Supplemental Material

Parsley *et al*.

Appendix A

Detailed Interview Results (Evidence Based on Response Processes)

Nick, Trimester One

Nick had the highest PAD-I score of the class at 100 out of 112. When asked why he thought he got this score, Nick answered,

Well, I think it has to do with the things I was saying earlier, just because of my interests within nature. So, I think it's become more, I don't know, of a passion as I've grown. I was never really on the complete major environmental track. I was pre-med, but then there was a switch and that felt right for me, so I kind of went with it. I have been doing it since then and enjoying that, so I think that's why I probably got that 100, because I really agree with a lot of these things.

When asked what prompted this switch in majors, Nick replied,

There was an awakening kind of thing. I should be doing what I love, instead of something that I could enjoy but wouldn't enjoy as much. College is expensive and I want to come here, and I want to be able to make money when I leave and sufficient enough to take care of myself and anyone else I would need to take care of or want to. So that was my idea that way, but through talking to people, I realized that although, yeah, the doctors do make a lot of money ... I was like, that's not the reason why I should be doing this. I should be doing this because I love it.

Nick's choice to switch majors is an example of his lack of PAD as it was driven by a desire to have a career that he truly loved because it involved nature, rather than one that would make him money. Nick's love of nature led not only to a lowered level of PAD but also to a

change in his career. However, this is not the only demonstration of his interest in plants, as he recounted:

> My first interest was in junior high when we had a ... Essentially it was a group of staff from my middle school that took a group of kids weekly on some kayaking or canoeing trip. Then from there, I got interested in nature. So, it's been a build from there into college.

Nick spoke about his experiences in middle school leading him into his current major and how this love of nature inspired that transition. He also brought up his mother as a plant mentor, and explained:

> I guess my mom always had a "stay outside until it's night" kind of idea. So we had to have our fun being in nature, so it just became part of my life and not like, oh, we live inside and when we go outside, it's a different place. But we spent a lot of our time outdoors.

His mother's approach of living life outside and not just regarding it as a separate space increased Nick's experiences with nature, which in turn led to his enjoyment of the outdoors. When asked about his current relationship with plants, Nick replied:

> I think since then, it's changed. It's come more to I want to understand plants more and understand nature more, instead of just experience it. Still experience it though because I have a love for it. I want to be in it, I want to learn about it, I want to know more about it. I think it's just changed from a, oh, let's go outside and whatever to I'm going on hikes, I'm noticing, oh, this species of whatever. Oh, that's an invasive species and stuff like that.

Nick noted that while his desire to be around plants has not changed, his desire to learn more about them has increased and that because of this he is able to look at plants in a more specific light when he is outdoors.

All of these ideas together indicate that Nick does not demonstrate a significant amount of PAD, and this is reflected in his PAD-I score. When asked if he thought anything about plants was boring, Nick responded that he could not think of anything, further demonstrating his low PAD levels. At the end of the trimester, Nick's score stayed at 100, indicating that his PAD levels did not change (despite his new knowledge of plants from his botany course), likely because of his already-existing appreciation for plants.

Ashley, Trimester One

Ashley had the lowest score of the class on the PAD-I with 68 out of 112. Due to technical difficulties, Ashley's response to the question of how she thought she got her score was not recorded. However, when asked how her opinions of plants had changed since the survey, she answered,

> Since I've taken botany, I've learned a lot more information about plants. Physiology, anatomy, I have a lot more respect for the different processes that I didn't know existed. It's a lot more complex than I thought it was. I thought it was very simple compared to animal physiology. They're two different categories but it's more complex than I thought it was.

Ashley spoke of how she entered her botany course with misconceptions that plants were simpler than animals or performed fewer physiological processes. These ideas changed in the time between taking the PAD-I and completing the interview, but they may have contributed to her low score on the PAD-I at the beginning of the trimester.

When asked about a plant mentor, Ashley noted that she did have pleasant memories of being around plants and her plant mentor (her father):

Most of my father's side of the family are farmers, they own farms. They plant corn, soybeans, things like that. In the Chicago area, we got the giant garden where we plant tomatoes, beans, bell peppers, all kinds of plants. My father and I and all of my siblings would always plant a garden every year. Not specifically about plants, but the best way to garden, I guess, so you get the best product.

