, and biodiversity loss. However, the course curriculum lacks structural and justice issues related to the environment. There is also no mention of environmental engineering and ways to solve the problems mentioned.

Pedagogical Methods for Science

Education is not one-size-fits-all. There are so many ways that different students can learn the same content, and a successful teacher can employ multiple methods in their class to reach as many students as they can. According to Gardner's theory of multiple intelligences, there are 9 types of intelligence, and individuals may have different levels of each. While Gardner himself does not believe there is a "'right way' to conduct a multiple intelligences education," but his theory has helped shape teaching methods today in order to reach more students that have different strengths (Gardner, 1983). However, the current education system is biased toward linguistic-verbal modes of teaching.

Pedagogical methods for science that are commonly employed or talked about in the literature can be broken down into lecture, discussions, flipped classroom, and active learning methods.

The classic and most commonly used method is the teacher-centered lecture. A lecture is an oral presentation given by the teacher, and can be accompanied by a powerpoint or other visual aids. In terms of Gardner's multiple intelligences, this appeals to individuals with high linguistic intelligence. Students in a lecture-based class gain factual knowledge in a lecture, but may not gain as much critical thinking abilities as discussion (Costin, 1972).

Discussions are a student-centered method, where the students discuss the content, or a question around the content, with aid from the teacher, who acts as the facilitator. Costin (1972) found that they can improve cognitive skills, like problem-solving, and can impart more intellectual curiosity in the students than lectures can.

A flipped classroom, as the name implies, reverses the typical structure of lecturing in class and doing assignments as homework, and students instead obtain the content at home, and do activities in class. The at-home learning could be done via pre-recorded lectures by the teacher or from third-party content, or just from reading. This method allows students to go over the content at their own pace.

Many types of pedagogical methods fall under active learning, and they can appeal to more types of Gardner's intelligences. Some examples include fieldwork, wet labs, or role-playing case studies. While the teacher can have a lot of flexibility in how they employ active learning, the teacher's effectiveness can play a large part in these methods' effectiveness (Waldrop, 2015).

METHODS

Student Surveys

To learn about student experiences of APES, I made and distributed a survey to send to a large UC Berkeley course, ESPM 50AC, taught by Dr. Kurt Spreyer. The course garners students from fields across campus, and Dr. Spreyer offered extra credit to his students who took the survey. The survey asks students to self-report on the content and presentation of the class, and how the class affected them. The first part included questions on the teacher's pedagogical methods, as well as what content was emphasized based on pre-classified categories I laid out. The second part asks about the students' personal environmental values, whether the course affected their future paths or not, and how they felt after the course. The survey originally had two versions: one specifically for APES, and another for non-AP, general environmental courses. However, due to complications with the survey, the latter did not appear and collect any responses. Due to this, I will only be observing APES responses.

Data Analysis

Most of the survey questions were Likert scales. Depending on the type of question, I analyzed these responses differently. For most questions, I grouped some of the answers in a bigger category for a simpler analysis. For example, on a 6-point scale ranging from "very frequently" to "never," I grouped "very frequently" and "frequently" and analyzed them together as "frequently," "occasionally," "rarely," and "very rarely" as "less frequently," and kept "never" as its own category. Due to the nonlinear nature of Likert scales, I did not perform any statistical analysis, in order to avoid making assumptions about values. For the short answer responses, I extracted major themes from the responses, and gave examples of a few representative responses for each theme.

RESULTS

Pedagogy and Content

To observe which pedagogical methods were most frequently used by teachers, I listed 10 methods on a 6-point Likert scale ranging from "very frequently" to "never." The 10 methods were condensed into 3 categories: "traditional," made up of lecture, homework, and exams; "active-learning," made up of discussion, field work, labs, public service, and projects; and "other," made up of flipped classroom, presentations, and other. The Likert scale points were condensed into 3 categories of "more frequently" ("very frequently" and "frequently"), "less frequently" ("occasionally," "rarely," and "very rarely"), and "never."