Even though Ashley had a low score on the PAD-I, she does have pleasant memories of being around plants as a child in the context of gardening and agriculture. However, when asked what he current relationship with plants was like, she answered,

It's not very good like it used to be. I don't have any plants; I don't garden anymore. My whole life is just work, school, work, school and sometimes sleep. So, I don't have ... I would like to have a garden again. I would like to do those things again, but I just don't have the time to dedicate into that.

Her lack of time availability to spend enjoying plants in the way that she used to (via gardening) is the determining factor in her current relationship with plants, which demonstrates a possible reason for her lowered PAD-I score. Additionally, when asked if she thought anything about plants was boring, she responded,

Where does the list start? I don't know if I have a specific answer on that. I think the most boring part so far is trying to memorize all of the new terminology and the new words that I've never seen before that are involved in anatomy and physiology with plants. I think that's the most boring, time consuming part of it.

When asked why this was boring to her, she answered:

A lot of the words I've never seen before. With human anatomy or physiology, I've seen those words before, I know what they mean. So, it was very easy to study and learn different processes. With plants though, I've never seen these words before, so it took a longer amount of time to learn anatomy or different processes in plants. Compared to my other biology classes.

The combination of previous misconceptions of plants, a poor current relationship with plants, and a distaste for the jargon associated with learning about them seems to have discouraged Ashley. This explains her low score of 68 on the PAD-I, though it could be much lower (the lowest possible score is 28). The fact that her score was not lower may be explained by her previous positive attitudes toward, and experiences with, plants. It appears that previous experiences are not enough to maintain low levels of PAD, and that these need to be supplemented with a continuation of positive experiences and relationships with plants. At the end of the trimester, Ashley scored a 67 on the PAD-I, which was one point lower than her original score. The relative consistency in her score likely demonstrates that knowledge of plants gleaned from her botany course was not enough to improve her level of PAD.

Tiffany, Trimester Two

Tiffany scored a 97 out of 112 on the PAD-I, which was the highest score in the class for that trimester. When asked why she thought she got this score, Tiffany answered,

Well, I've grown up in ... My backyard is basically a forest, so we do a lot of outdoor activities, and my parents always ... made us play outside, and so I've always been around plants. And my mom's a big plant lady, so she would bring me to the garden store when I was younger all the time. So, I've kinda had that exposure and background.

Tiffany cited being outdoors a lot and learning from her mother as a reason for her high score, a similar story to the one Nick told in trimester one. This makes sense as both students received the highest PAD-I scores in their respective trimesters. When asked if she had a plant mentor growing up, Tiffany responded,

I would definitely say my parents, my mom and my dad. My mom's very into gardening and she has a lot of house plants and stuff. And then my dad, he does a lot of outdoors-y stuff and hiking, and he's pretty knowledgeable about that kind of thing. So when we'd go on hikes in the woods, my dad would pick up a leaf and he would show it to us, and be like, "This is an oak leaf, and you can tell because of the structure, or the curve," you know, edges, or whatever, and then, "This is a maple, and you can see it's pointy," or like shagbark hickories, "Oh, you can see it's like shaggy," and just stuff like that. And then my mom, we would go to a garden store and be picking out plants to plant in our various gardens. And I'd be like, "Why can't you plant ..." and she was like, "Well, we can't do that one," and she'd explain, "Well, this is for the sun, but this is ... We're trying to find stuff for a shade garden," and things like that. So, understanding different environments plants thrive in. And then we had indoor plants, like, "Oh, this is ... They're used to warmer climates, we can't plant that outside," kind of thing.