More students reported that traditional methods were used more frequently, and more students reported that active-learning methods were used less frequently (Table 2).

Table 2. Frequency of pedagogical methods by APES teachers.

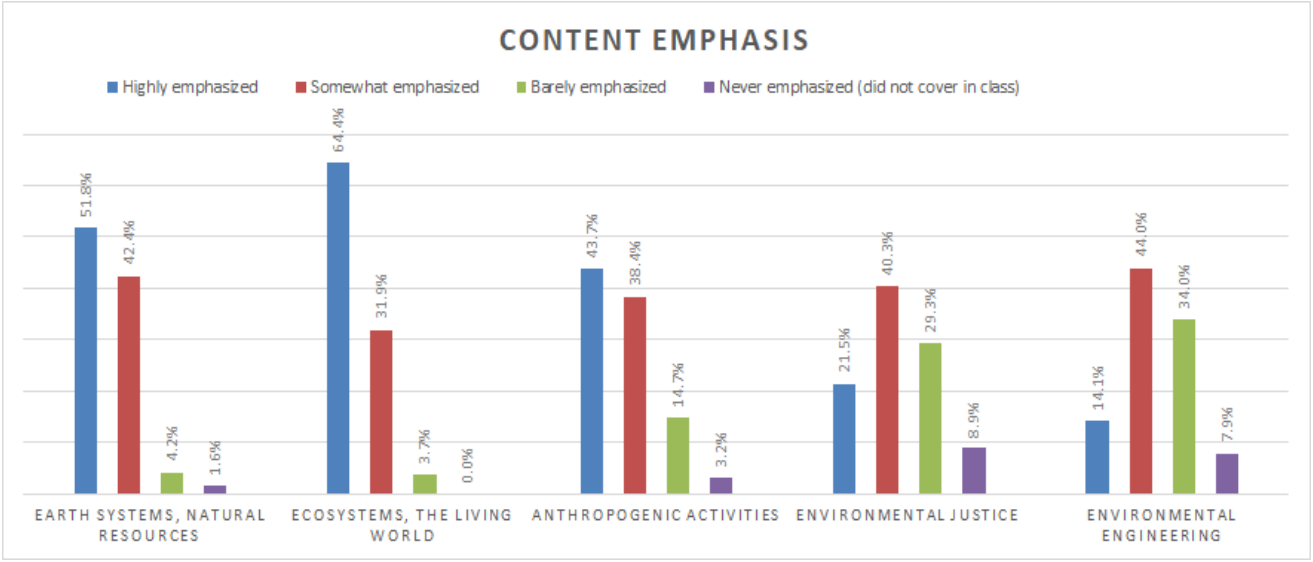
	More frequently	Less frequently	Never
Traditional	75.9%	22.9%	1.2%
Active-learning	36.6%	55.9%	7.5%

Respondents were then asked about the content of the course. While APES is a broad, interdisciplinary subject, I split it into three main categories: physical science (Earth systems and natural resources), biological science (ecosystems and the living world), and social science. However for the survey question, I named two specific topics within social science (anthropogenic activities and environmental justice) instead of letting it stand alone, like the other two. I also added environmental engineering as its own category, to differentiate solutions-based science from the rest.

APES classes place a higher emphasis on biological and physical science than social sciences (Figure 1). The physical and biological sciences had the highest number "highly emphasized" responses. Anthropogenic activities still has a higher number of responses for "highly emphasized" than the other options, but the gap between "highly" and "somewhat" are much closer than biological and physical sciences. On the other hand, there are a higher number of responses

for "somewhat" and "barely emphasized" than "highly" for the environmental justice and environmental engineering categories. APES classes place a higher emphasis on biological and physical science than social sciences.

Figure 1. Frequency of emphasized content.