Tiffany speaks in depth about both her parents and the types of information she learned from them regarding plants. Her father taught her information about plant morphology and identification, while her mother taught her about gardening and caring for house plants. This combination of different types of plant knowledge could be another reason for why she scored so highly on the PAD-I. When asked what her current relationship with plants is like, Tiffany replied,

Well, I absolutely love them. I think it's actually grown since I was younger. I'm absolutely loving my botany class right now. I'm very much the type of person that would rather go camping than go to a luxury hotel, and I love being outside. Whenever I get the chance, I walk somewhere. I think that I've definitely grown in my appreciation for plants too as I have learned more about them. And yeah, I definitely love being around them and learning more about them. And I always like to do more of it when I get the opportunity.

Tiffany talked about how her love for plants has only grown since she was young, and notes that the more she learns about them, the more she wants to learn. This positive feedback no doubt decreased her level of PAD. When asked if she thought anything about plants was boring, Tiffany responded,

I guess I'm more of an animal fan. If somebody would be like, "Do you like animals or plants better," it would probably be animals, like I think it's really cool how plants work and I enjoy learning more about how they interact in an ecosystem, 'cause I learned last year they can communicate with each other, and they do kind of move with the sun and stuff. But generally, I think plants are a little bit more boring because they aren't interactive with people, generally speaking, or as far as I know, or I guess they're less interactive than other things in an ecosystem. They just kinda sit there. But I guess in that aspect, they're kind of boring, but I think the more I learn about them, the more I get excited about them 'cause there's a lot of stuff I don't know about plants.

Despite her love of plants, Tiffany admits that she finds them less appealing than animals because animals move and interact with humans more so than plants. Even so, she still admits that there are things she does not know about plants, and that she recently learned they can communicate with one another. The combination of positive experiences with plant mentors, a

continued interest in plants, and learning new information about them likely contributed to her PAD-I score. Tiffany's score also stayed the same at the end of the trimester (97) just like Nick's did in trimester one. This indicates that her newfound knowledge of plants did not impact her level of PAD.

Brendon, Trimester Two

Brendon scored a 64 out of 112 which was the lowest score of the class for that trimester. When asked why he thought he received this score, Brendon answered,

> While I do enjoy nature, I'm more of a microbiologist. [Botany is] just [inaudible] required for my major. I don't per se care about plants. I don't have a background in plants outside of this course, speaking like academically. I would say that's probably why, I just don't have much of an affinity towards plants outside of like soil microbiology.

Brendon describes that he has more of an affinity for microbiology than plants, and that he does not have an affinity for, or care about, them much. This is likely a reason for his low PAD-I score. When asked if he had any plant mentors growing up, Brendon responded,

> I don't know if I really have one per se, I would say my Scout master of course taught me a lot about plants. I can understand like these plants you should stay away from. These plants they grow fruit you can eat, and things of that nature. My ex-girlfriend's mom, we're really good friends, and she's really into like plant conservation. I'd say she is, because you'll go hiking with her and she'd be like, "Oh, these plants are invasive", and talk about the environment and the ecosystem. Outside of that maybe I would say my botany professor, he's taught me a lot. I would say [professor] has probably taught me the most, he's definitely taught me a lot about the actual structure of plants.

While Brendon does identify a few experiences that have to do with a plant mentor, it does not appear he has a stable long-term relationship with one. He cites his ex-girlfriend's mother and his professor, the latter of which is required to instruct students about plants. This alone does not disqualify the professor as a plant mentor, but it does have an impact upon the relationship between Brendon and the professor. When asked what his current relationship with plants was like, Brendon replied,

> I eat occasional berries and fruit but that's extensively that's it. Obviously, I'm in a botany class, so I'm learning about them but most of it is based in food. I don't really have time to garden or do any conservations efforts with like school and work and everything going on, so it's pretty limited.

Brendon notes that his current relationship with plants is quite limited, as it is mostly about the food he eats. This is similar to Ashley in trimester one who also had a strained relationship with plants as she lacked the time and availability to spend time around them. When asked what he thought was boring about plants, Brendon responded,

> What's boring about them, I guess they don't do things, like animals do things. Like yes, plants evolve, they grow thorns, they modify their weeds, they get bigger, smaller, things of that nature. But I just don't think of plants in the same way. I look at a plant I'm like, oh, it's a plant. Also, it's like maybe you have a cactus with like a Venus fly trap, oh, that's crazy. But like looking at animals you have rats, then you can have a gorilla, those are vastly different things. I guess they're not mobile. I can't interact with a plant and it per se interact back with me. I can go for a run with my dog, or things like that. I guess it's just biomechanics is an interest of mine. How do animals move, how do they do the things they do? Why do they do them in that fashion? How do they evolve to do them?