Environmental problems and solutions are also an important aspect of APES content. First, I asked what were emphasized as environmental problems. The Likert scale question listed 9 problems, which were categorized into four groups: "political" (policies, government); "economic" (corporate practices, consumerism), "resource mismanagement" (land use change, natural resource management practices); and "unsustainable practices" (unsustainable individual practices, unsustainable tech, use of synthetic chemicals). All categories were reported to be "more frequently" emphasized than "less frequently." However, the gap between the two answers were significantly larger for resource mismanagement and unsustainable practices, indicating that those two were more "more frequently" emphasized. 27.2% and 18.9% of respondents reported that resource mismanagement and unsustainable practices, respectively, were less frequently emphasized, compared to 36.6% for political, and 42.9% for economic.

As for solutions, I classified three types of solutions: "structural reforms," "science/tech," and "individual behavior." For science/tech and individual behavior, there were a higher number of responses for "more frequently" than "less," the difference between them being 27.6% and

48.9% respectively. However, for structural reforms, 51.7% reported they were less frequently emphasized, compared to 42.5% saying more frequently.

Personal Effects

To learn about how the course affected students, I first asked how they felt after the course. I listed nine different emotions and adjectives, and asked respondents to rate themselves on a scale of 1 to 5 (1 being not at all, 5 being a great deal) on each one. Clear conclusions cannot be made on what "3" means, since the only base markers were 5 and 1. This leaves the numbers in between open for interpretation.

Most of the responses seem to hover around "3," indicating there were no "strong" feelings either way on the scale. However, there is a skew towards the lower end of the spectrum for negative emotions (apathy, depression, guilt, hopelessness), and towards the higher end for positive emotions (knowledgeable, optimistic, enthusiastic). However, it is still important to note that around 5% of respondents did feel a great deal of the negative emotions. Most people felt a significant amount of alarm.

Table 3. Emotions or feelings on the future of the environment after taking APES.

	Apathetic	Depressed	Guilty	Hopeless	Alarmed	Overwhelmed	Knowledgeable	Optimistic	Enthusiastic
5	11	7	11	8	48	21	54	21	47
4	25	20	48	33	65	55	83	55	72
3	42	65	63	62	45	42	37	75	49
2	42	50	41	65	19	46	11	33	20
1	68	46	24	21	10	24	4	6	2

APES had a bigger positive impact in encouraging students to pursue an environmental field in school than as a potential career path.

When asked if APES made an impact on respondents' choice of studies in college, 42.4% said it had little to no effect, 55% said it made them want to pursue an environmental field of study, and 2.6% said it discouraged them from pursuing an environmental field. When checked against the respondents' self-reported majors and minors, 59% of them were in an environmental major or minor, while 41% were non-environmental. On the other hand, when asked if APES made an

impact on respondents' potential future career path, 53.4% said it had little to no effect, 45.5% said it made them want to pursue an environmental field, and 1% said it discouraged them from pursuing an environmental field.

Lastly, I had a short answer question where students could report any additional information on their APES experience that they felt was not asked in the survey. From these responses, I was able to pull six main themes from them.

Overall, the responses reported a positive experience. Many of them were non-specific as to whether they were talking about the content or their learning environment, saying:

"It was awesome!"

Many students realized the importance of environmental issues by taking APES:

"APES taught me important environmental topic that are extremely relevant to current times."

"I think this should be a mandatory class for every student. It is important to learn about the world we live in and every person should know the impact they have on our future."

"This was my 'life changing' class"

Others felt that the topic coverage in the class could be improved:

"I felt that it could have been more focused on present-day issues rather than just covering material for the AP exam"

"I wish it had talked about environmental justice more, I come from a suburb where this isn't an issue but I don't think that means we shouldn't be talking about it."

"It lacked some hands-on experience"

For many, their APES experience was made by the teacher, both positively and negatively:

"Mine was particularly bad given the atmosphere of the classroom, as the students did not respect the teacher or give him a vehicle for conveying the material."

"My teacher was very passionate which most interested me in the course."

On the other hand, some students were able to have positive learning experiences despite feeling that their teachers did not contribute to that experience.