That's an interest of mine, like birds flying is crazy. Their bodies evolve based on physics to allow them to fly. Things like that are just of interest to me. That being said I am also into microbio, which like [inaudible] do things, so kind of two-fold.

Brendon notes that a lack of motion in plants is one reason why he finds them boring, as he has a specialized interest in animal biomechanics. He also likes that animals can interact with humans more so than plants. This is a similar answer to the one Tiffany gave in the same trimester. However, Tiffany had many positive experiences with a stable plant mentor relationship, and that trend continued into her current relationship with plants. This is likely the reason for Brendon receiving the lowest score, as he does not have a long-term plant mentor relationship or a positive current relationship with plants. However, Brendon was the only participant in both trimesters to improve his PAD-I score, as his post-test score increased to a 76. This indicates that for Brendon, something about his experiences in the botany course did improve his level of PAD-I. This seems to be because his attention sub-score increased dramatically from 9 to 17 points. His knowledge score also increased from 22 to 24, while his relative interest actually decreased from 12 to 11, and his attitude increased from 21 to 24. Of all the sub-scores, his attention changed the most, indicating that his experiences in the botany course mostly affected his attention to plants.

It is clear in both trimesters that positive experiences with plants, both past and present, play a large role in whether or not a student exhibits more PAD. However, in both students with the lowest scores, previous positive experiences did take place, but they seem to have been overpowered by lack of current experiences and finding plants boring. It is worth noting that Nick indicated no negative experiences with, or opinions of, plants, while Tiffany did feel that plants were sometimes boring due to their lack of movement. This likely explains why Nick

received a higher score than Tiffany did, indicating that the PAD-I is potentially capable of delineating amongst differing levels of PAD even at high or low ends of the scoring spectrum.

Appendix B

Scree Plot Generated for EFA Round One Analysis Indicating a Six-factor Model
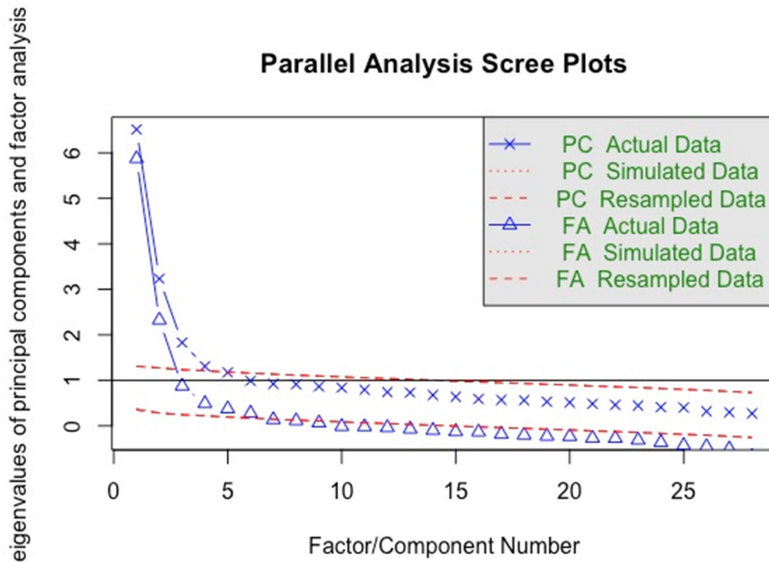
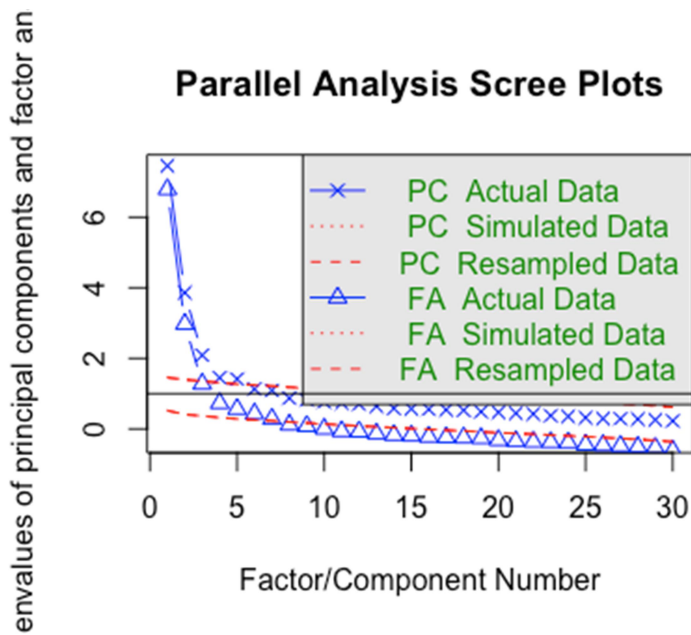**Appendix C**

Items and Factor Loadings for EFA Round 1

Factor Number	Factor Name	Question Text	Component of PAD	Loading Score
1	Caring for or Investment in Plants	I enjoy Caring for house plants	Attitude	0.653
		I enjoy gardening	Attitude	0.76
2	Necessity of Plants/ Importance of Plants	Plants have properties that can mitigate the effects of climate change	Knowledge	0.313
		Plants are an essential source of food for the world	Knowledge	0.658
		Plants are important to ecosystens	Knowledge	0.865
		Animals need plants to survive	Knowledge	0.799

3	Animals Better Than Plants (relative interest type)	I am more interested in learning about animals than I am about plants	Relative Interest	0.634
		I think animal classes are more relative to my future plans than plant classes are.	Relative Interest	0.651
		I am more interested in efforts to protect and conserve animals than I am in similar efforts with plants.	Relative Interest	0.503
4	Attention	I pay attention to how food crops grow in fields or gardens I pass by.	Attention	0.549
		I am aware of opportunities to learn about plants in an outdoor setting.	Attention	0.302
		I notice the crops that are grown near where I live.	Attention	0.702
		I can identify what part of a plant I am eating when I eat a vegetable.	Knowledge	0.41
5	Plants Better Than Animals	I think plants are more useful and important to learn about than animals.	Relative Interest	0.301
		I would rather have plants in my home than pets.	Relative Interest	0.513
		I think plants are unimportant to humans.	Knowledge	-0.375
		Plants blend into the background when I'm outdoors.	Attention	-0.455
		I am more likely to notice plants around me than I am to notice animals around me.	Relative Interest	0.517

| 6 | Positive Affect/Attention | I enjoy being outdoors so I can experience plant life in an immersive way. | Attitude | 0.484 |
		I would enjoy visiting a botanical garden.	Attitude	0.552
		I have a lot of good memories about plants.	Attitude	0.535
		When I take a walk outside, I notice the plants around me.	Attention	0.379
		Being around plants makes me feel relaxed.	Attitude	0.598
		When I am in a wooded area, I notice individual plants.	Attention	0.442
		In general, I am very interested in plants.	Attitude	0.324
Low-loads	No name (too low to load)	Life on earth could not exist without plants	Knowledge	.268 on 2
		When I was younger, someone actively taught me about plants.	Knowledge	.270 on 4
		I have taken or plan to take plant courses for my degree.	Attitude	.274 on 1