> *"The material in environmental science can outshine a teacher as my teacher was not the best but everyone in the class was still interested in the material."*
>
> *"I had a very apathetic APES teacher, so I didn't enjoy the class, but I loved the topic"*
> *"My teacher was very passionate about the topic but didn't teach the topic very well."*

Lastly, there is the perception (and reality) in some schools that APES is considered the "easiest" AP course:

> *"I thought APES was by far the easiest AP class I took, in terms of the AP test and the class itself."*

There is a large variety of perceptions and experiences of the course, both based in an individual's predisposition to the course material, as well as their teacher experience.

DISCUSSION

Student surveys of previous APES students aimed to understand student experiences in the course, both in terms of content learned as well as its impact on the individual. Results showed that most students generally had a positive experience, either because the teacher had a positive impact, or they were interested in the topic regardless of the teacher. Content was also depoliticized and emphasized on "hard" science, as opposed to social science.

Pedagogical methods

According to the survey, traditional methods were used more frequently than active-learning methods, with lectures, the quintessential example of "traditional," being the most common. However, the one-sided nature of lecturing can leave students behind and never give them a chance to catch up, especially for non-native language speakers (Mulligan and Kirkpatrick,

2000). Active-learning methods have also been shown to be more impactful in terms of deeper understanding and retention of knowledge (Waldrop 2015). In classrooms

Education is not one-size-fits-all, and this certainly is true for both teachers and students. The uniqueness of each classroom makes it difficult to implement any strict standardizations on pedagogical methods — each student has their own set of "intelligences" and thus, a way that educational content may stick with them better (Gardner, 1995). Thus, rather than making the conversation on teaching methods a duality, teachers should use a more balanced assortment of methods in order to be able to teach students equitably, and this includes an increase in the use of active-learning methods.

Content and politicization

The College Board recognizes that environmental science is taught differently in different contexts, saying "some courses are rigorous science courses that stress scientific principles and analysis and that often include a laboratory component; other courses emphasize the study of environmental issues from a sociological or political perspective rather than a scientific one" (College Board, 2018). However, APES "has been developed to be most like the former," and so it is not surprising that biological and physical sciences were emphasized more in classes than some social science topics or environmental engineering (College Board, 2018). Looking at the College Board's APES curriculum, none of the topics are explicitly on social science or engineering, but they are on biological or physical sciences (Table 1). Some of the topics may leave room for the teacher to be able to discuss social science or engineering, but since those are not tested on in the exam, it makes sense for them to also be brushed over in APES classes. However, still 82.1%, 61.7%, and 58.1% of students reported that anthropogenic activities, environmental justice, or environmental engineering were "highly" or "somewhat" emphasized, respectively, showing that teachers still do spend more time on those subjects than the AP exam requires of them.

Depoliticization of Environmental Problems and Solutions

All causes of environmental problems given in the survey question had a higher number of responses for "more frequently" emphasized than "less." Within this trend, however, unsustainable practices and resource mismanagement had a much bigger gap between the responses for "more" and "less." 27.2% and 18.9% of respondents reported that resource mismanagement and unsustainable practices, respectively, were less frequently emphasized, compared to 36.6% for political, and 42.9% for economic. The former two have wording that depoliticizes the issues, whereas the latter are inherently political. Thus, structural, sociopolitical causes of environmental problems seem to be less frequently emphasized. However, the fact that teachers may have brought in political or economic explanations into resource mismanagement or unsustainable practices cannot be discounted, making this less clear of a conclusion.

For solutions to environmental problems, individual behavior and science/technological solutions were the most frequently emphasized, at 73.5% and 62.1% respectively. Meanwhile, nearly 60% of respondents reported that structural reforms were less frequently or never emphasized as solutions. Structural reforms, comprised of policy and economic reforms, were again, less emphasized in APES classes.

Given that APES stresses "scientific principles" rather than "sociological or political perspectives," these finding are not surprising. However, the depoliticizing of inherently political issues do not benefit students at all. While many teachers believe in keeping a neutral classroom, education is inherently a political process, and attempting to depoliticize it is not feasible (Freire, 1970). Even when teachers tried to keep a neutral classroom, a study found that their behaviors differed from their beliefs, and that their own attitudes were expressed (Cotton, 2007). Thus, instead of trying to suppress the discussion of politics in environmental problems, environmental educators should use APES to push students to think critically about the role of sociopolitical and economic factors in environmental problems.

Environmental optimism and feelings about the future

Education is not neutral, especially in a class like APES, where the content can often be on relatively immediate impacts on a global scale. It is natural for one to have a reaction to any

educational content, and I wanted to see how students felt about the future of the environment, based on taking APES. 60.4% of respondents reported a "4" or "5" for "alarmed," showing that the course did succeed in instilling a sense of urgency regarding environmental problems. Generally speaking, students did not have exceptionally strong feelings in most categories, although it did seem that more people felt positively-characterized emotions, and fewer people felt negatively-characterized emotions. Environmental optimism is crucial for the improving the state of our environment, so this is a good indication that APES does contribute to an optimistic outlook of the future. However, over 20% of respondents answered "1" or "2" for "optimistic," meaning they felt none or very little optimism. Additionally, 14.4% of respondents felt strongly (answered "4" or "5") depressed, 19.1% felt strongly apathetic, and 21.7% felt strongly hopeless. These are significant numbers, and shows APES does not succeed in making all its students optimistic.

Impact on future paths

APES had a larger impact as a deciding factor on choice of college studies than it did on potential career paths. This could be because people could have wanted to pursue an additional environmental minor for their own enrichment, without it affecting their ultimate career plans.

Variability in the classroom

The optional short answer responses revealed that most people had a positive APES experience. However, many responses showed that their experience was made by their teacher, both positively and negatively. Even a "standardized" course like APES, which has the same curriculum across all its classrooms, can be different depending on the teacher. This also applies for content emphasis, as teachers can decide how much of the curriculum to modify. One student reported that their APES class had:

> *"... a good balance of biological information, social/political content, and technological information"*

while another said theirs:

"... never really went into politics in high school..."

Some teachers may choose to bring sociopolitical information into the course, while others will try to keep the class neutral. Ultimately, an analysis of AP courses will be difficult due to the nature of variability among classes.

APES also has different rigor depending on the teacher. One student cited that the course:

"...was by far the easiest AP class I took, in terms of the AP test and the class itself."

which may be representative of those who may not take APES because of their interest in the course, but rather to take the "easiest" AP courses to boost GPAs and impress college admissions. Although I do not have the data for this, it would be a mistake to assume that all, or even most students take APES solely for their interest in the subject. However, the comments show that most were able to walk away from the course feeling like they had learned enough the environment and the problems we face.

Limitations and Future Directions

As ESPM 50AC students were the only ones with access to the survey, the sample was not representative of the general population. UC Berkeley as an institution also has a unique demographic, which may have skewed the collected data. In the future, opening up the survey to a more representative sample of students will be important in getting a more accurate view on perspectives on the course.

The accuracy of responses can also be questioned, due to the fact that the students had taken the course between six months to several years before taking the survey. Since then, they are likely to have had exposure to the topic of environmental problems, whether it be through the media or other courses. It is impossible to isolate specific factors that shaped one's perspectives on a subject, especially when the sampling happened so far removed from the time they took the course.

Broader Implications and Conclusions

Although APES was effective in instilling a sense of urgency while maintaining optimism for most students, there is definitely room for improvement. The pedagogical methods used by teachers should be more diverse, including active-learning methods, in order to accommodate to more learning styles for students. The content should also expand to include sociopolitical implications of climate consequences, as well as room for discussion as to why

This study focused specifically on APES as one common way students can get environmental education, but we know the AP system has inherent access issues. Given the importance of understanding environmental problems and the need for EE, public education around the world should allow for easier access to EE courses, regardless of whether it is through AP or not.

Environmental problems are going to be at the forefront of my and future generations' minds, as human activities continue to do harm. In order to remain optimistic but realistic, environmental education should be action-oriented, interdisciplinary, and inclusive.

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