Appendix D

Initial Scree Plot Generated for EFA Round Two Indicating a Seven-factor Model
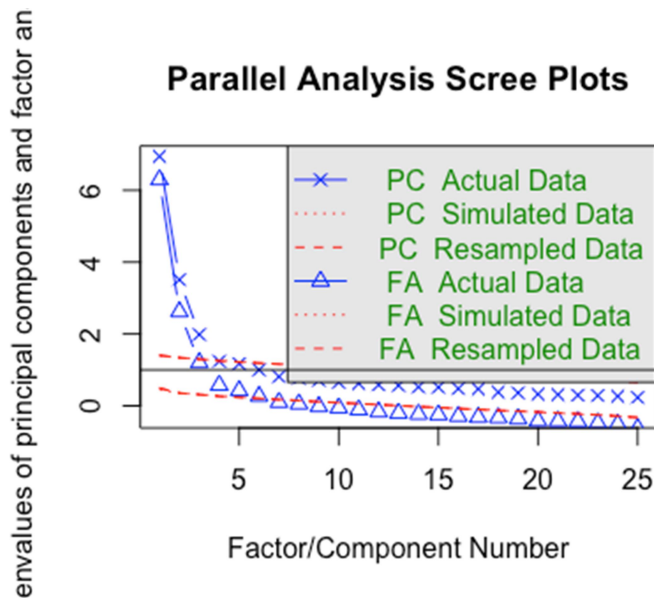

Appendix E

Second Scree Plot Generated for EFA Round Two after Removing Items 13, 14, 20, Indicating a

Six-factor Model
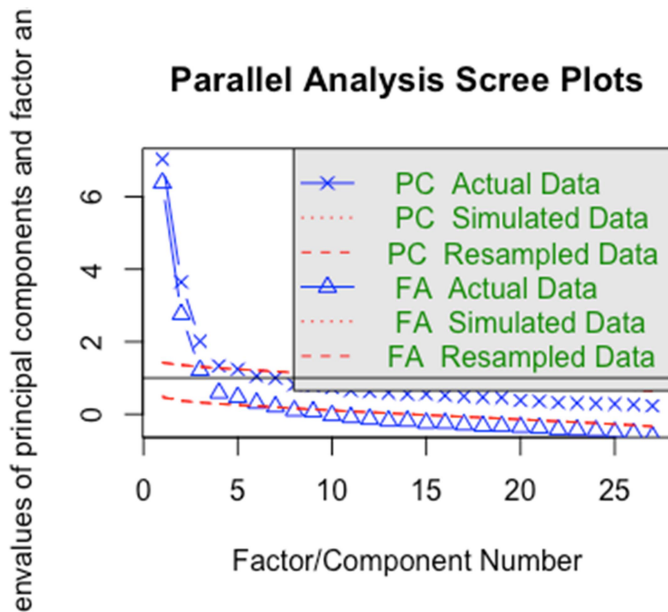
Appendix F

Third Scree Plot after Removing Items 13, 14, and 20-22, Indicating a Six-factor Model

Appendix G

Final Version of the PAD-I with Corresponding Factors

Caring for or Investment in Plants

1. I enjoy caring for house plants.

2. I enjoy caring for plants in an outdoor environment

3. I care about the plants that are in my neighborhood.

Necessity of Plants/ Importance of Plants

4. Plants are important because they help reduce the effects of climate change.

5. Plants are an important source of food for the world.

6. Plants are important to ecosystems.

7. Plants are important because they are a source of oxygen.

8. Plants are important because they are a source of new medicines.

9. Animals need plants in order to survive.

Plants Better than Animals (relative interest category)

10. I think plants are more useful to learn about than animals.

11. I think plants are more interesting to learn about than animals.

12. If I had to choose, I would rather keep houseplants than animal house pets.

13. When I go outdoors, I am more likely to notice the individual plants around me than any animals in the environment.

Animals Better than Plants (relative interest category)

14. Learning about animals interests me more than learning about plants.

15. Animal conservation is more interesting to me than plant conservation.

16. I think animals are more interesting than plants, in general.

Positive Affect

17. I enjoy going outdoors because of all the plants in the environment.

18. I would enjoy visiting a botanical garden.

19. I have a lot of good memories about plants.

20. Being around plants makes me feel happy.

21. In general, I think plants are very interesting organisms.

General Attention

22. I notice the crops that are grown near where I live.

23. When I take a walk outside, I notice the plants around me.

24. When I am in a wooded area I notice individual plants, not just the forest as a whole.

25. I notice all the plants in my environment, not just those that I eat.